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Jarrow and O'Hara(1989) found significant premiums in the prices of primes and scores, and attributed this price disparity to regulatory constraints in short sales and trust size limitations, thereby making transaction costs so large that the score will be preferable to dynamic hedging. The purpose of this paper is to further examine the premiums associated with primes and scores using more comprehensive data and more direct methodology. We show that the transaction cost saving hypothesis of Jarrow and O'Hara is not well supported, using a larger period with more observations. This leaves the question of why the premiums exist. We attempt to offer some alternative explanations.

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I. Introduction

Unbundling securities has gained significant attention of investors in recent years. In the absence of arbitrage opportunities, the total market value of any set of identical income streams received by investors should remain the same regardless of recapitalization, which is referred to, in general, as the value additivity principle (VAP).

The research on the unbundling of stocks through PRIMEs and SCOREs is limited because of its relatively short history. A recent study, Jarrow and O'Hara (1989), using five stocks' primes and scores around their initial offering, documents that the sum of prime and score prices considerably exceeds the price of underlying stock and thus the VAP does not hold. They examined three alternative hypotheses for the premiums: the market completeness hypothesis, the transaction cost hypothesis and the tax-based hypothesis. Their conclusion is that the large transaction costs of dynamic hedging contribute to the premiums and are a plausible reason for the overpricing of the prime and the score. Acknowledging the score as a long-term European call option, they argue that the long-term option created by the score avoids the cost of replicating such an option via dynamic hedging in the short-term options market, causing the score to be more valuable than predicted by a standard option pricing model. The costs of dynamic hedging occur when investors roll over short-term options to replicate a long-term option.

Therefore, the ability to save on transaction costs may make the sum of the prime and score prices greater than the price of the underlying stock.[1] However, the data used in Jarrow and O'Hara is very limited, including only five stocks, American Home Products, Bristol-Myers, DuPont, Exxon and Merck. Except for Exxon, four of the trusts were started at the beginning of 1987. Jarrow and O'Hara terminate their data in June 1987. This limits the number of months of their sample to between two and five months for these stocks. Exxon started in December of 1985, thus gives eighteen months of data for this firm. The small data set of five companies over a very short period 1, 2, 3, 4, and 18 months casts serious doubts on the confidence one has in their results. In Jarrow and O'Hara's own words, "our results, although encouraging, are inconclusive. Based on weak evidence....Additional research is needed along these lines." This paper provides such research using twenty four months of data for all twenty six of the firms that have primes and scores.[2]

This paper further investigates the VAP using more data of the scores and primes for a longer time period than the previous study and shows that the premiums of scores and primes do indeed exist but they may not be due to the transaction costs involved in dynamic hedging. This result leaves the question of why the premiums exist unanswered. We attempt to offer some alternative explanations.

The remainder of this paper is organized as follows. Section II briefly reviews the structure of primes and scores. Section III presents the results of the VAP tests. In Section IV, we reexamine the transaction cost saving hypothesis and provide evidence that the hypothesis is not well supported. Section V contains alternative hypotheses and concluding remarks.

II. Review of Primes and Scores

In 1983, Americus Shareowners Service Corp. created the first Americus Trust, the purpose of which was to divide an existing share of AT&T common stock into two distinct tradeable instruments: prime and score.[3] The second trust was offered on Exxon common stock in 1985. The remaining trusts such as trusts on American Express, American Home Product, ATT-Series 2, Amoco, ARCO, Bristol Myers, Chevron, Coca-Cola, Dow, DuPont, Kodak, Ford, GE, GM, GTE, Hewlett Packard, IBM, Johnson & Johnson, Merck, Mobil, Philip Morris, Procter & Gamble, Sears, Union Pacific, and Xerox were offered during 1987 (see Table 1 for details). The conversion of one share into a score and a prime, allows investors to separate the potential capital appreciation in excess of a stipulated dollar amount from the right to receive dividends and all other attributes of share ownership. The owner of the prime (primeholder) receives dividends and any appreciation in price up to a predetermined termination value whereas the owner of the score (scoreholder) receives the capital appreciation on the underlying stock, if any, over the predetermined termination value. The primeholder retains the voting right.

At the beginning of each trust, a shareholder can elect to tender each share to receive a unit. Each unit consists of one prime and one score. A trust may hold no more than five percent of a corporation's outstanding common stock. When this level is reached, the trust is closed and no additional shares may be tendered to the trust. The life of the trust is fixed at five years. At maturity, the outstanding units are converted into the corresponding stock. Prior to the termination of the trust, any unseparated unit and any prime and score component may be redeemed for the net asset value per unit. When the stock is tendered to the trust, there is an initial commission which decreases on a per share basis as the number of shares tendered increases. The primeholder is also charged an annual management fee of six cents per unit (five cents per unit for Exxon trust). There is no fee for converting a unit back into the underlying stock. The primes and scores are traded on the American Stock Exchange.

The primes and scores are comparable to income and capital shares, respectively, of dual purpose funds even though they are not completely analogous. The dual purpose funds are closed-end investment companies which are capitalized with two types of claims: income shares and capital shares. However, there are some differences. A prime and a score generally sell at a premium to the underlying common stock while the dual-purpose fund generally sells at a discount to its net asset value. A prime and a score can be exchanged into the original stock at any time. Also, the underlying asset of prime and score is common stock while the underlying asset of a dual purpose fund is a portfolio of securities. Ingersoll (1976) shows that the asset value of the dual purpose fund exceeds the market value and that it is not inconsistent with market equilibrium or efficiency for the capital shares to sell at a discount. Litzenberger and Sosin (1977b) show that institutional restrictions on short selling permit discounts on dual purpose funds to fluctuate within wide bounds, and these fluctuations are consistent with market efficiency.[4]

III. Tests of the Value Additivity Principle

A. The Data and Methodology

The data set includes the daily closing prices of primes, scores, and stocks for all the twenty-six companies from July 1987 to June 1989, collected from the Wall Street Journal as Jarrow and O'Hara.[5] Stock prices were adjusted for stock splits during the sample period.

Let us define the deviation of the sum of prime and score prices from the stock price as:

$$D_t = P_{pt} + P_{st} - P_t \tag{1}$$

where P_{pt}: the price of prime at time t,

P_{st}: the price of score at time t,

P_t: the price of stock at time t,

D_t: the deviation of prime and score prices from the stock price at time t.

When the premiums are tested using the actual data, noise in the prices of scores, primes and stocks should be considered, because we are dealing with the equilibrium relationship between the score and prime prices and the stock price.[6] Thus, the VAP is tested by observing the central tendency of the deviations of combined prime and score prices from the stock prices. By testing the randomness and convergence to zero of the time-series deviations, it can be determined whether or not the VAP holds systematically.

To test for the randomness and convergence to a nonpositive value of daily deviations of the combined values of primes and scores from the stock prices, the AR(1) model, which was used by Litzenberger and Sosin (1977b) and Burns (1987), is applied to the time series data of D_t, as

$$D_t = \mu + \rho D_{t-1} + e_t, \qquad t = 2,3,\ldots,T \tag{2}$$

where $\epsilon_t \sim N(0,\sigma_t^2)$

μ:constant,

ρ:the first order correlation coefficient between D_t and D_{t-1}.

From equation (2), the first order autocorrelation coefficient, which measures the rate at which the price differentials are narrowed, is examined for the randomness of D_t. The VAP suggests that $|\rho| < 1$ and μ is equal to zero. Therefore, the null hypothesis is

$$H_0: \ |\rho| < 1 \text{ and } \mu = 0.$$

The interpretation of μ and ρ can be confusing if the assumed AR(1) process does not fit the data. To avoid this problem of model misspecification, ARMA(1,1) also is applied to D_t as,

$$D_t = \mu + \rho D_{t-1} + e_t - \theta e_{t-1} \qquad t = 2,3,\ldots,T \tag{3}$$

where θ: the first order correlation coefficient between ϵ_t and ϵ_{t-1}.

In addition, the runs test and sign test are used to reexamine the randomness of D_t and whether the expected value of D_t equals zero, respectively, for nonparametric tests. The statistic of the runs test is

$$Z = \frac{R - n/2 - 1}{\sqrt{(n^2-2n)/4(n-1)}}$$

where: Z: standard normal distribution statistic,

R: number of runs,

n: number of observations.

The sign test calculates the sample median, the number of values above and below the hypothesized median and the normal distribution statistic, Z.

B. Empirical Findings

Table 2 presents the summary statistics of the average behavior of D_t, premiums or discounts and includes the maximum and minimum deviations of the combined values of primes and scores from the stock prices. The mean premium on primes and scores is $0.995, and the range of the mean premium is from $0.21 to $1.97. This compares to a mean of $1.20 and a range of $0.73 to $1.85 found by Jarrow and O'Hara.

In the AR(1) model, the VAP is assumed to hold if $\mu = 0$ and $|\rho| < 1$. Table 3 shows that the average of μ is 0.75, which is significantly greater than zero. The minimum value of μ is 0.21 for Exxon, which is greater than zero at the significance level of five percent. The rates of convergence vary from a low of 0.15 for Procter and Gamble to a high of 0.89 for Coca-Cola. The values of μ and ρ in Table 3 are statistically greater than zero at the ninety-five percent confidence level.

Table 4 reports the results of the ARMA(1,1) process. Table 4 shows that the average of μ is 0.846 and that of ρ is 0.862, which are significantly greater than zero.

These results do not support the VAP. The convergence rates, ρ, are much higher when we apply the ARMA(1,1) process rather than the AR(1) process. Also, the μ values of ARMA(1,1) process are significantly greater than zero for all the stocks. The convergence rates of ARMA(1,1) process are consistent with those of Litzenberger and Sosin (1977). A high convergence rate means that the premiums or discounts of primes and scores are persistent over time. The chi-square statistics for the ARMA(1,1) model are smaller than those for the AR(1) model in all of the companies. Thus, the ARMA(1,1) model appears to be better than the AR(1) model in explaining the behavior of premiums or discounts in scores and primes. In sum, the results from the AR(1) and ARMA(1,1) models are not consistent with the predictions of the VAP. These results are consistent with Jarrow and O'Hara.

Tables 5 and 6 report the results on nonparametric tests of D_t, runs test and sign test, respectively. The average expected number of runs is 249 when the sample is assumed to be random. But the actual number of runs is 157 on average, which is much smaller than the hypothesized number of 249. The results reject the randomness of D_t at the five percent significance level in all samples, which indicates that D_t observed above the median would be followed by another D_t above the median so that the behavior of D_t is systematic rather than random. The sign test is used to test the null hypothesis that the population median of premiums is equal to zero. Table 6 shows that D_t is significantly greater than zero at the five percent significance level for all the companies. Again, these results contradict the predictions of the value additivity principle.

IV. Reexamination of Dynamic Hedging Cost Saving Hypothesis

According to the dynamic hedging cost saving hypothesis, scores provide a means of saving on the costs of dynamic hedging. While long-term options like scores do not exist in the option market, it is possible to replicate a long-term option through a process of dynamic hedging, i.e., by rolling over short-term options in the options market. However, this may require enormous transactions costs. Even though the long-term characteristic of the score is not unique, the score may be valuable if it economizes on the transaction costs via dynamic hedging.

Jarrow and O'Hara (1989) use the Black-Scholes model with daily revised Implied Standard Deviations (ISD) relative to the model based on historical volatility measures as a means for testing the dynamic hedging cost saving hypothesis. They show that the Black-Scholes model based on ISDs revised daily is superior to the model based on historic variances for predicting score prices. Since the ISD may reflect the cost of dynamic hedging over the option's life whereas the historical volatilities do not, they argue that the premium may be attributable to the score's ability to save transaction costs of dynamic hedging.

However, this is indirect and weak evidence. The superior performance of the Black-Scholes model with ISDs revised daily may not be related to the dynamic hedging cost saving.[7] Chesney and Scott (1989) show that the Black-Scholes model with changing ISDs outperforms the Black-Scholes model with historic variances for predicting call option prices on the dollar/Swiss Franc exchange rates, which are short-term European options and thus do not have dynamic hedging cost savings. One possible interpretation of the superior performance of the Black Scholes model with ISDs revised daily is that the market makers and the traders are using the variations of the Black-Scholes formula with daily revisions in the variance implied in the score. Therefore, the comparison between the Black-Scholes model with historic variances and the one with ISDs revised daily may not be directly related to the dynamic hedging cost saving hypothesis, but instead merely indicate the superior performance of the Black-Scholes model with ISDs revised daily compared to the one with historic variances. We reexamine the dynamic hedging cost savings hypothesis using an alternative and direct method.

The dynamic hedging cost saving hypothesis predicts that dynamic hedging cost savings will decrease over time since the number of times a short-term option must be rolled over in order to create a long-term option such as score decreases when the maturity date is approached. Therefore, the premiums in scores and primes, which are equivalent to the dynamic hedging cost savings, will decrease over time. The dynamic hedging cost saving hypothesis, thus, implies the negative relationship between time and premiums in prime and scores.

One way to test the relationship is to calculate the Pearson correlation coefficient between time and premiums in scores and primes. We use two different data sets. One data set includes the whole period from July 1, 1987 to June 30, 1989. The other data set excludes the data from July 1, 1987 to December 31, 1987 in order to avoid a possible impact of the market crash of October 19, 1987, covering the period January 1, 1988 to June 30, 1989.

The results are presented in Table 7. Eleven out of twenty-six companies are significantly negative in the correlation coefficient when we use the data for the whole sample period (Panel A). However, only four out of twenty-six companies show significantly negative correlation coefficients for the period from January 1, 1988 to June 30, 1989 (Panel B). This casts serious doubts on the validity of the dynamic hedging cost savings hypothesis.

To investigate further the dynamic hedging cost saving hypothesis, four groups are constructed for different time periods. Group A includes the data set from July 1, 1987 to December 31, 1987. Group B consists of the data from January 1, 1988 to June 30, 1988. Group C consists of the data from July 1, 1988 to December 31, 1988. Group D consists of the data from January 1, 1989 to June 30, 1989. For the fixed lives of primes and scores, the null hypothesis on the premiums will be

H_1: mean of Group A > mean of Group B

H_2: mean of Group A > mean of Group C

H_3: mean of Group A > mean of Group D

H_4: mean of Group B > mean of Group C

H_5: mean of Group B > mean of Group D

H_6: mean of Group C > mean of Group D

For each hypothesis, the decision rule is

$$Reject\ H\ if \frac{X_i - X_j}{var(X_i)/n_i - var(X_j)/n_j} < Z$$

where X_i, X_j = the mean of Group i and j, respectively,

n_i, n_j = the sample size for Group i and j, respectively,

Z = the Z value at the five percent significance level.

Table 8 reports the results. Nine and eleven out of twenty-six companies are rejected under the hypotheses H_1 and H_2, respectively, in panels A and B of Table 8. In other words, the average premiums in scores and primes from July 1, 1987 to December 31, 1987 are significantly less than or equal to those from January 1, 1988 to June 30, 1988 and those from July 1, 1988 to December 31, 1988 for nine and eleven out of twenty-six companies, respectively. These results are not strongly inconsistent with the prediction of the dynamic hedging cost saving hypothesis. Note, however, that Group A covers the period including the market crash. The test results of H_3 and H_4 are stronger. Fifteen and sixteen out of twenty-six companies are rejected under H_3 and H_4 respectively, in panels C and D of Table 8. The average premiums in scores and primes from July 1, 1987 to December 31, 1987 are not significantly greater than those from January 1, 1989 to June 30, 1989 for fifteen out of twenty-six companies. Also, the average premiums in scores and primes from January 1, 1988 to June 30, 1988 are not significantly greater than those from July 1, 1988 to December 31, 1988 for sixteen out of twenty-six companies. For the hypotheses, H_5 and H_6, twenty-three and twenty-two out of twenty-six companies are rejected, respectively, in panels E and F of Table 8. The average premiums in scores and primes from January 1, 1988 to June 30, 1988 are not significantly greater than those from January 1, 1989 to June 30, 1989 for twenty-three out of twenty-six companies and the average premiums in scores and primes from July 1, 1988 to December 31, 1988 are not significantly greater than those from January 1, 1989 to June 30, 1989 for twenty-two out of twenty-six companies. Thus, the results are not consistent with H_5 and H_6.

In sum, the results strongly suggest that the premiums tend to increase as the maturity approaches, which is contradictory to the transaction cost saving hypothesis.

V. Concluding Remarks

We test the VAP using primes and scores based on parametric and nonparametric methods. The results based on both methods suggest that the deviations of combined score and prime prices from stock prices are significantly greater than zero and thus the VAP does not hold. We show that the transaction cost saving hypothesis for the deviations suggested by Jarrow and O'Hara (1989) is not well supported by empirical results using a large data set and more direct methodology. This result leaves the puzzling question: where does the premium come from? In light of the recent trend of unbundling a security and trading the components separately, this question seems to be very relevant and needs to be addressed.[8]

One possible answer may lie in the structure itself of primes and scores, i.e., the premium may be simply due to the fact that any investor can recombine the prime and score to get the stock at no fee prior to the termination date but not vice versa. Another possible reason, which is not mutually exclusive with the above, may be the expanded trading opportunities in an incomplete market. One of the critical assumptions underlying the VAP is the market completeness in Arrow-Debreu sense. Arbitrage assures in a complete market that the sum of the market values of the securities must equal the present value of the income streams no matter how the securities are issued to the contingent income streams. If the sum of the prime and score is lower than the stock price, the investor can get the arbitage profit by buying a prime and a score, exchanging them for a stock at the trust, and selling it back in the market. On the other hand, if the stock sells at discount, one needs to be able to buy the stock, tender it to the trust for a prime and a score, and sell them back in the market for an arbitrage. Since this is not permitted after the trust is closed, one needs to buy the stock and sell short a prime and a score and hold them until the maturity, unless the prime and score can be created using other securities so that the market is complete.[9] Thus, as Sosin (1978) shows, the premiums may be simply due to the neutral recapitalization, i.e., dividing the stock into a prime and score, which expands investors' trading opportunities in an incomplete market. Sosin(1978) argues that "if the recapitalization by firm expands the trading opportunities of investors, then the unambiguous prediction is that a neutral recapitalization by a firm would increase its value relative to the values of all other firms in its risk class."(p. 1230) A similar argument can be found in Mossin (1969) and Ingersoll (1987). However, direct empirical tests on exactly what conditions in an incomplete market must be present for the VAP to hold or break down are yet to be done.

Footnotes

1.Jarrow and O'Hara (1989) also investigate the possibility that the price differentials of scores and primes may lead to arbitrage opportunities. They show that transaction costs, small daily trading volumes in primes and scores, short-sale constraints and limits on the size of trust may restrict the ability of investors to arbitrage away these premiums.

2.In a related paper, Barber (1989) develops a simple tax model to demonstrate the size of the premium when the marginal investor in the prime is taxed at a lower rate than the marginal investor in the underlying common stock. He argues that primes and scores can sell at a premium to the underlying common stock when the marginal investor in the prime pays a tax rate on dividends which is less than the tax rate faced by the marginal investor in the common stock. The marginal investor in the prime can be an incorporated investor which receives a 70 percent corporate dividend tax exclusion. That is, the prime may be more valuable than the score because the prime gives the marginal investor the opportunity to receive the 70 percent corporate dividend tax exclusion. Barber shows, using primes and scores for November 1987-December 1988, that the cumulative abnormal excess returns and volumes in the prime increase through 10 days after the ex-dividend date; that behavior may be consistent with the dividend clientele hypothesis stating that tax-motivated buying and selling occurs surrounding the ex-dividend date. Barber's empirical results, however, do not strongly support his arguments because the excess returns and trading volumes in primes around ex-dividend dates are much less than those in scores and underlying stocks. Thus, the tax-based hypothesis is ignored in this paper.

3.The term "prime" stands for "prescribed right to income and to maximum equity," while "score" for "special claim on residual equity."

4.In a related study, Burns(1987) tests the VAP for financial assets, Standard Oil securities for 120 trading days from June 10 through Novenber 1, 1912. He finds that the daily prices of equivalent Standard Oil portfolios accurately describe their average market values and the portfolio values display covergent adjustment behavior that tends to equalize them quite rapidly. He also shows that the average difference between the market value of a portfolio of subsidiaries and the market value of Standard Oil old stock as a single unit, is not significantly different from zero. He therefore concludes that the result is consistent with the VAP in equilibrium.

5.AT&T-Series 1 was not used because AT&T was divested after the Series 1 was formed. It is not clear the impact the divestiture had on the prime and score values.

6.Modigliani and Miller (1958) state that the M-M theorem describes only the central tendency around which observations will scatter because there are lags and frictions in the equilibrium process. Litzenberger and Sosin (1977) test the M-M theorem by examining the central tendency of the observed departures between income and capital shares and net asset values.

7.Jarrow and O'Hara (1989) calculate the daily ISD from the score price. When they use the weighted ISD from the CBOE options in order to predict score prices, the Black-Scholes model with the ISD of the CBOE options is inferior to the Black-Scholes model with the ISD of score prices.

8.For example, the techniques of unbundling a security and trading the components separately can be found in the Unbundled Stock Units (USUs) and the SuperShares. USUs were proposed by Shearson-Lehman in December 1988. Each USU, with 30 years maturity, consists of a base yield bond, an incremental dividend preferred share, and an equity appreciation certificate. A base yield bond pays quarterly coupons equal to the current dividend payout and a predetermined face value at maturity. An incremental dividend preferred share pays dividends in excess of the current level and a predetermined face value at maturity. An equity appreciation certificate can be exchanged for one share at maturity for an exercise price. However, this USUs proposal was withdrawn by Shearson-Lehman for some reasons on March 18, 1989. SuperShares were proposed by SuperShare Services Corporation, a major owned subsidiary of Leland O'Brien Rubinstein Associates Incorporated. SuperShare trust consists of four types of SuperShares: Appreciation Supershares (Upside Appreciation SuperShares) which provide leveraged participation in market gains, Priority SuperShares (Index Income SuperShares) which provide income in a slightly rising market, Protection SuperShares (Downside Protection SuperShares) which protect a market portfolio against a decline of up to 30 percent in value, and High Yield SuperShares (Money Market Income Shares) which provide additional income during flat or rising markets.

9.It is well known that in a complete market the marginal rates of substitution should be the same for every investor and thus the VAP holds. However, in an incomplete market, it does not necessarily follow that the marginal rates of substitution of the different contingent claims are equated for every investor. Hirshleifer (1970) shows that the complete market requires that the marginal rates of substitution for all investors are equal to the market prices in each state. But in an incomplete market, the consumptive optimum condition is that a weighted sum of the marginal rates of substitution is equal to the price of security and thus the marginal rates of substitution may differ for each individual.

References

Barber, B., "Primes, Scores and Units," working paper, Graduate School of Business, University of Chicago (November 1989).

Burns, M., "New Evidence on the Value Additivity Principle," Journal of Financial and Quantitative Analysis (March 1987), 65-77.

Chesney, M. and L. Scott, "Pricing European Current Options: A Comparison of the Modified Black-Scholes Model and a Random Variance Model," Journal of Financial and Quantitative Analysis (September 1989), 267-284.

Hirshleifer, J., Investment, Interest and Capital, New York, Prentice-Hall (1970).

Ingersoll, J. E., "A Theoretical and Empirical Investigation of Dual Purpose Funds: An Application of Contingent Claims Analysis," Journal of Financial Economics (January/March 1976), 83-123.

Ingersoll, J. E., "Theory of Financial Decision Making," Rowmand & Littlefield (1987).

Jarrow, R. and M. O'Hara, "Primes and Scores: An Essay on Market Imperfections," Journal of Finance (December 1989), 1263-1288.

Litzenberger, R. and H. Sosin, "The Theory of Recapitalizations and the Evidence of Dual Purpose Funds," Journal of Finance (December 1977a), 1433-1453.

Litzenberger, R. and H. Sosin, "The Structure and Management of Dual Purpose Funds," Journal of Financial Economics 4 (1977b), 203-220.

Modigliani, F. and M. Miller, "The Cost of Capital, Corporate Finance, and the Theory of Investment," American Economic Review 48 (June 1958), 261-297.

Mossin, J., "Security Pricing and Investment Criteria in Competitive Markets," American Economic Review 59 (December 1969), 749-56.

Sosin, H., "Neutral Recapitalizations: Predictions and Tests Concerning Valuation and Welfare," Journal of Finance (September 1978), 1228-1234.

Varian, H., "The Arbitrage Principle in Financial Economics," Economic Perspectives, Vol. 1 (Fall 1987), 55-72.

Walter, D. and P. Strasen, "The Americus Trust Prime and Score Units," The Tax Magazine (April 1987), 221-227.

Table 1

Description of the Trusts[a]

Company	Term. date	Term. claim	Beginning trading
Amer. Exp.	08/24/92	50	07/13/87
Am. Home Pdt.	12/20/91	90	01/27/87
ATT-Series2	02/14/92	30	03/11/87
Amoco	03/30/92	105	05/01/87
Arco	07/01/92	116	07/28/87
Bristol Myers	02/14/92	110	03/11/87
Chevron	07/01/92	75	06/15/87
Coca-Cola	08/06/92	56	07/28/87
Dow	05/18/92	110	05/14/87
DuPont	03/27/92	110	02/19/87
Kodak	04/15/92	92	06/22/87
Exxon	09/20/90	60	12/05/85
Ford	06/30/92	104	06/22/87
GE	05/11/92	140	04/27/87
GM	06/30/92	107	07/28/87
GTE	07/15/92	44	07/06/87
HP	07/27/92	90	08/13/87
IBM	06/30/92	210	07/20/87
J&J	06/30/92	118	10/21/87
Merck	04/14/92	200	04/10/87
Mobil	06/30/92	60	07/01/87
Philip Morris	07/27/92	110	10/27/87
P & G	06/01/92	105	07/15/87
Sears	07/15/92	64	07/06/87
Union Pacific	04/15/92	87	05/28/87
Xerox	07/15/92	97	10/26/87

[a]Source: Barron's (March 14, 1988).
Term. date is the termination date of the trust.
Term. claim is the termination claim.

Table 2

Summary of Premiums in Primes and Scores[a]

Company	N	Mean	Median	S.D.	Min	Max
Amoco	505	0.57	0.63	1.09	-3.06	4.25
Am. Home Pdt.	505	0.58	0.50	1.15	-3.87	6.25
ATT-Series2	505	0.77	0.75	0.56	-1.13	2.75
Arco	489	0.60	0.63	1.04	-11.90	4.25
Amer. Express	500	0.50	0.50	0.49	-0.63	1.99
Bristol Myers	505	0.67	0.63	1.24	-3.00	6.75
Chevron	505	1.22	1.12	1.24	-3.88	10.37
Coca-Cola	489	0.94	0.50	1.53	-1.13	10.87
Dow	505	1.22	1.12	1.24	-3.88	10.38
DuPont	505	0.43	0.38	1.05	-4.88	5.45
Kodak	505	0.92	0.64	1.45	-2.13	15.12
Exxon	495	0.21	0.01	0.89	-4.00	7.00
Ford	505	0.59	0.63	1.07	-2.25	4.50
GE	505	0.93	0.88	1.40	-3.00	9.25
GM	489	0.60	0.50	0.94	-1.50	4.87
GTE	505	0.41	0.38	0.50	-0.75	2.13
HP	488	0.44	0.38	0.79	-2.00	4.50
IBM	495	1.11	1.00	1.11	-1.75	8.62
J & J	474	0.78	0.63	1.19	-6.25	5.25
Merck	505	1.28	0.63	2.46	-4.00	11.51
Mobil	505	0.31	0.26	0.63	-1.13	4.62
Philip Morris	489	1.97	1.50	2.47	-7.63	10.38
P & G	498	0.67	0.75	1.03	-5.00	11.88
Sears	505	0.36	0.37	0.51	-2.13	2.25
Union Pacific	505	0.75	0.75	0.70	-2.25	7.25
Xerox	488	0.78	0.63	1.25	-5.13	17.00

[a]Premium = Score price + Prime price - Stock price.
N is the number of observations.
Mean is the average of premium over the sample period.
Median is the median of premium over the sample period.
Min. is the minimum premium.
Max. is the maximum premium.
S.D. is the standard deviation of the premium.

Table 3

AR(1) Process Estimation of Premiums[a]

$$D_t = \mu + \rho D_{t-1} + \varepsilon_t$$

where D is the premium in primes and scores

Company	μ	ρ	R^2	χ^2
Amer. Home Prdt.	0.56 (0.12)	0.71 (0.03)	0.499	28.70*
Amoco	0.57 (0.08)	0.48 (0.03)	0.236	33.75*
Arco	0.59 (0.06)	0.30 (0.04)	0.088	9.42
AT&T-Series 2	0.81 (0.07)	0.82 (0.02)	0.664	33.51*
Amer. Express	0.50 (0.03)	0.48 (0.03)	0.234	43.21*
Bristol Myers	0.67 (0.10)	0.54 (0.03)	0.289	27.66*
Chevron	0.65 (0.04)	0.26 (0.04)	0.071	27.29*
Coca-Cola	0.95 (0.26)	0.89 (0.02)	0.796	58.55*
Dow	1.222 (0.08)	0.41 (0.04)	0.168	35.48*
DuPont	0.42 (0.07)	0.46 (0.04)	0.207	30.46*
Exxon	0.21 (0.05)	0.20 (0.04)	0.041	3.10
Ford	0.59 (0.08)	0.50 (0.03)	0.250	37.99*
GE	0.94 (0.11)	0.48 (0.04)	0.225	18.90*
GM	0.59 (0.10)	0.71 (0.03)	0.469	47.88*
GTE	0.75 (0.11)	0.68 (0.09)	0.319	44.05*
HP	0.44 (0.05)	0.32 (0.04)	0.103	51.70*
IBM	1.11 (0.09)	0.59 (0.03)	0.350	49.61*
J & J	0.79 (0.09)	0.46 (0.04)	0.210	53.96*
Kodak	0.92 (0.14)	0.68 (0.03)	0.451	45.27*
Merck	1.28 (0.28)	0.75 (0.02)	0.563	47.92*

Table 3 (continued)

Company	μ	ρ	R^2	χ^2
Mobil	0.31 (0.05)	0.58 (0.03)	0.334	26.67*
Philip Morris	2.07 (0.41)	0.86 (0.02)	0.736	79.42*
P & G	0.67 (0.05)	0.15 (0.04)	0.018	5.30
Sears	0.35 (0.04)	0.54 (0.03)	0.297	52.99*
Union	0.75 (0.03)	0.20 (0.04)	0.041	10.66*
Xerox	0.56 (0.04)	0.47 (0.03)	0.671	23.28*

[a]The numbers in parentheses represent standard errors and χ^2 are chi-square statistics which test the hypothesis that the residuals are white noise.

* represents that the statistics are significant at the five percent level.

Table 4

ARMA(1,1) Process Estimation of Premiums[a]

$$D_t = \mu + \rho D_{t-1} + \varepsilon_t + \theta\varepsilon_{t-1}$$

Company	μ	ρ	θ	χ^2
AHP	0.49	0.89	0.41	4.53
Amoco	0.58	0.84	0.49	5.11
Arco	0.59	0.35	0.06	9.08*
Am. Express	0.56	0.95	0.74	13.47*
AT&T-2	0.99	0.94	0.39	9.75*
Bristol Myers	0.66	0.87	0.52	6.66
Chevron	0.66	0.84	0.65	2.80
Coca-Cola	0.95	0.97	0.45	10.38*
Dow	1.21	0.86	0.61	18.42*
DuPont	0.40	0.84	0.55	20.10*
Exxon	0.21	0.36	0.16	3.01
Ford	0.75	0.98	0.82	19.55*
GE	0.95	0.82	0.47	5.19
GM	0.61	0.95	0.57	4.95
GTE	0.84	0.86	0.61	6.37
HP	1.50	0.99	0.88	7.27
IBM	1.23	0.98	0.78	8.65*
J & J	1.19	0.99	0.82	3.81
Kodak	0.90	0.93	0.53	8.17*
Merck	1.04	0.97	0.62	14.57*
Mobil	0.32	0.87	0.48	8.05*
Philip Morris	2.23	0.99	0.56	11.11*
P & G	0.68	0.95	0.89	3.82
Sears	0.41	0.89	0.43	17.24*
Union	0.76	0.70	0.52	3.83
Xerox	0.63	0.91	0.68	4.53

[a]The statistics related to μ, ρ, and θ are not shown in the table, but all estimates are significant at the five percent level.

* represents that the statistics are significant at the five percent level.

Table 5

Statistics for Runs Test

H_0: D_t is random

$$z = \frac{R-n/2-1}{\sqrt{(n^2-2n)/4(n-1)}}$$

Company	Number of runs above & down	Expected number[a]	Z statistics
Amer. Home Prdt.	138	253	-10.3*
Amoco	174	253	-7.04*
Arco	195	245	-4.50*
Amer. Express	175	249	-6.66*
AT&T-2	101	254	-13.6*
Bristol Myers	144	253	-9.70*
Chevron	190	252	-5.58*
Coca-Cola	105	245	-12.7*
Dow	196	253	-5.08*
DuPont	186	252	-5.91*
Exxon	212	248	-3.24*
Ford	163	253	-8.02*
GE	158	253	-8.45*
GM	110	245	-12.2*
GTE	103	251	-13.3*
HP	199	241	-3.28*
IBM	134	248	-10.2*
J & J	161	235	-6.89*
Kodak	118	253	-12.0*
Merck	173	253	-7.12*
Mobil	142	253	-9.89*
Philip Morris	143	243	-9.10*
P & G	180	249	-6.22*
Sears	150	253	-9.18*
Union	205	250	-4.02*
Xerox	127	243	-10.6*

[a]Expected number represents the hypothesized number of runs when the data are assumed to be random.

* indicates that the statistics are significant at the five percent level.

Table 6

Statistics for Sign Test

Company	Number above[a]	Number below[b]	Z-statistic
Amer. Home Prdt.	353	135	9.82*
Amoco	352	139	9.57*
Arco	384	83	13.88*
Amer. Express	398	67	15.30*
AT&T-2	471	29	19.72*
Bristol Myers	351	139	9.53*
Chevron	417	69	15.74*
Coca-Cola	336	116	10.30*
Dow	435	60	16.81*
DuPont	346	135	9.58*
Exxon	252	201	2.35*
Ford	342	139	9.21*
GE	369	120	11.21*
GM	336	127	9.67*
GTE	367	93	12.73*
HP	337	120	10.10*
IBM	438	46	17.77*
J & J	359	98	12.16*
Kodak	370	122	11.14*
Merck	343	146	8.86*
Mobil	325	143	8.37*
Philip Morris	434	46	17.66*
P & G	396	89	13.89*
Sears	364	107	11.79*
Union	436	48	17.59*
Xerox	376	92	13.08*

[a]Number of values above hypothesized median.

[b]Number of values below hypothesized median.

* indicates that the statistics are significant at the five percent level.

Table 7

Pearson Correlation Coefficients Between Time and Premiums or Discounts in Primes and Scores

Panel A: Total period (July 1, 1987 to June 30, 1989)

Company	Correlation coefficients	Prob.[a]
Amer. Home Prdt.	0.281	0.0001*
Amoco	0.126	0.0046*
Arco	-0.071	0.1162
Amer. Express	-0.141	0.0016*
AT&T-Series 2	-0.142	0.0014*
Bristol Myers	0.413	0.0001*
Chevron	-0.204	0.0001*
Coca-Cola	-0.574	0.0001*
Dow	0.217	0.0001*
DuPont	0.095	0.0334*
Exxon	0.135	0.0027*
Ford	0.252	0.0001*
GE	0.133	0.0028*
GM	-0.107	0.0177*
GTE	0.163	0.0272*
HP	-0.096	0.0336*
IBM	-0.334	0.0001*
J & J	0.309	0.0001*
Kodak	0.085	0.0576
Merck	-0.452	0.0001*
Mobil	-0.107	0.0164*
Philip Morris	0.632	0.0001*
P & G	0.069	0.1255
Sears	-0.594	0.0001*
Union	-0.079	0.0760
Xerox	-0.122	0.0070*

[a]Significance probability of the correlation.

* represents that the statistics are significant at the five percent level.

Table 7 (continued)

Panel B: Subperiod (January 1, 1988 to June 30, 1989)

Company	Correlation coefficients	Prob.[a]
Amer. Home Prdt.	-0.084	0.1037
Amoco	0.180	0.0004*
Arco	-0.012	0.8111
Amer. Express	0.177	0.0005*
AT&T-Series 2	0.226	0.0001*
Bristol Myers	0.398	0.0001*
Chevron	-0.018	0.7301
Coca-Cola	-0.141	0.0058*
Dow	0.418	0.0001*
DuPont	0.028	0.5853
Exxon	0.109	0.0343*
Ford	0.588	0.0001*
GE	0.300	0.0001*
GM	0.177	0.0005*
GTE	0.317	0.0001*
HP	-0.183	0.0003*
IBM	0.023	0.6494
J & J	0.569	0.0001*
Kodak	0.465	0.0001*
Merck	-0.352	0.0001*
Mobil	0.338	0.0001*
Philip Morris	0.719	0.0001*
P & G	0.162	0.0016*
Sears	-0.388	0.0001*
Union	-0.046	0.3765
Xerox	0.269	0.0001*

[a]Significance probability of the correlation.

* represents that the statistics are significant at the five percent level.

Table 8

Comparison of Mean Premiums Among Groups

Panel A: H_1: mean of A group > mean of B group

Company	A - B[a]	t-value
Amer. Home Prdt.	-1.17	-8.59*
Amoco	0.10	0.67*
Arco	0.35	1.98
Amer. Express	0.32	5.91
AT&T-Series 2	0.29	3.51
Bristol Myers	-0.34	-2.11*
Chevon	0.54	7.03
Coca-Cola	2.27	11.65
Dow	0.37	1.99
DuPont	-0.25	-1.56*
Exxon	-0.07	-0.57*
Ford	0.95	8.59
GE	0.42	2.37
GM	0.56	4.58
GTE	-0.21	-1.14*
HP	0.61	5.15
IBM	1.06	7.03
J & J	0.45	2.46
Kodak	0.86	4.60
Merck	2.05	5.86
Mobil	0.70	9.30
Philip Morris	-0.29	-1.19*
P & G	0.04	0.23*
Sears	0.42	8.15
Union	0.05	0.44*
Xerox	0.98	4.98

[a]Mean of Group A minus mean of Group B.

Group A includes scores and primes from July 1, 1987 to December 31, 1987.

Group B includes scores and primes from January 1, 1988 to June 30, 1988.

* indicates that the null hypothesis is rejected at the significance level of five percent.

Table 8 (continued)

Comparison of Mean Premiums Among Groups

Panel B: H_2: mean of A group > mean of C group

Company	A - C[a]	t-value
Amer. Home Prdt.	-1.22	-8.59*
Amoco	-0.12	-1.01*
Arco	-0.05	-0.26*
Amer. Express	0.59	11.68
AT&T-Series 2	0.38	4.70
Bristol Myers	-0.80	-4.90*
Chevon	0.32	2.84
Coca-Cola	2.98	16.51
Dow	-0.01	-0.06*
DuPont	0.02	0.11*
Exxon	-0.13	-1.07*
Ford	0.37	3.20
GE	0.47	2.58
GM	1.24	16.02
GTE	-0.13	-1.04*
HP	0.35	3.13
IBM	1.64	11.83
J & J	0.20	1.14*
Kodak	1.31	7.16
Merck	3.14	9.47
Mobil	0.55	7.33
Philip Morris	-0.93	-3.94*
P & G	0.16	1.04*
Sears	0.67	11.37
Union	0.27	2.66
Xerox	1.13	5.71

[a]Mean of Group A minus mean of Group C.

Group A includes scores and primes from July 1, 1987 to December 31, 1987.

Group C includes scores and primes from July 1, 1988 to December 31, 1988.

* indicates that the null hypothesis is rejected at the significance level of five percent.

Table 8 (continued)

Comparison of Mean Premiums Among Groups

Panel C: H_3: mean of A group > mean of D group

Company	A - D[a]	t-value
Amer. Home Prdt.	-1.02	-3.19*
Amoco	-0.46	-3.05*
Arco	0.32	1.92
Amer. Express	0.17	2.81
AT&T-Series 2	0.10	1.21*
Bristol Myers	-1.28	-8.46*
Chevon	0.56	6.57
Coca-Cola	2.48	13.44
Dow	-0.59	-3.33*
DuPont	-0.45	-3.16*
Exxon	-0.31	-2.37*
Ford	-0.52	-4.59*
GE	-0.55	-2.79*
GM	0.23	2.42
GTE	-0.08	-0.49*
HP	0.22	2.84
IBM	1.03	6.97
J & J	-0.85	-4.23*
Kodak	-0.48	-2.30*
Merck	3.06	9.37
Mobil	0.32	4.14
Philip Morris	-3.92	-11.56*
P & G	-0.31	-1.99*
Sears	0.78	14.77
Union	0.09	0.83*
Xerox	0.50	2.43

[a]Mean of Group A minus mean of Group D.

Group A includes scores and primes from July 1, 1987 to December 31, 1987.

Group D includes scores and primes from January 1, 1989 to June 30, 1989.

* indicates that the null hypothesis is rejected at the significance level of five percent.

Table 8 (continued)

Comparison of Mean Premiums Among Groups

Panel D: H_4: mean of B group > mean of C group

Company	B - C[a]	t-value
Amer. Home Prdt.	-0.05	-0.36*
Amoco	-0.12	-1.85*
Arco	-0.40	-3.67*
Amer. Express	0.27	5.29
AT&T-Series 2	0.09	2.46
Bristol Myers	-0.46	-3.37*
Chevon	-0.21	-1.88*
Coca-Cola	0.71	7.98
Dow	-0.38	-3.30*
DuPont	0.27	2.31
Exxon	-0.06	-0.63*
Ford	-0.58	-5.00*
GE	0.05	0.35*
GM	0.68	6.09
GTE	0.29	1.07*
HP	-0.26	-2.98*
IBM	0.48	6.17
J & J	-0.35	-2.80*
Kodak	0.45	5.35
Merck	1.09	5.80
Mobil	-0.15	-2.24*
Philip Morris	-0.64	-6.39*
P & G	0.12	1.21*
Sears	0.25	4.90
Union	0.22	2.79
Xerox	0.15	1.24*

[a]Mean of Group B minus mean of Group C.

Group B includes scores and primes from January 1, 1988 to June 30, 1988.

Group C includes scores and primes from July 1, 1988 to December 31, 1988.

* indicates that the null hypothesis is rejected at the significance level of five percent.

Table 8 (continued)

Comparison of Mean Premiums Among Groups

Panel E: H_5: mean of B group > mean of D group

Company	B - D[a]	t-value
Amer. Home Prdt.	0.15	1.34*
Amoco	-0.56	-3.77*
Arco	-0.03	-0.34*
Amer. Express	-0.15	-2.44*
AT&T-Series 2	-0.19	-3.71*
Bristol Myers	-0.94	-7.60*
Chevon	-0.02	-0.22*
Coca-Cola	0.21	2.17
Dow	-0.96	-7.66*
DuPont	-0.20	-1.67*
Exxon	-0.14	-2.31*
Ford	-1.47	-12.84*
GE	-0.97	-6.17*
GM	-0.33	-2.71*
GTE	-0.41	-2.63*
HP	-0.29	-3.32*
IBM	-0.03	-0.29*
J & J	-1.30	-10.79*
Kodak	-1.34	-9.90*
Merck	1.01	5.65
Mobil	-0.38	-5.65*
Philip Morris	-3.63	-13.77*
P & G	-0.35	-3.35*
Sears	0.36	8.43
Union	0.04	0.45*
Xerox	-0.48	-4.43*

[a]Mean of Group B minus mean of Group D.

Group B includes scores and primes from January 1, 1988 to June 30, 1988.

Group D includes scores and primes from January 1, 1989 to June 30, 1989.

* indicates that the null hypothesis is rejected at the significance level of five percent.

Table 8 (continued)

Comparison of Mean Premiums Among Groups

Panel F: H_6: mean of C group > mean of D group

Company	C - D[a]	t-value
Amer. Home Prdt.	0.20	1.86
Amoco	-0.34	-2.50*
Arco	0.37	4.10
Amer. Express	-0.42	-7.27*
AT&T-Series 2	-0.28	-5.77*
Bristol Myers	-0.48	-3.72*
Chevon	0.23	1.94
Coca-Cola	-0.50	-7.78*
Dow	-0.58	-5.28*
DuPont	-0.47	-5.28*
Exxon	-0.18	-1.80*
Ford	-0.89	-7.48*
GE	-1.02	-6.26*
GM	-1.01	-12.71*
GTE	-.88	-3.16*
HP	-0.03	-0.40*
IBM	-0.61	-6.84*
J & J	-1.05	-9.03*
Kodak	-1.79	-13.76*
Merck	-0.08	-0.52*
Mobil	-0.23	-3.46*
Philip Morris	-2.99	-11.62*
P & G	-0.47	-5.24*
Sears	0.11	2.36
Union	-0.18	-2.71*
Xerox	-0.63	-5.70*

[a]Mean of Group C minus mean of Group D.

Group C includes scores and primes from July 1, 1988 to December 31, 1988.

Group D includes scores and primes from January 1, 1989 to June 30, 1989.

* indicates that the null hypothesis is rejected at the significance level of five percent.