ON THE ASSOCIATION BETWEEN FACTOR MARKET AND CAPITAL MARKET PRICES: A TEST OF THE IMPACT OF ASR 190

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CHAPTER I

INTRODUCTION

The Security and Exchange Commission required certain firms to report replacement cost data beginning with their 1976 10-K filings. The objective of this reporting requirement was to provide information heretofore not contained in conventional financial statements. This research involves testing whether information content, defined in terms of assessed daily return distributions of a sample of reporting firms' common stock, was provided in the 10-K filings.

Empirical research on the relationship between replacement cost data and security prices was possible due to data requirements of the Security and Exchange Commission and the Financial Accounting Standards Board. Reporting of such data has been suggested for some time. Edwards and Bell (1961) advocated disaggregation of conventional accounting income into current operating profit and holding gains nearly two decades ago. Although managerial decision-making played the primary role in their analysis, they did make a casual extension to external users such as capital market agents.

Revsine (1973) provided a more rigorous association of replacement cost data and decisions of external users. In particular, Revsine identified a condition under which holding gains were precursors of shifts in the level of cash flow for a firm. These cash flow shifts were, in turn, mapped onto stock price changes. Revsine's condition was the existence of positive covariance between prices in the factor and product markets. Thus, increased input prices cause managers to increase output prices. The result is an increase in the firm's cash flow. Revsine labeled the price changes of this nature "Type A price changes" (p. 108).

Edwards and Bell (1961) presented replacement cost as a means of extracting an inflationary component from conventional historical cost income. Presumably, reporting a lower income number led to stock price reduction. By contrast, if Type A price changes predominate, Revsine's (1973) work suggested an increase in stock prices due to increased cash flows to the firm. Of course, both works referred to unanticipated replacement cost amounts. If all disclosures had been anticipated, no stock price changes would occur.

Any research methodology involving replacement cost data demands the prediction of the direction of stock price changes due to disclosure of that data. The Revsine (1973) work was primarily concerned with capital agents and was chosen as the analytical link between replacement cost data and stock price changes. Also, there exists empirical support for the importance of cash flows versus the importance of income figures. Stock price change is the expected result if Type A conditions predominate.

Previous Empirical Research

Only recently has empirical research involving replacement cost data emerged. Typical of empirical research not employing security price data was the study by Benston and Krasney (1978). They surveyed decisions of individuals who were presumably in a position to demand financial data from prospective borrowers. They found these individuals had little interest in replacement cost data.

Abdel-khalik and McKeown (1978) utilized security prices to test the information content of Value Line forecasts of replacement cost data. Their conclusions indicated these forecasts produced no appreciable market response. However, they supplied a caveat to their conclusions:

> . . . it is possible that forecasted replacement cost information was not the relevant type of information and that investors were awaiting the actual disclosures of replacement cost information before revising their expectations (p. 71).

Ro (1980) used security price data in testing market reaction to replacement cost Value Line forecasts of earnings per share and reported replacement cost earnings per share in 10-K reports. His methodology also included changes in predicted versus actual historical cost earnings per share. Grouping firms into "good news" and "bad news" portfolios, he found a significant difference at the 10% level. However, Ro suggested care in interpreting the results. The "good news" group stock price returns over a 26 week period were approximately zero, while the "bad news" group was significantly lower than zero. Thus, the significant difference was due to the negative abnormal returns of the "bad news" group. Ro suggested this significant difference applied to unexpected historical cost earnings and not replacement cost data.

In another study involving transaction volume, Ro (1981) found no significant statistical difference attributable to replacement cost disclosures. He concluded: "RC accounting data made public under ASR 190 did not contain new information" (p. 80).

Gheyara and Boatsman (1980) utilized four procedures to test for information content of the first release of SEC replacement cost data. Their results were consistent across all four tests and suggested mandated replacement cost disclosures did not introduce information during the test period.

Beaver, Christie, and Griffin (1980) tested security price reaction to RC disclosures in ASR 190, using 15 accounting variables based on replacement cost and historical cost differences. Employing Gonedes' (1975) T^2

procedure, they found no security price effects due to required replacement cost disclosures.

These studies dealt with the first replacement cost disclosures and, therefore, used no prior replacement cost data to develop a proxy for market reactions. Now that we have learned what was contained in those first disclosures, models incorporating the 1976 amounts may be used for generation of proxies for replacement cost expectations. Also, some learning may have taken place such that tests of 1976 data may lack generality.

This research speaks to two issues: first, the theoretical relation between replacement cost theory and stock price movement avoided in previous studies; second, it relies on three years of replacement cost disclosures, not solely the initial disclosures.

Boatsman and Revsine (1978) suggested a research methodology they believed necessary to test replacement cost disclosures:

1. Development of a theory which predicts the direction of the effect of replacement cost disclosures on a market parameter.

2. Formulation of an expectations model which estimates the value of the parameter in the absence of replacement cost data.

3. Measurement of the actual parameter after replacement cost disclosure.

4. Observation of the difference between the expected and actual parameters.

5. Determination whether the model predicted the difference observed in (4) above (p, 104).

The remainder of this research employs this Boatsman-Revsine methodology and is outlined below.

Chapter II provides an analytical link between replacement cost theory and the direction of stock price changes via association of RC theory with the Capital Asset Pricing Model. Also, three expectations models are developed as proxies for the beliefs of market agents regarding forthcoming disclosure.

Chapter III introduces the measurement processes for stock prices and their changes due to differences between the actual and expected results. This chapter also includes adjustments of daily stock price data to conform with the analytical development in Chapter II.

The fourth chapter details the empirical procedure used for data collection and presents results of the research along with a discussion of the results.

The final chapter presents summary and conclusions of the research.

CHAPTER II

ANALYTICAL DEVELOPMENT

The objective of this chapter is to provide an analytical link between Replacement Cost Income (RCI) and a firm's stock price change. To make this association, some important ideas of Revsine (1973) are utilized. RCI is defined following Revsine and is related to the firm's cash flow. A leading indicator notion is then invoked to predict the firm's future cash flows.

In another section, the firm's future cash flow is defined in terms of the Capital Asset Pricing Model (CAPM) which, in turn, is mapped onto the firm's stock price. Expectations models of the direction of change of the stock price in a replacement cost setting are introduced.

In addition to the above, some methodological questions involving daily stock price data and continuity of analytical development with empirical testing are resolved.

Replacement Cost Income

According to Revsine (1973), RCI is related to economic income in perfectly competitive markets, and, approximately equal to economic income in mixed markets. The following development utilizes equalities which would exist only in perfect competition.

A firm's value at time t (V_t) is the discounted value of the firm's expected future cash flows $E(Y_t)$, and can be written

$$V_t = \frac{E(Y_t)}{1 + g} \qquad (1)$$

where g is some appropriate discount factor. Rearranging (1) yields

$$V_t(1 + g) = E(Y_t) \qquad (2)$$

or

$$V_t + gV_t = E(Y_t). \qquad (3)$$

The term gV_t is economic income in the Fisherian/Hicksian mode. In the absence of factor price changes:

$$RCI_t = gV_t = COP_t \qquad (4)$$

where COP_t is the firm's current operating profit. Thus, COP_t is equal to the distributable operating flow component of economic income.

Replacement cost income, however, may contain two components, current operating profit and holding gains (HG). COP is the firm's distributable operating flow which a firm may dispense without impairment of its physical capital while holding gains are income which is not distributable. Holding gains constitute a change in firm value due to increases in factor input prices. Revsine (1973) relates this component of income to the unexpected income component of economic income. When holding gains are encountered, RCI_t can be written

$$RCI_t = gV_t + \Delta V_t = COP_t + HG_t. \tag{5}$$

Thus, in perfectly competitive markets, RCI_t is equal to economic income. Since economic income embodies future cash flows, RCI_t also embodies future cash flows and is relevant to firm valuation.

In less than competitive markets, RCI_t only approximates economic income. However, if positive covariance exists between factor and output prices, the HG_t component of RCI_t can be shown to be relevant as a lead indicator of changes in future cash flows. Revsine (1973) denotes such covariance as a Type A price change. The next section details the relation between Type A price changes and firm valuation.

Holding Gains and Stock Price Changes

Suppose a firm is able to pass on increased prices of inputs (as evidenced by holding gains) in the form of higher output prices. Suppose further, this is done such that a constant rate of profit is maintained. The firm's expected cash flow can be written

$$E(Y) = (1 + g)E(I) - E(I)$$

where Y is the expected cash flow, g is profit rate, I is the factor price, and E the Expectations Operator. An unexpected holding gain can be denoted dE(I). Differentiation of E(Y) with respect to E(I) results in

$$\frac{dE(Y)}{dE(I)} = g.$$

Thus, a one unit holding gain produces a g increase in expected cash flow. This increase in expected cash flow can be related to stock prices via the capital asset pricing model:

$$P = \frac{E(Y) - \lambda cov(Y,Rm)}{1 + R_F}$$

where P = stock price, λ = price of risk, Rm is the market return, and R_f = risk free rate of return. The total derivative respecting E(Y) is:

$$\frac{dP}{dE(Y)} = \frac{\partial P}{\partial E(Y)} + \frac{\partial P}{\partial \lambda}\frac{d\lambda}{dE(Y)} + \frac{\partial P}{\partial cov(.)}\frac{dcov(.)}{dE(Y)} .$$

Assuming no changes in variances or covariances,

$$\frac{dcov(.)}{dE(Y)} = \frac{d\lambda}{dE(Y)} = 0$$

then,

$$\frac{dP}{dE(Y)} = \frac{\partial P}{\partial E(Y)}$$

where,

$$\frac{\partial P}{\partial E(Y)} = \frac{1}{1 + R_f}$$

since a one unit change in price necessitates a $1 + R_f$ change in cash flow. Then,

$$\frac{dP}{dE(Y)} = \frac{1}{1 + R_f}$$

or,

$$dP = \frac{dE(Y)}{1 + R_f} .$$

Thus, a shift in the firm's expected cash flow will result in an increase in stock price which is equal to the present value of the shift.

Three methodological issues arise immediately:

1. Empirical testing of the above linkage will require a replacement cost expectations model, i.e., an operational measure of the unanticipated holding gain.

2. Some means for controlling changes in risk will be needed.

3. Lastly, many other factors impact upon stock prices, i.e., market-wide factors must be controlled. These issues are discussed in the following sections.

Replacement Cost Expectations Models

Three models were used as proxies for market expectations. The first model was the naive model

$$E(HG_{t+1}) = HG_t$$

where E is the expectations operator and HG is the holding gain. Thus,

$$E(HG_{t+1}) - HG_t = \Delta HG = 0. \qquad \text{Model I}$$

In words, this model stated no expected change in holding gains occurred from 1977 to 1978. There are sound economic grounds for believing that in well lubricated markets, an unbiased predication of a forthcoming price change is simply the most recent price change.

The second model incorporated inflation

$$E(HG_{t+1}) = HG_t \cdot \Delta WPI_t , \qquad \text{Model II}$$

where ΔWPI_t was the change in the wholesale price index during period t. It may have been possible to anticipate inflation in factor prices and, therefore, anticipate holding gains by use of such an index. This model provided a correction for such anticipations since only unanticipated gains are expected to impact on stock price.

A third expectations model using a similar rationale as the second expectations model was a cross-sectional one. Suppose market agents attempted to consider the general movement of holding gains in the market, along with firm-specific holding gains. Then, a model such as

$$HG_{nt+1} = \eta_n + \delta HG_{It} + \varepsilon_{nt} \qquad \text{Model III}$$

where

$$HG_{It} = \frac{\sum_{n=1}^{N} HG_{nt}}{N}$$

and n = the number of firms, provides a proxy for such expectations. This is not to say market agents actually calculated forecasts with these models, but only acted as if they did.

These models were used to form portfolios in a fashion presented later. The method of computing holding gains is included in Chapter IV. Appendix A contains holding gain computations based on the Chapter IV metric and these expectations models.

Market Model and Adjustments

The effects of market-wide phenomena were removed using the market model

$$R_{nt} = \alpha_n + \beta_n R_{mt} + \mu_{nt}$$

where

R_{nt} = the return on firm n at time t

R_{mt} = the return on the market index at time t

$\beta_n = \frac{cov(R_{nt}, R_{mt})}{var(R_{mt})}$

α_n = the intercept term

μ_{nt} = the disturbance term of firm n at time t.

Firm specific returns and the market index were taken from the CRSP daily return file. The equally weighted market index was used. The disturbance term μ_{nt} is interpreted as the return on security n at time t adjusted for effects of market-wide phenomena, i.e., an abnormal return.

A problem exists in estimating the market model with daily data. This problem arises because some securities are not traded on a daily basis. As Scholes and Williams (1977) pointed out, estimating parameters of the market model using daily returns results in variances and covariances which are biased. The relationship between these biases and trading frequency is known. Scholes and Williams corrected the biases as follows:

Let $$R^s_{nt} = \alpha^s_n + \beta^s_n R_{mt} + \varepsilon^s_{nt}$$

be the <u>observed</u> market model where the superscript s represents the corrected representation of the market model, where,

$$\alpha_n^s = E(R_{nt}^s) - \beta_n^s \, E(R_{mt}^2)$$

$$\beta_n^s = \frac{\mathrm{cov}(R_{nt}^s, R_{mt}^s)}{\mathrm{var}(R_{mt}^s)}$$

$$\varepsilon_{nt}^s \sim N(0, \sigma^2)$$

based on the assumption of normally distributed trading intervals.

Scholes and Williams (1977) showed the relationship between the <u>observed</u> market model and true market model is as follows:

$$\alpha_n^s = \alpha_n + (\beta_n - \beta_n^s) \, E(R_m), \text{ and}$$

$$\beta_n^s = \beta_n - (\beta_n^{s-} + \beta_n^{s+} - 2\beta_n \rho_m^s),$$

where

$$\beta_n^{s-} \equiv \frac{\mathrm{cov}(R_{nt}^s, R_{mt-1}^s)}{\mathrm{var}(R_{mt-1}^s)},$$

$$\beta_n^{s+} \equiv \frac{\mathrm{cov}(R_{nt}^s, R_{mt+1}^s)}{\mathrm{var}(R_{mt+1}^s)}, \text{ and}$$

$$\rho_m^s \equiv \frac{\mathrm{cov}(R_{mt}^s, R_{mt-1}^s)}{\sigma(R_{mt}^s)\ \sigma(R_{mt-1}^s)}$$

From these equations unbiased estimates of market model parameters are

$$\hat{\alpha}_n = \frac{1}{T-2}\sum_{t=2}^{T-1} R_{nt}^s - \hat{\beta}_n \frac{1}{T-2}\sum_{t=2}^{T-1} R_{mt}^s, \text{ and}$$

$$\hat{\beta}_n = \frac{b_n^- + b_n^+ + b_n}{1 + 2\hat{\rho}_m}$$

where b_n^-, b_n^+, and $\hat{\rho}_m$ are calculated values from the equations for β_n^{s-}, β_n^{s+}, and ρ_m^s.

These unbiased market model parameters were estimated to determine specific security returns.

Summary

In competitive markets, replacement cost income was shown to equate with economic income. In less than competitive markets, the holding gain component of replacement cost income was shown to be a lead indicator of cash flow shifts if positive covariance exists between the price of a firm's input and output factors.

These unexpected cash flows were related to the CAPM. When cash flow shifts are not accompanied by a change in risk, an unambiguous relation between CAPM valuation and unexpected cash flows was identified.

Three models were introduced as proxies for market expectations of holding gains. And, an unbiased procedure for removing the effects of market-wide phenomena from stock prices was specified. The next chapter deals with data collection.

CHAPTER III

EMPIRICAL PROCEDURES

This chapter presents data collection procedures and test methodology based on the theoretical analyses of the previous chapter. Sample selection, holding gain calculations, risk changes, and testing procedure are described.

Sample Selection

The sample of firms selected for this study met the following criteria:

1. They were subject to ASR 190 reporting requirements.

2. The common stock returns were listed on the CRSP daily returns file and had no missing returns during the test period.

3. They had a fiscal year ended December 31.

4. The 10-K reports allowed an unambiguous computation of holding gains or losses.

5. They had stable systematic risk.

Data used for this study were collected at the Dallas Public Library from 10-K microfische. These data contained elements used for computation of holding gains, firm identification number (CUSIP #) which identified firms on the CRSP returns file, and date of filing of the 10-K report needed to define the test period for a firm.

A total of 133 firms was selected for the original sample. Since this study required changes in holding gains as proxies for holding gain expectations, three years of 10-K reports were necessary. The first two years' data (1976 and 1977) were used to compute a holding gain change. Expectations models explained in the previous chapter were compared to these changes to specify the expected sign of change in holding gains for 1978 (reported in Spring of 1979) in the company's 10-K.

Sixteen companies were eliminated from the original sample when it was discovered their report dates did not coincide with the majority of firms' report dates. The reason for this exclusion was the sensitivity of the test statistic to a few firms with reporting dates vastly different from the others. A firm with a very early or late report date can dominate the test statistic (discussed later) which is based on the average of abnormal returns of portfolios formed according to report date. Thus, returns of firms with extreme dates will weight the average equally with larger portfolios comprised of firms with common report dates.

Holding Gains

Holding gains were not reported directly on a firm's 10-K. The following method was used to calculate holding gains:

Let RC_{nt} = Net replacement cost of assets for firm n at end of year t (replacement cost less accumulated replacement cost depreciation).

RCD_{nt} = Replacement cost depreciation expense for firm n in year t.

HG_{nt} = Holding gain of firm n in year t.

HC_{nt} = Net historical cost of assets for firm n at end of year t (historical cost less historical cost accumulated depreciation).

Then,

$$HG_{nt} = RC_{nt} - RC_{n,t-1} + RCD_{nt} - HC_{nt} + HC_{n,t-1}.$$

The calculated holding gain was the difference between reported net replacement cost (with replacement cost depreciation added back) adjusted for historical cost differences. These historical cost differences compensated for sales or additions of new assets during period t.

Most holding gain data pertained to long-lived assets. ASR 190 required reporting these data along with replacement cost of inventories. Of the 117 selected firms, 114 firms reported latest (FIFO) balance sheet figures for inventories. Three firms reported large differences between historical cost and replacement cost of inventories. These numbers were added to the computed holding gain in their respective years. Calculated holding gains are presented in Appendix A.

Risk Changes

The previously developed relationship between holding gains, security prices, and the market model presumed no changes in a firm's systematic risk over time. Therefore, it was necessary to constrain the sample to firms with stable systematic risk as captured in the slope parameter $\hat{\beta}_n$.

Brown, Durbin, and Evans (1975) have devised a method to test parameter stability using an unbiased and independent recursive residual in a moving regression of length m. The residual was defined as (matrix notation).

$$w_{nt} = \frac{R_{nt} - X'_{nt}\hat{\beta}_{nt-1}}{1 + X'_{nt}(X'_{nt-1}X_{nt-1})^{-1}X'_{nt}}$$

where X_{nt-1} and X_{nt} were the matrices of observations on security returns in this study.

$S_{nt} = S_{nt-1} + w^2_{nt}$ the residual sum of squares after fitting the model to the first t observations. The time segments in question are (1,m), ((m+1), 2m) ...((p-2)m+1, (p+1)m+1, (p+1)m), ((p-1)m+1,T).

A test of parameter stability was made with the statistic

$$F = \frac{(T-p)S_{n(1,T)} - \{S_{n(1,m)} + S_{n(m+1,2m)} + \cdots + S_{n(pm-m+1,T)}\}}{(p-1)\ \{S_{n(1,m)} + S_{n(m+1,2m)} + \cdots + S_{n(pm-m+1,T)}\}}$$

which, under the null hypothesis, had an F distribution with 2p-2 and T-2p degrees of freedom where $p=\frac{T}{m}$. Three test periods were chosen--two, five, and eight days. The stability of the Scholes and Williams (1977) adjusted daily parameters were tested over the same period for which they were estimated, 100 days surrounding the period of portfolio formation. A computer program testing a moving regression of this type, called TIMVAR, was provided by the authors and used in this study.

Twenty-eight firms were removed from the remaining sample. Twelve firms were removed due to parameter instability indicated by excessive F-statistics. Fourteen firms were removed due to missing data. Firms removed from the sample due to the parameter stability test are contained in Appendix C.

Testing Procedure

If the previously specified relationship between unexpected holding gains and stock prices is correct, then one would expect to observe positive abnormal returns on securities of firms with positive unexpected holding gains. The converse would be so for firms with lower than expected holding gains.

Thus, a trading strategy based upon buying firms with positive unexpected holding gains and selling short securities of firms with negative unexpected holding gains should result in abnormal profits. A test of market reaction to replacement cost disclosures was obtainable by examining such a trading strategy.

A statistical method for examining such a trading strategy has been developed by Jaffe (1974) and was utilized in this study. This method has the virtue of eliminating difficulties associated with cross-sectional correlation. Evidence has shown security residuals are correlated across firms and thus cannot be considered a sample of independent observations. However, security returns have shown no correlation with subsequent periods.

A portfolio was formed from securities of firms meeting previously defined criteria. For firms filing 10-K reports on day t, residuals were examined seven days before and seven days after their filing. For firms filing their 10-K's on day t+1, a second portfolio was formed seven days prior to their filing. The second portfolio included firms from portfolio one. Firms filing their 10-K's on day t+1 were included 15 times in a portfolio just as firms filing on day t. After the firms were included in 15 portfolios they were dropped from subsequent portfolios.

As an example of portfolio formation, consider the following: firm A files its 10-K on day t; firms B and C file their 10-K's on day t+1; firms D, E, and F file their 10-K's on day t+2; other firms (denoted ...) file their 10-K's on succeeding dates. Portfolio one consisted of firm A; portfolio two consisted of firms A, B, and C;

portfolio three contained firms A, B, C, D, E, and F; portfolio 16 contained firms B, C, D, E, F, and ... (see Figure 1).

	Portfolio Number					
	1	2	3	...	16	17
	A	A	A	.		
		B	B	.	B	
		C	C	.	C	
Firms in Portfolio			D	.	D	D
			E	.	E	E
			F	.	F	F
				.	.	.
					.	.
					.	.
						.

Figure 1. Portfolio Example

Define U_t as the rate of return on portfolio of day t.

$$\hat{U}_t = \sum_{n=1}^{S} \frac{\hat{u}_{nt} \cdot H_i}{S}$$

where,

S = the number of firms in the portfolio

$\hat{u}_{nt}$ = the estimated residual for security n in portfolio t

H_i = 1, if the reported holding gain from 1977 to 1978 was greater than the holding gain calculated in the expectations models

= -1, otherwise

For example, Model I was the naive model

$$\Delta HG_{nt} = HG_{nt} - HG_{n,t-1}.$$

If a firm exhibited a holding gain change from 1976 to 1977, then it was expected to exhibit an identical holding gain from 1977 to 1978. Actual calculations of 1977 to 1978 holding gain changes confirmed or denied these expectations. If expectations were exceeded, investors were assumed to purchase firm n common stock. If the price subsequently rises as predicted by the theory, a gain materializes.

If expectations were not met, firm n common stock was assumed sold short. If the price falls as predicted, a gain materializes. Thus, a portfolio strategy of long positions when $H_i = 1$ and a short position when $H_i = -1$ produces a positive $\hat{U}_t$ if the theory holds.

Model II utilized changes in wholesale prices for expected reported holding gains. Here, the 1976 to 1977 holding gain change was multiplied by the wholesale price index change to decide if firm n was bought or sold. The wholesale price index was obtained from the Department of Commerce, Bureau of Labor Statistics, Dallas, Texas. For 1977, the index was 194.2. For 1978, the index was 209.3. These year end indexes produced a 209.3 ÷ 194.2 = 1.078 wholesale price change used in this research.

Model III, the cross sectional model, involved the following regression equation:

$$HG_{n,t+1} = .205 + 1.76\ HG_{It}$$

The correlation coefficient was .50, t = 6.4436 and F = 41.52. If the $HG_{n,t+1}$ estimate was larger than the actual holding gain, a short selling scheme was indicated (H_i = -1) and a purchase scheme was indicated (H_1 = 1) when the estimate exceeded actual. Tables containing the signs of H_i for each of the three models are presented in Appendix B.

An estimate of the standard deviation of portfolio t was made using 50 observations before and 50 observations after day t.

$$\hat{SD}_t = \sqrt{\frac{1}{99}\sum_{i=1}^{50}(\hat{U}_{t,t-i} - \frac{1}{50}\sum_{j=1}^{50}\hat{U}_{t,t-j})^2 + \frac{1}{99}\sum_{k=1}^{50}(\hat{U}_{t,t+k} - \frac{1}{50}\sum_{m=1}^{50}\hat{U}_{t,t-m})^2}$$

The standardizes measure of abnormal performance of portfolio t was defined as

$$se_t = \frac{\hat{U}_t}{\hat{SD}_t}$$

The number of portfolios formed was 24. Therefore, the average portfolio return was

$$\overline{se} = \frac{1}{24}\sum_{t=1}^{24} se_t.$$

Results of these computations (se_t, $\hat{SD}_t$, and $\overline{se}$) are contained in Appendix D and discussed in Chapter IV.

The test statistic was

$$t = \frac{\overline{se}}{1/\sqrt{24}}$$

which has 24 x 99 = 2376 df. The calculated test statistic is presented in Appendix D and discussed in Chapter IV.

Summary

Methods of sample selection and holding gain calculations have been presented, as were proxies for holding gain expectations and abnormal returns. A test procedure was also described. The test evaluates the abnormal profits from a trading strategy of taking a long position in stocks of firms having positive unexpected holding gains and a short position in stocks of firms having negative unexpected holding gains. The next chapter presents results of the test.

CHAPTER IV

RESULTS AND ANALYSIS

A theory was presented linking replacement cost income to cash flow and cash flow to stock prices. Statistical procedures for dealing with instability in market model parameters and biases in daily stock return data were advanced. Likewise, holding gain calculation was addressed, as were models for isolating the unexpected component of a holding gain. The Jaffe test of information content of unexpected holding gains was proffered. This chapter presents the test results.

Hypotheses

The objective of this research is to test whether information content, defined in terms of assessed daily return distributions of a reporting firm's common stock, was provided by 1978 10-K filings. The distributions in question are those summarized by the Jaffe portfolio method. Three tests of information content were performed with three holding gain expectations models. The relevant hypothesis for any model is

H_o: Replacement cost data (holding gains) contain no information

H_a: Otherwise

The t-test described in the preceding chapter provides the basis for testing this null hypothesis,

$$H_o: \; t \leq 0 \quad \text{for } \overline{se} \leq 0$$

$$H_a: \; t > 0 \quad \text{for } \overline{se} > 0$$

The t-test is one sided, since a portfolio buy/sell scheme such as the one described should produce positive abnormal returns if information were present in replacement cost data.

Results of Portfolio Tests

Results are presented in full in Appendix D. Outcomes of interest are the portfolio t-tests based on the three expectations models.

	Model I	Model II	Model III
t	2.69205	-0.21927	0.407038

Model II, the wholesale price index model, and Model III, the cross-sectional model, clearly indicated no significant t-statistic, and thus support the null hypothesis. Model I exhibited a significant t-value (OSL>99%) and is therefore inconsistent with the null hypothesis. In sum, these mixed results support the contention of no information content of replacement cost data revealed in 1978 10-K reports.

Further examination of Model I tests supports this conclusion. Most values of se_t (abnormal performance of portfolio t) were small (see Appendix D). The exceptions were portfolios 23 and 24. Therefore, $\overline{se}$, or average abnormal performance of all portfolios, is driven by se_{23} and se_{24}. These data are recapped in Table I.

TABLE I

ANALYSIS OF OUTLIER EFFECTS

Portfolio	Firm	Sign of Model I	Sign of Model II	Sign of Model III
24	Anchor Hocking	+	-	+
23	Alcon Aluminum	+	-	-
23	Ametek	+	+	+
23	Anchor Hocking	+	-	+
23	Missouri Public Service	+	+	+
23	Montana Dakota	-	-	+

Portfolio 24 had a large abnormal return of 5.85765, but significant differences between t-statistics could not be attributed to this portfolio because model signs were offsetting. Portfolio 23 seemed to be the origin of differences between t-statistics (return = 6.37079).

Only one firm (Alcon Aluminum) indicated a sign difference between Model I and the others. Further examination of Alcon Aluminum's residuals revealed no large abnormal residual for the day in which it was included in portfolio 23.

The significant t-value for Model I was apparently the result of two factors: 1) a change in sign of Model I and Model II for Anchor Hocking in portfolio 24, and 2) a large, abnormal return in portfolio 23.

Further examination of daily residuals of portfolio 23 produced no aberrations. Residuals of portfolio 23 were somewhat, but not extravagantly, larger than any other residuals in this study. These data tended to support the conclusion portfolio 23 was simply an outlier.

Conclusion

Three expectations models of holding gains determined how a firm should be included in a portfolio buy/sell scheme for 15 days. Theory predicted this scheme would produce positive abnormal returns if information were present in reported holding gains. Two of three tests, based on three expectations models, produced insignificant t-test results. Although one model displayed significant statistical results, an investigation of those results pointed towards outlier effects as an explanation.

Significance tests of two models, in combination with the outlier interpretation of the third, supports the null hypothesis. The conclusion is therefore one of no information content in 1978 replacement cost data as reported on form 10-K.

CHAPTER V

SUMMARY AND CONCLUSIONS

This research developed a link between the holding gain component of replacement cost income and changes in the level of a firm's cash flow. Changes in cash flow were related to value changes with the Capital Asset Pricing Model (CAPM) providing a motivation for evaluating holding gain disclosures with stock prices.

Stock prices were examined by removing market-wide phenomena with the well-known market model (adjusted for biases in daily data). Some firms were eliminated because they did not comply with conditions of constant risk.

A trading scheme of buying and short selling stocks with reported unexpected holding gains was conducted. Three models were used for holding gain expectations. Tests of the trading scheme (based on the expectations models) were carried out. Two of the three expectations models generated average portfolio returns not statistically different from zero. The third expectations model generated significant trading profits, but close inspection revealed the significance was likely due to outlier effects. The hypothesis of information content of replacement cost data reported in 1978 10-K's was not supported.

Experimental Problems

It is possible that the analytical development contained assumptions contrary to reality. Revsine (1973) supported Edwards and Bell's (1961) contention that holding gains should be regarded as unexpected income. But this is so only in a perfectly competitive environment. In an environment of imperfect competition, replacement cost income can only be approximate economic income and, therefore, approximate unexpected cash flow. The degree of approximation is an empirical matter.

In addition, Revsine (1973) showed holding gains to be leading indicators of cash flows only in the absence of general price changes. Although one expectations model of this study extrapolated general price movements through the wholesale price index, it was unclear if this method compensated for an obvious departure from the theory.

The CAPM is a one period model. Clearly, holding gains for long-lived assets span more than one period. In imperfect markets, managers may be unwilling or unable to increase output prices in a time period corresponding to increased input prices. Type A price changes may occur, but over more than one period. Thus, the link of unexpected cash flows to stock prices via the one period CAPM may be tenuous.

Finally, testing of replacement cost data required expectations models. This study's expectations models were chosen arbitrarily. Although there was support for such models in the literature (especially the naive model), it is impossible to discern if any correct model was utilized.

Statistical Problems

Statistical problems arise in any empirical study. No direct control was exercised over other information contained in the 10-K reports. No control was made over industry factors. An assumption was that these factors averaged out over all firms in this study.

The Jaffe (1974) portfolio method employed in this study seemed to be sensitive to portfolios containing few firms. Small portfolios can (and did) result in large portfolio returns. These returns are weighed no less than returns of larger portfolios, and a few firms can dominate the average overall portfolios.

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APPENDIXES

APPENDIX A

CALCULATED HOLDING GAINS TABLE

TABLE II

CALCULATED HOLDING GAINS*

Firm	1977	1978
Boise Cascade	$252,000	$161,000
Borden	150,200	211,800
Boston Edison	110,027	184,447
Brockway Glass	29,818	34,183
Bunker Ramo	24,865	35,199
MacMillan	18,949	29,649
CLC of America	20,479	42,553
Carnation	80,000	90,000
Cascade Natural Gas	17,239	16,435
Ceco	4,290	15,266
Central Illinois Public Serv.	90,877	204,399
Central Telephone & Util.	149,676	217,658
Champion Spark Plug	48,036	60,224
MCA	22,150	18,283
Maine Public Service	40,736	41,579
Maremont	18,055	9,787
Masco	27,857	43,038
Melville	26,200	60,135
Mid Continent Telephone	16,288	49,717
Midland Ross	20,755	29,478
Missouri Public Service	44,262	63,644
Montana Dakota Utilities	101,399	85,355
Moore McCormack Resources	- 9,211	45,234
NCR	196,868	177,205
Central Illinois Power & Light	138,000	101,000
The Charter Co.	18,300	45,200
The Chesapeake Corp. of America	70,002	40,036
Chesebrough Ponds	21,706	24,655
McCullough Oil	2,223	2,427
McLough Steel	177,330	58,699
Mapco	59,422	59,581
Marathon Oil	318,566	231,982
Media General	42,895	9,003
Medusa	87,189	50,129
Memoriex	34,000	44,000
Mercantile Stores	25,062	33,049
Metro Media	37,053	46,607
Minnesota Gas	35,870	69,703
Missouri Pacific	594,400	668,600
Mohasco	39,847	47,798
Monsanto	325,000	842,500
Montana Power	91,871	86,408
Morrison Knudson	19,384	12,215
Motorola	125,500	137,596
Mountain Fuel Supply	76,000	133,000

TABLE II (Continued)

Firm	1977	1978
Monford	$ 17,949	$- 11,336
NL Industries	- 7,332	199,186
Nashua	19,764	17,321
Bell & Howell	16,000	32,000
Bemis	38,000	32,000
Bethlehem Steel	557,000	106,200
Nalco Chemical	21,265	18,371
National Can	31,019	33,212
National Distellers & Chem.	78,741	90,662
Natomas	38,241	62,906
N.E. Gas & Electric	76,987	68,346
Newmont Mining	213,000	113,000
Nicor	167,979	245,853
National Gypsum	73,943	82,739
National Tea	10,437	30,467
Nevada Power	86,146	73,940
The New York Times	15,889	20,342
Norfolk & Western RR	149,000	297,000
American Tel. & Tel.	9,283,905	10,568,515
American Water Works	192,991	184,103
Ametek	10,600	17,500
Amfak	65,492	108,994
Anchor Hocking	49,823	51,509
Armstrong Cork	75,678	118,511
Asarco	345,224	186,193
Avon	71,900	107,800
Ball	27,979	29,938
Barnes Group	20,764	24,101
Barber Oil	23,502	24,968
Bay State Gas	15,139	- 57,810
Big Three Industries	55,061	59,917
Boeing	138,200	116,100
Borg Warner	86,900	116,100
Burroughs	247,067	122,996
Buttes Gas & Oil	40,033	7,846
Canadian Occidental	19,515	3,569
Carolina Power & Light	401,800	165,741
Castle & Cook	36,980	56,554
Caterpillar Tractor	- 222,900	159,990
Central Hudson Gas & Electric	56,574	76,450
AFM	47,215	76,519
ATO	22,226	26,873
Abbott Labs	73,626	76,359
Akzona	52,219	63,037
Albany	18,554	14,736
Alcan Aluminum	508,000	546,000
Allegheny	20,498	20,235

TABLE II (Continued)

Firm	1977	1978
Allegheny Airlines	$ 49,171	$ 98,538
Allegheny Power Systems	1,152,916	353,581
Allied Products	75,560	91,600
Amcord	34,211	45,515
Amerace	16,723	19,476
Amerada Hess	138,000	206,000
American Brands	139,680	171,910
American Cyanamid	367,000	366,000
American Manufacturing	19,441	45,547

*Calculated holding gains of firms used in the portfolio test (000's omitted).

APPENDIX B

SIGNS OF HOLDING GAINS TABLE

TABLE III

SIGNS OF HOLDING GAINS*

Firm	Model I	Model II	Model III
Boise Cascade	-	-	-
Borden	+	+	+
Boston Edison	+	+	+
Brockway Glass	+	+	+
Bunker Ramo	+	+	+
MacMillan	+	+	+
CLC of America	+	+	+
Carnation	+	+	+
Cascade Natural Gas	-	-	+
Ceco	+	+	+
Central Illinois Public Ser. Serv.	+	+	+
Central Telephone & Util.	+	+	+
Champion Spark Plug	+	+	+
MCA	+	+	+
Maine Public Service	+	-	+
Maremont	-	-	+
Masco	+	+	+
Melville	+	+	+
Mid Continent Telephone	+	+	+
Midland Ross	+	+	+
Missouri Public Service	+	+	+
Montana Dakota Utilities	-	-	+
Moore McMormack Resources	+	+	+
NCR	-	-	+
Central Illinois Power & Light	-	-	+
The Charter Co.	+	+	+
The Chesapeake Corp. of America	-	-	+
Chesebrough Ponds	+	+	+
McCullough Oil	+	+	+
McLouth Steel	-	-	-
Mapco	+	-	+
Marathon Oil	-	-	-
Media General	-	-	+
Medusa	-	-	+
Memorex	+	+	+
Mercantile Stores	+	+	+
Metro Media	+	+	+
Minnesota Gass	+	+	+
Missouri Pacific	+	+	-
Mohasco	+	+	+
Monsanto	+	+	+
Montana Power	-	-	+

TABLE III (Continued)

Firm	Model I	Model II	Model III
Morrison Knudson	-	-	+
Motorola	+	+	+
Mountain Fuel Supply	+	+	+
Monford	-	-	+
NL Industries	+	+	+
Nashua	-	-	+
Bell & Howell	+	+	+
Bemis	-	-	+
Bethlehem Steel	-	-	-
Nalco Chemical	-	-	+
National Can	+	-	+
National Distillers & Chem.	+	+	+
Natomas	+	+	+
N.E. Gas & Electric	-	+	+
Newmont Mining	-	+	-
Nicor	+	+	+
National Gypsum	+	+	+
National Tea	+	+	+
Nevada Power	-	+	+
The New York Times	+	+	+
Norfolk & Western RR	+	+	+
American Tel. & Tel.	+	+	-
American Water Works	-	+	+
Ametek	+	+	+
Amfak	+	+	+
Anchor Hocking	+	-	+
Armstrong Cork	+	+	+
Asarco	-	-	-
Avon	+	+	+
Ball	+	-	+
Barnes Group	+	+	+
Barber Oil	+	-	+
Bay State Gas	-	-	+
Big Three Industries	+	+	+
Boeing	-	-	+
Borg Warner	+	+	+
Burroughs	-	-	-
Buttes Gas & Oil	-	-	+
Canadian Occidental	-	-	-
Carolina Power & Light	-	-	-
Castle & Cook	+	+	+
Caterpillar Tractor	+	+	+
Central Hudson Gas & Electric	+	+	+
AMF	+	+	+
ATO	+	+	+
Abbott Labs	+	-	+
Akzona	+	+	+

TABLE III (Continued)

Firm	Model I	Model II	Model III
Albany	-	-	+
Alcan Aluminum	+	-	-
Allegheny	-	-	+
Allegheny Airlines	+	+	+
Allegheny Power Systems	-	-	-
Allied Products	+	+	+
Amcord	+	+	+
Amerace	+	+	+
Amerada Hess	+	+	+
American Brands	+	+	+
American Cyanamid	-	-	-
American Manufacturing	+	+	+

*This table contains the signs of differences between calculated and expected holding gains, H_i, used in calculating expected abnormal returns of the portfolios.

APPENDIX C

TABLE OF FIRMS ELIMINATED FROM PORTFOLIO ANALYSIS

TABLE IV

FIRMS ELIMINATED FROM PORTFOLIO ANALYSIS*

Firm	m	F(s)	Data
Allis Chalmers	8	1.87	
Alpha Portland			x
American Air Lines	8	2.00	
American Bakers			x
American Broadcasting	5	1.78	
American Can			x
American National Resources			x
American Standard	5,8	1.81,2.27	
Athlone Labs			x
Bell Canada			x
CBS	8	1.75	
CIT Financial			x
Central South West			x
Central Maine Power			x
Chessie Systems	8	1.77	
Marathon Manufacturing	8	1.89	
McDonalds	8	2.05	
McGraw Edison			x
McNeil	5	1.64	
Mead	5	1.84	
Middle South Utilities			x
3M	8	1.83	
Minnesota Power & Light			x
Mobil			x
Murphy Oil			x
National Steel	5,8	2.53,1.81	
N.Y. State Electric & Gas			x
Niagra Mohawk			x

*These firms were not included in portfolios due to unstable time series parameters. They exceeded critical F-values of either $F_{38,60} = 1.59$ for a moving regression of length m = 5 or $F_{24,76} = 1.73$ for a moving regression of length = 8. Firms denoted x were not included in portfolios due to missing data on the CRSP file.

APPENDIX D

PORTFOLIO STATISTICS TABLE

TABLE V

PORTFOLIO STATISTICS*

Portfolio	se	$\hat{SD}$
	a. Model I	
	$\overline{se}$ = 0.549512	
	t = 2.69205	
1	-0.643837	0.00388134
2	-2.04661	0.00317227
3	1.5991	0.00239191
4	1.46925	0.00236714
5	-2.77041	0.00193973
6	0.638246	0.00176246
7	-0.37093	0.00174202
8	-0.720717	0.00175683
9	0.0810359	0.00176873
10	-0.0930718	0.00176616
11	2.73734	0.00170479
12	-0.392	0.0017842
13	-0.482369	0.00177436
14	-1.70031	0.00175458
15	1.98735	0.00172342
16	0.102665	0.00175762
17	1.1026	0.00174948
18	0.514547	0.00178236
19	0.520745	0.0017684
20	-0.868522	0.00178326
21	-0.745682	0.00187906
22	1.04141	0.00185116
23	6.37079	0.00192275
24	5.85765	0.00225653
	b. Model II	
	$\overline{se}$ = -0.0447582	
	t = -0.21927	
1	-0.643837	0.00388134
2	-2.04661	0.00317227
3	1.5991	0.00239191
4	1.46925	0.00236714
5	-2.77041	0.00193973
6	-0.535462	0.00176246
7	-0.567957	0.00174202
8	-0.863409	0.00175683
9	0.194295	0.00176873
10	0.414205	0.00176616
11	2.5626	0.00170479

TABLE V (Continued)

Portfolio	se	$\hat{SD}$
	Model II (Cont.)	
12	0.0688994	0.0017842
13	-0.855275	0.00177436
14	-2.07388	0.00175458
15	1.39577	0.00172342
16	0.445159	0.00175762
17	0.438033	0.00174948
18	0.215021	0.00178326
19	1.671	0.0017684
20	-1.35163	0.00178326
21	-1.68737	0.00187906
22	1.04602	0.00185116
23	6.65993	0.00192275
24	-5.85765	0.00225653
	c. Model III	
	$\overline{se}$ = 0.0830864	
	t = 0.407038	
1	-0.643837	0.00388134
2	-2.04661	0.00317227
3	-0.442554	0.00239191
4	0.202077	0.00236714
5	-2.21795	0.00193973
6	0.187075	0.00176246
7	-0.169449	0.00174202
8	0.918524	0.00175683
9	-0.829207	0.00176873
10	-0.490537	0.00176616
11	2.2406	0.00170479
12	0.0530749	0.0017842
13	-1.69004	0.00177436
14	-0.700146	0.00175458
15	1.96535	0.00172342
16	0.583166	0.00175762
17	1.68264	0.00174948
18	-0.889872	0.00178236
19	1.61971	0.0017684
20	-2.18312	0.00178326
21	-0.251519	0.00187906
22	-2.10107	0.00185116
23	1.34011	0.00192275
24	5.85765	0.00225653

*Statistics for the portfolio tests based on the three expectations models.

VITA

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