Control Number: 45570

Item Number: 306

Addendum StartPage: 0

RECEIVED
2016 SEP -1 AM 11:47
PUBLIC UTILITY COMMISSION
FILING CLERK

SOAH DOCKET NO. 473-16-2873.WS
PUC DOCKET NO. 45570

APPLICATION OF MONARCH	§	BEFORE THE STATE OFFICE
UTILITIES I, L.P. TO CHANGE RATES	§	OF
FOR WATER AND SEWER SERVICE	§	ADMINISTRATIVE HEARINGS

WORKPAPERS OF MONARCH UTILITIES I, L.P.'S WITNESS PAUL R. MOUL

Monarch Utilities I, L.P.'s. ("Monarch") files the attached workpapers in support of Paul R. Moul's Rebuttal Testimony pursuant to SOAH Order No. 4.

Respectfully submitted,

LLOYD, GOSSELINK, ROCHELLE & TOWNSEND, P.C.
816 Congress Avenue, Suite 1900
Austin, Texas 78701
Telephone: (512) 322-5800
Facsimile: (512) 472-0532

LAMBETH TOWNSEND
State Bar No. 20167500

GEORGIA N. CRUMP
State Bar No. 05185500

WILLIAM A. FAULK, III
State Bar No. 24075674

ATTORNEYS FOR MONARCH UTILITIES I, LP

CERTIFICATE OF SERVICE

I hereby certify that on this 1st day of September, 2016, a true and correct copy of the foregoing document has been sent via facsimile, certified mail, return receipt requested, first class mail, or hand-delivered to all parties of record.

WILLIAM A. FAULK III

317618/7177606

306

OTS Statement No. 1
Witness: Emily Sears

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PENNSYLVANIA AMERICAN WATER COMPANY

Docket No. R-2011-2232243

Direct Testimony

of

Emily Sears

Office of Trial Staff

Concerning:

Rate of Return

Q. **PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

A. My name is Emily Sears. My business address is Pennsylvania Public Utility Commission, P.O. Box 3265, Harrisburg, PA 17105-3265.

Q. **BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

A. I am employed by the Pennsylvania Public Utility Commission in the Office of Trial Staff (OTS) as a Fixed Utility Financial Analyst.

Q. **WHAT IS YOUR EDUCATIONAL AND EMPLOYMENT EXPERIENCE?**

A. My educational and professional background is set forth in Appendix A, which is attached.

Q. **PLEASE DESCRIBE THE ROLE OF OTS IN RATE PROCEEDINGS.**

A. OTS is responsible for protecting the public interest in rate proceedings. The OTS analysis in this proceeding is based on its responsibility to represent the public interest. This responsibility requires the balancing of the interests of ratepayers and the Company.

Q. **WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

A. The purpose of my direct testimony is to address rate of return, including capital structure, the cost of common equity, and the overall fair rate of return for Pennsylvania American Water Company (PAWC or Company).

BACKGROUND

Q. WHAT IS THE GENERAL DEFINITION OF RATE OF RETURN IN THE CONTEXT OF A RATE CASE?

A. Rate of return generally is the amount of revenue an investment generates, usually expressed as a percentage of the amount of capital invested, over a given period of time. Rate of return is one of the components of the revenue requirement formula.

Q. WHAT IS THE REVENUE REQUIREMENT FORMULA?

A. The revenue requirement formula used in base rate cases is as follows:

$$RR = E + D + T + (RB \times ROR)$$

Where:

RR	=	Revenue Requirement
E	=	Operating Expense
D	=	Depreciation Expense
T	=	Taxes
RB	=	Rate Base
ROR	=	Overall Rate of Return

In the above formula, the rate of return is expressed as a percentage. The calculation of that rate is independent of the determination of the appropriate rate base value for ratemaking purposes. As such, the appropriate total dollar return is dependent upon the proper computation of the rate of return and the proper valuation of the Company's rate base.

Q. WHAT CONSTITUTES A FAIR AND REASONABLE OVERALL RATE OF RETURN?

A. A fair and reasonable overall rate of return is one which will allow the utility the opportunity to recover those costs prudently incurred by all classes of capital used to finance the rate base during the prospective period in which its rates will be in effect.

The *Bluefield Water Works* and *Hope Natural Gas* cases of 1923 and 1944, respectively (cited below), set forth the principles that are generally accepted by regulators throughout the country as the appropriate criteria for measuring a fair rate of return:

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties; but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. A rate of return may be reasonable at one time and become too high or too low by changes affecting opportunities for investment, the money market and business conditions generally.

Bluefield Water Works & Improvements Co. v. Public Service Comm. of West Virginia, 292 U.S. 679, 692-93 (1923).

> It is important that there be enough revenue not only for operating expenses but also for the capital costs of the

> business. These include service on the debt and dividends on the stock. By that standard the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital.

FPC v. Hope Natural Gas Co., 320 U.S. 591, 603 (1944).

While interpretations of these excerpted citations may vary somewhat, they provide general guidelines for the regulator to determine a fair rate of return.

Q. PLEASE EXPLAIN HOW YOU CALCULATED THE OVERALL RATE OF RETURN?

A. The overall rate of return in this rate proceeding is calculated using the weighted average cost of capital method, which is the interaction of the following components: the percentage of long-term debt, the percentage of preferred stock, the percentage of common equity, the cost of long-term debt, the cost rate of preferred stock, and the cost rate of common equity. It is necessary to determine the proportion of each type of capital (referred to as the capital structure) which has financed the rate base and assign the appropriate cost rate to each capital component. The cost rates of debt and preferred stock are fixed, and can be computed accurately. The cost rate of common equity is not fixed, and it is more difficult to measure.

The overall rate of return is then calculated using the proportions of capital and cost rates for each type of capital. OTS Exhibit No. 1, Schedule 1, page 1, demonstrates the interaction of the capital structure and the cost rates of each type of capital. By multiplying each capital component's capital ratio by its associated cost rate, a weighted cost rate is derived for each capital component. The overall rate of return is the sum of the weighted cost rates.

COMPANY POSITION

Q. PLEASE SUMMARIZE THE COMPANY'S RATE OF RETURN CLAIM IN THIS CASE.

A. Company witness Paul R. Moul recommended the following rate of return for PAWC:

Type of Capital	Ratios	Cost Rate	Weighted Cost Rate
Long-Term Debt	48.20 %	6.10 %	2.94 %
Preferred Stock	0.68 %	8.11 %	0.06 %
Common Equity	51.12 %	11.50 %	5.88 %
Total	100.00 %		8.88 %

Source: PAWC Exhibit No. 11-A, Page 1 of 33, Schedule 1 [1 of 1].

OTS POSITION

Q. PLEASE SUMMARIZE YOUR RATE OF RETURN RECOMMENDATION IN THIS CASE.

A. I recommend the following rate of return for PAWC:

Type of Capital	Ratios	Cost Rate	Weighted Cost Rate
Long-Term Debt	48.20 %	6.10 %	2.94 %
Preferred Stock	0.68 %	8.11 %	0.06 %
Common Equity	51.12 %	8.56 %	4.38 %
Total	100.00 %		7.38 %

Source: OTS Exhibit No. 1, Schedule No. 1, Page 1.

PROXY (BAROMETER) GROUP

Q. WHAT IS A PROXY GROUP, AS USED IN BASE RATE CASES?

A. A proxy group, also called a barometer group, is a group of companies which act as a benchmark for the subject utility in a base rate case.

Q. WHAT ARE THE REASONS FOR USING A BAROMETER GROUP?

A. A barometer group is typically utilized since the use of data exclusively from one company may be less reliable than using a barometer group. The lower reliability occurs because the data for one company may be subject to events which can cause short-term anomalies in the marketplace. The rate of return on common equity for a single company could become distorted in these particular circumstances, and would therefore not be representative of similarly situated companies. The use of a barometer group has the effect of smoothing out potential anomalies associated with a single company.

A barometer group cost of equity is also used as a benchmark to satisfy the long established guideline of utility regulation that seeks to provide the subject utility with the opportunity to earn a return equal to that of similar risk enterprises.

Q. WHAT BAROMETER GROUP DID MR. MOUL USE IN HIS ANALYSIS?

A. Mr. Moul selected American States Water, American Water Works Co., Aqua America, Inc., California Water Services Group, Connecticut Water Services, Middlesex Water Company, SJW Corporation, and York Water Company. (PAWC Exhibit No. 11-A, page 5 of 33, Schedule 3 [2 of 2]).

Q. DO YOU AGREE WITH THE BAROMETER GROUP MR. MOUL USED IN HIS ANALYSIS?

A. I agree with Mr. Moul's barometer group, with the exception of American Water Works Co. I have also included Artesian Resources Corporation in my barometer group.

Q. PLEASE EXPLAIN WHY YOU EXCLUDED AMERICAN WATER WORKS CO. FROM YOUR BAROMETER GROUP AND INCLUDED ARTESIAN RESOURCES CORP.

A. I excluded American Water Works Co. from my barometer group due to a short trading history. American Water Works Co.'s stock went public in 2008, which results in only 3 years of trading data. For analysis, I look at the last 5 years of trading data; therefore, American Water Works Co.'s trading history is too short to provide useful information. Furthermore, when selecting a barometer group I begin with the Water Utility Industry listed in Value Line. Artesian Resources was included on this list as of April 22, 2011; it, however, was not included in the previous edition, and therefore could not be included in Mr. Moul's group.

CAPITAL STRUCTURE

Q. WHAT IS THE COMPANY'S CLAIMED CAPITAL STRUCTURE?

A. The Company has proposed a capital structure of 48.20% long-term debt, 0.68% preferred stock, and 51.12% equity for the future-test year ending December 31, 2011. (PAWC Exhibit No. 11-A, Page 1 of 31, Schedule 1 [1 of 1]).

Q. WHAT IS THE BASIS FOR THE COMPANY'S CLAIMED CAPITAL STRUCTURE?

A. In PAWC Statement No. 11, page 15, lines 3-5, Mr. Moul claims that these capital structure ratios are the best approximation of the mix of capital the Company will employ to finance its rate base during the period new rates are in effect.

Q. DO YOU AGREE WITH THE COMPANY'S CLAIMED CAPITAL STRUCTURE?

A. Yes. I agree with the Company's claimed capital structure.

Q. WHAT IS THE BASIS FOR YOUR AGREEMENT WITH THE COMPANY'S CLAIMED CAPITAL STRUCTURE?

A. The Company's capital structure accurately represents the capital employed in its rate base. The capital structure is also consistent with the capital structures of the companies selected for my barometer group (OTS Exhibit No. 1, Schedule 1, page 2).

	PAWC	Barometer Group
Long-term Debt	48.20%	48.98%
Preferred Stock	0.68%	0.24%
Common Equity	51.12%	50.78%

Therefore, the Company's claimed capital structure is appropriate.

<u>**COST RATE OF LONG-TERM DEBT**</u>

Q. WHAT IS THE COMPANY'S CLAIMED COST RATE OF LONG-TERM DEBT?

A. The Company has proposed a cost rate of long-term debt of 6.10%, which represents the Company's expected cost of long-term debt for the future test year ending December 31, 2011. (PAWC Exhibit No. 11-A, Page 12 of 33, Schedule 6 [3 of 4]).

Q. WHAT IS THE BASIS FOR THE COMPANY'S CLAIMED COST RATE OF LONG-TERM DEBT?

A. Mr. Moul calculates the Company's claimed cost rate of long-term debt in PAWC Exhibit No. 11-A, Page 12 of 33, Schedule 6 [3 of 4]. The long-term debt cost rate of 6.10% is a weighted cost rate based on the Company's long-term debt issues expected to be outstanding at December 31, 2011.

Q. DO YOU AGREE WITH THE COMPANY'S CLAIMED COST RATE OF LONG-TERM DEBT?

A. Yes. I agree with the Company's calculation of 6.10% for the cost rate of long-term debt.

Q. WHAT IS THE BASIS FOR YOUR AGREEMENT WITH THE COST RATE OF LONG-TERM DEBT?

A. OTS Exhibit No. 1, Schedule No. 2, shows the range of cost rates for long-term debt of A-rated and Baa-rated Public Utility Bonds from June 2010 to June 2011. The range is 5.01% to 6.18% with an average of 5.60%. The Company's claimed cost rate of long-term debt of 6.10%, while on the high side of the range, is within the stated range.

<u>COST RATE OF PREFERRED STOCK</u>

Q. WHY IS PREFERRED STOCK INCLUDED IN THIS PROCEEDING?

A. Preferred stock can be considered a hybrid instrument of both debt and equity instruments. Since PAWC has used preferred stock to finance its rate base, it is included in this proceeding.

Q. WHAT IS THE COMPANY'S CLAIMED COST RATE OF PREFERRED STOCK?

A. The Company has proposed a cost rate of preferred stock of 8.11%, which represents the Company's forecasted cost of preferred stock for the future test year ending December 31, 2011. (PAWC Exhibit No. 11-A, Page 14 of 33, Schedule 7 [1 of 2]).

Q. WHAT IS THE BASIS FOR THE COMPANY'S CLAIMED COST RATE OF PREFERRED STOCK?

Mr. Moul calculates the Company's claimed cost rate of preferred stock in PAWC Exhibit No. 11-A, Page 14 of 33, Schedule 7 [1 of 2]. The preferred stock cost rate of 8.11% is a weighted cost rate based on the Company's preferred stock issues expected to be outstanding at December 31, 2011.

Q. DO YOU AGREE WITH THE COMPANY'S CLAIMED COST RATE OF PREFERRED STOCK?

A. Yes. I agree with the Company's claimed preferred stock cost rate of 8.11%.

Q. WHAT IS THE BASIS FOR YOUR AGREEMENT WITH THE COST RATE OF PREFERRED STOCK?

A. Since preferred stock is more like debt in that the cost rate is fixed, I have used the Mergent Bond Record "a" and "baa" rated Moody's Preferred Stock Yield Averages. PAWC Exhibit No. 11-A, page 15 of 33, Schedule 7 [2 of 2] shows that the series of preferred stock was issued in 1940, 1971, and 1991. A review of the historical averages shows that the Company's claimed cost rate for preferred stock is in line with yields at the time of issue. Therefore, 8.11% is an appropriate cost rate of preferred stock.

<u>COST OF EQUITY</u>

Q. WHAT IS THE COMPANY'S CLAIMED COST OF EQUITY?

A. The Company has proposed a cost of equity of 11.50%. (PAWC Exhibit No. 11-A, Page 1 of 33, Schedule 1 [1 of 1]).

Q. WHAT IS THE BASIS FOR THE COMPANY'S CLAIMED COST OF EQUITY?

A. Mr. Moul's testimony, PAWC Statement No. 11, page 3, lines 5-14, opines that the cost of common equity is established using capital market and financial data relied upon by investors when assessing the relative risk, and hence the cost of equity, for a water utility, such as PAWC. In this regard, he relied on four recognized measures of the cost of equity: the Discount Cash Flow (DCF) model, the Risk Premium (RP) analysis, the Capital Asset Pricing Model (CAPM), and the Comparable Earnings (CE) approach. Further on page 4, the table lists Mr. Moul's results for each measure, based on his proxy group of eight water companies referred to as the "Water Group":

Measure	Water Group
DCF	11.44%
Risk Premium	11.25%
CAPM	12.06%
Comparable Earnings	12.40%
Average	11.79%
Median	11.75%
Mid-point	11.83%

Mr. Moul's testimony, Statement No. 11, page 4, lines 6-8, states that the average of the DCF and RP method is 11.35%, and the average of the DCF, RP, and CAPM methods is 11.58%. Mr. Moul recommends a rate of return on common equity of 11.50%, stating it is a reasonable representation of all results.

Q. DO YOU AGREE WITH MR. MOUL'S PROPOSED COST OF EQUITY?

A. No. Mr. Moul gives inappropriate weight to the CAPM, Risk Premium, and Comparable Earnings methods. Further, Mr. Moul's cost of equity recommendation is biased due to several inappropriate adjustments. These adjustments include a dividend yield adjustment, a stale growth rate, a leverage (market to book) adjustment, a size adjustment, and an unnecessary adjustment of CAPM betas. Also, Mr. Moul's financial data comparison is misleading.

WEIGHTS GIVEN TO METHODS

Q. DO YOU AGREE WITH THE COMPANY'S WEIGHTED RELIANCE ON THE USE OF THE CAPM, RP, AND CE MODELS?

A. No. While I am not opposed to using the CAPM results as a check to the results of the DCF calculation, it is inappropriate to give the CAPM and RP models equal weigh because the models do not directly relate to determining an appropriate rate of return. Further, the CE approach used by Mr. Moul compares the historic returns of companies of dissimilar business and financial risk, making it inapplicable in this proceeding.

Q. PLEASE DISCUSS FURTHER YOUR REASONS FOR DISAGREEING WITH THE PRIMARY RELIANCE ON THE CAPM AND RP MODELS.

A. The Capital Asset Pricing Model and the Risk Premium method give results that indicate to an investor what the equity cost rate should be if current economic and regulatory conditions are the same as those present during the historical period in which the risk premium's were determined. By comparing CAPM and RP results with the current expected equity returns (DCF results), an investor can make rational buy and sell decisions. The relevancy of these methods does not carry over from the investment decision making process into the regulatory process.

Regulators can never be certain that economic and regulatory conditions underlying the historical period during which the risk premiums were calculated are the same today or in the future.

Q. GIVEN THE FACT THAT ECONOMIC AND REGULATORY CONDITIONS TODAY CAN AND ARE OFTEN DIFFERENT FROM THE HISTORIC PERIOD, HOW DOES THIS AFFECT THE RESULTS FROM THE CAPM AND RP METHOD?

A. The CAPM and the RP method do not measure the current rate of return on common equity directly. Instead, the CAPM and the RP method determine the rate of return on common equity indirectly by observing the cost of debt. An implicit assumption when using the CAPM and the RP method is that the variables determining the equity cost rate and debt cost rate are the same, which allows the analyst to apply a constant risk premium (difference between risk free rate and the return on the market). However, the variables determining the cost rates in the two markets affect the cost rates differently, leading to a changing risk premium. The use of a constant risk premium fails to capture the effect of changing economic conditions on risk premiums over time.

Q. IS THERE ANY ACADEMIC EVIDENCE THAT QUESTIONS THE CREDIBILITY OF THE CAPM MODEL?

A. Yes. An article, which appeared in the *New York Times* on February 18, 1992, summarizes a CAPM study conducted by professors Eugene F. Fama and Kenneth R. French (OTS Exhibit No. 1, Schedule No. 3) Their study examined the importance of beta, CAPM's risk factor, in explaining returns on common stock. In CAPM theory, the higher a stock's beta, the higher the expected return on that stock. They found that the model did not do well in predicting actual returns, and suggest the use of more elaborate multi-factor models. A more recent article in the *Journal of Economic Perspectives* states that "the attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor, poor enough to invalidate the way it is used in applications" (OTS Exhibit No. 1, Schedule No. 4). As a result of this information, I believe investors will place less credibility on a model that is academically proven <u>not</u> to accurately predict returns.

Q. PLEASE DISCUSS YOUR REASONS FOR DISAGREEING WITH THE USE OF THE CE MODEL.

A. Mr. Moul uses this model to analyze returns earned by other firms in order to identify the appropriate return in this proceeding. To accomplish this, Mr. Moul selected, from <u>Value Line</u>, companies with similar ranks in terms of timeliness, safety, financial strength, price stability, beta, and technical rank. Mr. Moul then determines the average historical return from 2005 to 2009, and the projected return for 2013 to 2015.

The use of the CE model is inappropriate for several reasons. Notably, none of the companies in Mr. Moul's analysis are utility companies, and therefore may not have similar risks in the long run. Further, while the companies Mr. Moul selected using March 2011 information may have been similar based on his factors, these factors can change. Using Value Line information as of April 22, 2011, many of the companies presently on Mr. Moul's list would be excluded from his CE group given the new updated parameters of the Water Group. For example, the Timeliness Rank changed from 2-3 to 3-4 and the Technical Rank went from 3 to 3-4. These changes would require a different CE barometer group. These changes show that the risks of the companies change with the economy. Value Line updates several industries a week on a rotating basis, and it takes 3 months for the same industry to be re-evaluated. Therefore, using the returns for the companies listed in Mr. Moul's CE group going back six months, let alone six years, is not appropriate because the companies are only similar for one short period of time (as little as one week).

Furthermore, in Company Statement No. 11, page 43, lines 10-22, Mr. Moul quotes the previously referenced *Bluefield* case. However, Mr. Moul's excerpt omitted the following underlined text, "undertakings which are attended by corresponding risks and uncertainties, but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures." Mr. Moul's Exhibit No. 11-A, page 33 of 33, Schedule 14 [2 of 2], shows that he has included several highly profitable enterprises such as Dun & Bradstreet-projecting a 47.0% return, Pitney Bowes-earning an average return of 61.7%, Total System Svcs.-earning an average return of 117.9%, and Waters Corp.-earning an average return of 55.9%. Also, for example, while Total System Svcs. is earning on average 117.9%, and is excluded for the "Average" average excluding values >20%, the company is included in the "Projected" average excluding values >20%; due to its highly profitable nature, it should be excluded from the barometer group all together.

Finally, the historical (2005 to 2009) and estimated (2013 to 2015) accounting returns do not include any information on what market return investors expect today (2011).

Q. WHAT IS THE COMMISSION'S HISTORICAL TREATMENT OF THE COMPARABLE EARNINGS APPROACH?

A. The Commission has long recognized the problem with this method. Regarding the use of non-utility companies' historical book earnings in an attempt to determine a cost of equity for a utility, the Commission stated:

> The use of nonregulated companies as a comparable group for regulated firms under the comparable earnings method of computing a rate of return on common equity requires numerous unsupportable assumptions and results in a highly speculative finding.

Pennsylvania Public Utility Commission v. Philadelphia Electric Co. (1980) 33 PUR4th 319, 341 (1980).

> NFGD employed comparable earnings as a check on the common equity cost rates produced by its other methodology. NFGD M.B. p. 170. NFGD did not use comparable earnings as a common equity cost rate determinant. Additionally, it was noted that comparable earnings are not market related but accounting related ratios.

Pa PUC v National Fuel Gas Distribution Corp., Docket No. R-00940021, p. 199, Order entered December 1, 1994.

DISCOUNT CASH FLOW MODEL

Q. WHAT IS THE DCF FORMULA IN ITS SIMPLEST FORM, AS USED IN BASE RATE CASES?

A. The DCF formula in its simplest form, as used in base rate cases, is the cost of equity equal to a dividend yield plus a growth rate.

DIVIDEND YIELD ADJUSTMENT

Q. WHAT DIVIDEND YIELD ADJUSTMENT HAS MR. MOUL PROPOSED IN HIS ANALYSIS?

A. Mr. Moul has proposed an ex-dividend adjustment to the dividend yields of his barometer group. Mr. Moul adjusts the "month-end prices to reflect the buildup of the dividend in the price that has occurred since the last ex-dividend date." (PAWC Statement No. 11, Paul R. Moul, p. 18, lines 19-21).

Q. IS MR. MOUL'S EX-DIVIDEND ADJUSTMENT APPROPRIATE?

A. No. Mr. Moul's ex-dividend adjustment is inappropriate for three reasons. First, my review of the academic literature fails to uncover any support for the application of an ex-dividend adjustment to the dividend yield in the DCF formula as proposed by Mr. Moul. Second, Mr. Moul has not provided any evidence in his testimony that suggests investors make this adjustment, in the context of the DCF model. Finally, I am not aware of any financial publications that provide ex-dividend adjusted yields to investors that might be used for their financial investment decision making. Arguably, if such information was an important factor in an investor's decision making process then main stream financial publications would include it on a regular basis.

<u>**GROWTH RATE**</u>

Q. WHAT GROWTH RATE HAS MR. MOUL CHOSEN FOR HIS ANALYSIS?

A. Mr. Moul has chosen a growth rate of 7.00% for the Water Group (PAWC Statement No. 11, page 26, lines 9-11).

Q. WHAT IS THE BASIS FOR MR. MOUL'S GROWTH RATE?

A. PAWC Statement No. 11, page 26, lines 6-7 shows that Schedule 10 provides a range of growth rates from 6.63% to 9.62%. Further on lines 9-11, Mr. Moul states it is his opinion that an investor expected growth rate of 7.00% for the Water Group is a reasonable point estimate for earnings per share growth in this case.

Q. DO YOU AGREE WITH MR. MOUL'S RECOMMENDED GROWTH RATE?

A. No. While it is possible that at the time Mr. Moul did his analysis, the growth rate was around 7.00%, if Mr. Moul performed the same analysis with current data, the results would be different. Value Line's April 22, 2011 issue for the Water Utility Industry has stated that "Water Utility stocks have been met with some resistance since our January review…all but a single issue covered in our *Survey* gave back some ground…most of the companies reported disappointing earnings in the fourth quarter…revenue growth seemed to fall short of expectations…The group's growth prospects going forward are not overly impressive either." (OTS Exhibit No. 1 Schedule No. 5). Therefore, the growth rates differ between January (Company data) and April (OTS data).

LEVERAGE (MARKET-TO-BOOK) ADJUSTMENT

Q. WHAT IS FINANCIAL LEVERAGE?

A. Generally, financial leverage is the use of debt capital to supplement equity capital. A firm with significantly more debt than equity is considered to be highly leveraged.

Q. WHAT IS A MARKET-TO-BOOK RATIO?

A. Generally, a market-to-book ratio is used to evaluate a public firm's equity value. This is done by comparing a company's equity market value to a company's equity book value.

Q. WHAT ADJUSTMENT HAS MR. MOUL PROPOSED IN HIS ANALYSIS?

A. Mr. Moul proposes a 102 basis point "leverage" adjustment to account for applying a market valued cost of equity to a book valued equity capital structure (PAWC Statement No. 11, page 31).

Q. IS THE TERM "LEVERAGE" APPROPRIATE FOR THIS TYPE OF ADJUSTMENT?

A. No. Currently, there is no term for this type of adjustment. Mr. Moul does not propose to change the capital structure of the utility (a leverage adjustment), nor does he propose to apply the market-to-book ratio to the DCF model (a market-to-book adjustment). Instead, Mr. Moul is proposing an adjustment to account for applying the market value cost rate of equity to the book value of the utility's equity.

Q. WHAT IS THE BASIS FOR MR. MOUL'S PROPOSED LEVERAGE ADJUSTMENT?

A. In Mr. Moul's testimony, PAWC Statement No. 11, page 26, lines 20-24, he theorizes that if regulators use the results of the DCF to compute the weighted average cost of capital based on a book value capital structure used for ratemaking purposes, those results will not reflect the higher level of financial risk associated with the book value capital structure. Mr. Moul believes this is because the capitalization of a utility measured at its market value contains more equity, less debt and, therefore, less risk than the capitalization measured at its book value.

Q. HOW DOES MR. MOUL CALCULATE THE LEVERAGE ADJUSTMENT USED IN HIS ANALYSIS?

A. Mr. Moul states in PAWC Statement No. 11, page 31, lines 17-19, "The 1.02% adjustment is merely a convenient way to compare the 11.44% return computed directly with the Modigliani & Miller formulas to the 10.42% return generated by the DCF model based on a market value capital structure."

. HOW DOES MR. MOUL CALCULATE THE 11.44% RETURN COMPUTED DIRECTLY WITH THE MODIGLIANI & MILLER FORMULAS?

A. Mr. Moul uses the following formulas found in PAWC Statement No. 11, Appendix E, page 12:

$$ku = ke - (((ku - i)\ 1\text{-}t)\ D/E) - (ku - d)\ P/E$$

and $$ke = ku + (((ku - i)\ 1\text{-}t)\ D/E) + (ku - d)\ P/E)$$

Where:

ku = cost of equity for an all equity firm

ke = market determined cost equity

i = cost of debt

d = dividend rate on preferred stock

D = debt ratio

P = preferred stock ratio

E = common equity ratio

Q. DO YOU AGREE WITH MR. MOUL'S "LEVERAGE ADJUSTMENT"?

A. No. Mr. Moul's adjustment is inappropriate for several reasons. These reasons include the way in which Mr. Moul's adjustment is inconsistent with how rating agencies assess financial risk, Commission precedent, academic literature, and the use of Mr. Moul's circular formula for this adjustment.

Q. PLEASE SUMMARIZE MR. MOUL'S TESTIMONY REGARDING COMMENTS ON HIS LEVERAGE ADJUSTMENT AND FINANCIAL RISK.

A. PAWC Statement No. 11, page 29, lines 2-6 states that "The leverage adjustment is not intended, nor was it designed, to address the reasons that stock prices vary from book value…The leverage adjustment deals with the issue of financial risk and does not transform the DCF result to a book value return through a market-to-book adjustment."

Q. PLEASE EXPLAIN HOW RATING AGENCIES ASSESS FINANCIAL RISK.

A. Rating agencies assess financial risk based upon the company's booked debt obligations and the ability of its cash flow to cover the interest payments on those obligations. The agencies use a company's financial statements for their analysis, not market capitalization. Therefore, no matter how the Company's investments are valued in the market place, the financial risk does not change.

Q. WHAT OTHER COMMENTS DO YOU HAVE REGARDING THE LEVERAGE ADJUSTMENT AND FINANCIAL LEVERAGE?

A. Since, as described above, financial risk does not change, the only difference between the capital structures is the market capitalization vs the book value of equity. Since Mr. Moul has stated that his leverage adjustment is not designed to address the reasons that the stock prices vary from book value, there is no need for a leverage adjustment.

Q. PLEASE DISCUSS WHY COMMISSION PRECEDENT IS A REASON TO REJECT MR. MOUL'S "LEVERAGE ADJUSTMENT".

A. There are several cases in which the same "leverage adjustment" has been rejected. First, the Commonwealth Court in *Blue Mountain Consolidated Water Company v. Pennsylvania Public Utility Commission*, 57 Pa. Commonw. 363, 426 A.2d 724 (1981), stated that the "[R]ecord must be remanded to the Public Utility Commission for clarification of findings concerning fair rate of return." On remand, the Commission responded to the Court's request for clarification by identifying 7 principles that were applied to analyze the company's required and lawful rate of return. At 55 P.U.R. 502, p. 503-504 (1982) the Commission's third identified principle states:

> (3) Market price-book value ratios are not a goal of regulation but a result of regulation, general economic factors and individual company's characteristics of management, operations and perceived future. In general, we view a market-book ratio in the area of one-to-one as appropriate for regulated industry.

Second, in *Pennsylvania Public Utility Commission v. Metropolitan Edison Co.*, Docket No. R-00061366, p. 34 (Order entered January 11, 2007), the Commission did not accept the company's financial risk increment related to the leverage difference between market capital structures and book value capital structures. Third, in *Pennsylvania Public Utility Commission v. Aqua Pennsylvania, Inc.*, Docket No. R-00072711, (Order entered July 31, 2008), the Commission rejected the ALJ's recommendation for a leverage adjustment stating, "[T]he fact that we have granted leverage adjustments in the past does not mean that such adjustments are indicated in all cases." Opinion at p. 38 Most recently, in the case of

Pennsylvania Public Utility Commission, et al v. City of Lancaster-Bureau of Water, Docket No. R-2010-2179103, the Commission agreed with the OTS position and stated in the Order entered July 14, 2011, "any adjustment to the results of the market based DCF...are unnecessary and will harm ratepayers. Consistent with our determination in *Aqua 2008* there is no need to add a leverage adjustment."

Q. MR. MOUL HAS CITED MODIGLIANI AND MILLER'S RESEARCH ON THE SUBJECT OF CAPITAL STRUCTURE AND COST OF CAPITAL AS JUSTIFICATION FOR HIS LEVERAGE ADJUSTMENT. IS THIS APPROPRIATE?

A. No. Mr. Moul has misinterpreted Modigliani and Miller's theory and used it in a way the researchers never advocated. Modigliani and Miller's research primarily sought to understand company capital investment behavior, not the financial risk associated with a stock's market price diverging from its book value. Also, the adjustment and formula employed by Mr. Moul cannot be found in the research he cites.

Q. EXPLAIN FURTHER WHAT THE WORK OF MODIGLIANI AND MILLER STATES ABOUT THE EFFECT OF THE TYPE OF CAPITAL EMPLOYED, DEBT OR EQUITY, ON THE VALUE OF THE FIRM.

A. The work of Modigliani and Miller actually points to the opposite conclusion of Mr. Moul:

> That is, the market value of any firm is independent of its capital structure.[1]

Furthermore,

> ...the value of any firm must be independent of its financial structure.[2]

Q. ARE YOU AWARE OF ANY OTHER ACADEMIC LITERATURE THAT SUPPORTS MR. MOUL'S "LEVERAGE ADJUSTMENT"?

A. No. I am not aware of any other academic literature that supports Mr. Moul's "leverage adjustment".

Q. ARE THERE FLAWS IN THE FORMULAS MR. MOUL USES IN HIS ANALYSIS?

A. Yes. First, Mr. Moul's formulas, $ku = ke - (((ku - i)\ 1\text{-}t)\ D/E) - (ku - d)\ P/E$ and $ke = ku + (((ku - i)\ 1\text{-}t)\ D/E) + (ku - d)\ P/E)$, do not appear anywhere in the research he cites. Second, his formula to determine the cost of equity of a 100% equity firm does not actually determine the cost of equity of a 100% equity firm.

1 Modigliani, Franco and Miller, Merton H. "The Cost of Capital, Corporation Finance, and the Theory of Investment" *American Economic Review*, Jun58, p268.

2 Modigliani, Franco and Miller, Merton H. "The Cost of Capital, Corporation Finance, and the Theory of Investment: Reply" *American Economic Review*, Jun65, p525.

Instead, the formula assumes the rate to 9.00%. Third, the 11.44% market determined cost equity (ke) is solved by using the 9.00% "solved" for in the formula for "ku". Finally, the literature Mr. Moul cites does not espouse using the formulas in a DCF adjustment setting.

Q. PLEASE EXPLAIN HOW MR. MOUL'S FORMULA DOES NOT ACTUALLY DETERMINE THE COST OF EQUITY OF A 100% EQUITY FIRM.

A. This can be seen easily on page E-12 of Mr. Moul's appendix. The formula "solving" for *ku*, cost of equity for an all-equity firm does not actually solve for "ku". In order to solve for a variable in algebra, such as "ku" in this case, every appearance of that variable must be moved to one side. Mr. Moul's equation has not done this, as seen on page E-12 the term "ku" listed on both sides of the equation. Further, in Mr. Moul's formula on page E-12 the "ku" on the right hand side of the equation is solved for before the left hand side "ku" is solved (which are the same factor). That is to say that "ku" is solved before "ku" is solved, which is not possible. There is also no source for the 9.00% on the right hand side of the equation, which is the "ku" variable. Therefore, Mr. Moul's 9.00% is arbitrary, and cannot be relied upon.

CAPITAL ASSET PRICING MODEL

Q. WHAT IS THE CAPM FORMULA IN ITS SIMPLEST FORM, AS USED IN BASE RATE CASES?

A. The CAPM formula in its simplest form, as used in base rate cases, is the cost of equity equal to the risk free rate of return plus a risk premium.

Q. WHAT IS THE RISK PREMIUM FORMULA IN ITS SIMPLEST FORM, AS USED IN BASE RATE CASES?

A. The risk premium formula in its simplest form, as used in base rate cases, is risk premium equal to the rate of return on the overall stock minus the risk free rate of return, multiplied by beta (systematic risk).

INFLATED CAPM BETAS

Q. HOW HAS MR. MOUL INFLATED THE BETAS EMPLOYED IN HIS CAPM ANALYSIS?

A. Mr. Moul has used the same logic for inflating his CAPM betas that he used to enhance his DCF returns, through a financial risk, or leverage, adjustment (PAWC Statement No. 11, page 38-39). Such enhancements are unwarranted for beta in a CAPM analysis for the same reasons that enhancements are unwarranted for DCF results. Also, if the unadjusted Value Line betas do not reflect an accurate investment risk, as Mr. Moul contends, the question naturally arises as to why Value Line does not publish betas that are adjusted for leverage. Until this type of adjustment is demonstrated in the academic literature to be valid, such leverage adjusted betas in a CAPM model should be appropriately rejected.

SIZE ADJUSTMENT

Q: WHAT IS MR. MOUL'S SIZE ADJUSTMENT?

A. Mr. Moul makes a 120 basis point adjustment because he believes as the size of a firm decreases, its risk and hence, it's required return increases (PAWC Statement No. 11, page 41, lines 10-11). Further, Mr. Moul uses the SBBI Yearbook to argue that the returns for stocks in lower deciles had returns in excess of those shown by the simple CAPM, and the Ibbotson data "confirms" this phenomenon for electric and gas companies, where small-cap companies have outperformed large-cap companies by over 300 basis points over the last 80 years. (PAWC Statement No. 11, page 41, lines 19-23).

Q. WHY IS MR. MOUL'S SIZE ADJUSTMENT UNNECESSARY?

A. Mr. Moul's size adjustment is unnecessary because while there is technical literature supporting adjustments relating to the size of a company, this literature is not specific to the utility industry. Furthermore, in addressing the technical literature of SBBI, one can see that making an adjustment based on this source would be in error because it is not specific to utilities, suffers from a survivorship bias and the January effect, and is unpredictable.

Q. IS THERE ANY ACADEMIC EVIDENCE THAT SUPPORTS THE LACK OF VALIDITY OF THE BUSINESS RISK ADJUSTMENT FOR UTILITY COMPANIES?

A. Yes. OTS Exhibit No. 1, Schedule No. 6, presents an article by Annie Wong, "Utility Stocks and the Size Effect: An Empirical Analysis", from the *Journal of Midwest Finance Association* in 1993, pp. 95-101, that concluded:

> The objective of this study is to examine if the size effect exists in the utility industry. After controlling for equity values, there is some weak evidence that firm size is a missing factor from the CAPM for the industrial but not for utility stocks. This implies that although the size phenomenon has been strongly documented for the industrials, the findings suggest that there is no need to adjust for the firm size in utility rate regulation.

While this article is older, until such time as a credible up-to-date article is provided to refute these findings, the size adjustment should be rejected.

Q. DO YOU HAVE ANY COMMENTS REGARDING MR. MOUL'S USE OF THE SBBI YEARBOOK TO "CONFIRM" THE SIZE PHENOMENON FOR ELECTRIC AND GAS COMPANIES?

A. Yes. Mr. Moul erroneously refers to electric and gas companies from the SBBI yearbook as stated in R. Morin's <u>New Regulatory Finance</u> book, pages 181-182 (2006). What Mr. Moul fails to note is that the SIC code for the companies is 49, for which there are no regulated utility companies included (OTS Exhibit No. 1, Schedule No.7). The companies under this SIC code include utility contractors, fiber optics-equipment and systems companies, electric contractors, pipe line contractors, and a citrus fruit grove. Therefore, Mr. Moul's evidence of the size effect is not relevant to the utility industry.

Q. CAN YOU EXPLAIN WHY MR. MOUL'S SIZE ADJUSTMENT SUFFERS FROM A SURVIVORSHIP BIAS?

A. Mr. Moul's size adjustment suffers from survivorship bias because the source he relies on, the SBBI Yearbook, measures the historical difference in return between large companies and small companies in major indices over a long period of time. Survivorship bias refers to the tendency for failed companies to be excluded from performance studies because they no longer exist. This skews results higher because only companies strong enough to survive the period are included in the study. Furthermore, in order for a small company to break into a national index, it must be very successful. Therefore, it is reasonable to believe that the return of the small companies being measured, the ones that make it onto the list, are considerably higher than the return of many small firms that were not successful enough to be on the list or have failed. The returns of those less successful small firms are not reflected in the SBBI data but surely are considered by investors. Therefore, by simply measuring exceptionally successful small firms, a subset of all small firm returns, the size effect has a survivorship bias that does not accurately portray investor expectations.

Q. CAN YOU EXPLAIN WHY MR. MOUL'S SIZE ADJUSTMENT SUFFERS FROM THE JANUARY EFFECT?

A. The size effect is seasonal and is sometimes called the January effect because virtually all of the small stock effect occurs in the month of January.[3] Therefore, the excess returns that Mr. Moul claims is attributable to a firm's size are also equally attributable to the month of January. Currently, there is no generally accepted explanation for this effect. To recommend regulatory support of a size premium present in only one month (January) is unreasonable.

Q. PLEASE DISCUSS THE UNPREDICTABILITY OF THE SBBI YEARBOOK'S SIZE PREMIUM.

A. The Ibbotson SBBI 2009 Yearbook states on page 105, "By simple definition, one cannot expect risky companies to always outperform less risky companies; otherwise they would not be risky." It continues "One thing that we do know about the size premium is that it is cyclical in nature…It is not unusual for the size premium to follow several years of consistently positive values with several years of consistently negative values…We should actually expect periods of small stock underperformance as well as over performance in the future." Using this information, one could argue that the performance of large stocks is equal to that

3 Ibbotson SBBI 2009 Classic Yearbook, page 101.

of small stocks on average. Therefore, Mr. Moul's size adjustment is not necessary.

RISK ANALYSIS

Q. PLEASE SUMMARIZE MR. MOUL'S TESTIMONY REGARDING FINANCIAL DATA COMPARISON FOR PAWC AND THE WATER GROUP.

A. Mr. Moul discusses several categories of risk on pages 10-13 of PAWC Statement No. 11, including size, market ratios, common equity ratio, return on book equity, operating ratios, coverage, and quality of earnings, internally generated funds, and betas. Mr. Moul concludes that the Company has a higher degree of capital intensity than the water group, its equity returns display more variability, its returns were lower, and its creditor protection was weaker.

Q. WHAT COMMENTS DO YOU HAVE REGARDING MR. MOUL'S FINANCIAL DATA COMPARISON FOR PAWC AND THE WATER GROUP?

A. First, I would like to point out that the analysis on "Return on Book Equity" applies a standard deviation for PAWC to the Water group's average return. The standard deviation for the Water Group is 1.55%, instead of 0.7%, and when divided by the average 9.5% return average, the coefficient of variation is 0.165, instead of 0.074 (OTS Exhibit No. 1, Schedule No. 8, page 1 of 10). This shows that PAWC has less variability in earnings, and thus less risk, than the Water Group. Furthermore, a review of the Water Group financial data in OTS Exhibit No. 1, Schedule No. 8, shows that PAWC falls within the ranges of the Water Group. By falling within the ranges of the Water Group, they have thus outperformed some companies in all criteria. The conclusion, then, is that PAWC has a risk profile similar to that of the Water Group.

<u>COST OF COMMON EQUITY</u>

Q. WHAT IS YOUR RECOMMENDATION FOR THE APPROPRIATE COST OF COMMON EQUITY IN THIS PROCEEDING?

A. Based upon my analysis, I recommend a cost of common equity of 8.56%.

Q. WHAT IS THE BASIS FOR YOUR RECOMMENDATION?

A. I arrived at this equity return using the DCF method. I used the CAPM method only as a check to my DCF results. My DCF analysis employed a spot dividend yield, a 52 week dividend yield, and a combination of earnings growth forecasts and a log-linear regression analysis growth rate.

<u>DISCOUNTED CASH FLOW</u>

Q. PLEASE EXPLAIN YOUR DCF ANALYSIS.

A. My analysis employs the standard discrete DCF model as portrayed in the following formula:

$$k = D_1/P_0 + g$$

Where:

k	=	Cost of equity
D_1	=	Dividend expected during the year
P_0	=	Current price of the stock
g	=	Expected growth rate of dividends

When a forecast of D_1/P_0 is not available, D_0/P_0 (the current dividend divided by the current price) must be adjusted by ½ the expected growth rate [4] in order to account for changes in the dividend paid in period 1.

Q. PLEASE EXPLAIN HOW YOU DEVELOPED THE DIVIDEND YIELDS USED IN YOUR DCF ANALYSIS.

A. A representative dividend yield must be calculated over a time frame that avoids the problems of short-term anomalies and "stale" data series. For purposes of my DCF analysis, the dividend yield calculation places equal emphasis on the most recent spot and 52 week average dividend yields. The following table summarizes my dividend yield computations for the barometer group:

4 The adjustment of ½ the growth rate is used when the timing of the dividend increase is not known for certain. It could occur next month, or in the twelfth month. On average, it is safe to assume that the increase will occur half way through the prospective year. Therefore, an adjustment by ½ the expected growth rate is appropriate.

	Spot 07/2011 (%)	52-week Average (%)	Average (%)
Eight Company Barometer Group	3.41	3.49	3.45

Source: OTS Exhibit No. 1, Schedule No. 9.

Q. WHAT INFORMATION DID YOU RELY UPON TO DETERMINE YOUR EXPECTED GROWTH RATE?

A. I have used two approaches to arrive at a representative growth rate. I have examined both earnings growth forecasts and log-linear regression analysis data.

Q. PLEASE EXPLAIN YOUR USE OF EARNINGS GROWTH FORECASTS.

A. I have used five year projected growth rate estimates from established forecasting entities including Value Line, S&P, Yahoo Finance, Clear Station, MSN Money, Morningstar, and Smart Money.

Q. WHAT WERE THE RESULTS OF YOUR FORECASTED EARNINGS GROWTH RATES?

A. The expected growth rates for the eight company barometer group are presented in OTS Exhibit No. 1, Schedule No. 10, page 1 of 3. The growth rates are 5.50%, 7.17%, 3.76%, 5.67%, 3.67%, 3.00%, 10.67%, and 6.0%. The average of the eight companies' growth rate forecasts is 5.68%.

Q. DO YOU HAVE ANY ADDITIONAL COMMENTS ON THE RESULTS FOR THE 5 YEAR PROJECTED GROWTH RATES?

A. Yes. While these 5 year projected growth rates can be used in analyses, one must be aware that analysts' estimates may be biased.

Q. PLEASE EXPLAIN.

A. Analysts' estimates are an attempt to forecast future cash flows and thus expected earnings growth. However, it should be kept in mind that prudent judgment must be exercised as to the sustainability of forecasted growth rates with respect to the base earnings. If the base year earnings are abnormally high, the growth rates from which they are calculated will be biased downward. Similarly, if the base year earnings are abnormally low, the growth rates from which they are calculated will be biased upward. As a result, it is necessary to employ a methodology to smooth out the abnormally high or low base year earnings.

Q. WHAT METHODOLOGY DO YOU RECOMMEND TO DETERMINE A MORE APPROPRIATE LONG TERM GROWTH RATE?

A. I recommend using a log-linear regression analysis.

Q. WHAT IS A LOG-LINEAR REGRESSION, FOR THE PURPOSES OF DETERMINING A LONG-TERM GROWTH RATE?

A. A log-linear regression is a standard time-series linear regression in which data points are plotted as natural logarithms.

Linear regression analysis assumes that a linear relationship exists between two variables. This means that if the two variables were plotted on a graph, a straight line would take shape, and a best fit line could be calculated. However, in certain cases, raw growth data was plotted and instead of a straight line being formed, a hyperbola was formed. In these cases, the data must be transformed before a regression can be calculated. To create a linear relationship with the growth data, the earnings per share must be transformed by the natural log, or log with a base e. The natural log data is then plotted and the slope of the best fit line is determined; this slope is the growth rate, but in natural log form. To make the slope meaningful, one calculates the inverse log.

Q. HOW HAVE YOU USED THE LOG-LINEAR REGRESSION IN DETERMINING AN APPROPRIATE LONG-TERM GROWTH RATE?

A. For my log-linear regression analysis, I calculated the natural log of the earnings per share for each company for each year from 2005 to 2015. I then calculated the slope of the linear regression line created by the earnings per share data points. The slope coefficient is the continuous growth rate that must be converted to an annual growth rate. To arrive at an annual growth rate, I took the antilog of the continuous growth rate and subtracted one.

Q. DO OTHER FINANCIAL PUBLICATIONS EMPLOY LOG-LINEAR REGRESSION ANALYSIS?

A. Yes. I/B/E/S International, Inc. employs log-linear regression analysis when calculating five year growth rates. Academic literature such as *Intermediate Financial Management* by Eugene F. Brigham and Louis C. Gapenski support the use of log-linear regression analysis when calculating growth rates. (OTS Exhibit No. 1, Schedule No. 11).

Q. WHAT WERE THE RESULTS OF YOUR LOG-LINEAR GROWTH RATE ANALYSIS?

A. The results of my log-linear regression analysis are growth rates of 9.29%, 6.85%, 3.39%, 5.29%, 4.43%, 4.17%, 1.50% and 5.99% This data results in an average growth rate of 5.11 %. (OTS Exhibit No. 1, Schedule No. 10, page 2 of 3).

Q. WHAT ARE THE RESULTS OF YOUR DISCOUNTED CASH FLOW ANALYSIS BASED ON YOUR RECOMMENDED DIVIDEND YIELDS AND GROWTH RATES?

A. The following table summarizes my results:

	Range	Selection
Eight Company Barometer Group	8.52 - 8.61%	8.56%

Source: OTS Exhibit No. 1,
Schedule No. 12.

Q. WHAT IS THE BASIS FOR YOUR SELECTION OF THE MIDPOINT OF THE DCF RANGE FOR THE BAROMETER GROUP?

A. I chose the midpoint of the range in order to balance the analysts' optimistic estimates with the log-linear regression analysis.

Q. WHAT IS THE BASIS FOR RECOMMENDING THE SAME MIDPOINT FOR PAWC?

A. As shown in OTS Exhibit No. 1, Schedule No. 1, page 2, PAWC has a similar capital structure as the barometer group, and has no difference in risk when compared to the barometer group. Therefore, the midpoint of my range is appropriate in this case.

Q. HAVE YOU TAKEN INTO CONSIDERATION MARKET PRESSURE AND SELLING AND ISSUANCE EXPENSES IN MAKING YOUR RECOMMENDATIONS?

A. Yes. I have considered these items, but have not made any adjustments to account for them. I believe that market pressure, selling and issuance expenses are an additional cost of capital that are incurred at the time of issuance. The efficient market hypothesis asserts that prices on traded assets (e.g. stocks, bonds, or property) already reflect all known information, and therefore are unbiased in the sense that they reflect the collective beliefs of all investors about future prospects[5]. Therefore, the current market price of common stock already reflects these selling and issuance costs, as investors already capitalized market pressure and issuance expenses in determining the value of the stock at the time of purchase. Since my analysis is market based, these items have been taken into consideration. As a result, I have made no additional adjustments to account for market pressure, selling and issuance expenses.

CAPITAL ASSET PRICING MODEL (CAPM)

Q. EXPLAIN YOUR LIMITED USE OF THE CAPM MODEL.

A. I have included a CAPM analysis as a result of an increased interest by the Commission in confirming the DCF results submitted in base rate cases by the use of a second method. It is my professional opinion that the CAPM should be used as the second method to check the DCF results.

Q. PLEASE EXPLAIN YOUR CAPM ANALYSIS.

A. My analysis employs the standard CAPM model as portrayed in the following formula:

---

5 Fama, Eugene (1970). "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance 25: 383-417.*

$$K = R + \beta(R_m - R_f)$$

Where:

k	=	Cost of equity
R_f	=	Risk-free rate of return
R_m	=	Expected rate of return on the overall stock market
β	=	Beta measures the systematic risk of an asset

The CAPM formula above is actually a form of the more general risk premium approach and is based on modern portfolio theory. The method hypothesizes that the investor required return on a company's stock is equal to the return on a "risk free" asset plus an equity premium reflecting that company's investment risk. In the CAPM, two types of risk are associated with a stock: (1) firm-specific risk (unsystematic risk) and (2) market risk (systematic risk) which is measured by a firm's beta. The CAPM only allows for investors to receive a return for bearing systematic risk. Unsystematic risk is assumed to be diversified away, therefore does not earn a return.

Q. WHAT IS BETA, AS EMPLOYED IN YOUR USE OF THE STANDARD CAPM MODEL?

A. Beta is a measure of the systematic risk of a stock in relation to the rest of the stock market. A stock's beta is estimated by running a linear regression of a stock's return against the return on the overall stock market. The beta of a stock with an identical price pattern as the overall stock market will have a beta of 1. A stock with a price movement that is greater than the overall stock market will have a beta that is greater than 1, and would be described as having more investment risk than the market. Conversely, a stock with a price movement that is less than the overall stock market will have a beta of less than 1, and would be described as having less investment risk than the market.

Q. WHAT BETA DID YOU CHOOSE FOR YOUR CAPM ANALYSIS?

A. In estimating an equity cost rate for the group of eight water utility companies, I am using the average of the betas for the companies as provided in the Value Line Investment Survey. As shown on OTS Exhibit No. 1, Schedule No. 13 the average beta for the eight company barometer group is 0.73, and would be described as having less investment risk than the market.

Q. WHAT RISK-FREE RATE OF RETURN HAVE YOU CHOSEN FOR YOUR CAPM ANALYSIS?

A. For my CAPM analysis, I have chosen to use the risk-free rate of return (R_f) from the projected yield on 10-year Treasury Bonds. While the yield on the short-term T-Bill is a more theoretically correct parameter to represent a risk-free yield, this yield can be extremely volatile. The volatility of short-term T-Bills is directly influenced by Federal Reserve policy. At the other extreme, the 30-year Treasury Bond yield exhibits more stability, but is not risk-free. Long-term Treasury Bonds have substantial maturity risk associated with the market risk and the risk of unexpected inflation. Long-term treasuries normally offer higher yields to compensate investors for these risks. As a result, I chose to use the projected yield on the 10-year Treasury Bond because it balances the short comings of the other two alternatives. As shown on Schedule No. 14 of OTS Exhibit No. 1, the yield on the 10-year Treasury Bond is expected to range between 3.20% and 5.00% over the next five-years. For my analysis, I chose 3.84%, which is the average over the next five years.

Q. PLEASE EXPLAIN HOW YOU DETERMINED THE RETURN ON THE OVERALL STOCK MARKET, AS EMPLOYED IN YOUR CAPM ANALYSIS.

A. To arrive at a representative expected return on the overall stock market, I surveyed three sources. As shown in OTS Exhibit No. 1, Schedule No. 15, Value Line expects its universe of 1500 stocks to have an average yearly return of 14.47% over the next 3 to 5 years, based on a forecasted dividend yield of 2.00% and a yearly index appreciation of 60%. Morningstar expects the S&P 500 index to have an average yearly return of 12.78% over the next 5 years, based upon a forecasted dividend yield of 2.18% and an expected increase in the S&P 500 index of 10.60%. A historical return for the S&P Composite Index is routinely used as a benchmark for the expected return on the overall stock market. This component can vary widely depending on the historic period used.

Q. EXPLAIN THE RANGE OF EXPECTED RETURN ON THE OVERALL STOCK MARKET YOU CALCULATED USING THE HISTORICAL RETURN FOR THE S&P COMPOSITE INDEX.

A. Using the geometric mean of historic returns, I calculated the following results:

Time Period	Return
84 Years	9.81%
43 Years	9.73%
23 Years	9.36%
12 Years	2.93%
7 Years	5.52%
Average	7.47%

Source: OTS Exhibit No. 1, Schedule No. 15, p. 2.

Q. WHAT ARE THE EXPECTED RETURNS ON THE OVERALL STOCK MARKET BASED ON YOUR FORECASTED AND HISTORIC CAPM ANALYSIS?

A. The results of these 2 expected return calculations are presented on OTS Ex. No. 1, Sch. 15. These results are 13.62% for my forecasted CAPM analysis and 7.47% for my historical CAPM analysis.

Q. WHAT ARE THE COST OF EQUITY RESULTS FROM YOUR FORECASTED AND HISTORIC CAPM ANALYSIS?

A. The results of these two analyses are as follows:

	CAPM cost of equity
Forecasted	10.99%
Historic	6.49%

Source: OTS Exhibit No. 1, Sch. 16.

Q. HOW DID YOU INCORPORATE THESE RESULTS INTO YOUR OVERALL COST OF EQUITY?

A. I have included the results of this CAPM analysis in my overall cost of equity calculation only as a check to my DCF result. The DCF model measures the cost of equity directly by measuring the discounted present value of future cash flows of the company and it is these cash flows that actually pay dividends to shareholders. The CAPM model is flawed, first theoretically because it measured the cost of equity indirectly through the cost of a risk free asset and second in practice because it can be manipulated by the time period used to calculate the overall market return. Despite these flaws in the CAPM, it is a commonplace cost of equity measure, and is appropriate as a check. My recommended return of 8.56% is within the range of the CAPM results thereby confirming the reasonableness of my DCF results.

<u>**OVERALL RATE OF RETURN**</u>

Q. WHAT IS THE COMPANY'S PROPOSED OVERALL RATE OF RETURN?

A. The Company's proposed overall rate of return is 8.88% (PAWC Exhibit No. 11-A, page 1 of 33, Schedule 1 [1 of 1]).

Q. WHAT IS OTS'S RECOMMENDED OVERALL RATE OF RETURN?

A. OTS Exhibit No. 1, Schedule No. 1, page 1 of 2, shows the calculation of an appropriate overall rate of return for Pennsylvania American Water Company to be 7.38%.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

Emily Sears

Professional Experience

- **Commonwealth of Pennsylvania, Public Utility Commission**
  Fixed Utility Financial Analyst
  Office of Trial Staff
  May 2009 - Present

- **Commonwealth of Pennsylvania, Public Utility Commission**
  Fixed Utility Financial Analyst
  Bureau of Fixed Utility Services
  April 2008 – May 2009

- **Nationwide Insurance Company**
  Personal Lines Underwriting Screener
  October 2004 – May 2007

Education

- **University of Pittsburgh, College of Business Administration**
  Bachelors of Science in Business Administration
  Major – Finance
  August 2004

- **Society of Utility and Regulatory Financial Analysts**
  Certified Rate of Return Analyst
  June 2010

TESTIMONY SUBMITTED:

I have testified and/or submitted testimony in the following proceedings:

- Duquesne Light Company, Docket No. M-2009-2093217
- West Penn Power Company d/b/a Allegheny Power, Docket No. M-2009-2093218
- Duquesne Light Company, Docket No. M-2009-2123948
- West Penn Power Company d/b/a Allegheny Power, Docket No. M-2009-2123951
- Utilities, Inc. – Westgate, Docket No. R-2009-2117389
- Utilities, Inc. of Pennsylvania, Docket No. R-2009-2117402

- PECO Energy Company - Electric Division, Docket No. P-2009-2143607
- PECO Energy Company – Gas Division, Docket No. P-2009-2143588
- Philadelphia Gas Works, Docket No. R-2009-2139884
- York Water Company, Docket No. R-2010-2157140
- City of Lancaster, Docket No. R-2010-2179103
- Columbia Gas of Pennsylvania, Inc., Docket No. R-2010-2215623
- CMV Sewage, Inc., Docket No. R-2011-2218562

OTS Exhibit No. 1
Witness: Emily Sears

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PENNSYLVANIA AMERICAN WATER COMPANY

Docket No. R-2011-2232243

Exhibit to Accompany

the

Direct Testimony

of

Emily Sears

Office of Trial Staff

Concerning:

Rate of Return

OTS Exhibit No. 1
Schedule 1
Page 1 of 2

Summary of Cost of Capital

Type of Capital	Ratio	Cost Rate	Weighted Cost
Long term Debt	48.20%	6.10%	2.94%
Preferred Stock	0.68%	8.11%	0.06%
Common Equity	51.12%	8.56%	4.38%
Total			7.38%

OTS Exhibit No. 1
Schedule 1
Page 2 of 2

Summary of Cost of Capital

Type of Capital	2010 Ratio	2009 Ratio	2008 Ratio	2007 Ratio	2006 Ratio
American States Water					
Long term Debt	44.26%	45.97%	46.19%	46.93%	48.56%
Preferred Stock	0.00%	0.00%	0.00%	0.00%	0.00%
Common Equity	55.74%	54.03%	53.81%	53.07%	51.44%
	100.00%	100.00%	100.00%	100.00%	100.00%
Aqua America					
Long term Debt	56.60%	55.55%	54.06%	55.40%	50.75%
Preferred Stock	0.00%	0.00%	0.00%	0.00%	0.00%
Common Equity	43.40%	44.45%	45.94%	44.60%	49.25%
	100.00%	100.00%	100.00%	100.00%	100.00%
Artesian Resources Corp					
Long term Debt	52.48%	53.77%	55.06%	51.87%	59.84%
Preferred Stock	0.00%	0.00%	0.00%	0.00%	0.00%
Common Equity	47.52%	46.23%	44.94%	48.13%	40.16%
	100.00%	100.00%	100.00%	100.00%	100.00%
California Water					
Long term Debt	52.39%	47.08%	41.64%	42.63%	43.32%
Preferred Stock	0.00%	0.00%	0.00%	0.55%	0.55%
Common Equity	47.61%	52.92%	58.36%	56.82%	56.13%
	100.00%	100.00%	100.00%	100.00%	100.00%
Connecticut Water Services					
Long term Debt	49.49%	50.59%	46.94%	47.78%	44.44%
Preferred Stock	0.34%	0.35%	0.39%	0.40%	0.44%
Common Equity	50.16%	49.06%	52.67%	51.82%	55.12%
	100.00%	100.00%	100.00%	100.00%	100.00%
Middlesex Water					
Long term Debt	43.11%	46.62%	45.57%	48.97%	49.51%
Preferred Stock	1.08%	1.26%	1.30%	1.47%	1.50%
Common Equity	55.81%	52.12%	53.12%	49.55%	48.99%
	100.00%	100.00%	100.00%	100.00%	100.00%
SJW Corp.					
Long term Debt	53.69%	49.41%	46.00%	47.73%	41.77%
Preferred Stock	0.00%	0.00%	0.00%	0.00%	0.00%
Common Equity	46.31%	50.59%	54.00%	52.27%	58.23%
	100.00%	100.00%	100.00%	100.00%	100.00%
York Water Company					
Long term Debt	48.26%	45.72%	54.51%	46.50%	48.31%
Preferred Stock	0.00%	0.00%	0.00%	0.00%	0.00%
Common Equity	51.74%	54.28%	45.49%	53.50%	51.69%
	100.00%	100.00%	100.00%	100.00%	100.00%
5 Year Average					
Long term Debt	48.98%				
Preferred Stock	0.24%				
Common Equity	50.78%				

Source: Compustat

OTS Exhibit No. 1
Schedule No. 2

Mergent Bond Record Public Utiltiy Bonds		A-Rated	Baa-Rated	Range
	Jun-10	5.46%	6.18%	5.01%
	Jul-10	5.26%	5.98%	5.01%
	Aug-10	5.01%	5.55%	5.10%
	Sep-10	5.01%	5.53%	5.26%
	Oct-10	5.10%	5.62%	5.26%
	Nov-10	5.37%	5.85%	5.32%
	Dec-10	5.56%	6.04%	5.26%
	Jan-11	5.57%	6.06%	5.37%
	Feb-11	5.68%	6.10%	5.46%
	Mar-11	5.56%	5.97%	5.53%
	Apr-11	5.55%	5.98%	5.55%
	May-11	5.32%	5.74%	5.55%
	Jun-11	5.26%	5.67%	5.56%
Average		**5.36%**	**5.87%**	5.56%
				5.57%
				5.62%
				5.67%
				5.68%
				5.74%
				5.85%
				5.59%
				5.97%
				5.98%
				5.98%
				6.04%
				6.06%
				6.10%
				6.18%
Average of Range				**5.60%**

Market Place

A Study Shakes Confidence In the Volatile-Stock Theory

By ERIC N. BERG

One of the most enduring ideas of modern finance is facing its most serious challenge. Two scholars of finance say they have disproved the theory, common among investors, that stocks more volatile than the market as a whole are the best performers.

Eugene F. Fama and Kenneth R. French, business professors at the University of Chicago, traced the performance of thousands of stocks over 50 years but found no link between relative volatility and long-term returns. The many investors who try to beat the market by buying widely swinging issues are misguided, they say.

The importance of "beta," the investment community's term for a stock's volatility relative to the market, has long been under challenge. But it is still closely watched by analysts, and business students are still taught that they can earn higher returns by buying stocks whose swings are wider than the market's.

"The fact is," Professor Fama said in a recent telephone interview, "beta as the sole variable explaining returns on stocks is dead."

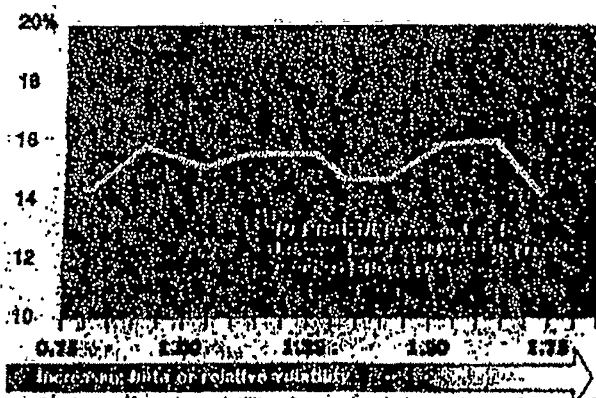
Some still favor relatively volatile stocks, among them William F. Sharpe, a retired Stanford University professor who won the 1990 Nobel Memorial Prize in Economic Science for theories based on beta. "It is a remarkable set of empirical results about what happened in the past," he said of the University of Chicago study. "But I am not willing to make investment decisions based on the theory that there is no relationship between beta, properly measured, and expected returns."

If Professors Fama and French

Continued on Page D5

Knocking Down a Popular Theory

Annual returns on stock investments, based on relative volatility.*



Increasing [illegible]

Beta measures the volatility of a stock relative to the market.

*Returns are based on average one-month Treasury bill yields, annualized, and average market returns, July 1963 to December 1990.

Source: Eugene F. Fama and Kenneth R. French, University of Chicago

The New York Times

Market Place

A Study Shakes Confidence In the Volatile-Stock Theory

Continued From First Business Page

are right, however, the impact could be far reaching. Some highly volatile groups of stocks that have enjoyed wide followings — airlines, for example — could lose a portion of their appeal if beta-believing investors side with the professors.

Additionally, many executives of publicly held companies have taken the view that if their own company's stock is more volatile than the market as a whole, any project they invest in — from a lowly piece of new equipment to a huge joint venture — must generate an extra high return to compensate investors for swings in the stock's price and earnings. The professors' work could force many companies to rethink the way they approach capital spending, finance scholars say.

Finally, many publicly held utilities have used beta to justify rate requests. They figure the returns that investors demand, given their companies' betas, and develop rate structures that allow them to earn these returns. But recognizing that their low betas tend to argue against large rate increases, a growing number of utilities had already turned to other approaches. More will probably do so if the research of Professors Fama and French gains currency.

• • •

And if investors decide to quit following betas, other theories of market behavior are likely to gain influence. "What we are really talking about is opening the floodgates to a whole new generation of research into what truly drives stock prices," said Anthony B. Sanders, an Ohio State University professor of finance who is currently a visiting professor at the University of Chicago. "Once you hammer a model like the old one cloned, you generate all sorts of additional academic interest."

Professor Fama has already won worldwide recognition for his efficient-markets theory — the notion that because investors all have essentially the same information it is impossible to consistently earn returns greater than those justified by the risks.

• • •

Professor Sharpe used Professor Fama's theory as an assumption to develop the capital-asset pricing model, which links returns to risk, as measured by beta.

Professor Sharpe says that a diversified portfolio can reduce the risks peculiar to individual companies — that General Motors stock, for example, will be hurt by a strike. Investors, therefore, earn no rewards for bearing this risk, according to the Sharpe theory.

But investors do earn higher returns for bearing the other type of risk, known as market risk, Professor Sharpe says. This risk, which remains even after an investor diversifies, depends on how much an individual stock is dragged up or down by the market as a whole. Stocks like that of the biotechnology company Genentech, which have betas of more than 1.0, are more volatile than the market, while stocks like that of the power company Consolidated Edison, which have betas of less than 1.0, are calmer than the market.

To calculate market risk, or beta, finance professionals compare changes in the prices of individual stocks with changes in market indicators like the Standard & Poor's 500-stock index. Professor Sharpe and his followers say that in general, the higher a stock's beta, or volatility relative to the market, the greater its long-term returns.

• • •

Professors Fama and French disagree. Their paper, just published by the University of Chicago's Center for Research in Security Prices, says that long-term returns depend not on beta, but on company size and price-to-book ratios. Smaller companies, as measured by the market value of their shares, and those with low prices relative to their book values have in fact outperformed the market, they say.

The professors theorize that investors view smaller companies as more vulnerable to economic downturns and therefore demand higher returns. They also say that low price-to-book ratios typically reflect financial problems, another reason for investors to demand higher returns.

Professors Fama and French are by no means the first to fire an intellectual salvo at the capital-asset pricing model. Since Professor Sharpe developed the model in the early 1960's, a broad array of rival theories has emerged to explain stock price movements: the January effect, which says that stocks usually gain at the beginning of the year, to the weekend effect, which says stocks generally perform poorly on Mondays. Most recently, the arbitrage pricing theory says that stocks are driven by powerful economywide forces like unanticipated inflation and spikes in interest rates.

But finance experts say that Professors Fama and French have presented the most conclusive evidence against beta.

"What they have proven fairly rigorously is what other academics have been talking about for some time," said Richard Roll, a finance professor at the University of California at Los Angeles, who with others developed the arbitrage pricing theory.

Equity Issues This Week

Journal of Economic Perspectives—Volume 18, Number 3—Summer 2004—Pages 25–46

The Capital Asset Pricing Model: Theory and Evidence

Eugene F. Fama and Kenneth R. French

The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of asset pricing theory (resulting in a Nobel Prize for Sharpe in 1990). Four decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. It is the centerpiece of MBA investment courses. Indeed, it is often the only asset pricing model taught in these courses.[1]

The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor—poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions. But they may also be caused by difficulties in implementing valid tests of the model. For example, the CAPM says that the risk of a stock should be measured relative to a comprehensive "market portfolio" that in principle can include not just traded financial assets, but also consumer durables, real estate and human capital. Even if we take a narrow view of the model and limit its purview to traded financial assets, is it

[1] Although every asset pricing model is a capital asset pricing model, the finance profession reserves the acronym CAPM for the specific model of Sharpe (1964), Lintner (1965) and Black (1972) discussed here. Thus, throughout the paper we refer to the Sharpe-Lintner-Black model as the CAPM.

■ *Eugene F. Fama is Robert R. McCormick Distinguished Service Professor of Finance, Graduate School of Business, University of Chicago, Chicago, Illinois. Kenneth R. French is Carl E. and Catherine M. Heidi Professor of Finance, Tuck School of Business, Dartmouth College, Hanover, New Hampshire. Their e-mail addresses are ⟨eugene.fama@gsb.uchicago.edu⟩ and ⟨kfrench@dartmouth.edu⟩, respectively.*

legitimate to limit further the market portfolio to U.S. common stocks (a typical choice), or should the market be expanded to include bonds, and other financial assets, perhaps around the world? In the end, we argue that whether the model's problems reflect weaknesses in the theory or in its empirical implementation, the failure of the CAPM in empirical tests implies that most applications of the model are invalid.

We begin by outlining the logic of the CAPM, focusing on its predictions about risk and expected return. We then review the history of empirical work and what it says about shortcomings of the CAPM that pose challenges to be explained by alternative models.

The Logic of the CAPM

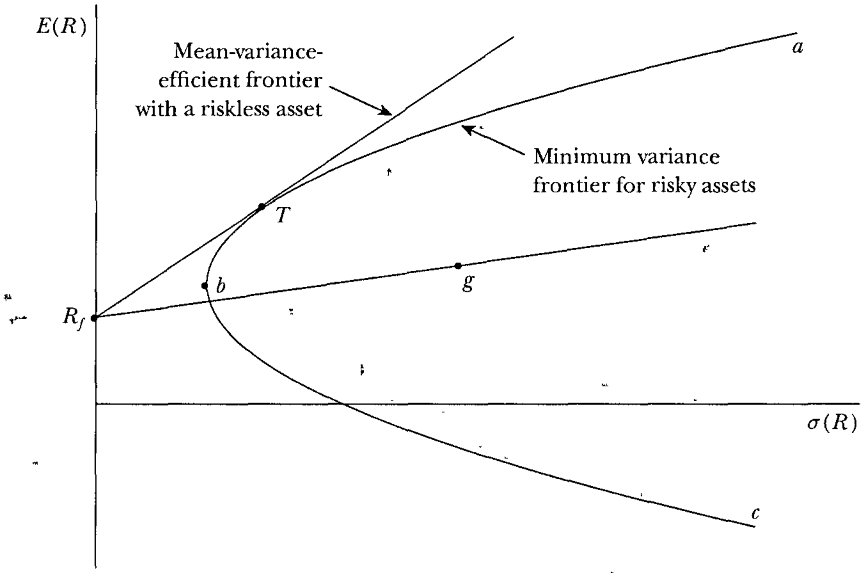
The CAPM builds on the model of portfolio choice developed by Harry Markowitz (1959). In Markowitz's model, an investor selects a portfolio at time $t - 1$ that produces a stochastic return at t. The model assumes investors are risk averse and, when choosing among portfolios, they care only about the mean and variance of their one-period investment return. As a result, investors choose "mean-variance-efficient" portfolios, in the sense that the portfolios 1) minimize the variance of portfolio return, given expected return, and 2) maximize expected return, given variance. Thus, the Markowitz approach is often called a "mean-variance model."

The portfolio model provides an algebraic condition on asset weights in mean-variance-efficient portfolios. The CAPM turns this algebraic statement into a testable prediction about the relation between risk and expected return by identifying a portfolio that must be efficient if asset prices are to clear the market of all assets.

Sharpe (1964) and Lintner (1965) add two key assumptions to the Markowitz model to identify a portfolio that must be mean-variance-efficient. The first assumption is *complete agreement*: given market clearing asset prices at $t - 1$, investors agree on the joint distribution of asset returns from $t - 1$ to t. And this distribution is the true one—that is, it is the distribution from which the returns we use to test the model are drawn. The second assumption is that there is *borrowing and lending at a risk-free rate*, which is the same for all investors and does not depend on the amount borrowed or lent.

Figure 1 describes portfolio opportunities and tells the CAPM story. The horizontal axis shows portfolio risk, measured by the standard deviation of portfolio return; the vertical axis shows expected return. The curve *abc*, which is called the minimum variance frontier, traces combinations of expected return and risk for portfolios of risky assets that minimize return variance at different levels of expected return. (These portfolios do not include risk-free borrowing and lending.) The tradeoff between risk and expected return for minimum variance portfolios is apparent. For example, an investor who wants a high expected return, perhaps at point *a*, must accept high volatility. At point *T*, the investor can have an interme-

Figure 1
Investment Opportunities



diate expected return with lower volatility. If there is no risk-free borrowing or lending, only portfolios above b along abc are mean-variance-efficient, since these portfolios also maximize expected return, given their return variances.

Adding risk-free borrowing and lending turns the efficient set into a straight line. Consider a portfolio that invests the proportion x of portfolio funds in a risk-free security and $1 - x$ in some portfolio g. If all funds are invested in the risk-free security—that is, they are loaned at the risk-free rate of interest—the result is the point R_f in Figure 1, a portfolio with zero variance and a risk-free rate of return. Combinations of risk-free lending and positive investment in g plot on the straight line between R_f and g. Points to the right of g on the line represent borrowing at the risk-free rate, with the proceeds from the borrowing used to increase investment in portfolio g. In short, portfolios that combine risk-free lending or borrowing with some risky portfolio g plot along a straight line from R_f through g in Figure 1.[2]

[2] Formally, the return, expected return and standard deviation of return on portfolios of the risk-free asset f and a risky portfolio g vary with x, the proportion of portfolio funds invested in f, as

$$R_p = xR_f + (1 - x)R_g,$$

$$E(R_p) = xR_f + (1 - x)E(R_g),$$

$$\sigma(R_p) = (1 - x)\sigma(R_g), \; x \leq 1.0,$$

which together imply that the portfolios plot along the line from R_f through g in Figure 1.

To obtain the mean-variance-efficient portfolios available with risk-free borrowing and lending, one swings a line from R_f in Figure 1 up and to the left as far as possible, to the tangency portfolio T. We can then see that all efficient portfolios are combinations of the risk-free asset (either risk-free borrowing or lending) and a single risky tangency portfolio, T. This key result is Tobin's (1958) "separation theorem."

The punch line of the CAPM is now straightforward. With complete agreement about distributions of returns, all investors see the same opportunity set (Figure 1), and they combine the same risky tangency portfolio T with risk-free lending or borrowing. Since all investors hold the same portfolio T of risky assets, it must be the value-weight market portfolio of risky assets. Specifically, each risky asset's weight in the tangency portfolio, which we now call M (for the "market"), must be the total market value of all outstanding units of the asset divided by the total market value of all risky assets. In addition, the risk-free rate must be set (along with the prices of risky assets) to clear the market for risk-free borrowing and lending.

In short, the CAPM assumptions imply that the market portfolio M must be on the minimum variance frontier if the asset market is to clear. This means that the algebraic relation that holds for any minimum variance portfolio must hold for the market portfolio. Specifically, if there are N risky assets,

$$\text{(Minimum Variance Condition for } M) \quad E(R_i) = E(R_{ZM}) + [E(R_M) - E(R_{ZM})]\beta_{iM}, \quad i = 1, \ldots, N.$$

In this equation, $E(R_i)$ is the expected return on asset i, and β_{iM}, the market beta of asset i, is the covariance of its return with the market return divided by the variance of the market return,

$$\text{(Market Beta)} \quad \beta_{iM} = \frac{\text{cov}(R_i, R_M)}{\sigma^2(R_M)}.$$

The first term on the right-hand side of the minimum variance condition, $E(R_{ZM})$, is the expected return on assets that have market betas equal to zero, which means their returns are uncorrelated with the market return. The second term is a risk premium—the market beta of asset i, β_{iM}, times the premium per unit of beta, which is the expected market return, $E(R_M)$, minus $E(R_{ZM})$.

Since the market beta of asset i is also the slope in the regression of its return on the market return, a common (and correct) interpretation of beta is that it measures the sensitivity of the asset's return to variation in the market return. But there is another interpretation of beta more in line with the spirit of the portfolio model that underlies the CAPM. The risk of the market portfolio, as measured by the variance of its return (the denominator of β_{iM}), is a weighted average of the covariance risks of the assets in M (the numerators of β_{iM} for different assets).

Thus, β_{iM} is the covariance risk of asset i in M measured relative to the average covariance risk of assets, which is just the variance of the market return.[3] In economic terms, β_{iM} is proportional to the risk each dollar invested in asset i contributes to the market portfolio.

The last step in the development of the Sharpe-Lintner model is to use the assumption of risk-free borrowing and lending to nail down $E(R_{ZM})$, the expected return on zero-beta assets. A risky asset's return is uncorrelated with the market return—its beta is zero—when the average of the asset's covariances with the returns on other assets just offsets the variance of the asset's return. Such a risky asset is riskless in the market portfolio in the sense that it contributes nothing to the variance of the market return.

When there is risk-free borrowing and lending, the expected return on assets that are uncorrelated with the market return, $E(R_{ZM})$, must equal the risk-free rate, R_f. The relation between expected return and beta then becomes the familiar Sharpe-Lintner CAPM equation,

$$\text{(Sharpe-Lintner CAPM)} \quad E(R_i) = R_f + [E(R_M) - R_f]\beta_{iM},\ i = 1, \ldots, N.$$

In words, the expected return on any asset i is the risk-free interest rate, R_f, plus a risk premium, which is the asset's market beta, β_{iM}, times the premium per unit of beta risk, $E(R_M) - R_f$.

Unrestricted risk-free borrowing and lending is an unrealistic assumption. Fischer Black (1972) develops a version of the CAPM without risk-free borrowing or lending. He shows that the CAPM's key result—that the market portfolio is mean-variance-efficient—can be obtained by instead allowing unrestricted short sales of risky assets. In brief, back in Figure 1, if there is no risk-free asset, investors select portfolios from along the mean-variance-efficient frontier from a to b. Market clearing prices imply that when one weights the efficient portfolios chosen by investors by their (positive) shares of aggregate invested wealth, the resulting portfolio is the market portfolio. The market portfolio is thus a portfolio of the efficient portfolios chosen by investors. With unrestricted short selling of risky assets, portfolios made up of efficient portfolios are themselves efficient. Thus, the market portfolio is efficient, which means that the minimum variance condition for M given above holds, and it is the expected return-risk relation of the Black CAPM.

The relations between expected return and market beta of the Black and Sharpe-Lintner versions of the CAPM differ only in terms of what each says about $E(R_{ZM})$, the expected return on assets uncorrelated with the market. The Black version says only that $E(R_{ZM})$ must be less than the expected market return, so the

[3] Formally, if x_{iM} is the weight of asset i in the market portfolio, then the variance of the portfolio's return is

$$\sigma^2(R_M) = Cov(R_M, R_M) = Cov\left(\sum_{i=1}^{N} x_{iM}R_i,\ R_M\right) = \sum_{i=1}^{N} x_{iM}Cov(R_i, R_M).$$

premium for beta is positive. In contrast, in the Sharpe-Lintner version of the model, $E(R_{ZM})$ must be the risk-free interest rate, R_f, and the premium per unit of beta risk is $E(R_M) - R_f$.

The assumption that short selling is unrestricted is as unrealistic as unrestricted risk-free borrowing and lending. If there is no risk-free asset and short sales of risky assets are not allowed, mean-variance investors still choose efficient portfolios—points above *b* on the *abc* curve in Figure 1. But when there is no short selling of risky assets and no risk-free asset, the algebra of portfolio efficiency says that portfolios made up of efficient portfolios are not typically efficient. This means that the market portfolio, which is a portfolio of the efficient portfolios chosen by investors, is not typically efficient. And the CAPM relation between expected return and market beta is lost. This does not rule out predictions about expected return and betas with respect to other efficient portfolios—if theory can specify portfolios that must be efficient if the market is to clear. But so far this has proven impossible.

In short, the familiar CAPM equation relating expected asset returns to their market betas is just an application to the market portfolio of the relation between expected return and portfolio beta that holds in any mean-variance-efficient portfolio. The efficiency of the market portfolio is based on many unrealistic assumptions, including complete agreement and either unrestricted risk-free borrowing and lending or unrestricted short selling of risky assets. But all interesting models involve unrealistic simplifications, which is why they must be tested against data.

Early Empirical Tests

Tests of the CAPM are based on three implications of the relation between expected return and market beta implied by the model. First, expected returns on all assets are linearly related to their betas, and no other variable has marginal explanatory power. Second, the beta premium is positive, meaning that the expected return on the market portfolio exceeds the expected return on assets whose returns are uncorrelated with the market return. Third, in the Sharpe-Lintner version of the model, assets uncorrelated with the market have expected returns equal to the risk-free interest rate, and the beta premium is the expected market return minus the risk-free rate. Most tests of these predictions use either cross-section or time-series regressions. Both approaches date to early tests of the model.

Tests on Risk Premiums

The early cross-section regression tests focus on the Sharpe-Lintner model's predictions about the intercept and slope in the relation between expected return and market beta. The approach is to regress a cross-section of average asset returns on estimates of asset betas. The model predicts that the intercept in these regressions is the risk-free interest rate, R_f, and the coefficient on beta is the expected return on the market in excess of the risk-free rate, $E(R_M) - R_f$.

Two problems in these tests quickly became apparent. First, estimates of beta for individual assets are imprecise, creating a measurement error problem when they are used to explain average returns. Second, the regression residuals have common sources of variation, such as industry effects in average returns. Positive correlation in the residuals produces downward bias in the usual ordinary least squares estimates of the standard errors of the cross-section regression slopes.

To improve the precision of estimated betas, researchers such as Blume (1970), Friend and Blume (1970) and Black, Jensen and Scholes (1972) work with portfolios, rather than individual securities. Since expected returns and market betas combine in the same way in portfolios, if the CAPM explains security returns it also explains portfolio returns.[4] Estimates of beta for diversified portfolios are more precise than estimates for individual securities. Thus, using portfolios in cross-section regressions of average returns on betas reduces the critical errors in variables problem. Grouping, however, shrinks the range of betas and reduces statistical power. To mitigate this problem, researchers sort securities on beta when forming portfolios; the first portfolio contains securities with the lowest betas, and so on, up to the last portfolio with the highest beta assets. This sorting procedure is now standard in empirical tests.

Fama and MacBeth (1973) propose a method for addressing the inference problem caused by correlation of the residuals in cross-section regressions. Instead of estimating a single cross-section regression of average monthly returns on betas, they estimate month-by-month cross-section regressions of monthly returns on betas. The times-series means of the monthly slopes and intercepts, along with the standard errors of the means, are then used to test whether the average premium for beta is positive and whether the average return on assets uncorrelated with the market is equal to the average risk-free interest rate. In this approach, the standard errors of the average intercept and slope are determined by the month-to-month variation in the regression coefficients, which fully captures the effects of residual correlation on variation in the regression coefficients, but sidesteps the problem of actually estimating the correlations. The residual correlations are, in effect, captured via repeated sampling of the regression coefficients. This approach also becomes standard in the literature.

Jensen (1968) was the first to note that the Sharpe-Lintner version of the

[4] Formally, if x_{ip}, $i = 1, \ldots, N$, are the weights for assets in some portfolio p, the expected return and market beta for the portfolio are related to the expected returns and betas of assets as

$$E(R_p) = \sum_{i=1}^{N} x_{ip} E(R_i), \text{ and } \beta_{pM} = \sum_{i=1}^{N} x_{ip} \beta_{pM}.$$

Thus, the CAPM relation between expected return and beta,

$$E(R_i) = E(R_f) + [E(R_M) - E(R_f)]\beta_{iM},$$

holds when asset i is a portfolio, as well as when i is an individual security.

relation between expected return and market beta also implies a time-series regression test. The Sharpe-Lintner CAPM says that the expected value of an asset's excess return (the asset's return minus the risk-free interest rate, $R_{it} - R_{ft}$) is completely explained by its expected CAPM risk premium (its beta times the expected value of $R_{Mt} - R_{ft}$). This implies that "Jensen's alpha," the intercept term in the time-series regression,

$$\text{(Time-Series Regression)} \quad R_{it} - R_{ft} = \alpha_i + \beta_{iM}(R_{Mt} - R_{ft}) + \varepsilon_{it},$$

is zero for each asset.

The early tests firmly reject the Sharpe-Lintner version of the CAPM. There is a positive relation between beta and average return, but it is too "flat." Recall that, in cross-section regressions, the Sharpe-Lintner model predicts that the intercept is the risk-free rate and the coefficient on beta is the expected market return in excess of the risk-free rate, $E(R_M) - R_f$. The regressions consistently find that the intercept is greater than the average risk-free rate (typically proxied as the return on a one-month Treasury bill), and the coefficient on beta is less than the average excess market return (proxied as the average return on a portfolio of U.S. common stocks minus the Treasury bill rate). This is true in the early tests, such as Douglas (1968), Black, Jensen and Scholes (1972), Miller and Scholes (1972), Blume and Friend (1973) and Fama and MacBeth (1973), as well as in more recent cross-section regression tests, like Fama and French (1992).

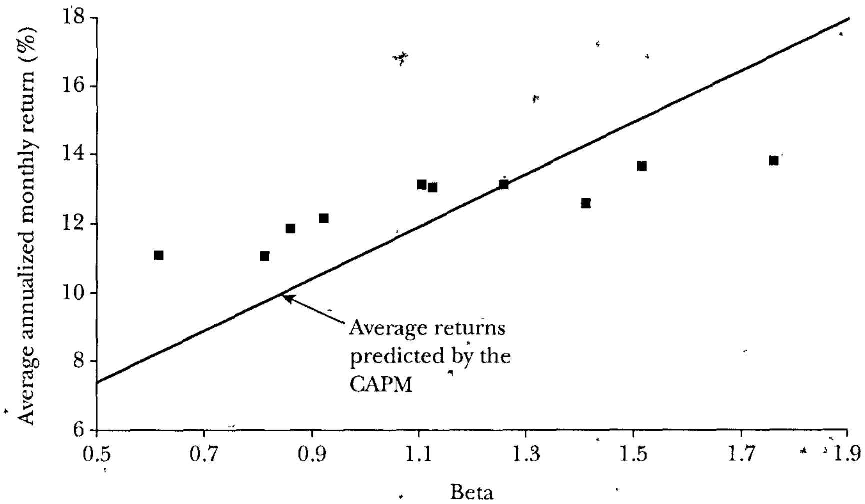
The evidence that the relation between beta and average return is too flat is confirmed in time-series tests, such as Friend and Blume (1970), Black, Jensen and Scholes (1972) and Stambaugh (1982). The intercepts in time-series regressions of excess asset returns on the excess market return are positive for assets with low betas and negative for assets with high betas.

Figure 2 provides an updated example of the evidence. In December of each year, we estimate a preranking beta for every NYSE (1928–2003), AMEX (1963–2003) and NASDAQ (1972–2003) stock in the CRSP (Center for Research in Security Prices of the University of Chicago) database, using two to five years (as available) of prior monthly returns.[5] We then form ten value-weight portfolios based on these preranking betas and compute their returns for the next twelve months. We repeat this process for each year from 1928 to 2003. The result is 912 monthly returns on ten beta-sorted portfolios. Figure 2 plots each portfolio's average return against its postranking beta, estimated by regressing its monthly returns for 1928–2003 on the return on the CRSP value-weight portfolio of U.S. common stocks.

The Sharpe-Lintner CAPM predicts that the portfolios plot along a straight

[5] To be included in the sample for year t, a security must have market equity data (price times shares outstanding) for December of $t - 1$, and CRSP must classify it as ordinary common equity. Thus, we exclude securities such as American Depository Receipts (ADRs) and Real Estate Investment Trusts (REITs).

Figure 2
Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on Prior Beta, 1928–2003



line, with an intercept equal to the risk-free rate, R_f, and a slope equal to the expected excess return on the market, $E(R_M) - R_f$. We use the average one-month Treasury bill rate and the average excess CRSP market return for 1928–2003 to estimate the predicted line in Figure 2. Confirming earlier evidence, the relation between beta and average return for the ten portfolios is much flatter than the Sharpe-Lintner CAPM predicts. The returns on the low beta portfolios are too high, and the returns on the high beta portfolios are too low. For example, the predicted return on the portfolio with the lowest beta is 8.3 percent per year; the actual return is 11.1 percent. The predicted return on the portfolio with the highest beta is 16.8 percent per year; the actual is 13.7 percent.

Although the observed premium per unit of beta is lower than the Sharpe-Lintner model predicts, the relation between average return and beta in Figure 2 is roughly linear. This is consistent with the Black version of the CAPM, which predicts only that the beta premium is positive. Even this less restrictive model, however, eventually succumbs to the data.

Testing Whether Market Betas Explain Expected Returns

The Sharpe-Lintner and Black versions of the CAPM share the prediction that the market portfolio is mean-variance-efficient. This implies that differences in expected return across securities and portfolios are entirely explained by differences in market beta; other variables should add nothing to the explanation of expected return. This prediction plays a prominent role in tests of the CAPM. In the early work, the weapon of choice is cross-section regressions.

In the framework of Fama and MacBeth (1973), one simply adds predetermined explanatory variables to the month-by-month cross-section regressions of returns on beta. If all differences in expected return are explained by beta, the average slopes on the additional variables should not be reliably different from zero. Clearly, the trick in the cross-section regression approach is to choose specific additional variables likely to expose any problems of the CAPM prediction that, because the market portfolio is efficient, market betas suffice to explain expected asset returns.

For example, in Fama and MacBeth (1973) the additional variables are squared market betas (to test the prediction that the relation between expected return and beta is linear) and residual variances from regressions of returns on the market return (to test the prediction that market beta is the only measure of risk needed to explain expected returns). These variables do not add to the explanation of average returns provided by beta. Thus, the results of Fama and MacBeth (1973) are consistent with the hypothesis that their market proxy—an equal-weight portfolio of NYSE stocks—is on the minimum variance frontier.

The hypothesis that market betas completely explain expected returns can also be tested using time-series regressions. In the time-series regression described above (the excess return on asset i regressed on the excess market return), the intercept is the difference between the asset's average excess return and the excess return predicted by the Sharpe-Lintner model, that is, beta times the average excess market return. If the model holds, there is no way to group assets into portfolios whose intercepts are reliably different from zero. For example, the intercepts for a portfolio of stocks with high ratios of earnings to price and a portfolio of stocks with low earning-price ratios should both be zero. Thus, to test the hypothesis that market betas suffice to explain expected returns, one estimates the time-series regression for a set of assets (or portfolios) and then jointly tests the vector of regression intercepts against zero. The trick in this approach is to choose the left-hand-side assets (or portfolios) in a way likely to expose any shortcoming of the CAPM prediction that market betas suffice to explain expected asset returns.

In early applications, researchers use a variety of tests to determine whether the intercepts in a set of time-series regressions are all zero. The tests have the same asymptotic properties, but there is controversy about which has the best small sample properties. Gibbons, Ross and Shanken (1989) settle the debate by providing an F-test on the intercepts that has exact small-sample properties. They also show that the test has a simple economic interpretation. In effect, the test constructs a candidate for the tangency portfolio T in Figure 1 by optimally combining the market proxy and the left-hand-side assets of the time-series regressions. The estimator then tests whether the efficient set provided by the combination of this tangency portfolio and the risk-free asset is reliably superior to the one obtained by combining the risk-free asset with the market proxy alone. In other words, the Gibbons, Ross and Shanken statistic tests whether the market proxy is the tangency portfolio in the set of portfolios that can be constructed by combining the market portfolio with the specific assets used as dependent variables in the time-series regressions.

Enlightened by this insight of Gibbons, Ross and Shanken (1989), one can see a similar interpretation of the cross-section regression test of whether market betas suffice to explain expected returns. In this case, the test is whether the additional explanatory variables in a cross-section regression identify patterns in the returns on the left-hand-side assets that are not explained by the assets' market betas. This amounts to testing whether the market proxy is on the minimum variance frontier that can be constructed using the market proxy and the left-hand-side assets included in the tests.

An important lesson from this discussion is that time-series and cross-section regressions do not, strictly speaking, test the CAPM. What is literally tested is whether a specific proxy for the market portfolio (typically a portfolio of U.S. common stocks) is efficient in the set of portfolios that can be constructed from it and the left-hand-side assets used in the test. One might conclude from this that the CAPM has never been tested, and prospects for testing it are not good because 1) the set of left-hand-side assets does not include all marketable assets, and 2) data for the true market portfolio of all assets are likely beyond reach (Roll, 1977; more on this later). But this criticism can be leveled at tests of any economic model when the tests are less than exhaustive or when they use proxies for the variables called for by the model.

The bottom line from the early cross-section regression tests of the CAPM, such as Fama and MacBeth (1973), and the early time-series regression tests, like Gibbons (1982) and Stambaugh (1982), is that standard market proxies seem to be on the minimum variance frontier. That is, the central predictions of the Black version of the CAPM, that market betas suffice to explain expected returns and that the risk premium for beta is positive, seem to hold. But the more specific prediction of the Sharpe-Lintner CAPM that the premium per unit of beta is the expected market return minus the risk-free interest rate is consistently rejected.

The success of the Black version of the CAPM in early tests produced a consensus that the model is a good description of expected returns. These early results, coupled with the model's simplicity and intuitive appeal, pushed the CAPM to the forefront of finance.

Recent Tests

Starting in the late 1970s, empirical work appears that challenges even the Black version of the CAPM. Specifically, evidence mounts that much of the variation in expected return is unrelated to market beta.

The first blow is Basu's (1977) evidence that when common stocks are sorted on earnings-price ratios, future returns on high E/P stocks are higher than predicted by the CAPM. Banz (1981) documents a size effect: when stocks are sorted on market capitalization (price times shares outstanding), average returns on small stocks are higher than predicted by the CAPM. Bhandari (1988) finds that high debt-equity ratios (book value of debt over the market value of equity, a measure of leverage) are associated with returns that are too high relative to their market betas.

Finally, Statman (1980) and Rosenberg, Reid and Lanstein (1985) document that stocks with high book-to-market equity ratios (B/M, the ratio of the book value of a common stock to its market value) have high average returns that are not captured by their betas.

There is a theme in the contradictions of the CAPM summarized above. Ratios involving stock prices have information about expected returns missed by market betas. On reflection, this is not surprising. A stock's price depends not only on the expected cash flows it will provide, but also on the expected returns that discount expected cash flows back to the present. Thus, in principle, the cross-section of prices has information about the cross-section of expected returns. (A high expected return implies a high discount rate and a low price.) The cross-section of stock prices is, however, arbitrarily affected by differences in scale (or units). But with a judicious choice of scaling variable X, the ratio X/P can reveal differences in the cross-section of expected stock returns. Such ratios are thus prime candidates to expose shortcomings of asset pricing models—in the case of the CAPM, shortcomings of the prediction that market betas suffice to explain expected returns (Ball, 1978). The contradictions of the CAPM summarized above suggest that earnings-price, debt-equity and book-to-market ratios indeed play this role.

Fama and French (1992) update and synthesize the evidence on the empirical failures of the CAPM. Using the cross-section regression approach, they confirm that size, earnings-price, debt-equity and book-to-market ratios add to the explanation of expected stock returns provided by market beta. Fama and French (1996) reach the same conclusion using the time-series regression approach applied to portfolios of stocks sorted on price ratios. They also find that different price ratios have much the same information about expected returns. This is not surprising given that price is the common driving force in the price ratios, and the numerators are just scaling variables used to extract the information in price about expected returns.

Fama and French (1992) also confirm the evidence (Reinganum, 1981; Stambaugh, 1982; Lakonishok and Shapiro, 1986) that the relation between average return and beta for common stocks is even flatter after the sample periods used in the early empirical work on the CAPM. The estimate of the beta premium is, however, clouded by statistical uncertainty (a large standard error). Kothari, Shanken and Sloan (1995) try to resuscitate the Sharpe-Lintner CAPM by arguing that the weak relation between average return and beta is just a chance result. But the strong evidence that other variables capture variation in expected return missed by beta makes this argument irrelevant. If betas do not suffice to explain expected returns, the market portfolio is not efficient, and the CAPM is dead in its tracks. Evidence on the size of the market premium can neither save the model nor further doom it.

The synthesis of the evidence on the empirical problems of the CAPM provided by Fama and French (1992) serves as a catalyst, marking the point when it is generally acknowledged that the CAPM has potentially fatal problems. Research then turns to explanations.

One possibility is that the CAPM's problems are spurious, the result of data dredging—publication-hungry researchers scouring the data and unearthing contradictions that occur in specific samples as a result of chance. A standard response to this concern is to test for similar findings in other samples. Chan, Hamao and Lakonishok (1991) find a strong relation between book-to-market equity (B/M) and average return for Japanese stocks. Capaul, Rowley and Sharpe (1993) observe a similar B/M effect in four European stock markets and in Japan. Fama and French (1998) find that the price ratios that produce problems for the CAPM in U.S. data show up in the same way in the stock returns of twelve non-U.S. major markets, and they are present in emerging market returns. This evidence suggests that the contradictions of the CAPM associated with price ratios are not sample specific.

Explanations: Irrational Pricing or Risk

Among those who conclude that the empirical failures of the CAPM are fatal, two stories emerge. On one side are the behavioralists. Their view is based on evidence that stocks with high ratios of book value to market price are typically firms that have fallen on bad times, while low B/M is associated with growth firms (Lakonishok, Shleifer and Vishny, 1994; Fama and French, 1995). The behavioralists argue that sorting firms on book-to-market ratios exposes investor overreaction to good and bad times. Investors overextrapolate past performance, resulting in stock prices that are too high for growth (low B/M) firms and too low for distressed (high B/M, so-called value) firms. When the overreaction is eventually corrected, the result is high returns for value stocks and low returns for growth stocks. Proponents of this view include DeBondt and Thaler (1987), Lakonishok, Shleifer and Vishny (1994) and Haugen (1995).

The second story for explaining the empirical contradictions of the CAPM is that they point to the need for a more complicated asset pricing model. The CAPM is based on many unrealistic assumptions. For example, the assumption that investors care only about the mean and variance of one-period portfolio returns is extreme. It is reasonable that investors also care about how their portfolio return covaries with labor income and future investment opportunities, so a portfolio's return variance misses important dimensions of risk. If so, market beta is not a complete description of an asset's risk, and we should not be surprised to find that differences in expected return are not completely explained by differences in beta. In this view, the search should turn to asset pricing models that do a better job explaining average returns.

Merton's (1973) intertemporal capital asset pricing model (ICAPM) is a natural extension of the CAPM. The ICAPM begins with a different assumption about investor objectives. In the CAPM, investors care only about the wealth their portfolio produces at the end of the current period. In the ICAPM, investors are concerned not only with their end-of-period payoff, but also with the opportunities they will have to consume or invest the payoff. Thus, when choosing a portfolio at time $t-1$, ICAPM investors consider how their wealth at t might vary with future *state variables*, including labor income, the prices of consumption goods and the nature of portfolio opportunities at t, and expectations about the labor income, consumption and investment opportunities to be available after t.

Like CAPM investors, ICAPM investors prefer high expected return and low return variance. But ICAPM investors are also concerned with the covariances of portfolio returns with state variables. As a result, optimal portfolios are "multifactor efficient," which means they have the largest possible expected returns, given their return variances and the covariances of their returns with the relevant state variables.

Fama (1996) shows that the ICAPM generalizes the logic of the CAPM. That is, if there is risk-free borrowing and lending or if short sales of risky assets are allowed, market clearing prices imply that the market portfolio is multifactor efficient. Moreover, multifactor efficiency implies a relation between expected return and beta risks, but it requires additional betas, along with a market beta, to explain expected returns.

An ideal implementation of the ICAPM would specify the state variables that affect expected returns. Fama and French (1993) take a more indirect approach, perhaps more in the spirit of Ross's (1976) arbitrage pricing theory. They argue that though size and book-to-market equity are not themselves state variables, the higher average returns on small stocks and high book-to-market stocks reflect unidentified state variables that produce undiversifiable risks (covariances) in returns that are not captured by the market return and are priced separately from market betas. In support of this claim, they show that the returns on the stocks of small firms covary more with one another than with returns on the stocks of large firms, and returns on high book-to-market (value) stocks covary more with one another than with returns on low book-to-market (growth) stocks. Fama and French (1995) show that there are similar size and book-to-market patterns in the covariation of fundamentals like earnings and sales.

Based on this evidence, Fama and French (1993, 1996) propose a three-factor model for expected returns,

$$\text{(Three-Factor Model)} \quad E(R_{it}) - R_{ft} = \beta_{iM}[E(R_{Mt}) - R_{ft}] + \beta_{is}E(SMB_t) + \beta_{ih}E(HML_t).$$

In this equation, SMB_t (small minus big) is the difference between the returns on diversified portfolios of small and big stocks, HML_t (high minus low) is the difference between the returns on diversified portfolios of high and low B/M stocks, and the betas are slopes in the multiple regression of $R_{it} - R_{ft}$ on $R_{Mt} - R_{ft}$, SMB_t and HML_t.

For perspective, the average value of the market premium $R_{Mt} - R_{ft}$ for 1927–2003 is 8.3 percent per year, which is 3.5 standard errors from zero. The average values of SMB_t, and HML_t are 3.6 percent and 5.0 percent per year, and they are 2.1 and 3.1 standard errors from zero. All three premiums are volatile, with annual standard deviations of 21.0 percent $(R_{Mt} - R_{ft})$, 14.6 percent (SMB_t) and 14.2 percent (HML_t) per year. Although the average values of the premiums are large, high volatility implies substantial uncertainty about the true expected premiums.

One implication of the expected return equation of the three-factor model is that the intercept α_i in the time-series regression,

$$R_{it} - R_{ft} = \alpha_i + \beta_{iM}(R_{Mt} - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \varepsilon_{it},$$

is zero for all assets i. Using this criterion, Fama and French (1993, 1996) find that the model captures much of the variation in average return for portfolios formed on size, book-to-market equity and other price ratios that cause problems for the CAPM. Fama and French (1998) show that an international version of the model performs better than an international CAPM in describing average returns on portfolios formed on scaled price variables for stocks in 13 major markets.

The three-factor model is now widely used in empirical research that requires a model of expected returns. Estimates of α_i from the time-series regression above are used to calibrate how rapidly stock prices respond to new information (for example, Loughran and Ritter, 1995; Mitchell and Stafford, 2000). They are also used to measure the special information of portfolio managers, for example, in Carhart's (1997) study of mutual fund performance. Among practitioners like Ibbotson Associates, the model is offered as an alternative to the CAPM for estimating the cost of equity capital.

From a theoretical perspective, the main shortcoming of the three-factor model is its empirical motivation. The small-minus-big (SMB) and high-minus-low (HML) explanatory returns are not motivated by predictions about state variables of concern to investors. Instead they are brute force constructs meant to capture the patterns uncovered by previous work on how average stock returns vary with size and the book-to-market equity ratio.

But this concern is not fatal. The ICAPM does not require that the additional portfolios used along with the market portfolio to explain expected returns "mimic" the relevant state variables. In both the ICAPM and the arbitrage pricing theory, it suffices that the additional portfolios are well diversified (in the terminology of Fama, 1996, they are multifactor minimum variance) and that they are sufficiently different from the market portfolio to capture covariation in returns and variation in expected returns missed by the market portfolio. Thus, adding diversified portfolios that capture covariation in returns and variation in average returns left unexplained by the market is in the spirit of both the ICAPM and the Ross's arbitrage pricing theory.

The behavioralists are not impressed by the evidence for a risk-based explanation of the failures of the CAPM. They typically concede that the three-factor model captures covariation in returns missed by the market return and that it picks up much of the size and value effects in average returns left unexplained by the CAPM. But their view is that the average return premium associated with the model's book-to-market factor—which does the heavy lifting in the improvements to the CAPM—is itself the result of investor overreaction that happens to be correlated across firms in a way that just looks like a risk story. In short, in the behavioral view, the market tries to set CAPM prices, and violations of the CAPM are due to mispricing.

The conflict between the behavioral irrational pricing story and the rational risk story for the empirical failures of the CAPM leaves us at a timeworn impasse. Fama (1970) emphasizes that the hypothesis that prices properly reflect available information must be tested in the context of a model of expected returns, like the CAPM. Intuitively, to test whether prices are rational, one must take a stand on what the market is trying to do in setting prices—that is, what is risk and what is the relation between expected return and risk? When tests reject the CAPM, one cannot say whether the problem is its assumption that prices are rational (the behavioral view) or violations of other assumptions that are also necessary to produce the CAPM (our position).

Fortunately, for some applications, the way one uses the three-factor model does not depend on one's view about whether its average return premiums are the rational result of underlying state variable risks, the result of irrational investor behavior or sample specific results of chance. For example, when measuring the response of stock prices to new information or when evaluating the performance of managed portfolios, one wants to account for known patterns in returns and average returns for the period examined, whatever their source. Similarly, when estimating the cost of equity capital, one might be unconcerned with whether expected return premiums are rational or irrational since they are in either case part of the opportunity cost of equity capital (Stein, 1996). But the cost of capital is forward looking, so if the premiums are sample specific they are irrelevant.

The three-factor model is hardly a panacea. Its most serious problem is the momentum effect of Jegadeesh and Titman (1993). Stocks that do well relative to the market over the last three to twelve months tend to continue to do well for the next few months, and stocks that do poorly continue to do poorly. This momentum effect is distinct from the value effect captured by book-to-market equity and other price ratios. Moreover, the momentum effect is left unexplained by the three-factor model, as well as by the CAPM. Following Carhart (1997), one response is to add a momentum factor (the difference between the returns on diversified portfolios of short-term winners and losers) to the three-factor model. This step is again legitimate in applications where the goal is to abstract from known patterns in average returns to uncover information-specific or manager-specific effects. But since the momentum effect is short-lived, it is largely irrelevant for estimates of the cost of equity capital.

Another strand of research points to problems in both the three-factor model and the CAPM. Frankel and Lee (1998), Dechow, Hutton and Sloan (1999), Piotroski (2000) and others show that in portfolios formed on price ratios like book-to-market equity, stocks with higher expected cash flows have higher average returns that are not captured by the three-factor model or the CAPM. The authors interpret their results as evidence that stock prices are irrational, in the sense that they do not reflect available information about expected profitability.

In truth, however, one can't tell whether the problem is bad pricing or a bad asset pricing model. A stock's price can always be expressed as the present value of expected future cash flows discounted at the expected return on the stock (Campbell and Shiller, 1989; Vuolteenaho, 2002). It follows that if two stocks have the same price, the one with higher expected cash flows must have a higher expected return. This holds true whether pricing is rational or irrational. Thus, when one observes a positive relation between expected cash flows and expected returns that is left unexplained by the CAPM or the three-factor model, one can't tell whether it is the result of irrational pricing or a misspecified asset pricing model.

The Market Proxy Problem

Roll (1977) argues that the CAPM has never been tested and probably never will be. The problem is that the market portfolio at the heart of the model is theoretically and empirically elusive. It is not theoretically clear which assets (for example, human capital) can legitimately be excluded from the market portfolio, and data availability substantially limits the assets that are included. As a result, tests of the CAPM are forced to use proxies for the market portfolio, in effect testing whether the proxies are on the minimum variance frontier. Roll argues that because the tests use proxies, not the true market portfolio, we learn nothing about the CAPM.

We are more pragmatic. The relation between expected return and market beta of the CAPM is just the minimum variance condition that holds in any efficient portfolio, applied to the market portfolio. Thus, if we can find a market proxy that is on the minimum variance frontier, it can be used to describe differences in expected returns, and we would be happy to use it for this purpose. The strong rejections of the CAPM described above, however, say that researchers have not uncovered a reasonable market proxy that is close to the minimum variance frontier. If researchers are constrained to reasonable proxies, we doubt they ever will.

Our pessimism is fueled by several empirical results. Stambaugh (1982) tests the CAPM using a range of market portfolios that include, in addition to U.S. common stocks, corporate and government bonds, preferred stocks, real estate and other consumer durables. He finds that tests of the CAPM are not sensitive to expanding the market proxy beyond common stocks, basically because the volatility of expanded market returns is dominated by the volatility of stock returns.

One need not be convinced by Stambaugh's (1982) results since his market proxies are limited to U.S. assets. If international capital markets are open and asset prices conform to an international version of the CAPM, the market portfolio should include international assets. Fama and French (1998) find, however, that betas for a global stock market portfolio cannot explain the high average returns observed around the world on stocks with high book-to-market or high earnings-price ratios.

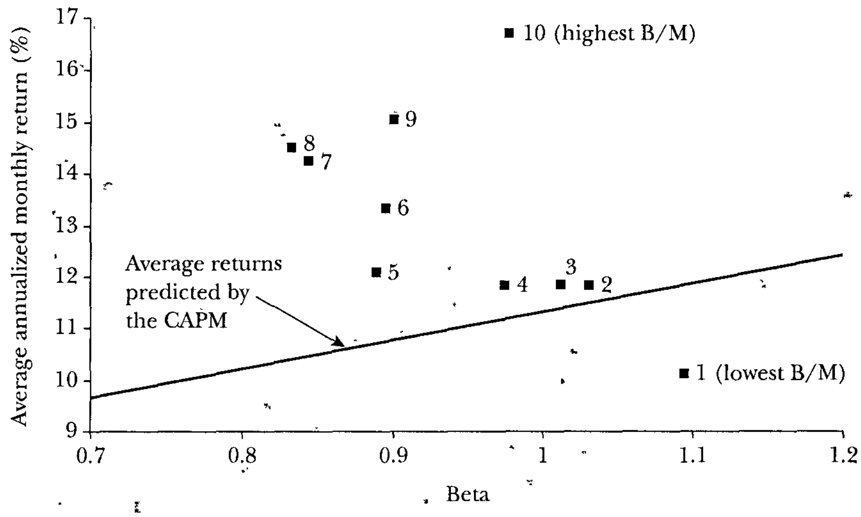
A major problem for the CAPM is that portfolios formed by sorting stocks on price ratios produce a wide range of average returns, but the average returns are not positively related to market betas (Lakonishok, Shleifer and Vishny, 1994; Fama and French, 1996, 1998). The problem is illustrated in Figure 3, which shows average returns and betas (calculated with respect to the CRSP value-weight portfolio of NYSE, AMEX and NASDAQ stocks) for July 1963 to December 2003 for ten portfolios of U.S. stocks formed annually on sorted values of the book-to-market equity ratio (B/M).[6]

Average returns on the B/M portfolios increase almost monotonically, from 10.1 percent per year for the lowest B/M group (portfolio 1) to an impressive 16.7 percent for the highest (portfolio 10). But the positive relation between beta and average return predicted by the CAPM is notably absent. For example, the portfolio with the lowest book-to-market ratio has the highest beta but the lowest average return. The estimated beta for the portfolio with the highest book-to-market ratio and the highest average return is only 0.98. With an average annualized value of the riskfree interest rate, R_f, of 5.8 percent and an average annualized market premium, $R_M - R_f$, of 11.3 percent, the Sharpe-Lintner CAPM predicts an average return of 11.8 percent for the lowest B/M portfolio and 11.2 percent for the highest, far from the observed values, 10.1 and 16.7 percent. For the Sharpe-Lintner model to "work" on these portfolios, their market betas must change dramatically, from 1.09 to 0.78 for the lowest B/M portfolio and from 0.98 to 1.98 for the highest. We judge it unlikely that alternative proxies for the market portfolio will produce betas and a market premium that can explain the average returns on these portfolios.

It is always possible that researchers will redeem the CAPM by finding a reasonable proxy for the market portfolio that is on the minimum variance frontier. We emphasize, however, that this possibility cannot be used to justify the way the CAPM is currently applied. The problem is that applications typically use the same

[6] Stock return data are from CRSP, and book equity data are from Compustat and the Moody's Industrials, Transportation, Utilities and Financials manuals. Stocks are allocated to ten portfolios at the end of June of each year t (1963 to 2003) using the ratio of book equity for the fiscal year ending in calendar year $t - 1$, divided by market equity at the end of December of $t - 1$. Book equity is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Depending on availability, we use the redemption, liquidation or par value (in that order) to estimate the book value of preferred stock. Stockholders' equity is the value reported by Moody's or Compustat, if it is available. If not, we measure stockholders' equity as the book value of common equity plus the par value of preferred stock or the book value of assets minus total liabilities (in that order). The portfolios for year t include NYSE (1963–2003), AMEX (1963–2003) and NASDAQ (1972–2003) stocks with positive book equity in $t - 1$ and market equity (from CRSP) for December of $t - 1$ and June of t. The portfolios exclude securities CRSP does not classify as ordinary common equity. The breakpoints for year t use only securities that are on the NYSE in June of year t.

Figure 3
Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on B/M, 1963–2003



market proxies, like the value-weight portfolio of U.S. stocks, that lead to rejections of the model in empirical tests. The contradictions of the CAPM observed when such proxies are used in tests of the model show up as bad estimates of expected returns in applications; for example, estimates of the cost of equity capital that are too low (relative to historical average returns) for small stocks and for stocks with high book-to-market equity ratios. In short, if a market proxy does not work in tests of the CAPM, it does not work in applications.

Conclusions

The version of the CAPM developed by Sharpe (1964) and Lintner (1965) has never been an empirical success. In the early empirical work, the Black (1972) version of the model, which can accommodate a flatter tradeoff of average return for market beta, has some success. But in the late 1970s, research begins to uncover variables like size, various price ratios and momentum that add to the explanation of average returns provided by beta. The problems are serious enough to invalidate most applications of the CAPM.

For example, finance textbooks often recommend using the Sharpe-Lintner CAPM risk-return relation to estimate the cost of equity capital. The prescription is to estimate a stock's market beta and combine it with the risk-free interest rate and the average market risk premium to produce an estimate of the cost of equity. The typical market portfolio in these exercises includes just U.S. common stocks. But empirical work, old and new, tells us that the relation between beta and average return is flatter than predicted by the Sharpe-Lintner version of the CAPM. As a result, CAPM estimates of the cost of equity for high beta stocks are too high (relative to historical average returns) and estimates for low beta stocks are too low (Friend and Blume, 1970). Similarly, if the high average returns on value stocks (with high book-to-market ratios) imply high expected returns, CAPM cost of equity estimates for such stocks are too low.[7]

The CAPM is also often used to measure the performance of mutual funds and other managed portfolios. The approach, dating to Jensen (1968), is to estimate the CAPM time-series regression for a portfolio and use the intercept (Jensen's alpha) to measure abnormal performance. The problem is that, because of the empirical failings of the CAPM, even passively managed stock portfolios produce abnormal returns if their investment strategies involve tilts toward CAPM problems (Elton, Gruber, Das and Hlavka, 1993). For example, funds that concentrate on low beta stocks, small stocks or value stocks will tend to produce positive abnormal returns relative to the predictions of the Sharpe-Lintner CAPM, even when the fund managers have no special talent for picking winners.

The CAPM, like Markowitz's (1952, 1959) portfolio model on which it is built, is nevertheless a theoretical tour de force. We continue to teach the CAPM as an introduction to the fundamental concepts of portfolio theory and asset pricing, to be built on by more complicated models like Merton's (1973) ICAPM. But we also warn students that despite its seductive simplicity, the CAPM's empirical problems probably invalidate its use in applications.

■ *We gratefully acknowledge the comments of John Cochrane, George Constantinides, Richard Leftwich, Andrei Shleifer, René Stulz and Timothy Taylor.*

[7] The problems are compounded by the large standard errors of estimates of the market premium and of betas for individual stocks, which probably suffice to make CAPM estimates of the cost of equity rather meaningless, even if the CAPM holds (Fama and French, 1997; Pastor and Stambaugh, 1999). For example, using the U.S. Treasury bill rate as the risk-free interest rate and the CRSP value-weight portfolio of publicly traded U.S. common stocks, the average value of the equity premium $R_{Mt} - R_{ft}$ for 1927–2003 is 8.3 percent per year, with a standard error of 2.4 percent. The two standard error range thus runs from 3.5 percent to 13.1 percent, which is sufficient to make most projects appear either profitable or unprofitable. This problem is, however, hardly special to the CAPM. For example, expected returns in all versions of Merton's (1973) ICAPM include a market beta and the expected market premium. Also, as noted earlier the expected values of the size and book-to-market premiums in the Fama-French three-factor model are also estimated with substantial error.

References

Ball, Ray. 1978. "Anomalies in Relationships Between Securities' Yields and Yield-Surrogates." *Journal of Financial Economics.* 6:2, pp. 103–26.

Banz, Rolf W. 1981. "The Relationship Between Return and Market Value of Common Stocks." *Journal of Financial Economics.* 9:1, pp. 3–18.

Basu, Sanjay. 1977. "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis." *Journal of Finance.* 12:3, pp. 129–56.

Bhandari, Laxmi Chand. 1988. "Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence." *Journal of Finance.* 43:2, pp. 507–28.

Black, Fischer. 1972. "Capital Market Equilibrium with Restricted Borrowing." *Journal of Business.* 45:3, pp. 444–54.

Black, Fischer, Michael C. Jensen and Myron Scholes. 1972. "The Capital Asset Pricing Model: Some Empirical Tests," in *Studies in the Theory of Capital Markets.* Michael C. Jensen, ed. New York: Praeger, pp. 79–121.

Blume, Marshall. 1970. "Portfolio Theory: A Step Towards its Practical Application." *Journal of Business.* 43:2, pp. 152–74.

Blume, Marshall and Irwin Friend. 1973. "A New Look at the Capital Asset Pricing Model." *Journal of Finance.* 28:1, pp. 19–33.

Campbell, John Y. and Robert J. Shiller. 1989. "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors." *Review of Financial Studies.* 1:3, pp. 195–228.

Capaul, Carlo, Ian Rowley and William F. Sharpe. 1993. "International Value and Growth Stock Returns." *Financial Analysts Journal.* January/February, 49, pp. 27–36.

Carhart, Mark M. 1997. "On Persistence in Mutual Fund Performance." *Journal of Finance.* 52:1, pp. 57–82.

Chan, Louis K.C., Yasushi Hamao and Josef Lakonishok. 1991. "Fundamentals and Stock Returns in Japan." *Journal of Finance.* 46:5, pp. 1739–789.

DeBondt, Werner F. M. and Richard H. Thaler. 1987. "Further Evidence on Investor Overreaction and Stock Market Seasonality." *Journal of Finance.* 42:3, pp. 557–81.

Dechow, Patricia M., Amy P. Hutton and Richard G. Sloan. 1999. "An Empirical Assessment of the Residual Income Valuation Model." *Journal of Accounting and Economics.* 26:1, pp. 1–34.

Douglas, George W. 1968. *Risk in the Equity Markets: An Empirical Appraisal of Market Efficiency.* Ann Arbor, Michigan: University Microfilms, Inc.

Elton, Edwin J., Martin J. Gruber, Sanjiv Das and Matt Hlavka. 1993. "Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios." *Review of Financial Studies.* 6:1, pp. 1–22.

Fama, Eugene F. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance.* 25:2, pp. 383–417.

Fama, Eugene F. 1996. "Multifactor Portfolio Efficiency and Multifactor Asset Pricing." *Journal of Financial and Quantitative Analysis.* 31:4, pp. 441–65.

Fama, Eugene F. and Kenneth R. French. 1992. "The Cross-Section of Expected Stock Returns." *Journal of Finance.* 47:2, pp. 427–65.

Fama, Eugene F. and Kenneth R. French. 1993. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics.* 33:1, pp. 3–56.

Fama, Eugene F. and Kenneth R. French. 1995. "Size and Book-to-Market Factors in Earnings and Returns." *Journal of Finance.* 50:1, pp. 131–55.

Fama, Eugene F. and Kenneth R. French. 1996. "Multifactor Explanations of Asset Pricing Anomalies." *Journal of Finance.* 51:1, pp. 55–84.

Fama, Eugene F. and Kenneth R. French. 1997. "Industry Costs of Equity." *Journal of Financial Economics.* 43:2 pp. 153–93.

Fama, Eugene F. and Kenneth R. French. 1998. "Value Versus Growth: The International Evidence." *Journal of Finance.* 53:6, pp. 1975–999.

Fama, Eugene F. and James D. MacBeth. 1973. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy.* 81:3, pp. 607–36.

Frankel, Richard and Charles M.C. Lee. 1998. "Accounting Valuation, Market Expectation, and Cross-Sectional Stock Returns." *Journal of Accounting and Economics.* 25:3 pp. 283–319.

Friend, Irwin and Marshall Blume. 1970. "Measurement of Portfolio Performance under Uncertainty." *American Economic Review.* 60:4, pp. 607–36.

Gibbons, Michael R. 1982. "Multivariate Tests of Financial Models: A New Approach." *Journal of Financial Economics.* 10:1, pp. 3–27.

Gibbons, Michael R., Stephen A. Ross and Jay Shanken. 1989. "A Test of the Efficiency of a Given Portfolio." *Econometrica.* 57:5, pp. 1121–152.

Haugen, Robert. 1995. *The New Finance: The*

Case against Efficient Markets. Englewood Cliffs, N.J.: Prentice Hall.

Jegadeesh, Narasimhan and Sheridan Titman. 1993. "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency." *Journal of Finance.* 48:1, pp. 65–91.

Jensen, Michael C. 1968. "The Performance of Mutual Funds in the Period 1945–1964." *Journal of Finance.* 23:2, pp. 389–416.

Kothari, S. P., Jay Shanken and Richard G. Sloan. 1995. "Another Look at the Cross-Section of Expected Stock Returns." *Journal of Finance.* 50:1, pp. 185–224.

Lakonishok, Josef and Alan C. Shapiro. 1986. Systemaitc Risk, Total Risk, and Size as Determinants of Stock Market Returns." *Journal of Banking and Finance.* 10:1, pp. 115–32.

Lakonishok, Josef, Andrei Shleifer and Robert W. Vishny. 1994. "Contrarian Investment, Extrapolation, and Risk." *Journal of Finance.* 49:5, pp. 1541–578.

Lintner, John. 1965. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economics and Statistics.* 47:1, pp. 13–37.

Loughran, Tim and Jay. R. Ritter. 1995. "The New Issues Puzzle." *Journal of Finance.* 50:1, pp. 23–51.

Markowitz, Harry. 1952. "Portfolio Selection." *Journal of Finance.* 7:1, pp. 77–99.

Markowitz, Harry. 1959. *Portfolio Selection: Efficient Diversification of Investments.* Cowles Foundation Monograph No. 16. New York: John Wiley & Sons, Inc.

Merton, Robert C. 1973. "An Intertemporal Capital Asset Pricing Model." *Econometrica.* 41:5, pp. 867–87.

Miller, Merton and Myron Scholes. 1972. "Rates of Return in Relation to Risk: A Reexamination of Some Recent Findings," in *Studies in the Theory of Capital Markets.* Michael C. Jensen, ed. New York: Praeger, pp. 47–78.

Mitchell, Mark L. and Erik Stafford. 2000. "Managerial Decisions and Long-Term Stock Price Performance." *Journal of Business.* 73:3, pp. 287–329.

Pastor, Lubos and Robert F. Stambaugh. 1999. "Costs of Equity Capital and Model Mispricing." *Journal of Finance.* 54:1, pp. 67–121.

Piotroski, Joseph D. 2000. "Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers." *Journal of Accounting Research.* 38:Supplement, pp. 1–51.

Reinganum, Marc R. 1981. "A New Empirical Perspective on the CAPM." *Journal of Financial and Quantitative Analysis.* 16:4, pp. 439–62.

Roll, Richard. 1977. "A Critique of the Asset Pricing Theory's Tests' Part I: On Past and Potential Testability of the Theory." *Journal of Financial Economics.* 4:2, pp. 129–76.

Rosenberg, Barr, Kenneth Reid and Ronald Lanstein. 1985. "Persuasive Evidence of Market Inefficiency." *Journal of Portfolio Management.* Spring, 11, pp. 9–17.

Ross, Stephen A. 1976. "The Arbitrage Theory of Capital Asset Pricing." *Journal of Economic Theory.* 13:3, pp. 341–60.

Sharpe, William F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." *Journal of Finance.* 19:3, pp. 425–42.

Stambaugh, Robert F. 1982. "On The Exclusion of Assets from Tests of the Two-Parameter Model: A Sensitivity Analysis." *Journal of Financial Economics.* 10:3, pp. 237–68.

Stattman, Dennis. 1980. "Book Values and Stock Returns." *The Chicago MBA: A Journal of Selected Papers.* 4, pp. 25–45.

Stein, Jeremy. 1996. "Rational Capital Budgeting in an Irrational World." *Journal of Business.* 69:4, pp. 429–55.

Tobin, James. 1958. "Liquidity Preference as Behavior Toward Risk." *Review of Economic Studies.* 25:2, pp. 65–86.

Vuolteenaho, Tuomo. 2002. "What Drives Firm Level Stock Returns?" *Journal of Finance.* 57:1, pp. 233–64.

This article has been cited by:

1. Moawia Alghalith. 2009. Alternative theory of asset pricing. *Journal of Asset Management* **10**:2, 73-74. [CrossRef]
2. Jean-Luc Besson, Michel M Dacorogna, Paolo de Martin, Michael Kastenholz, Michael Moller. 2009. How Much Capital Does a Reinsurance Need?. *The Geneva Papers on Risk and Insurance Issues and Practice* **34**:2, 159-174. [CrossRef]
3. Caroline Fohlin, Steffen Reinhold. 2009. Common stock returns in the pre-WWI Berlin Stock Exchange. *Cliometrica* . [CrossRef]
4. C. Emre Alper, Oya Pinar Ardic, Salih Fendoglu. 2009. THE ECONOMICS OF THE UNCOVERED INTEREST PARITY CONDITION FOR EMERGING MARKETS. *Journal of Economic Surveys* **23**:1, 115-138. [CrossRef]
5. Stuart Hyde, Mohamed Sherif. 2009. Tests of the conditional asset pricing model: further evidence from the cross-section of stock returns. *International Journal of Finance & Economics* n/a-n/a. [CrossRef]
6. Lerzan Aksoy, Bruce Cooil, Christopher Groening, Timothy L Keiningham, Atakan Yalçın. 2008. The Long-Term Stock Market Valuation of Customer Satisfaction. *Journal of Marketing* **72**:4, 105-122. [CrossRef]
7. Dimo Dimov, Gordon Murray. 2008. Determinants of the Incidence and Scale of Seed Capital Investments by Venture Capital Firms. *Small Business Economics* **30**:2, 127-152. [CrossRef]
8. Julius Hemminki, Vesa Puttonen. 2008. Fundamental indexation in Europe. *Journal of Asset Management* **8**:6, 401-405. [CrossRef]
9. Sudipta Basu. 2008. Panel on Big Unanswered Questions in Accounting—Synopsis. *Accounting Horizons* **22**:4, 449. [CrossRef]
10. Chyi Lin Lee, Jon Robinson, Richard Reed. 2008. Listed property trusts and downside systematic risk sensitivity. *Journal of Property Investment & Finance* **26**:4, 304-328. [CrossRef]
11. Michael J. Mauboussin. 2008. The Wisdom and Whims of the Collective. *CFA Institute Conference Proceedings Quarterly* **24**:4, 1-8. [CrossRef]
12. Peter Blair Henry. 2007. Capital Account Liberalization: Theory, Evidence, and SpeculationCapital Account Liberalization: Theory, Evidence, and Speculation. *Journal of Economic Literature* **45**:4, 887-935. [Abstract] [View PDF article] [PDF with links]
13. Sven Husmann, Andreas Stephan. 2007. On estimating an asset's implicit beta. *Journal of Futures Markets* **27**:10, 961-979. [CrossRef]
14. Graham Bornholt. 2007. Extending the capital asset pricing model: the reward beta approach. *Accounting & Finance* **47**:1, 69-83. [CrossRef]
15. Roland Burgman, Göran Roos. 2007. The importance of intellectual capital reporting: evidence and implications. *Journal of Intellectual Capital* **8**:1, 7-51. [CrossRef]
16. Gerhard Kristandl, Nick Bontis. 2007. The impact of voluntary disclosure on cost of equity capital estimates in a temporal setting. *Journal of Intellectual Capital* **8**:4, 577-594. [CrossRef]
17. Kevin J. Stiroh. 2007. New Evidence on the Determinants of Bank Risk. *Journal of Financial Services Research* **30**:3, 237-263. [CrossRef]
18. Holger Daske. 2006. Economic Benefits of Adopting IFRS or US-GAAP - Have the Expected Cost of Equity Capital Really Decreased?. *Journal of Business Finance <html_ent glyph="@amp;" ascii="&"/> Accounting*, ahead of print060428035417008. [CrossRef]

19. Holger Daske. 2006. Economic Benefits of Adopting IFRS or US-GAAP - Have the Expected Cost of Equity Capital Really Decreased?. *Journal of Business Finance <html_ent glyph="@amp;" ascii="&"/> Accounting* **33**:3-4, 329-373. [CrossRef]

20. Peter L. Bernstein. 2005. Capital Ideas: From the Past to the Future. *Financial Analysts Journal* **61**:6, 55-59. [CrossRef]

21. Vijay Gondhalekar, C.R. Narayanaswamy, Sridhar SundaramThe Long-Term Risk Effects of the Gramm-Leach-Bliley Act (GLBA) on the Financial Services Industry 361-377. [CrossRef]

WATER UTILITY INDUSTRY

INDUSTRY TIMELINESS: 54 (of 96)

Water utility stocks have been met with some resistance since our January review. Indeed, all but a single issue covered in our *Survey* gave back some ground. And the exception advanced less than 10% in price. As a result, the group, as a whole, has slipped into the bottom half of the pack for Timeliness after residing in the top quartile last time around.

Wall Street's apprehension is not surprising, given that most of the companies reported disappointing earnings in the fourth-quarter. (First-quarter results were not released as of the day of this report). Indeed, revenue growth, although healthy thanks to continued progress on the regulatory front, seemed to fall short of expectations. Earnings, meanwhile, were further frustrated by the increasing costs of doing business.

The group's growth prospects going forward are not overly impressive either. With the exception of *American Water Works*, not a single stock in this industry stands out for Timeliness or 3- to 5-year price appreciation potential. The companies here face stiff headwinds on the cost front, as many of the country's water systems are aging and increasing in the need for repairs and maintenance. Financial constraints are of further concern, with the financial moves that are likely to be made in order to maintain infrastructures dilutive to share-net growth.

Insatiable Thirst

As an essential part of life for all forms of life, demand for water is undeniable. As a result, the delivery of this liquid, which water utilities are responsible for, is nearly as vital. Indeed, water providers are responsible for the safe and timely delivery of water to millions of Americans every day. Demand for water ought to continue to grow along with the population, creating the most favorable landscape for companies operating in this area.

Favorable Backing

Although the services of most utilities reach across state lines nowadays, state regulatory boards have been put in place to maintain a balance of power between providers and customers. Among their main responsibilities is to review and rule on general rate case requests submitted by providers looking to recover costs. That being said, it is easy to recognize the importance that they play to utilities. Many boards have become far more business friendly in recent years, auguring well for utilities.

Deleterious Costs

Despite a more favorable regulatory climate, providers still have troubles facing them. Infrastructures are decaying rapidly and, in many cases, need complete overhauls. The costs to make the repairs are exorbitant many operating in this space do not have the funds on hand to foot the bill. Indeed, most are strapped for cash and will have to look to outside financiers to keep up. Although consolidation trends present unique opportunities for those with the financial capabilities to throw their hat in the ring, such as *Aqua America*, others are just trying to stay afloat. Unfortunately, the financing costs to stay in business, whether it be additional share or debt offerings, will probably drown most and dilute shareholder gains moving ahead.

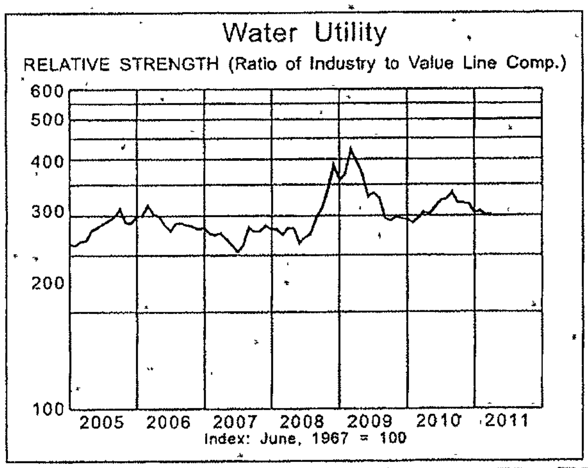
Conclusion

The bulk of the stock's in this group have lost any luster they had from a growth perspective. Although the share-price weakness makes for more attractive entry points, only *American States Water* stands out for appreciation potential. That said, the dividends of many help make for worthwhile total return appeal in some cases. Again *American States Water*, along with *American Water Works*, and newcomer *SJW Corp.*, top the list on this account. (Readers can see more about *SJW* in the pages that follow). That said, we do think that there are better options out there for investors looking to add an income-producing stock to the portfolios. The average Electric Utility stock, for example generates better income. Plus, the financial constraints mentioned above sit in the back of our heads when it come to thinking about the payout down the road. Elsewhere *Aqua America* is an interesting issue. Its acquisition-friendly ways, especially its recent venture into the solar power arena, may interest more risk-tolerant investors. As always, we advise potential investors to take a more thorough look at the individual stocks before making any monetary commitments.

Andre J. Costanza

Composite Statistics: Water Utility Industry

2007	2008	2009	2010	2011	2012		14-16
3691.8	3613.3	4137 7	4510	4785	5050	Revenues ($mill)	5925
d168.8	372.0	399.6	490	535	490	Net Profit ($mill)	750
NMF	NMF	38.2%	39.0%	39.0%	39.0%	Income Tax Rate	39.0%
NMF	NMF	1 5%	5.0%	7.0%	8.0%	AFUDC % to Net Profit	10.0%
51.1%	51.1%	52.3%	52.0%	52.0%	51.0%	Long-Term Debt Ratio	51.0%
48 9%	48 9%	47 7%	48.0%	48.0%	49.0%	Common Equity Ratio	49.0%
13134.6	12795.2	13744 0	14300	14950	15475	Total Capital ($mill)	16785
14542.8	14542 8	15611.0	17500	18250	18975	Net Plant ($mill)	21500
.3%	4.4%	4 4%	5.0%	5.5%	6.0%	Return on Total Cap'l	8.0%
NMF	6 0%	6.5%	7.0%	7.5%	8.0%	Return on Shr. Equity	9.5%
NMF	6.0%	6 5%	7.0%	7.5%	8.0%	Return on Com Equity	9.5%
NMF	3.0%	2.2%	3.0%	3.0%	3.5%	Retained to Com Eq	4.5%
NMF	50%	67%	65%	62%	57%	All Div'ds to Net Prof	55%
NMF	20 7	19 3		*Bold figures are Value Line estimates*		Avg Ann'l P/E Ratio	21.0
NMF	1.25	1.29				Relative P/E Ratio	1 40
2.2%	2.4%	3.5%				Avg Ann'l Div'd Yield	2.6%



UTILITY STOCKS AND THE SIZE EFFECT: AN EMPIRICAL ANALYSIS

Annie Wong*

I. Introduction

The objective of this study is to examine whether the firm size effect exists in the public utility industry. Public utilities are regulated by federal, municipal, and state authorities. Every state has a public service commission with board and varying powers. Often their task is to estimate a fair rate of return to a utility's stockholders in order to determine the rates charged by the utility. The legal principles underlying rate regulation are that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks," and that the return to a utility should be sufficient to "attract capital and maintain credit worthiness." However, difficulties arise from the ambiguous interpretation of the legal definition of *fair and reasonable rate of return* to an equity owner.

Some finance researchers have suggested that the Capital Asset Pricing Model (CAPM) should be used in rate regulation because the CAPM beta can serve as a risk measure, thus making risk comparisons possible. This approach is consistent with the spirit of a Supreme Court ruling that equity owners sharing similar level of risk should be compensated by similar rate of return.

The empirical studies of Banz (1981) and Reinganum (1981) showed that small firms tend to earn higher returns than large firms after adjusting for beta. This phenomenon leads to the proposition that firm size is a proxy for omitted risk factors in determining stock returns. Barry and Brown (1984) and Brauer (1986) suggested that the omitted risk factor could be the differential information environment between small and large firms. Their argument is based on the fact that investors often have less publicly available information to assess the future cash flows of small firms than that of large firms. Therefore, an additional risk premium should be included to determine the appropriate rate of return to shareholders of small firms.

The samples used in prior studies are dominated by industrial firms, no one has examined the size effect in public utilities. The objective of this study is to extend the empirical findings of the existing studies by investigating whether the size effect is also present in the utility industry. The findings of this study have important implications for investors, public utility firms, and state regulatory agencies. If the size effect does exist in the utility industry, this would suggest that the size factor should be considered when the CAPM is being used to determine the fair rate of return for public utilities in regulatory proceedings.

II. Information Environment of Public Utilities

In general, utilities differ from industrials in that utilities are heavily regulated and they follow similar accounting procedures. A public utility's financial reporting is mainly regulated by the Securities and Exchange Commission (SEC) and the Federal Energy Regulatory Commission (FERC). Under the Public Utility Holding Company Act of 1935, the SEC is empowered to regulate the holding company systems of electric and gas utilities. The Act requires registration of public utility holding companies with the SEC. Only under strict conditions would the purchase, sale or issuance of securities by these holding companies be permitted. The purpose of the Act is to keep the SEC and investors informed of the financial conditions of these firms. Moreover, the FERC is in charge of the interstate operations of electric and gas companies. It requires utilities to follow the accounting procedures set forth in its Uniform Systems of Accounts. In particular, electric and gas utilities must request their Certified Public Accountants to certify that certain schedules in the financial reports are in conformity with the Commission's accounting requirements. These detailed reports are submitted annually and are open to the public.

*Western Connecticut State University. The author thanks Philip Perry, Robert Hagerman, Eric Press, the anonymous referee, and Clay Singleton for their helpful comments.

The FERC requires public utilities to keep accurate records of revenues, operating costs, depreciation expenses, and investment in plant and equipment. Specific financial accounting standards for these purposes are also issued by the Financial Accounting Standards Board (FASB). Uniformity is required so that utilities are not subject to different accounting regulations in each of the states in which they operate. The ultimate objective is to achieve comparability in financial reporting so that factual matters are not hidden from the public view by accounting flexibility.

Other regulatory reports tend to provide additional financial information about utilities. For example, utilities are required to file the FERC Form No. 1 with the state commission. This form is designed for state commissions to collect financial and operational information about utilities, and serves as a source for statistical reports published by state commissions.

Unlike industriales, a utility's earnings are predetermined to a certain extent. Before allowed earnings requests are approved, a utility's performance is analyzed in depth by the state commission, interest groups, and other witnesses. This process leads to the disclosure of substantial amount of information.

III. Hypothesis and Objective

Due to the Act of 1935, the Uniform Systems of Accounts, the uniform disclosure requirements, and the predetermined earnings, all utilities are reasonably homogeneous with respect to the information available to the public. Barry and Brown (1984) and Brauer (1986) suggested that the difference of risk-adjusted returns between small and large firms is due to their differential information environment. Assuming that the differential information hypothesis is true, then uniformity of information availability among utility firms would suggest that the size effect should not be observed in the public utility industry. The objective of this paper is to provide a test of the size effect in public utilities.

IV. Methodology

1. Sample and Data

To test for the size effect, a sample of public utilities and a sample of industriales matched by equity value are formed so that their results can be compared. Companies in both samples are listed on the Center for Research in Security Prices (CRSP) Daily and Monthly Returns files. The utility sample includes 152 electric and gas companies. For each utility in the sample, two industrial firms with similar firm size (one is slightly larger and the other is slightly smaller than the utility) are selected. Thus, the industrial sample includes 304 non-regulated firms.

The size variable is defined as the natural logarithm of market value of equity at the beginning of each year. Both the equally-weighted and value-weighted CRSP indices are employed as proxies for the market returns. Daily, weekly and monthly returns are used. The Fama-MacBeth (1973) procedure is utilized to examine the relation between risk-adjusted returns and firm size.

2. Research Design

All utilities in the sample are ranked according to the equity size at the beginning of the year, and the distribution is broken down into deciles. Decile one contains the stocks with the lowest market values while decile ten contains those with the highest market values. These portfolios are denoted by MV_1, $MV_2, \ldots,$ and MV_{10}, respectively.

The combinations of the ten portfolios are updated annually. In the year after a portfolio is formed, equally-weighted portfolio returns are computed by combining the returns of the component stocks within the portfolio. The betas for each portfolio at year t, β_p's, are estimated by regressing the previous five years of portfolio returns on market returns:

$$\tilde{R}_{pt} = \alpha_p + \beta_p \tilde{R}_{mt} + \tilde{U}_{pt} \qquad (1)$$

where

R_{pt} = periodic return in year t on portfolio p

R_{mt} = periodic market return in year t

U_{pt} = disturbance term.

Banz (1981) applied both the ordinary and generalized least squares regressions to estimate β; and concluded that the results are essentially identical (p.8). Since adjusting for heteroscedasticity does not necessarily lead to more efficient estimators, the ordinary least squares procedures are used in this study to estimate β in equation (1).

The following cross-sectional regression is then run for the portfolios to estimate γ_i, i = 0, 1, and 2:

$$R_{pt} = \gamma_0 + \gamma_1\hat{\beta}_{pt} + \gamma_2\hat{S}_{pt} + U_{pt} \quad (2)$$

where

$\hat{\beta}_{pt}$ = estimated beta for portfolio p at year t, t=1968, ..., 1987

$\hat{S}_{pt}$ = mean of the logarithm of firm size in portfolio p at the beginning of year t

U_{pt} = disturbance term.

Depending on whether daily, weekly or monthly returns are used, a portfolio's average return changes periodically while its beta and size only change once a year. The γ_1 and γ_2 coefficients are estimated over the following four subperiods: 1968-72, 1973-77, 1978-82 and 1983-1987. If portfolio betas can fully account for the differences in returns, one would expect the average coefficient for the beta variable to be positive and for the size variable to be zero. A t-statistic will be used to test the hypothesis. The coefficients of a matched sample are also examined so that the results between industrial and utility firms can be compared.

V. Analysis of Results

1. Equity Value of the Utility Portfolios

The mean equity values of the ten size-based utility portfolios are reported in Table 1. Panels A and B present the average firm size of these portfolios at the beginning and end of the test period, 1968-1987. The first interesting observation from Table 1 is that the difference in magnitude between the smallest and the largest market value utility portfolios is tremendous. In Panel A, the average size of MV_1 is about $31 million while that of MV_{10} is over $1.4 billion. In Panel B, that is twenty years later, they are $62 million and $5.2 billion, respectively. Another interesting finding is that there is a substantial increase in average firm size from MV_9 to MV_{10}. Since these two findings are consistent over the entire test period, the average portfolio market values for interim years are not reported. These results are similar to the empirical evidence provided by Reinganum (1981).

The utility sample in this study contains 152 firms whereas Reinganum's sample contains 535 firms that are mainly industrial companies. Two conclusions may be drawn from the results of the Reinganum study and this one. First, utilities and industriales are similar in the sense that their market values vary over a wide spectrum. Second, the fact that there is a huge jump in firm size from MV_9 to MV_{10} indicates that the distribution of firm size is positively skewed. To correct for the skewness problem, the natural logarithm of the mean equity value of each portfolio is calculated. This variable is then used in later regressions instead of the actual mean equity value.

2. Betas of the Utility and Industrial Samples

The betas based on monthly, weekly and daily returns are reported for the utility and industrial samples. For simplicity, they will be referred to as monthly, weekly, and daily betas. In all cases, five years of returns are used to estimate the systematic risk. The betas estimated over the 1963-67 time period are used to proxy for the betas in 1968, which is the beginning of the test period. By the same token, the betas obtained from the time period 1982-86 are used as proxies for the betas in 1987, which is the end of the test period.

The betas from using the equally-weighted and value-weighted indices are calculated in order to check whether the results are affected by the choice of market index. Since the results are similar, only those obtained from the equally-weighted index are reported and analyzed.

Table 2 reports the monthly, weekly and daily betas of the two samples at the beginning and end of the test period. Panel A shows the various betas of the industrial portfolios. Two conclusions may be drawn. First, in the 1960's, smaller market value portfolios tend to have relatively larger betas. This is consistent with the empirical findings by Banz (1981) and Reinganum (1981). Second, this trend seems to vanish in the 1980's, especially when weekly and daily returns are used.

The betas of the utility portfolios are presented in Panel B. The table shows that none of the utility betas are greater than 0.71. A comparison between Panels A and B reveals that utility portfolios are relatively less risky than industrial portfolios after controlling for firm size. The comparison also reveals that, unlike industrial stocks, betas of the utility portfolios are not related to the market values of equity.

The negative correlation between firm size and beta in the industrial sample may introduce a multicolinearity problem in estimating equation (2). Banz (p.11) had addressed this issue and concluded that the test results are not sensitive to the multicolinearity problem. For the utility sample, this problem does not exist.

3. Tests on the Coefficients of Beta and Size

The beta and firm size are used to estimate γ_1 and γ_2 in equation (2). A t-statistic is used to test if the mean values of the gammas are significantly different from zero. The tests were performed for four 5-year periods which are reported in Table 3. The mean of the gammas and their t-statistic are presented in Panel A for the utilities and in Panel B for the industrial firms.

The empirical results for the utility sample are reported in Panel A of Table 3. When monthly returns are used, 60 regressions were run to obtain 60 pairs of gammas for each of the 5-year periods. When daily returns are used, over 1200 regressions were run for each period to obtain the gammas. The results are similar: in all of the time periods tested, none of the average coefficients for beta and size are significantly different from zero. When weekly returns are used, 260 pairs of gammas were obtained. The average coefficients for beta are not significant in any test period, and the average coefficients for size are not significant in three of the test periods. For the test period of 1978-82, the average coefficient for size is significantly negative at a 5% level.

The test results for the industrial sample are reported in Panel B of Table 3. When monthly returns are used, the average coefficient estimates for size and beta are significant and have the expected sign only in the 1983-87 test period. When weekly returns are used, only the size variable is significantly negative in the 1978-82 period. When daily returns are used, the coefficient estimates for betas and size are not significant at any conventional level.

According to the CAPM, beta is the sole determinant of stock returns. It is expected that the coefficient for beta is significantly positive. However, the empirical findings reported in this study and in Fama and French (1992) only provide weak support for beta in explaining stock returns. The empirical findings in this study also suggest that the size effect varies over time. It is not unusual to document the firm size effect at certain time periods but not at others. Banz (1981) found that the size effect is not stable over time with substantial differences in the magnitude of the coefficient of the size factor (p.9, Table 1). Brown, Kleidon and Marsh (1983) not only have shown that size effect is not constant over time but also have reported a reversal of the size anomaly for certain years.

The research design of this study allows us to keep the sample, test period, and methodology the same with the holding-period being the only variable. The size effect is documented for the industrial sample in one of the four test periods when monthly returns are used and in another when weekly returns are used. When daily returns are used, no size effect is observed. For the utility sample, the size effect is significant in only one test period when weekly returns are used. When monthly and daily returns are used, no size effect is found. Therefore, this study concludes that the size effect is not only time-period specific but also holding-period specific.

VI. Concluding Remarks

The fact that the two samples show different, though weak, results indicates that utility and industrial stocks do not share the same characteristics. First, given firm size, utility stocks are consistently less risky than industrial stocks. Second, industrial betas tend to decrease with firm size but utility betas do not. These findings may be attributed to the fact that all public utilities operate in an environment with regional monopolistic power and regulated financial structure. As a result, the business and financial risks are very similar among the utilities regardless of their sizes. Therefore, utility betas would not necessarily be expected to be related to firm size.

The objective of this study is to examine if the size effect exists in the utility industry. After controlling for equity values, there is some weak evidence that firm size is a missing factor from the CAPM for the industrial but not for the utility stocks. This implies that although the size phenomenon has been strongly documented for the industriales, the findings suggest that there is no need to adjust for the firm size in utility rate regulations.

References

Banz, R.W. "The Relationship Between Return and Market Value of Common Stocks," *Journal of Financial Economics*, (March 1981): 3-18.

Barry, C.B. and S.J. Brown. "Differential Information and the Small Firm Effect," *Journal of Financial Economics*, (1984): 283-294.

Brauer, G.A. "Using Jump-Diffusion Return Models to Measure Differential Information by Firm

Size," *Journal of Financial and Quantitative Analysis*, (December 1986): 447-458.

Brown, P., A.W. Kleidon, and T.A. Marsh. "New Evidence on the Nature and Size Related Anomalies in Stock Prices," *Journal of Financial Economics*, (1983): 33-56.

Fama, E.F. and K.R. French. "The Cross-Section of Expected Stock Returns," *Journal of Finance*, (June 1992): 427-465.

Fama, E.F. and J.D. MacBeth. "Risk Return and Equilibrium: Empirical Tests," *Journal of Political Economy*, (May/June 1973): 607-636.

Reinganum, M.R. "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings' Yields and Market Values," *Journal of Financial Economics*, (March 1981): 19-46.

Table 1

Average Equity Size of the Utility Portfolios at the Beginning and End of the Test Period
(Dollar figures in millions)

	A: Beginning (1968)	B: End (1987)
MV_1	$31	$62
MV_2	$77	$177
MV_3	$113	$334
MV_4	$161	$475
MV_5	$220	$715
MV_6	$334	$957
MV_7	$437	$1,279
MV_8	$505	$1,805
MV_9	$791	$2,665
MV_{10}	$1,447	$5,399

Table 2

Betas of the Two Samples at the Beginning and End of the Test Period

	Monthly Betas		Weekly Betas		Daily Betas	
	1963-67	1982-86	1963-67	1982-86	1963-67	1982-86
Panel A: Industrial Firms						
MV_1	0.89	1.00	1.15	0.95	1.11	0.92
MV_2	0.94	0.87	1.07	1.01	1.14	1.01
MV_3	0.88	0.82	1.12	0.86	1.14	1.04
MV_4	0.69	0.74	1.00	0.83	1.03	0.86
MV_5	0.73	0.80	1.05	0.96	1.13	1.01
MV_6	0.66	0.82	1.03	1.01	1.05	1.04
MV_7	0.64	0.81	0.97	1.04	0.98	1.09
MV_8	0.62	0.75	0.97	1.11	1.00	1.20
MV_9	0.52	0.78	0.84	1.06	0.94	1.16
MV_{10}	0.43	0.65	0.78	1.01	0.86	1.22
Panel B: Public Utilities						
MV_1	0.30	0.37	0.31	0.43	0.30	0.40
MV_2	0.28	0.38	0.37	0.47	0.36	0.44
MV_3	0.22	0.42	0.33	0.42	0.31	0.49
MV_4	0.27	0.35	0.36	0.52	0.34	0.54
MV_5	0.25	0.45	0.37	0.61	0.35	0.62
MV_6	0.25	0.41	0.39	0.54	0.40	0.65
MV_7	0.20	0.35	0.34	0.54	0.37	0.63
MV_8	0.17	0.38	0.34	0.65	0.33	0.68
MV_9	0.19	0.34	0.35	0.60	0.34	0.71
MV_{10}	0.18	0.29	0.38	0.59	0.39	0.71

Table 3

Tests on the Mean Coefficients of Beta (γ_1) and Size (γ_2)

$$R_{pt} = \gamma_{ot} + \gamma_{1t}\hat{\beta}_{pt} + \gamma_{2t}\hat{S}_{pt} + U_{pt}$$

Returns Used:		Monthly (t-value)	Weekly (t-value)	Daily (t-value)
Panel A: Utility Sample				
1968-72	γ_1	-0.46% (-0.26)	-0.32% (-0.42)	-0.02% (-0.18)
	γ_2	-0.07% (-0.78)	-0.01% (-0.51)	-0.00% (-0.46)
1973-77	γ_1	-0.28% (-0.13)	0.14% (0.14)	-0.03% (-0.21)
	γ_2	-0.11% (-0.70)	-0.03% (-0.67)	-0.00% (-0.53)
1978-82	γ_1	0.55% (0.36)	0.54% (1.00)	0.05% (0.43)
	γ_2	-0.10% (-0.75)	-0.05% (-1.71)*	-0.01% (-1.60)
1983-87	γ_1	1.74% (1.28)	-0.24% (-0.51)	-0.02% (-0.18)
	γ_2	-0.16% (-1.54)	-0.03% (-0.86)	-0.01% (-0.63)
Panel B: Industrial Sample				
1968-72	γ_1	-0.36% (-0.27)	-0.28% (-0.55)	-0.02% (-0.32)
	γ_2	0.07% (0.43)	-0.01% (-0.19)	0.00% (0.51)
1973-77	γ_1	1.34% (0.64)	-0.23% (-0.31)	0.14% (1.45)
	γ_2	-0.01% (-0.06)	-0.04% (-0.85)	-0.00% (-0.64)
1978-82	γ_1	-0.84% (-0.28)	-0.56% (-0.91)	-0.09% (-0.81)
	γ_2	-0.29% (-0.75)	-0.01% (-1.72)*	-0.00% (-1.33)
1983-87	γ_1	2.51% (1.83)*	0.34% (0.64)	0.11% (1.40)
	γ_2	-0.25% (-1.90)*	-0.01% (-0.43)	0.00% (0.14)

* Significant at the 5% level based on a one-tailed test.

 OTS Exhibit No. 1
WP-I Schedule No. 7
Page 1 of 2

SICCODE.com™
THE WORLDWIDE BUSINESS DIRECTORY

- LOG IN   LOG OUT
- EDIT Your PROFILE
- EDIT Your SIC Codes
- EDIT Your Products

MAIN MENU
- HOME
- BUY PRODUCTS
- ABOUT SICCODE
- ADVERTISE WITH US
- WHAT'S A SIC CODE
- ZIP/AREA CODES
- FREE LEGAL FORMS
- SIC to NAICS CODES
- SURPLUS MARKET
- STOCK QUOTES
- WEATHER
- SIC Descriptions

Acquisition Business Research Links
- EXCLUDED PARTIES LIST SYSTEM
- PRODUCT SERVICE CODES
- NAICS CODES
- FED BizOpps
- CAGE CODES
- BUREAU OF LABOR STATISTICS
- DUNS NUMBER SEARCH
- LOCATION CODES - PLACE OF PERFORMANCE
- SERVICE CONTRACT WAGE RATES
- DAVIS BACON WAGE RATES

SEARCH   GO ?
ADVANCED   KEYWORDS or SIC   PRODUCTS   COMPANY

Advanced Search
Your **Company** search resulted in 6 matches.
Displaying 1 to 6

Electric Gas & Sanitary Services + (49)

ECI-Electronic Communications Inc. - Fairdale KY 40118 US
Equipment repair for the communications industry. Light duty construction assistance, special projects, equipment modifications and installations for the utility industry. Provider of reverse sensing saftey equipment for fleet vehicles.
Utility Contractors
SICCODES:1623-08, 3999-06, 4813-02, 4841, 4899, 49, 4900, 4911, 4941-02, 7319-06, 7500, 7629-03, 7699-99, 89,

Global Maintech Corporation - Blomington MN 55420 US
Global Maintech Corporation offers the Virtual Command Center for Enterprise monitoring, control, and automation. This product is currently controlling many Fortune 1000 data centers including General Electric, Citicorp, 3M, Wyeth, AIG, Bear Stearns, Met Life, and WellPoint. Our Virtual Command Center can remotely render graphically or in just text the console of any target computer allowing any number of operators to control that computer. In addition, a flexible and powerful script language can intercept the console traffic and/or SNMP allowing for automated event monitoring, alerts, management, and logging. Best of all, no software modifications are necessary on the target computers. You can run your entire enterprise remotely. This means that one or more data centers across one or more continents can be controlled from any number of control centers. You can even control equipment that is not in a data center (e.g. a single remote computer).
Fiber Optics-Equipment & Systems (Mfrs)
SICCODES:3357-01, 3569-07, 3571, 3571-01, 3571-03, 3572, 3572-98, 36, 3629, 3629-98, 3643-01, 3669-02, 3694-01, 3699-02, 3699-05, 3823-09, 3825, 4226, 4813-01,

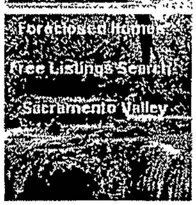
H D Electronics, Inc. - Dilworth MN 56529 US
Service and repair of underground line locators
Electric Contractors
SICCODES:1731-01, 36, 3612-02, 3699, 4011-01, 49, 4900, 4911, 4925-03, 5051-01, 5063, 5063-12, 5063-29, 5063-30, 5211-35, 7389-43, 7629, 7629-03, 8711-15,

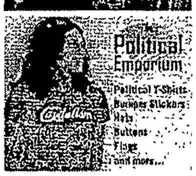
NanHai Bright Electrical Lighting Co.,LDT - FoShan 528222 CH
I'm a sales from a lighting export factory in china.Our products ship to american and europe.We have our own UL,CUL and CE approve.We are the big supplier for Kichler,Quorum and Globo.
Electrical Work
SICCODES:1731, 1731-01, 3264, 3264-98, 3357-03, 3357-04, 3357-05, 3548, 3585-10, 36, 3612-02, 3613-02, 3619, 3621-01, 3621-02, 3621-04, 3625-04, 3629, 3629-01,

Site Lines, Inc. - Howell MI 48843 US
TV Inspection, Grouting, Air & Deflection Testing, Perma-Liner point repairs, Lining, Lateral Grouting
Pipe Line Contractors
SICCODES 1623-01, 1623-07, 49, 4900, 4952, 4959, 7389, 7389-99, 7699-02, 8731-11,

Sunai - Minoga 32-046 PL
sunai, outsourcing, it, wsparcie, informatyczne, informatyka, informatyka, pomoc, zarz¹dzanie, zarzadanie, us³ugi, baza danych, bazy danych, komputery, komput
Citrus Fruit Grove
SICCODES:0174, 0174-01, 0175, 0271, 0742-03, 0752-12, 0752-20, 0762-02, 1051, 1100, 1111, 1112,

OTS Exhibit No. 1
WP-F Schedule No: 7
Page 2 of 2





1200, 1221, 1222, 1231, 1423, 1452, 1472,

1

Advanced Search

[Top]

Company name:

City:

State:

ZipCode:

Country: United States

SICCODE: 49

Results: ◉ Exactly match SICCode
○ Start with SICCode

[Advanced Search]

Please feel free to narrow your search in any one of these areas.

Home - Zip/Area code - Free Legal Forms - NAICS/SIC cross reference
Terms and Conditions - Edit business listing
Advertise On Siccode.com

OTS Exhibit No. 1
Schedule No. 8
Page 1 of 10

Return on Book Equity

	2009	2008	2007	2006	2005	Average	Std Dev
Pennsylvania American	8.50%	9.00%	7.80%	8.40%	9.60%	8.66%	0.677%

Water Group	2009	2008	2007	2006	2005	Average	Std Dev
American States Water	8.80%	7.10%	9.50%	8.40%	10.20%	8.80%	1.173%
American Water Works Co	NMF	NMF	NMF	NMF	NMF		
Aqua America Inc	9.60%	9.60%	10.00%	10.60%	11.70%	10.30%	0.883%
California Water Services Grp	9.80%	10.00%	8.10%	7.60%	9.30%	8.96%	1.060%
Connecticut Water Svs Inc	9.50%	9.20%	8.90%	7.00%	7.90%	8.50%	1.032%
Middlesex Water Co	7.00%	8.90%	8.80%	8.50%	8.40%	8.32%	0.766%
SJW Corp	6.40%	9.40%	8.90%	19.40%	12.20%	11.26%	4.995%
York Water Co	9.60%	9.40%	9.60%	10.50%	11.80%	10.18%	1.001%
Average	8.67%	9.09%	9.11%	10.29%	10.21%	9.47%	1.56%

Coefficients of Variation 1.56%/9.47% 0.164731

Pennsylvania-American Water Company
Capitalization and Financial Statistics
2005-2009, Inclusive

	2009	2008	2007	2006	2005	
			(Millions of Dollars)			
Amount of Capital Employed						
Permanent Capital	$ 1,956.2	$ 1,805.9	$ 1,677.6	$ 1,499.6	$ 1,590.2	
Short-Term Debt	$ 10.9	$ 90.6	$ 80.1	$ 180.9	$ 12.4	
Total Capital	$ 1,967.1	$ 1,896.5	$ 1,757.7	$ 1,680.5	$ 1,602.7	
Capital Structure Ratios						
Based on Permanent Capital:						Average
Long-Term Debt	51.0%	51.1%	50.6%	47.8%	53.9%	50.9%
Preferred Stock	0.7%	0.8%	0.8%	0.9%	0.9%	0.8%
Common Equity [1]	48.2%	48.1%	48.5%	51.2%	45.2%	48.2%
	99.9%	100.0%	99.9%	99.9%	100.0%	99.9%
Based on Total Capital:						
Total Debt incl. Short Term	51.3%	53.5%	52.9%	53.5%	54.3%	53.1%
Preferred Stock	0.7%	0.7%	0.8%	0.8%	0.9%	0.8%
Common Equity [1]	48.0%	45.8%	46.3%	45.7%	44.8%	46.1%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Rate of Return on Book Common Equity [1]	8.5%	9.0%	7.8%	8.4%	9.6%	8.7%
Operating Ratio [2]	59.4%	59.2%	62.1%	61.2%	59.3%	60.2%
Coverage incl. AFUDC [3]						
Pre-tax: All Interest Charges	3.20 x	3.28 x	2.83 x	2.94 x	3.07 x	3.06 x
Post-tax: All Interest Charges	2.31 x	2.35 x	2.10 x	2.16 x	2.25 x	2.23 x
Overall Coverage: All Int. & Pfd. Div.	2.31 x	2.35 x	2.09 x	2.16 x	2.25 x	2.23 x
Coverage excl. AFUDC [3]						
Pre-tax: All Interest Charges	3.19 x	3.26 x	2.83 x	2.94 x	3.07 x	3.06 x
Post-tax: All Interest Charges	2.31 x	2.33 x	2.09 x	2.16 x	2.25 x	2.23 x
Overall Coverage: All Int. & Pfd. Div.	2.31 x	2.32 x	2.09 x	2.16 x	2.25 x	2.23 x
Quality of Earnings & Cash Flow						
AFC/Income Avail. for Common Equity	0.4%	1.6%	0.2%	0.3%	0.0%	0.5%
Effective Income Tax Rate	40.3%	40.8%	40.1%	40.1%	39.4%	40.1%
Internal Cash Generation/Construction [4]	112.0%	62.9%	55.5%	71.8%	71.9%	74.8%
Gross Cash Flow/ Avg. Total Debt [5]	24.2%	18.9%	14.9%	16.4%	16.3%	18.1%
Gross Cash Flow Interest Coverage [6]	5.13 x	4.24 x	3.38 x	3.70 x	3.71 x	4.03 x
Common Dividend Coverage [7]	4.43 x	3.36 x	2.83 x	3.40 x	2.85 x	3.37 x

See Page 2 for Notes.

AMERICAN STATES WATER CO
Capitalization and Financial Statistics
2005-2009, Inclusive

	2009	2008	2007	2006	2005	
			(Millions of Dollars)			
Amount of Capital Employed						
Permanent Capital	$ 666.0	$ 577.7	$ 570.0	$ 552.2	$ 536.7	
Short-Term Debt	$ 17.4	$ 74.7	$ 37.2	$ 32.0	$ 27.0	
Total Capital	$ 683.4	$ 652.4	$ 607.2	$ 584.2	$ 563.7	
						Average
Market-Based Financial Ratios						
Price-Earnings Multiple	21 x	27 x	25 x	27 x	18 x	24 x
Market/Book Ratio	183.5%	194.5%	233.3%	229.0%	191.5%	206.4%
Dividend Yield	2.9%	2.9%	2.4%	2.5%	3.1%	2.8%
Dividend Payout Ratio	61.6%	78.8%	58.9%	66.7%	56.4%	64.5%
Capital Structure Ratios						
Based on Permanent Captial:						
Long-Term Debt	46.0%	46.2%	47.0%	48.6%	50.1%	47.6%
Preferred Stock	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Common Equity [1]	54.0%	53.8%	53.0%	51.4%	49.9%	52.4%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Based on Total Capital:						
Total Debt Incl. Short Term	47.4%	52.4%	50.2%	51.4%	52.5%	50.8%
Preferred Stock	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Common Equity [1]	52.6%	47.6%	49.8%	48.6%	47.5%	49.2%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Rate of Return on Book Common Equity [1]	8.8%	7.1%	9.5%	8.4%	10.2%	8.8%
Operating Ratio [2]	79.8%	80.4%	77.7%	79.0%	73.9%	78.2%
Coverage incl. AFUDC [3]						
Pre-tax: All Interest Charges	3.16 x	2.65 x	3.25 x	2.84 x	4.57 x	3.29 x
Post-tax: All Interest Charges	2.32 x	2.03 x	2.28 x	2.09 x	2.97 x	2.34 x
Overall Coverage: All Int. & Pfd. Div.	2.32 x	2.03 x	2.28 x	2.09 x	2.97 x	2.34 x
Coverage excl. AFUDC [3]						
Pre-tax: All Interest Charges	3.16 x	2.65 x	3.25 x	2.84 x	4.57 x	3.29 x
Post-tax: All Interest Charges	2.32 x	2.03 x	2.28 x	2.09 x	2.97 x	2.34 x
Overall Coverage: All Int. & Pfd. Div.	2.32 x	2.03 x	2.28 x	2.09 x	2.97 x	2.34 x
Quality of Earnings & Cash Flow						
AFC/Income Avail. for Common Equity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Effective Income Tax Rate	39.0%	37.9%	42.9%	40.5%	44.8%	41.0%
Internal Cash Generation/Construction [4]	73.5%	61.4%	86.2%	72.8%	62.2%	71.2%
Gross Cash Flow/ Avg. Total Debt [5]	22.5%	20.0%	19.6%	21.4%	20.8%	20.9%
Gross Cash Flow Interest Coverage [6]	4.27 x	3.65 x	3.73 x	3.97 x	5.69 x	4.26 x
Common Dividend Coverage [7]	4.14 x	3.74 x	3.63 x	4.15 x	3.93 x	3.92 x

See Page 2 for Notes.

AMERICAN WATER WORKS CO INC
Capitalization and Financial Statistics
2005-2009, Inclusive

	2009	2008	2007 (Millions of Dollars)	2006	2005	Average
Amount of Capital Employed						
Permanent Capital	$ 9,436.3	$ 9,012.8	$ 9,360.6	$ 8,999.0	$ 9,239.2	
Short-Term Debt	$ 119.5	$ 479.0	$ 220.5	$ 719.7	$ 374.1	
Total Capital	$ 9,555.8	$ 9,491.9	$ 9,581.1	$ 9,718.7	$ 9,613.3	
Market-Based Financial Ratios						
Price-Earnings Multiple	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Market/Book Ratio	80.8%	74.3%	NMF	NMF	NMF	77.6%
Dividend Yield	4.2%	2.0%	NMF	NMF	NMF	3.1%
Dividend Payout Ratio	NMF	NMF	NMF	NMF	NMF	#DIV/0!
Capital Structure Ratios						
Based on Permanent Captial:						
Long-Term Debt	56.9%	53.5%	51.2%	57.3%	69.6%	57.7%
Preferred Stock	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%
Common Equity [1]	43.1%	46.4%	48.7%	42.6%	30.3%	42.2%
	100.0%	100.0%	99.9%	100.0%	99.9%	100.0%
Based on Total Capital:						
Total Debt Incl. Short Term	57.4%	55.9%	52.4%	60.5%	70.8%	59.4%
Preferred Stock	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Common Equity [1]	42.5%	44.1%	47.6%	39.5%	29.2%	40.6%
	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
Rate of Return on Book Common Equity [1]	NMF	NMF	NMF	NMF	NMF	#DIV/0!
Operating Ratio [2]	74.4%	75.9%	76.3%	87.9%	94.8%	81.9%
Coverage incl. AFUDC [3]						
Pre-tax: All Interest Charges	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Post-tax: All Interest Charges	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Overall Coverage: All Int. & Pfd. Div.	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Coverage excl. AFUDC [3]						
Pre-tax: All Interest Charges	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Post-tax: All Interest Charges	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Overall Coverage: All Int. & Pfd. Div.	NMF x	NMF x	NMF x	NMF x	NMF x	#DIV/0! x
Quality of Earnings & Cash Flow						
AFC/Income Avail. for Common Equity	-8.0%	-4.0%	-3.3%	-5.5%	-3.0%	-4.8%
Effective Income Tax Rate	NMF	NMF	NMF	NMF	NMF	#DIV/0!
Internal Cash Generation/Construction [4]	82.4%	58.3%	61.9%	62.3%	93.2%	71.6%
Gross Cash Flow/ Avg. Total Debt [5]	14.5%	12.6%	8.5%	6.7%	7.6%	10.0%
Gross Cash Flow Interest Coverage [6]	3.59 x	3.25 x	2.53 x	2.21 x	2.47 x	2.81 x
Common Dividend Coverage [7]	5.71 x	10.18 x	NMF x	NMF x	NMF x	7.95 x

See Page 2 for Notes.

AQUA AMERICA INC
Capitalization and Financial Statistics
2005-2009, Inclusive

	2009	2008	2007	2006	2005	Average
			(Millions of Dollars)			
Amount of Capital Employed						
Permanent Capital	$ 2,555.3	$ 2,316.0	$ 2,217.3	$ 1,906.1	$ 1,719.6	
Short-Term Debt	$ 27.5	$ 80.6	$ 56.9	$ 119.2	$ 138.5	
Total Capital	$ 2,582.8	$ 2,396.6	$ 2,274.2	$ 2,025.2	$ 1,858.1	
Market-Based Financial Ratios						
Price-Earnings Multiple	24 x	23 x	32 x	36 x	32 x	29 x
Market/Book Ratio	231.4%	225.8%	318.5%	376.5%	383.5%	307.2%
Dividend Yield	3.0%	3.0%	2.1%	1.8%	1.7%	2.3%
Dividend Payout Ratio	71.6%	70.0%	67.1%	63.1%	56.1%	65.6%
Capital Structure Ratios						
Based on Permanent Captial:						
Long-Term Debt	56.6%	54.2%	55.9%	51.6%	52.5%	54.2%
Preferred Stock	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
Common Equity [1]	43.4%	45.7%	44.0%	48.3%	47.4%	45.8%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Based on Total Capital:						
Total Debt incl. Short Term	57.1%	55.7%	57.0%	54.4%	56.1%	56.1%
Preferred Stock	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
Common Equity [1]	42.9%	44.2%	42.9%	45.5%	43.9%	43.9%
	100.0%	100.0%	100.0%	100.0%	100.1%	100.0%
Rate of Return on Book Common Equity [1]	9.6%	9.6%	10.0%	10.6%	11.7%	10.3%
Operating Ratio [2]	64.6%	64.0%	64.1%	61.5%	60.4%	62.9%
Coverage incl. AFUDC [3]						
Pre-tax: All Interest Charges	3.51 x	3.37 x	3.32 x	3.61 x	3.84 x	3.53 x
Post-tax: All Interest Charges	2.52 x	2.43 x	2.42 x	2.57 x	2.75 x	2.54 x
Overall Coverage: All Int. & Pfd. Div.	2.52 x	2.43 x	2.42 x	2.57 x	2.75 x	2.54 x
Coverage excl. AFUDC [3]						
Pre-tax: All Interest Charges	3.47 x	3.32 x	3.28 x	3.54 x	3.80 x	3.48 x
Post-tax: All Interest Charges	2.48 x	2.37 x	2.38 x	2.51 x	2.70 x	2.49 x
Overall Coverage: All Int. & Pfd. Div.	2.48 x	2.37 x	2.38 x	2.51 x	2.70 x	2.49 x
Quality of Earnings & Cash Flow						
AFC/Income Avail. for Common Equity	2.8%	3.8%	3.1%	4.3%	2.7%	3.3%
Effective Income Tax Rate	39.4%	39.7%	38.9%	39.6%	38.4%	39.2%
Internal Cash Generation/Construction [4]	69.0%	65.5%	62.8%	47.2%	54.4%	59.8%
Gross Cash Flow/ Avg. Total Debt [5]	19.2%	18.5%	17.8%	17.4%	18.4%	18.3%
Gross Cash Flow Interest Coverage [6]	4.89 x	4.49 x	4.12 x	4.10 x	4.39 x	4.40 x
Common Dividend Coverage [7]	3.62 x	3.56 x	3.35 x	3.21 x	3.53 x	3.45 x

See Page 2 for Notes.

CALIFORNIA WATER SERVICE GP
Capitalization and Financial Statistics
2005-2009, Inclusive

	2009	2008	2007	2006	2005	Average
			(Millions of Dollars)			
Amount of Capital Employed						
Permanent Capital	$ 807.9	$ 693.3	$ 681.1	$ 675.4	$ 573.9	
Short-Term Debt	$ 12.0	$ 40.0	$ -	$ -	$ -	
Total Capital	$ 819.9	$ 733.3	$ 681.1	$ 675.4	$ 573.9	
Market-Based Financial Ratios						
Price-Earnings Multiple	21 x	20 x	27 x	29 x	25 x	24 x
Market/Book Ratio	206.0%	195.0%	215.4%	229.2%	231.8%	215.5%
Dividend Yield	2.9%	3.2%	2.9%	2.9%	3.1%	3.0%
Dividend Payout Ratio	60.4%	61.4%	77.3%	85.8%	77.4%	72.5%
Capital Structure Ratios						
Based on Permanent Captial:						
Long-Term Debt	47.9%	41.9%	42.9%	43.5%	48.0%	44.8%
Preferred Stock	0.0%	0.0%	0.5%	0.6%	0.6%	0.3%
Common Equity [1]	52.1%	58.1%	56.6%	56.0%	51.4%	54.8%
	100.0%	100.0%	100.0%	100.1%	100.0%	100.0%
Based on Total Capital:						
Total Debt incl. Short Term	48.7%	45.0%	42.9%	43.5%	48.0%	45.6%
Preferred Stock	0.0%	0.0%	0.5%	0.6%	0.6%	0.3%
Common Equity [1]	51.3%	55.0%	56.6%	56.0%	51.4%	54.1%
	100.0%	100.0%	100.0%	100.1%	100.0%	100.0%
Rate of Return on Book Common Equity [1]	9.8%	10.0%	8.1%	7.6%	9.3%	9.0%
Operating Ratio [2]	81.5%	80.0%	83.1%	83.4%	81.3%	81.9%
Coverage incl. AFUDC [3]						
Pre-tax: All Interest Charges	3.78 x	4.11 x	3.63 x	3.16 x	3.54 x	3.64 x
Post-tax: All Interest Charges	2.66 x	2.93 x	2.58 x	2.30 x	2.46 x	2.59 x
Overall Coverage: All Int. & Pfd. Div.	2.66 x	2.88 x	2.56 x	2.28 x	2.44 x	2.56 x
Coverage excl. AFUDC [3]						
Pre-tax: All Interest Charges	3.66 x	3.94 x	3.50 x	3.02 x	3.49 x	3.52 x
Post-tax: All Interest Charges	2.54 x	2.77 x	2.45 x	2.16 x	2.42 x	2.47 x
Overall Coverage: All Int. & Pfd. Div.	2.54 x	2.72 x	2.43 x	2.15 x	2.40 x	2.45 x
Quality of Earnings & Cash Flow						
AFC/Income Avail. for Common Equity	7.6%	8.6%	8.3%	10.6%	3.3%	7.7%
Effective Income Tax Rate	40.3%	37.7%	39.9%	39.7%	42.4%	40.0%
Internal Cash Generation/Construction [4]	49.3%	65.0%	54.0%	43.2%	50.0%	52.3%
Gross Cash Flow/ Avg. Total Debt [5]	21.7%	30.3%	22.2%	21.1%	21.7%	23.4%
Gross Cash Flow Interest Coverage [6]	4.08 x	5.37 x	4.14 x	3.88 x	4.12 x	4.32 x
Common Dividend Coverage [7]	3.23 x	3.88 x	2.71 x	2.75 x	2.85 x	3.08 x

See Page 2 for Notes.