Accounting-Based Stock Price Anomalies: Separating Market Inefficiencies from Risk*

Victor Bernard, University of Michigan
Jacob Thomas, Columbia University
James Wahlen, University of North Carolina at Chapel Hill

September 1996

Forthcoming, Contemporary Accounting Research

---

*Before his untimely death, our coauthor, mentor and friend Victor Bernard was Price Waterhouse Professor of Accounting at the University of Michigan. We are grateful for helpful comments from Peter Easton, anonymous referees, and participants in the 1996 *Contemporary Accounting Research* Conference. We have also received helpful comments from W. Blacconiere, J. Collins, L. Daley, I. Dichev, G. Imhoff, S. Penman, G. Salamon, R. Sloan, T. Stober, R. Stulz, and workshop participants at the following universities: Alberta (Empirical Accounting Research Conference), Auckland, George Washington, Indiana, Macquarie, Maryland (6th Annual Conference on Financial Economics and Accounting), Melbourne, Pennsylvania, New South Wales, North Carolina, Otago, Queensland, Rice, Rutgers, Tennessee, Victoria, and Washington (St. Louis), and at the CRSP Seminar on the Analysis of Security Prices at the University of Chicago. Special thanks to Dave Larcker, Jane Ou, and Steve Penman for assistance with estimation of Pr values. Financial support was provided by the Columbia Business School Research Fund for Jacob Thomas and by the KPMG Peat Marwick Fellowship program for James Wahlen.

Abstract. We examine six accounting-based stock price anomalies using two sets of tests to determine the extent to which the anomalies (a) represent market mispricing, or (b) reflect premia for unidentified risks. Market mispricing is indicated if the anomalous returns are concentrated around subsequent earnings announcements, in patterns suggesting that the earnings information causes traders to reexamine their prior (incorrect) beliefs. Mispricing is also indicated if anomalous returns on zero investment portfolios are positive, period after period. Our results indicate that an anomaly based on earnings momentum probably reflects market mispricing, but that two value/glamour anomalies (based on the book/market ratio and the earnings/price ratio), and two anomalies based on computerized fundamental analyses (from Ou and Penman 1989 and Holthausen and Larcker 1992) are more likely to reflect risk premia than indicated by prior research. Evidence on a sixth anomaly, based on price momentum, is mixed.

Recent years have witnessed a growing body of evidence that raises new doubts about the informational efficiency of stock markets.[1] The evidence exists in the form of apparently abnormal returns to portfolios constructed on the basis of publicly available information.[2] However, the dilemma that often clouds such evidence is that the estimated abnormal returns could be nothing more than a premium for some risk that the researcher has failed to identify and measure accurately. If so, the evidence does not indicate a departure from market efficiency, but rather an imperfection in our ability to quantify the risks that affect asset pricing.[3]

This study examines six well-known accounting-based market anomalies, using two approaches in combination to indicate whether estimated abnormal returns reflect market inefficiency or some unidentified risk premium. Our first approach is based on two assumptions.[4] First, if a security is mispriced, corrections will occur around subsequent information releases, as the new information causes traders to reexamine their prior (incorrect) beliefs. Bubbles or cases of mispricing where prices deviate from and return to fundamental values for no apparent reason, are not considered here. Second, if a security is mispriced, a disproportionate amount of price correction occurs at future earnings announcements, relative to non-announcement periods. In addition to earnings, these announcements include other related information such as sales (usually) and dividends (often). The set of information released at earnings announcements is more likely to correct mispricing, relative to other possible information releases, because it relates

---

1 See Fama (1991) or Bernard (1992) for a general review of the evidence, and Summers (1986) for a discussion of issues related to rejecting market efficiency. See Ball (1992) or Bernard, Thomas, and Abarbanell (1993) for a review of evidence focused on market efficiency with respect to earnings and other accounting information.

2 As discussed in Ball (1992), whether or not such mispricing exceeds transactions costs is irrelevant; the existence of trades at prices that do not fully reflect public information implies informational inefficiency. Further discussion of this point is provided in section six.

3 Alternatively, the profits observed by researchers could be illusory—explainable as the product of market imperfections (such as taxes) or of potential experimental problems (such as survivorship bias and data snooping).

4 This approach was first used in Bernard and Thomas (1989, 1990) and has been used subsequently in a number of recent papers to examine various momentum and value/glamor strategies (e.g., Chopra, Lakonishok and Ritter 1992 and Chan, Jegadeesh and Lakonishok 1995).

to a prior period and potentially resolves uncertainty and divergent beliefs amongst investors regarding prior events.

Under these assumptions, if an anomaly reflects mispricing that is corrected by the information released around earnings announcements, there should be a concentration of abnormal returns around earnings announcements in the quarters after the mispricing occurs. Moreover, these abnormal returns should have signs and magnitudes consistent with the predictable bias in market forecasts of future earnings. For example, if the market consistently overestimates future earnings for firms with high stock price relative to book value (say, by overestimating the persistence of past earnings growth), the predictable price decreases that occur in the future should be concentrated at earnings announcements and the pattern of price corrections observed should be consistent with the pattern in which the market's biased forecasts are corrected. Abnormal returns around earnings announcements are calculated over brief periods (three days) so that any errors in the measurement of associated risk premia should be small.

This approach does not provide a perfect divining rod for separating mispricing from mismeasured risk, since risk premia need not necessarily arise smoothly through time and might be concentrated around information events like earnings announcements (Ball and Kothari 1991).[5] However, explanations for temporary increases in systematic risk around earnings announcements are difficult to construct. First, temporary increases in risk around earnings announcements would cause temporary increases in expected returns, which imply stock price declines (i.e., negative observed returns), unless temporary increases in expected future dividends also occur at those earnings announcements. Second, depending on the magnitudes involved, portfolio returns predictably concentrated in the days surrounding earnings announcements may be reconciled with market efficiency only if the portfolio risk is extremely high over these brief intervals; we document some three-day returns that would constitute annual returns in excess of 100 percent.

---

[5] Why risk associated with firms' information releases should be systematic and nondiversifiable is, however, less than clear. Ball and Kothari (1991) conclude that shifts in beta around earnings announcements are unlikely to explain the observed average earnings-announcement-day abnormal stock returns.

Third, when the reactions to subsequent earnings announcements are predictably *negative*, any attempt to explain such reactions as a product of mismeasurement of risk is, at best, strained.[6] When the returns are predictably positive at some times and predictably negative at others *for the same portfolio,* the strain on a risk-based explanation is compounded. Finally, if one can predict not only the signs of abnormal returns around subsequent information releases, but also their magnitudes, the evidence is particularly difficult to explain except as the product of mispricing.

The second approach we use investigates the consistency with which zero investment portfolios, representing long (short) investments in stocks expected to perform well (poorly), generate positive returns. If the mean returns on a zero investment portfolio reflect a reward for risk, that risk should surface in the form of negative realized returns in at least *some* periods. If, however, these returns are *always* positive, risk-based explanations are strained; they must be based on the notion that even though such losses were never observed within the sample period, their *ex ante* probability is still significant.[7] Conversely, observing many losses increases the likelihood that the abnormal returns associated with that strategy are due to mismeasured risk.

Readers with strong beliefs that a particular anomaly is due to mispricing might remain unconvinced even if many losses are observed for that anomaly. They might argue that the risk observed in the zero-investment portfolios might be due to correlation between that anomaly and various risk factors and stock price effects (e.g., the size effect of Banz 1981).[8] That is, all of the

---

6 Such an explanation would have to claim that the portfolio offers a *hedge* against risk that is so valuable that investors are willing to absorb losses on the portfolio—and that this hedging ability exists for only a few days surrounding an earnings announcement.

7 In addition, we examine whether a strategy tends to construct portfolios with disproportionate numbers of small size stocks, and whether profits to the strategy arise mainly in January. If so, anomalous returns to the strategy are likely to be a product of the well-known size effect.

8 Other types of risk that might also potentially be captured by our zero investment portfolios include (a) diversifiable or unsystematic risk, (b) the market learning over time, and (c) the market being inefficient in some periods, but not others. By forming large portfolios (hundreds of stocks, often over a thousand stocks, are held in each portfolio) we diversify away most if not all unsystematic risk. Market learning is unlikely to be an issue since an examination of the period-by-period profitability in chronological order did not uncover any obvious structural change after which the profitability declined and risk increased. As mentioned above, we do not consider cases in the third category, which encompasses bubbles and cases where prices deviate from and return to fundamental values for no apparent reason.

risk we observe for zero investment portfolios and a portion of the abnormal returns associated with certain anomalies might be due to these commingled risk factors/effects, but the remainder of the abnormal return is due to correction of mispricing captured by the anomaly. Although we offer some evidence on the extent to which the size effect might be commingled with these anomalies, we are unable to eliminate all potentially commingled risk factors/effects and isolate the profitability that is due solely to the anomaly. However, we believe the distributions of returns we report for each anomaly provide a simple but powerful representation of the risk associated with implementing strategies based on that anomaly. The distributions we report allow readers to assess whether the historic mean profitability generated by each anomaly (after deducting transactions costs they deem relevant) are sufficient to compensate for the observed volatility.

To summarize, the evidence from these two approaches in combination is more likely to indicate mispricing if (1) economically large abnormal returns are predictably concentrated around subsequent earnings announcements, with signs and magnitudes consistent with the predictable portion of subsequent earnings, and (2) zero investment portfolio returns are consistently positive for different subperiods. Conversely, the *absence* of these attributes increases the likelihood that the anomaly is an artifact of mismeasured risk.[9]

The six accounting-based anomalies chosen for examination here have defied explanation based on standard adjustments for risk and are selected because they are more likely, relative to other anomalies, to (a) reflect a failure of the market to fully digest available accounting information, (b) be useful in predicting future earnings, relative to biased market forecasts, and (c) are thus particularly likely to involve a concentration of abnormal returns about subsequent earnings announcements, if indeed the anomalies represent market mispricing. The six anomalies

---

[9] It is also possible that a strategy could produce zero investment portfolio returns that are consistently positive for different subperiods, but not generate abnormal returns that are concentrated around subsequent earnings announcements. This would suggest mispricing that is corrected uniformly (via various information events like analyst forecast revisions) and not concentrated at earnings announcements. None of the six strategies examined here produce returns with these attributes.

examined include two momentum strategies, two fundamental analysis strategies, and two value/glamour strategies. Summary descriptions of the strategies examined are provided next.

(1) *Standardized unexpected earnings (SUE) effect*. Several studies have documented "post-earnings-announcement drift", an apparently lagged reaction to earnings momentum (e.g., Ball and Brown 1968, Jones and Litzenberger 1970, Rendleman, Jones, and Latane 1982).[10] The anomaly is exploited by forming portfolios on the basis of recently announced earnings information; the statistic used is standardized unexpected earnings (SUE). Bernard and Thomas (1989, 1990) subject this anomaly to a battery of adjustments for risk, as well as tests like those conducted here, and argue that the anomaly is best explained as a product of mispricing. The anomaly is included here as a benchmark and to examine whether the anomaly persists in recent years.

(2) *Announcement quarter returns effect*. In this case, portfolios are formed not on the basis of momentum in earnings information, but on the basis of momentum in abnormal returns since the prior earnings announcement. This anomaly requires continuations in price movements over several months, as documented in Jegadeesh and Titman (1993), as opposed to the reversals of prior returns documented over multi-year intervals by DeBondt and Thaler (1985) and Chopra, Lakonishok and Ritter (1992).[11] Our approach differs from Jegadeesh and Titman: we form portfolios based on abnormal returns over periods *ending on earnings announcements*, whereas they use month-ends. Our approach was first used by Foster, Olsen, and Shevlin (1984) and they found no abnormal returns over a 60-day post-announcement window; using a longer post-announcement period, we document positive abnormal returns. More recently, Chan, Jegadeesh, and Lakonishok (1995) analyze variants of the price momentum strategy and conclude that these strategies are partially related to the earnings momentum strategy and are driven by biased market expectations of future earnings, with price corrections occurring when future earnings are revealed.

(3) *The Ou/Penman Pr anomaly*. Ou and Penman (1989) form portfolios based on a computerized fundamental analysis of a wide array of financial statement ratios. Their analysis converts a set of financial ratios into a prediction of the sign of future annual earnings changes. The trading strategy involves buying (selling) firms for which the predicted likelihood of future earnings increases is high (low). Ou and Penman conclude that their strategy successfully predicts

---

[10] Several recent studies also document that analysts' forecasts of earnings do not fully reflect the implications of current earnings for future earnings (e.g., Abarbanell and Bernard 1992).

[11] Beaver and Landsman (1981), using price movements over 20 months to identify prior winner and loser portfolios, find *no* subsequent abnormal performance, a result in between the continuations observed by Jegadeesh and Titman (based on price movements of 12 months or less) and the reversals observed by DeBondt and Thaler and others (based on price movements over 36 months or more).

future earnings changes and also produces substantial portfolio abnormal returns. Their tests indicate that these abnormal returns cannot be explained by a variety of firm risk characteristics (beta, leverage, etc.) or by other accounting-based strategies (book-to-market or earnings-to-price ratio strategies). Others suggest that the results may be explainable as a function of risk (e.g., Ball 1992, Stober 1992 and Grieg 1992).

(4) *The Holthausen/Larcker Pr anomaly*. The approach of Holthausen and Larcker (1992) differs from Ou/Penman in that the computerized fundamental analysis of financial statement ratios is designed to predict future abnormal stock returns directly, as opposed to future earnings changes. Holthausen and Larcker predict the sign of one-year ahead excess returns, based on three different controls for risk (market-adjusted returns, size-adjusted returns, and Jensen alphas). Holthausen and Larcker indicate that their strategy produces abnormal returns but draw no firm conclusions on whether the results indicate mispricing or risk mismeasurement. Although this strategy is the only one that has not been linked to biased market forecasts of earnings, we include this strategy because it is (a) based on accounting ratios and (b) related in concept to the class of strategies that seek to detect deviations from fundamental value, such as the Ou/Penman strategy.

(5) *The book-to-market anomaly* (Stattman 1980, Rosenberg, Reid, and Lanstein 1985). This value/glamour strategy invests long in stocks with high ratios of book value-to-market value of equity (which are value stocks that are undervalued relative to book value), and sells short stocks with low ratios of book value-to-market value of equity (which are glamour stocks that are overvalued relative to book value). The book-to-market effect has been described variously as (a) a product of risk (Fama and French 1993, 1995), (b) a market inefficiency (Lakonishok, Shleifer, and Vishny 1994 and La Porta, Lakonishok, Shleifer, and Vishny 1995), and (c) caused (in part) by selection bias in the COMPUSTAT database (see Kothari, Shanken, and Sloan 1995 and Breen and Korajczyk 1994, and the rebuttal by La Porta 1995a). Recent papers in the second category have linked abnormal returns earned by this strategy to the market overestimating the future persistence of past growth in earnings.

(6) *The price-earnings anomaly* (Basu 1977, 1978, 1983). This well-documented value/glamour strategy, which involves long (short) positions in high (low) earnings-to-price ratio stocks, has been attributed by a variety of researchers to either mispricing, risk mismeasurement, or other factors. See Jaffe, Keim, and Westerfield (1989) for a relatively recent analysis. As with the B/M strategy, recent research has attempted to link this and related anomalies (such as cash flow to price) to biased market forecasts of future earnings (e.g., Lakonishok, Shleifer, and Vishny 1994).

A brief summary of our results is as follows. We concur with Bernard/Thomas that the SUE effect is more easily explained as a product of mispricing than as a mismeasurement of risk. In contrast, the findings point toward risk mismeasurement for the Holthausen/Larcker strategy and the earnings/price ratio. Although the Ou/Penman strategy and the book-to-market strategy

exhibit concentrations of abnormal returns around future earnings announcements, which suggests mispricing, they also exhibit considerable variance and losses in many subperiods for the zero investment portfolio returns.[12] Consistent with the results of prior studies, both the Ou/Penman and the book-to-market strategies are highly correlated with the well-known size and small price effects. We provide new evidence that indicates that much of the abnormal performance for these two strategies, and the concentrated announcement period abnormal returns in particular, is explained by size/small price effects. For the remaining strategy, based on announcement quarter returns, our evidence is mixed. Although this strategy produces abnormal returns that are concentrated around subsequent earnings announcements and are correlated with the predictable earnings changes announced on those days, consistent with the results of Chan, Jegadeesh and Lakonishok (1995), the zero investment portfolio returns show considerable variability and many loss subperiods.

The remainder of the paper is organized as follows. In the next section, we describe our data sources and experimental procedures. Our results on the extent of correlation among the anomalies and their ability to produce excess returns are reported in section three. Section four contains the results of our examination of features of the abnormal returns around subsequent earnings announcements (whether they are concentrated at those announcements, whether they are of large magnitudes, and whether they are correlated with subsequent earnings news). In the fifth section, we examine the consistency with which these strategies are profitable through time. In section six, we consider the possible effects of two additional research design issues: transactions costs and possible sample selection bias. A summary and conclusions are presented in the final section.

---

[12] Unlike the book-to-market ratio, the Ou/Penman strategy shows an ability to predict future earnings changes (especially for fourth quarters), which suggests that this strategy might capture a market mispricing.

Data and methods

Data sources and sample selection

The data used here include both quarterly and annual financial statement data from COMPUSTAT and stock return data from CRSP (NYSE and AMEX firms) for the period 1973-1992. Our sample includes firms on CRSP for which at least 10 consecutive quarterly earnings numbers (before extraordinary items and discontinued operations) are available on any of the COMPUSTAT quarterly industrial files produced in 1982 through 1987, or 1992.[13] The same editions of the COMPUSTAT annual industrial files are used to obtain data for the many variables required by the computerized fundamental analyses of Ou and Penman (1989) and Holthausen and Larcker (1992) and to compute the earnings-to-price and book-to-market ratios. Some observations are lost due to seasonal differencing of earnings data, missing financial statement data, missing earnings announcement dates, or missing CRSP returns. The number of observations varies across tests and are drawn from a maximum of 190,487 firm-quarters and 60,277 firm-years.

Calculation of factors on which trading strategies are based

As will be described, each of the six anomalies studied here requires calculation of a factor on which to base trading positions. The first two factors (SUE and announcement quarter returns) are based on quarterly data and are calculated at each quarterly earnings announcement. The remaining four are computed at each annual (fourth quarter) earnings announcement.

Standardized unexpected earnings

Standardized unexpected earnings (SUE) are calculated as seasonal differences in quarterly earnings (COMPUSTAT quarterly data item 8), scaled by the market value of the firm's

[13] The starting point for this sample was the database used by Bernard and Thomas (1989, 1990), which was drawn from 1982—1987 COMPUSTAT tapes. This original database was updated by adding data from the 1992 COMPUSTAT files for firms that were already present in the Bernard/Thomas database and by including new firms in the 1992 COMPUSTAT Annual Industrial file that have been added since 1987.

common equity at the end of that fiscal quarter (product of COMPUSTAT quarterly data items 61 and 14). Another possible scale factor (requiring more data) is the firm-specific historical standard deviation of seasonally differenced earnings; Bernard and Thomas (1990, footnote 14) indicate that the two approaches yield similar amounts of price drifts.

Announcement quarter returns

This factor is based on market-adjusted returns from the day after the preceding earnings announcement through the day of the current announcement. Market-adjusted returns are the differences between firm returns and returns on the value-weighted NYSE/AMEX index, both compounded over this period.

Ou/Penman "Pr"

Ou and Penman (1989) construct a computerized fundamental analysis, beginning with a wide set of financial statement ratios. They use logit regressions to identify the subset of financial statement ratios that successfully predict the signs of one-year ahead deviations in earnings from a random walk with drift process. These ratios are then included in an earnings prediction model based on their prediction performance estimated over a prior period. This model is then applied to financial data of a subsequent period to predict the probability of an earnings increase (labeled "Pr", with values between 0 and 1) for the coming year. The Ou-Penman logit models use a total of 28 financial ratios to make predictions for 1973-1977 and 1978-1983. We use the same logit models to make predictions for those years, and re-estimate logit models (using their approach over a previous estimation period) to produce Pr's for the 1984-1988 and 1989-1992 periods.[14]

Holthausen/Larcker "Pr"

Holthausen and Larcker (1992) construct logit models using financial ratios to predict the sign of future size-adjusted returns (and, in separate analyses, market-adjusted returns and Jensen

[14] To generate Pr's for the two most recent periods, we start with the same set of 28 financial ratios that were used in either of the two estimation periods examined in Ou/Penman and adopt their approach to delete variables and build parsimonious models. The model estimated from 1978-1983 data is used to produce predictions for 1984-1988, and 1984-1988 data is used to estimate models for predictions during 1989-1992.

alphas). They use 19 ratios to develop return predictions for two periods: 1978-1982 and 1983-1988. We use the same logit models to make predictions for those years, and re-estimate the logit models (again, using their approach over a previous estimation period) to produce predictions for 1973-1977 and for 1989-1992.[15]

Book-to-market (B/M) ratio

The book-to-market ratio is the book value of common equity (COMPUSTAT annual data item 60) scaled by the market value of common equity (product of COMPUSTAT annual data items 25 and 199), both measured at the end of the fiscal year.

Earnings-to-price (E/P) ratio

The earnings/price ratio is equal to annual earnings (COMPUSTAT annual data item 58) scaled by the market value of common equity at the end of the fiscal year (product of COMPUSTAT annual data items 25 and 199).

Our portfolios include firms in the extreme quintiles of the factors underlying the anomalies. To reduce data overload, we report the difference between the top and bottom quintiles for the various attributes we examine (e.g., abnormal returns, earnings surprises). For the E/P and B/M strategies, quintiles are formed after deleting firm-years with negative earnings and book value, respectively.[16] Quintile assignments are based on comparison of factor values to their distributions in the *prior* calendar year. By using only prior period data to make assignments, we avoid the hindsight bias discussed in Holthausen (1983).

---

[15] The corresponding estimation periods are 1969-1972 and 1983-1988, respectively. Although we examine market-adjusted returns here, we use Holthausen and Larcker's Pr constructed with size-adjusted returns because that Pr appears to dominate the other two variants in terms of future performance. We do not, however, expect our results to be sensitive to whether market- or size-adjusted Prs are used because of the high correlation between (a) the size- and market-adjusted Prs (correlation statistic = 0.660), as well as (b) the related size- and market-adjusted returns (correlation statistic = 0.974; see their Table 1, p. 380-381). Also, Holthausen and Larcker report (Table 1, panel C, page 381) that their size-adjusted Pr strategy is slightly more correlated with future market-adjusted returns than size-adjusted returns (0.069 vs. 0.065).

[16] Separate treatment of firms with negative earnings or book value is consistent with prior research (e.g., Lakonishok, Shleifer, and Vishny 1994). Analysis of negative E/P and B/M portfolios indicates little evidence of abnormal returns from holding these portfolios.

Estimation of abnormal returns

For our first approach, which focuses on abnormal returns concentrated around future earnings announcements, we assume all the data necessary to calculate the six factors (e.g., SUE, Pr, E/P, B/M) and assign firms to quintiles are available on each earnings announcement date. This assumption is clearly valid for the two momentum strategies and the E/P strategy. Contrary to the view commonly held in the finance literature (e.g., Fama and French 1995), one need not wait for the balance sheet release date (which is typically a few weeks after the earnings announcement date) to compute year-end book value of equity, required for the B/M strategy. This number is known when earnings are released (barring a few exceptions, which are relatively small and infrequent, that relate to items which bypass earnings but affect owners' equity), because it equals beginning book value plus earnings less dividends for that year plus new issues of stock, net of any repurchases.[17] This assumption does not hold, however, for the two Pr strategies because they incorporate certain items, such as inventory levels, that are publicly available only at the balance sheet release date. Thus, the returns on these strategies over the first few weeks after earnings announcements could represent a response to that new information. It turns out, however, that the abnormal returns on the Pr strategies in those first few weeks are small and have little bearing on the overall results.

As an alternative, one can form portfolios after waiting for a sufficiently long period of time (e.g., until July 1 of the year following the calendar year in which the year-end falls, as in Fama and French 1995), to ensure that the information necessary to construct the portfolios is available, but then other problems arise. First, patterns of abnormal returns and earnings surprises between the earnings release and July 1 are lost. Note that this period can be as much as a year or

[17] We ignore the complication that some fourth quarter dividends are not announced as of the earnings announcement date, because we assume they can be estimated fairly accurately using past dividends. A related question is whether market values should be computed as of the year-end (as we have done) or as of a few months later when the balance sheet is almost certainly publicly available. The first method assumes that the market price as of the year-end incorporates an unbiased estimate of the fourth quarter earnings and dividends needed to estimate year-end book values, whereas the second method assumes that incremental information about the following year's operations that is incorporated in the subsequent market value does not cause any systematic bias in market or book value.

more for firms with year-ends early in the calendar year. More important, much of the abnormal performance for some strategies (e.g., the SUE anomaly) occurs soon after the earnings release date and would be missed if portfolios were formed many months later. Second, information regarding the length of the period between fiscal year-end and any observed abnormal return is lost if returns for firms with different year-ends are aggregated over calendar periods rather than in event time. That is, one might not discern that abnormal returns are earned primarily in the fourth quarter (say) following year-end, when firms with different year-ends are aggregated over calendar periods. Overall, the advantages of our methods overcome potential concerns about the availability of information on the earnings release date for some strategies.

We estimate future abnormal returns as compounded raw returns less the compounded return on the value-weighted NYSE/AMEX index, over two windows each quarter: (1) a non-announcement window of variable length, beginning the day after the first announcement and ending three days before the next quarter's earnings announcement, and (2) a three-day announcement window consisting of the two days before and the day of the next quarter's earnings announcement.[18] Returns are compounded and then market-adjusted over announcement and non-announcement windows for the next eight quarterly earnings announcements. We do not require that announcements have complete data for all 16 windows to be included in the sample; they are only excluded from portfolios for those windows for which their data are missing. The compounded, market-adjusted returns are then averaged across firms in a given portfolio for each window and these averages are summed across windows to produce cumulative (multi-window) estimated abnormal returns.[19]

We do not control explicitly for the size effect (e.g., Banz 1981) or the related small price effect (e.g., Blume and Stambaugh 1983) when estimating abnormal returns. In addition to

---

[18] We make no attempt to control for standard measures of risk (e.g., beta), because prior studies have already documented that such controls do not explain the returns to the strategies we examine.

[19] We obtained similar results when market-adjusted returns were first compounded across windows and then averaged across firms in each portfolio.

generating higher returns, especially in January, small firms also exhibit positive returns at earnings announcements, *unconditional on the news released at those dates* (see Chari, Jagannathan and Ofer 1988). That is, announcement period returns are biased upwards for portfolios that contain a disproportionate amount of small stocks, and could mistakenly be interpreted as being due to price corrections occurring in response to information released on those dates. All explicit size controls are imperfect, and—more importantly—leave traces of the size effect that could influence the results in unpredictable ways.[20] However, given the considerable potential for size differences between extreme portfolios for some anomalies, and the negative correlation between size and observed returns, we provide evidence on the extent to which a strategy is correlated with the size/small price effects.

One of the procedures we follow to indicate whether anomalous returns are attributable to the size effect is to create a seventh strategy based on size. We report abnormal returns earned by investing long in small firms and short in large firms (extreme size quintile portfolios) subsequent to those firms' annual earnings announcements, where size is based on market capitalization as of January 1 of the calendar year in which that annual earnings was announced. In addition, we also discuss results obtained by deleting firms with stock prices less than $5 on January 1 of the portfolio-formation year, to provide evidence on the extent of potential contamination due to the small price effect. Although we do not explicitly control for the size/small price effects, we regard them as being fundamental anomalies that are beyond the scope of this study.

---

[20] Size controls based on size decile portfolios (e.g., Foster, Olsen, and Shevlin 1984 and Bernard and Thomas 1989, 1990) might fail to eliminate the size effect because treatment and control firms are not always matched perfectly on size. Especially within the smaller deciles, where substantial variation in the size effect remains, the mismatch can have an important influence on results. Additionally, even though the control firms are designed to be of similar size, they would typically *not* be announcing earnings at the same time as the firms in the factor portfolios; thus, the size effect would still remain for announcement windows. Alternative size controls based on fitted regression estimates (e.g., Fama and French 1992), which assume a linear relation between returns and some size measure, could be considered for studies with standard return accumulation windows (like months or years); such controls are not easily implemented here, however, because the windows are unique to each observation.

Our second approach employs implementable trading procedures to form zero investment portfolios using each strategy. We use the quarterly returns to these zero investment portfolios to examine the distribution of quarterly returns to each strategy over time, and to assess the proportion of loss quarters for different anomalies. For these tests we use raw returns rather than market-adjusted returns because the long and short positions are hedged and serve as controls for each other. Every trading day we identify firms announcing earnings and prepare to take long positions in the top quintile and short positions in the bottom quintile firms on the day following the announcement. On that day, if (say) L firms are included in the long portfolio and (say) S firms are included in the short portfolio, we invest \$1/L in each long firm and \$1/S in each short firm. Thus, the combined long and short positions initially constitute a zero investment portfolio with a total of \$1 invested in each long and short position. If, however, there are no firms from either the top or bottom quintile on a given date, we defer investment until enough days pass to permit a match, wherein at least one firm is available for both long and short positions.

The long and short positions initiated each day are then maintained until the end of that calendar quarter. At the beginning of the next quarter, we re-invest each long/short portfolio combination (investing \$1/L and \$1/S in each firm in each long and short portfolio) to achieve a new set of zero investment portfolios at the beginning of the next calendar quarter, and hold the position until that quarter ends. This process continues until each portfolio has been held for 100 days for the SUE anomaly and 260 days for the remaining anomalies and for the size portfolios.[21] We hold the stocks for a predetermined number of trading days (as opposed to holding them until the earnings announcement one or four quarters hence) to assure that long and short positions always offset each other. If a stock is delisted during the holding period, we replace that stock with the value-weighted market index for the period after the delisting date.

---

[21] The 100-day (260-day) period is selected to include the first (first four) earnings announcement(s) following the portfolio formation for most observations. Initially, we examined only a 100-day holding period for both of the strategies based on quarterly data—the SUE effect and the announcement quarter return effect. As will be shown, returns to the latter strategy over such a short interval are quite small. The main results reported here are thus based on a 260-day holding period.

With respect to both sets of tests, we rely on descriptive statements of economic significance to assess the profits and risks of each strategy, and do not make statements about the statistical significance of portfolio abnormal returns for the following reasons. Our tests are aimed primarily at an assessment of the profits and risks associated with these six strategies. Thus, the most fundamental tests should focus on the economic significance of earnings and returns to our hedge portfolios rather than on their statistical significance. Additionally, because of the large sample sizes in this study, even a slight deviation from zero in the sample mean is likely to be deemed statistically significant by standard *t*-tests. Conducting more complex statistical tests (e.g., bootstrapping) introduces substantial computational problems associated with controlling for cross-sectional correlation and other problems of statistical inference across varying returns horizons and strategies. Therefore, inasmuch as we might like to draw statistical conclusions, given that the benefits of statistical tests are limited and the costs are large we do not construct measures of statistical significance.

Correlations among anomalies and overall profitability

Correlation among the strategies.

Because the factors underlying the six anomalies examined here may incorporate similar effects, we report the correlations among the six factors and their correlations with size. To compute the correlations based on variables at comparable points in time, we only consider fourth quarter values for the two strategies based on quarterly data. Table 1, panel A, contains the Pearson correlations among the quintile ranks of the six factors and size. (Similar results are obtained for decile ranks.) Most correlations are close to zero. Exceptions include the positive correlations between SUE and E/P (0.16) and between SUE and announcement quarter returns

(0.23); both correlations are expected.[22] Several cases of significant correlation involve the Ou/Penman Pr, which is negatively correlated with E/P (-0.20), positively correlated with B/M (0.37), and positively correlated with size (0.26). Finally, B/M is positively correlated with E/P (0.43) and size (0.35).[23]

Correlations between size and the various factors vary over a wide range. The highest correlations are observed for B/M and Ou/Penman Pr; thus, in interpreting the results it is important to recognize that the two factors may reflect a significant size effect. Note that the Holthausen/Larcker Pr is *negatively* correlated with size (-0.18). All other correlations are between 0 and 0.10.[24]

Overall, the correlations suggest that the six anomalies capture different phenomena for the most part. Interestingly, the two computerized fundamental analysis strategies, described by Holthausen/Larcker and Ou/Penman, produce predictors that are *not* very highly correlated (0.03). Although the two strategies are designed to predict variables that should be positively correlated, namely future earnings changes and future excess returns, the two predictors themselves are quite different.

Ability of the six factors to predict market-adjusted returns

Table 1, panel B summarizes the market-adjusted returns to each of the six anomalies, as well as the comparison strategy based on size, from the day of portfolio formation through the earnings announcement four quarters hence. All strategies produce positive differences between market-adjusted long and short portfolio returns over the first four quarterly earnings

---

22 SUE and E/P are likely to be positively correlated since they both have current earnings in the numerator and current price in the denominator. SUE and announcement quarter returns are related since they both rely on news released since the last earnings announcement.

23 Recall that our size portfolios include smallest (largest) firms in the highest (lowest) quintile. Thus, a positive correlation between size and a factor (e.g., Ou/Penman Pr or B/M) indicates that the highest quintile portfolio for that factor is more likely to include smaller firms.

24 These correlation measures only reflect linear relations between the various factor quintiles and size. Analysis of the 5x5 frequency tables between each factor and size quintiles indicates some evidence of non-linear relationships, especially for the E/P ratio.

announcements following portfolio formation. By the first quarterly announcement following portfolio formation, the SUE (announcement quarter returns) anomaly generates the highest (lowest) return of 5.90 (0.26) percent, and by the fourth quarterly announcement following portfolio formation the B/M (Holthausen/Larcker Pr) anomaly generates the highest (lowest) return of 8.85 (3.48) percent. Although we do not provide details of the variation in market-adjusted returns for the middle three quintiles, there is a general linear trend across the five quintiles for all factors. As might be expected, these returns can be magnified by basing the long and short positions on extreme deciles rather than quintiles.

As an extreme benchmark for assessing future abnormal returns earned by implementing the six strategies, consider the abnormal returns that can be earned between adjacent quarterly announcements based on perfect foresight of future quarterly earnings. If one formed portfolios by investing long in the quintile of firms that will announce the most positive contemporaneous SUE that quarter and short in the quintile that will announce the most negative SUE that quarter, one would earn a combined market-adjusted return of about 12.0 percent. Of this total market-adjusted return, roughly 4.5 percent is earned during the three days surrounding the earnings announcement, and roughly 7.5 percent is earned during the nonannouncement window.

Consistent with prior studies, the market-adjusted returns to the SUE strategy are earned primarily in the first period, approaching almost one-half the returns earned by the perfect foresight benchmark portfolio mentioned above. The market adjusted returns to the SUE strategy reach a peak of 7.7 percent by the third earnings announcement and reverse thereafter. The second strategy—based on announcement quarter returns—also produces positive market-adjusted returns of about 6.3 percent over four quarters. Although the returns are relatively small in the first period, by the end of the fourth period they cumulate to a level of approximately the same magnitude as the SUE effect. Foster, Olsen, and Shevlin (1984) found no returns to this strategy, but they examined only the 60 trading days subsequent to portfolio formation, which corresponds roughly to the first period.

Both Pr strategies produce positive market-adjusted returns over the four quarters. Returns to the Ou/Penman strategy (about 4.8 percent) are slightly larger than those for the Holthausen/Larcker strategy (about 3.5 percent). Additional analyses (not reported in the tables) indicate that these results are sensitive to adjustments for the small size and low stock price effects. Using size-adjusted abnormal returns instead of market-adjusted returns increases the profitability of the Holthausen/Larcker strategy and reduces the profitability of the Ou/Penman strategy. Deleting stocks with low prices also has a similar effect. Differences between the magnitudes of returns reported in the original papers and those we observe appear to be due largely to years that are in our samples but excluded in theirs.[25]

The book-to-market effect is large and positive—about 8.9 percent over the four quarters. The amount is only about two-thirds as large as the book-to-market effect in Fama and French (1992), at least in part because the more recent years in our dataset are ones for which the book-to-market strategy performs poorly.[26] Note that a substantial portion of our return on B/M accrues in the fourth quarter. Since that period includes January for a majority of firms (those with calendar year-ends), there appears to be a substantial overlap between the B/M effect and the January size effect. The benchmark returns from portfolios based on size, reported in the bottom row of panel B, provide some confirmation of this overlap. Also, the abnormal returns to the B/M strategy decrease to almost zero when size-adjusted returns are used (results not reported).

The returns to the E/P anomaly average about 7.6 percent over the four-quarter interval; again, nearly half of that return occurs in the last quarter, which includes January for most firms. While there is evidence of low correlation between E/P and size in panel A, the results are

---

[25] For the Holthausen/Larcker strategy, we compared their results with our results based on size-adjusted returns (not reported here). The combination of market-adjusted returns and size-adjusted Pr's we report here was not considered by them (see our footnote 15).

[26] Fama and French (1992, Table 2) report a difference of 1.53 percent per month between the highest and lowest 1/20 of the book-to-market distribution, implying an annualized difference of about 18 percent; their table suggests an annualized difference between quintile portfolios of about 13 percent.

consistent with the findings of prior research that there is some overlap between the E/P effect and the January effect (see Jaffe, Keim, and Westerfield 1989).

In summary, the results in Figure 1 and Table 1 panel B are consistent with prior findings, even though our sample firms, sample period, and procedures differ from those in prior studies. All six strategies produce positive market-adjusted returns and all but the Holthausen/Larcker Pr strategy produce market-adjusted returns roughly between five and nine percent over the first year.

Market-adjusted returns around subsequent earnings announcements

Our first set of tests is designed to help assess whether the anomalies are explained by market inefficiency or mismeasurement of risk. First, we assess the extent to which strategies predict future changes in earnings. Second, we examine whether the returns to the six strategies are concentrated around subsequent earnings announcements and whether those returns are consistent in sign and magnitude with predictable changes in earnings being announced on those dates, as if those earnings announcements serve to correct investor misperceptions.

Ability to predict future earnings "news"

If factors underlying any of the six anomalies are to predict abnormal returns around subsequent earnings announcements, they must reflect information about future earnings that stock prices do not reflect. As a prelude to the stock price tests, we examine the relation between the six factors and the subsequent behavior of earnings. Table 2 is based on the same portfolios used in Table 1, panel B—with long (short) positions in the highest (lowest) quintile for each of the six factors. Table 2 reports the differences in earnings changes (specifically, seasonally differenced earnings scaled by end of quarter price to produce SUEs) between the long (highest quintile) and short (lowest quintile) positions for each factor over the four quarters prior to and

the eight quarters subsequent to portfolio formation.[27] Note that any changes observed represent changes above and beyond the changes in the previous year; that is, for quarters 1 through 4 (5 through 8), the changes are relative to the earnings for quarters -3 through 0 (1 through 4), respectively. Also note that current SUE is the factor used to implement the first anomaly, whereas past and future SUEs are the variables being examined in Table 2 for all anomalies.

These earnings changes represent a convenient and generic variable to portray predictable market surprises to future quarterly earnings announcements. Results of accounting research indicate that the seasonal random walk is a reasonable first approximation for market expectations of future earnings (e.g., Foster 1977 and Bernard and Thomas 1990), and that this expectation is biased. To the extent this expectation is correlated with the market's earnings expectations for the portfolios we examine, the earnings changes in Table 2 represent predictable surprises that would cause the market to correct prior mispricing in a similar pattern. However, the seasonal random walk model may not capture the market's expectations for all firms, especially those with extreme levels of earnings or extreme past growth in earnings. If, as postulated in Lakonishok, Shleifer, and Vishny (1994) and La Porta (1995b), the market incorrectly projects past earnings growth into the future for value/glamour stocks, a seasonal random walk *with drift* would better represent the market's biased earnings expectations. While the earnings changes we report in Table 2 would not represent earnings surprises for such firms, earnings surprises can be inferred by comparing the level of past and future earnings changes. In essence, earnings changes represent raw data that can be transformed by readers to infer whether the market's biased expectations are captured by more complex models.

Consistent with evidence in Bernard and Thomas (1990), Table 2 shows that the SUE factor predicts subsequent SUEs: positively for the next three quarters, negatively for the fourth quarter, and weakly negatively thereafter. For example, the SUE strategy for quarter 1 predicts a mean earnings change difference of 6.26 percent, which represents the difference between the

[27] All SUE values greater (less) than 100 percent (-100 percent) are winsorized to 100 percent (-100 percent).

mean earnings increase of 3.66 percent for top quintile firms and the mean earnings decrease of -2.60 percent for bottom quintile firms. Given the historic relation between current and future quarter SUE's, an efficient market should expect such results. However, if the market is not efficient and is surprised by these predictable patterns, one would expect positive stock price reactions at the next three quarterly earnings announcements, a negative reaction to the fourth report, and weakly negative reactions thereafter. Additional evidence on this point is discussed later in the paper.

The second row of Table 2 shows that announcement quarter returns also predict subsequent earnings changes, in much the same pattern as that observed for the SUE anomaly. The magnitudes of the earnings surprises, however, are weaker.

The Ou/Penman Pr is designed to predict earnings changes and it succeeds. The third row of Table 2 shows that the Ou/Penman portfolios experience positive SUE for each of the eight subsequent quarters, especially quarter 4. As noted by Ou/Penman, this pattern of earnings changes represents a reversal of the pattern experienced in the four quarters before portfolio formation. The Holthausen/Larcker Pr, which is designed to predict excess returns rather than earnings changes, is not a good predictor of earnings changes; SUEs for all eight future quarters are roughly zero.

The pattern of earnings changes associated with the B/M and E/P portfolios run counter to the view that they represent the market surprises underlying the abnormal returns in Table 1, panel B. Examination of the earnings changes experienced by the long and short portfolios separately indicates the following pattern underlying the combined results reported in Table 2. For the B/M strategy, high (low) B/M firms experienced average earnings decreases (increases) of about -1.33 (0.33) percent over the four quarters before portfolio formation, and additional average earnings decreases (increases) of about -1.21 (0.16) percent over the quarters 1 through 4 after portfolio formation, with a decline in the earnings momentum over quarter 5 and 6 and a mild reversal in quarters 7 and 8. That is, high (low) B/M stocks experienced earnings declines

(increases) both over the year before and the year after portfolio formation. These patterns are also inconsistent with the view that the abnormal returns in Table 1 are due to the market projecting earnings growth from the year before portfolio formation to the year after portfolio formation.

Our results differ from those reported by Lakonishok, Shleifer, and Vishny (1994) (and Fama and French 1995 to a lesser extent): they report that high (low) B/M stocks show a five-year geometric average earnings growth rate of -27.4 (30.9) percent over the prior five years and growth rates of 43.6 (5) percent over the five years after portfolio formation.[28] Because they examine earnings growth over longer windows, they do not focus on earnings changes occurring right around the period of portfolio formation. Given that stock price reactions occur soon after portfolio formation for this strategy (see Table 1, panel B), we do not see how biased market forecasts of future earnings explain abnormal returns earned by this strategy.

For the E/P strategy, the results in Table 2 summarize the following pattern: the high E/P quintile exhibits higher earnings growth over the four quarters prior to portfolio formation than the low E/P quintile (average SUEs of 1.84 versus 0.18 percent per quarter). Curiously, this difference reverses in the quarters after portfolio formation. The results in Table 2 are derived from the following underlying data: the high E/P portfolio generates average earnings changes of -1.54 percent and -0.68 percent for quarters 1-4 and 5-8, whereas the low E/P portfolio generates average earnings changes of -0.50 percent and -0.22 percent for quarters 1-4 and 5-8. As with the B/M strategy, we cannot see why the market would be positively surprised by this decline in earnings growth for the high E/P portfolios. Admittedly, the decline in earnings experienced by the low E/P portfolio is consistent with that portfolio exhibiting stock price declines.

---

[28] In addition to differences in samples examined and the periods over which earnings growth are studied, there are numerous other differences between Lakonishok, Shleifer and Vishny and our study. Some of these other differences include the scale variable used (we scale by price, they use beginning-of-period earnings) and treatment of outliers (we Winsorize at ± 100 percent of price, they make no adjustments). Because of these research design differences we have been unable to reconcile completely our results with theirs

The results in Table 2 are not expected to be conclusive. If observed earnings patterns can be reconciled with biased market forecasts of earnings and predictable surprises at future earnings announcements, the likelihood is increased that an anomaly captures correction of prior mispricing. Otherwise, we cannot rule out the possibility that mispricing exists, but that either a more complex model of biased market earnings forecasts is responsible for the observed abnormal returns, or the correction of mispricing is unrelated to biased earnings forecasts.

Stock price reactions around subsequent announcements

The ability of the six factors to predict stock price reactions to subsequent earnings announcements is reflected in Figures 1 and 2 and in Table 3. Figure 1 shows the path of cumulative market-adjusted returns over the four post-formation quarters, for portfolios long (short) in the highest (lowest) quintile of each of the six factors. As mentioned earlier, each period between earnings announcements is split into a nonannouncement window and a three-day announcement window. Even though nonannouncement windows are actually of varying length, for purposes of producing Figure 1 they are treated as being of equal length (equal to the average duration of 60 trading days). Figure 2 juxtaposes the market-adjusted returns to the six anomalies (and the size portfolios) during the three-day announcement windows for the eight quarters after portfolio formation on the corresponding SUEs from Table 2 (assumed to represent market surprises), to highlight the relation between the two. Table 3 presents abnormal returns cumulated over non-announcement and announcement windows for each of the next eight quarters. The market-adjusted returns reported in Table 1, panel B, Figure 1, and Figure 2 are all taken from the data in Table 3. To calibrate the magnitude of observed abnormal returns, recall that a hedge portfolio based on perfect foresight of next quarter's earnings would produce mean non-announcement period market-adjusted returns of 7.5 percent, and mean announcement period market-adjusted returns of 4.5 percent.

The SUE effect

Figure 2, panel A (as well as the graph for the SUE effect in Figure 1 and the first row in Table 3), extends the results documented in Bernard and Thomas (1990) to the larger sample used here. The signs and pattern of the market-adjusted returns mimic the signs and patterns of seasonally-differenced quarterly earnings. Seasonally-differenced earnings for the SUE portfolios are positive, but declining over the first three subsequent quarters. As if the market is surprised by this pattern, the market-adjusted returns are also positive but declining across the announcement periods for the first three quarters. In the fourth quarter, earnings are lower than the earnings of the comparable quarter of the prior year (the quarter in which the SUE was calculated), and again the market appears surprised by this, reacting negatively. Overall, the results suggest that the market fails to recognize fully the time series pattern followed by quarterly earnings. This failure occurs despite the fact that quarterly earnings have consistently followed this pattern across a broad spectrum of industries for at least five decades (see Foster 1977; Bernard and Thomas 1990; Bernard 1992).

The results in Figure 1 and Table 3 indicate that a disproportionate share of the returns earned by the SUE portfolios are concentrated around earnings announcements. Over each of the first three quarters after portfolio formation, about 25 percent of the market-adjusted return arises in the 3-day window around earnings announcements. The market-adjusted return around the *first* subsequent announcement—1.33 percent—is much larger than any reasonable risk premium. This return is the composite of a positive return of 1.03 percent for the highest SUE quintile and a negative return of -0.30 percent for the lowest SUE quintile. These three-day returns constitute annualized compounded returns of about 136 percent and -22 percent, respectively. Such negative reactions for low SUE firms with bad earnings news prior to portfolio formation could be explained as a product of mismeasured risk only if such firms offered a hedge against risk that was so valuable that investors were satisfied with returns much below that earned by the market. Moreover, this hedge was expected only for those three days.

The signs and pattern of the market-adjusted returns to the SUE strategy, in conjunction with the concentration of those returns around subsequent earnings announcements, make it difficult to explain the returns as a risk premium. The results are more consistent with stocks being mispriced after earnings announcements because of expectations for future earnings that are systematically biased. The mispricing is subsequently corrected when these expectations are not supported by new earnings data, with a large proportion of the correction occurring on earnings release dates.[29]

Announcement quarter returns

Figure 2, panel B (and the corresponding plot in Figure 1 and the second row of Table 3), shows that, as in the case of the SUE strategy, portfolios based on announcement-quarter returns generate seasonally-differenced earnings that are positive, but declining in magnitude, over the next three quarters. As if this pattern surprises the market, the excess returns around the announcements are also positive and declining in magnitude over the first three quarters. Unlike the SUE strategy, earnings surprises are zero for the fourth quarter, and excess returns are close to zero around this announcement. While the overall excess returns are not as concentrated in the three-day announcement windows as they are for the SUE strategy, the change in gradient around earnings announcements is clearly visible in Figure 1. These results demonstrate a linkage between momentum in abnormal returns and momentum in earnings changes, explaining (in part) the findings of Jegadeesh and Titman (1993) (see also Chan, Jegadeesh, and Lakonishok 1995).

The evidence is surprising in two respects. First, the positive correlation between excess returns before and after earnings announcements suggests weak-form market inefficiency, consistent with market underreaction to new information. Even those stocks whose prices have moved *most* in the announcement quarter appear not to have moved enough to reflect, on

---

[29] The mean abnormal returns and SUE's reported in the different tables and figures represent distributions of varying degrees of skewness. Median results are of the same sign as the mean results, but often of smaller magnitude. We focus on the mean results, however, because they offer a convenient economic interpretation (e.g., the mean abnormal return equals the amount that would be earned by equally-weighted portfolios) that is not available for medians. Also, means can be compared with results of prior research.

average, the predictable earnings changes in upcoming quarters. The concentration of excess returns during announcement windows and the correlation with earnings surprises released at those dates reduces the likelihood that these returns are due to an omitted risk factor.

Second, the evidence appears at first blush to be inconsistent with Foster, Olsen, and Shevlin (1984), who document essentially no size-adjusted returns to this strategy. However, Foster, Olsen, and Shevlin examined only the first 60 trading days after the initial announcement. Note that this period usually does *not* include the next announcement, and that returns up to the first subsequent quarter are close to zero in our sample. The extension of the holding period beyond 60 days is largely responsible for explaining the difference between our results and those of Foster, Olsen, and Shevlin.

Ou/Penman Pr effect

Figure 2 panel C shows that market-adjusted returns around the subsequent eight earnings announcements are always positive for the Ou/Penman Pr portfolios—once again resembling the patterns (in terms of *signs*) observed for seasonally-differenced earnings. That is, the Ou/Penman strategy predicts future earnings news and the announcement window returns are consistent with those predictions.

Although this consistency between the earnings news and announcement period abnormal returns suggests that the Ou/Penman strategy exploits market mispricing, there are indications to the contrary. First, unlike the patterns observed in panels A and B of Figure 2, the *magnitudes* of the abnormal returns and earnings news in panel C are not related. For example, the magnitudes for earnings news increase from quarter 1 to quarter 4, whereas the magnitudes of abnormal returns do not. Second, again unlike the patterns observed in Figure 1 and Table 3 for the first two strategies, there is no consistency between the returns for the non-announcement and announcement windows; the three-day announcement period intervals for the Ou/Penman strategy account for almost all of the cumulative return, and the non-announcement window returns sum to nearly zero. Given that some earnings news leaks out to the market before the earnings

announcement, we would expect earnings news to be positively correlated with both announcement and non-announcement window returns. Finally, the quintile of firms with the highest Pr values also contain a disproportionate share of small and/or low price firms, which have been shown to have more positive abnormal returns at earnings announcements than other firms. To calibrate the potential impact of the size effect on announcement window returns, note that the size portfolio earns about one percent on earnings announcements (see panel G in Figure 2), *even though the earnings news released at those announcements is neutral*. To calibrate the potential impact of the small price effect, we replicated the analysis after deleting firms with price less than $5. The announcement period abnormal returns are reduced by about one-half and the overall positive returns observed for this strategy are almost completely eliminated (e.g., the four-quarter return of 4.78 percent in Figure 1 is reduced to 1.09 percent).

In sum, even though the Ou/Penman strategy appears to capture market mispricing because it predicts future earnings changes and produces abnormal returns that are concentrated at those announcements, there is other evidence suggesting that the pattern of announcement window returns observed for this strategy are driven by the small firm/low price effect.

Holthausen/Larcker Pr effect

The Holthausen/Larcker Pr is not a good predictor of subsequent earnings changes, and produces relatively small market-adjusted returns around subsequent earnings announcements (see Figure 1, Figure 2, panel D, and Table 3.) Consistent with the evidence on earnings surprises, average three-day announcement period returns are close to zero. Thus, if the Holthausen/Larcker Pr variable captures mispricing, it must be in a form that is corrected through time, even though information about firms' prospects is to *some* extent concentrated around earnings announcements. Alternatively, the smooth pattern of excess returns to the Holthausen/Larcker strategy may reflect a premium for an unknown risk. Another possible explanation is that positive abnormal returns are generated around earnings announcements, but

they are offset by a negative announcement window size effect, created by the short portfolio containing more small stocks than the long portfolio (see Table 1, panel A).

There is reason to expect the Holthausen/Larcker strategy to be more susceptible to a risk-based explanation than the Ou/Penman strategy. The Holthausen/Larcker Prs are designed to predict abnormal returns. If the risk adjustments used in the Holthausen/Larcker approach are incomplete or misspecified, then excess returns to this strategy could be positively related to risk *by construction*.[30] Ou/Penman Pr's are one step removed from the prediction of returns; they are designed to predict earnings changes. Ou/Penman selected this indirect approach to mitigate concerns about risk (see Ou and Penman 1989, footnote 3).

The book-to-market effect

Table 3 shows that mean returns to B/M portfolios exceed 16 percent over two years. Figure 1, Figure 2 panel E, and Table 3 indicate that much of this return (about 30 percent) is concentrated in the three-day intervals surrounding earnings announcements. However, the earnings surprises at these announcements are negative and inconsistent with the positive announcement window excess returns (see related discussion in section 4A). As with the Ou/Penman results, the positive announcement window returns are partially due to the inclusion of small size/low price stocks in the high B/M quintile. Deleting stocks with price less than $5 reduces the announcement window returns (as well as the aggregate cumulative abnormal returns) by about one-half. That is, contrary to the preliminary indications from the announcement window return evidence, the B/M ratio may not reflect market mispricing that is corrected around earnings announcements; the abnormal returns are uncorrelated with earnings surprises, and much of the abnormal returns (both the concentrated announcement period returns as well as the overall returns) are due largely to size and low price effects.

Earnings-to-price effect

[30] The same points can be made for the other two variants of Pr examined by Holthausen/Larcker.

The results for the E/P effect are reported in panel F of Figure 2, Figure 1 and the sixth row of Table 3. Although the market-adjusted returns to this strategy are more than 13 percent for the overall two-year period, the announcement window excess returns are small, and unrelated to the negligible earnings surprises observed. Thus, the market-adjusted returns appear to arise smoothly over time—consistent with a failure to control fully for risk.

Consistency of market-adjusted returns through calendar time

Our second set of tests examines the distributions of quarter-by-quarter profits earned over time by zero-investment portfolios based on each strategy. These distributions of quarterly profits are summarized in Table 4. This evidence needs to be combined with the results from the first set of tests (see summary of combined results in Table 5) to make a more balanced evaluation of each anomaly. An anomaly is more likely to be due to mispricing if it exhibits attributes consistent with mispricing under both approaches, and it is more likely to be due to mismeasured risk if the evidence consistently points the other way. For cases with mixed evidence, the conclusions are less clear (see section 1 for additional discussion). In any case, we believe readers will benefit from a simple description of the distribution of profits they would have earned in the past from implementing each anomaly.

Volatility measures are most readily interpretable when the magnitude of the position at risk is held constant through time.[31] Thus, as described previously, the approach used in the following tests ensures that we initiate perfectly offsetting investments in top and bottom quintile stocks each day and hold both positions for fixed periods. Any volatility in the series of returns can be attributed to variation in *rates* of return, as opposed to variation in amounts invested. Note that if the success of a strategy depends on an imbalance between top and bottom quintile

[31] In the tests examined thus far, this condition does not hold. Each stock is assigned to a quintile the day after it announces earnings where quintile assignments are made relative to quintile cutoffs from the prior year, and held until the next announcement. Thus, the number of stocks in the top and bottom quintiles are often considerably different at each point in time.

stocks (because of some ability to predict the *timing* of differential movements for the two groups), returns to the perfectly offsetting positions reported in Table 4 will not reflect that success.

Also, in the spirit of movement to a more readily implementable strategy, our approach in Table 4 involves one other difference, relative to the approach underlying prior tables. We now continue to hold our positions, whether or not subsequent announcement dates are available. If the stock is delisted, we invest the proceeds in the value-weighted market index and continue to hold that position. Thus, in contrast to the prior tests, which require availability of the next earnings announcement date, there is no potential "hindsight bias" from excluding firms based on ex post knowledge that there are insufficient data on subsequent earnings announcement dates. In addition, unlike our prior tests, the tests presented in this section do not require the assumption that mispricing be corrected disproportionately around earnings announcement dates.

Finally, another important difference between the two approaches relates to differences in the holding period: even though the means in Table 4 relate to quarterly holdings, they do not constitute a return for the entire quarter because many positions are opened or closed during the quarter. As a result, the mean returns in Table 4 will be less than the quarterly mean returns reported earlier and less than 1/4th the four-quarter mean returns reported earlier.[32]

Table 4, panel A, reports the distribution of quarter-by-quarter returns to zero investment portfolios constructed for each anomaly. The results in Table 4 do not represent rates of return *per se*, since the net investment is zero in each portfolio; they represent the mean of the net returns—return on long position ($1/*L* in each of *L* stocks) less return on short position ($1/*S* in each of *S* stocks)—earned by the many zero investment portfolios held each calendar quarter. In Table 4, panel B, we focus on first quarters alone (which includes January) to provide an indication of the extent to which profits from each anomaly are seasonal and concentrated in that

[32] Analysis of the differences between the two sets of results (Tables 3 and 4) for each of the strategies reveals that differences in the procedures employed and sample membership impact the results for each strategy to different extents, with no obvious commonalities across strategies.

quarter, to show potential contamination by the size effect. The mean, standard deviation, and frequency of loss quarters are reported in the bottom three rows of panels A and B for both sets of distributions. In addition, Figure 3 provides a graphic depiction of zero investment portfolio returns to each strategy in first quarters versus second, third and fourth quarters.

From the results in Table 4, panel A, only the SUE strategy emerges as one that is likely to exploit market mispricing. Specifically, the distribution for the SUE strategy exhibits a substantially positive mean quarterly return (2.81 percent per quarter), a relatively low time-series standard deviation (2.40 percent), and few quarters with losses (10.53 percent). The distributions for the remaining strategies exhibit lower mean returns (ranging between 0.27 percent for the Ou/Penman Pr strategy and 1.52 percent for the Holthausen/Larcker Pr strategy) and considerable risk, evidenced by the much higher standard deviations (ranging between 3.60 percent for the E/P strategy and 6.07 percent for the B/M strategy) and proportions of loss quarters (ranging between 23.7 percent for the Holthausen/Larcker Pr strategy and 47.4 percent for the Ou/Penman Pr strategy).

The results in Table 4, panel B, and in Figure 3 indicate that much of the positive returns generated by the Ou/Penman Pr and B/M strategies occur in the first calendar quarter, probably reflecting the high January returns observed for small firms and low price stocks. The means for the distributions are much higher and the proportion of loss quarters are much lower in Table 4 panel B, relative to panel A, for these two strategies. These strategies generate little in terms of abnormal returns during the three quarters that do not include January. In contrast, the announcement quarter returns strategy and the Holthausen/Larcker Pr strategy are less profitable in the first quarter, relative to the other three quarters. The remaining strategies (SUE and E/P) exhibit consistent results across both panels, suggesting they are least affected by size effects.

These results are consistent with some of our findings described earlier regarding abnormal returns around subsequent earnings announcements. First, the SUE effect does not appear to be due to a mismeasured risk premium. Not only are the announcement window returns

correlated with the predictable earnings news reported in those announcements, the strategy exhibits net losses in only eight of the 76 quarters examined. Second, the Holthausen/Larcker Pr and E/P strategies, both of which behaved in our prior tests as if they could be explained as premia for unidentified risks, are confirmed here as being risky; they exhibit high volatility and many loss quarters.

Third, the B/M effect, which in prior tests behaved in ways not fully consistent with mispricing, is shown here to involve a substantial amount of risk. Also, additional confirmation is provided in Table 4 on the link between the B/M effect and the size effect. Given the large positive first quarter returns (mean of 6.56 percent in panel B versus 1.13 percent in panel A), the proportion of loss periods is likely to be reduced if one moves from the quarterly returns periods we use to annual returns periods, as in Lakonishok, Shleifer, and Vishny (1994) and La Porta, Lakonishok, Shleifer, and Vishny (1995).[33] However, we argue that this reduction is simply due to the dominance of the size effect operating in the first quarter, and should not be interpreted as evidence in support of the B/M effect representing market mispricing. If the B/M anomaly captures a mispricing derived from systematic errors in the market's expectations for earnings growth, it should not produce consistent losses in the second, third, and fourth quarters (e.g., 30 of 57 second, third and fourth quarters result in net negative returns).

For the Ou/Penman strategy, the results in Table 4 and Figure 3 add a new dimension to our earlier analysis. Unlike the conflicting results discussed in section four, results in Table 4 are unambiguous: they suggest considerable variation in returns through time and a high risk of loss. As with the B/M strategy, the importance of the size effect and the concentration of profits in the first quarter is evident. The mean of all first quarter returns is 5.36 percent (compared to a mean of 0.27 percent for all quarters), only one of the 34 loss quarters for this strategy occurs in a first

[33] For the 1974-1989 period of overlap between our data and that of Lakonishok, Shleifer, and Vishny, the frequency of losses for the B/M anomaly is equivalent; we report five years of loss, as they do. There is also agreement on which specific years generate the losses in four of five cases, even though Lakonishok, Shleifer and Vishny do not examine calendar (January to December) years.

quarter, and negative returns are earned in 33 of 57 second, third and fourth quarters. Again, it is difficult to reconcile the poor performance of this strategy in the second, third, and fourth quarters with the strategy capturing a mispricing based on systematic errors in earnings expectations.

Regarding the extent to which the announcement quarter returns strategy represents mispricing, the results in Table 4 and Figure 3 provide a very different picture than the results in section four. While the earlier results indicated strong support for the mispricing explanation, the results in Table 4 suggest considerable risk, evidenced by the high standard deviation (4.53 percent relative to a mean return of 0.97 percent) and high proportion of loss quarters (32.89 percent). Overall, we are unable to reach a conclusion about this strategy because of the diametrically opposite results observed for the two sets of tests (section four versus section five).

Additional research design issues: Transactions costs and selection biases

We do not examine whether the abnormal returns to these six strategies represent arbitrage opportunities net of transactions costs for a number of reasons (see Ball 1992 for a detailed explanation). First, we are uncomfortable relating market efficiency to the absence of arbitrage profits, as in Jensen (1978), if trades occur systematically at prices above or below equilibrium values that are reached at a later date, and those equilibria can derived from publicly available information.[34] Second, even if we attempted to incorporate transactions costs, whose costs should we consider? By reporting abnormal returns before transactions costs, investors can assess whether the abnormal returns reported here exceed the transactions costs they deem relevant.

To what extent should our conclusions be tempered by the potential for selection bias? While the COMPUSTAT sample-expansion bias described by Ball, Kothari, and Shanken (1995) and Kothari, Shanken, and Sloan (1995) applies only to the 1973-1978 portion of our sample, other

[34] Another undesirable feature of this definition, as noted by Ball, is that increasing the level of transactions costs increases the level of efficiency in a market: a predictable return of 2.5 percent would be treated as evidence of inefficiency if transactions costs equalled 2 percent, but not if transactions costs increased to 3 percent.[35]

forms of survivorship bias could always be present since we are unable to implement procedures like those used by Breen and Korajczyk (1994). The presence of such biases might raise questions about strategies we classify as being consistent with mispricing (e.g., Brown and Pope 1995). However, there is evidence that survivorship bias is not a concern for the one strategy, based on SUE, we include in this group. Prior research (e.g., Watts 1978) has shown that the SUE strategy is successful even on samples free of survivorship bias. We also find evidence consistent with this conclusion in our sample. We repeated the analysis in Table 4 for the SUE strategy for all firms that were on the COMPUSTAT files as of 1987, and tracked their profitability over the last 22 quarters (87:I to 92:II). The results are similar to those reported in Table 4 for the overall sample; we observed one more loss quarter (92:I) than the two loss quarters reported in Table 4 (91:I and 92:II).

Turning to the four strategies we classify as not being consistent with mispricing, any potential survivorship bias should not alter our conclusions. The presence of a selection bias might create positive abnormal returns in the aggregate for these strategies, but if a strategy does not predict future earnings changes, does not generate concentrated abnormal returns at future earnings announcements, and is associated with profitability that varies considerably over subperiods, even in the presence of survivorship bias, it is unlikely to represent mispricing in the absence of such bias.

Summary and conclusions

This study conducts two sets of tests intended to help discriminate between stock price anomalies that are explainable because of a failure to control for risk and those that reflect market mispricing. The premise of the analysis is simple. First, if mispricing exists, it should ultimately be eliminated around subsequent information releases, as the new information causes traders to reexamine their (previously incorrect) beliefs. Second, if mispricing exists, a disproportionate amount of price correction should occur around earnings announcements because these

announcements constitute important information releases. Given these assumptions, an anomaly that constitutes mispricing should generate abnormal returns that tend to be concentrated around subsequent earnings announcements, and those returns should be related to the earnings "news" that corrects market agents' beliefs. If the returns are large enough per unit time and follow predictable patterns, it strains plausibility to attribute them to errors in the measurement of required risk premia. In addition, if the returns to a zero investment strategy designed to exploit the anomaly are consistently positive period after period, a risk-based explanation is less plausible.

We recognize that these or any other tests are limited in their ability to separate market inefficiencies from risk control problems. In the absence of a full understanding of asset pricing, one can never completely overcome the joint hypothesis problem first pointed out by Fama (1970): one cannot test market efficiency without simultaneously testing some model of expected returns. However, the two sets of analyses offered here provide considerable new evidence which allows readers to revise their prior beliefs about the likelihood of alternative explanations for anomalous stock price behavior.

Of the six anomalies examined here, the evidence is most consistent with market inefficiency for the anomaly based on standardized unexpected earnings (SUEs). This result confirms results in Bernard and Thomas (1990), but over a larger sample: more firms and more years of data. The explanations based on mismeasured risk would need to become considerably more complex than any proposed so far to be consistent with the evidence we present here. For another anomaly, based on announcement quarter returns (rather than news derived from quarterly earnings as in the SUE strategy), the evidence is mixed. Some of the results point clearly to mispricing while others point clearly to the strategy involving considerable risk.

While the evidence on the Ou/Penman strategy and the book-to-market strategy is somewhat mixed, it is more easily reconciled with a risk-based explanation. Consistent with a mispricing hypothesis, the returns to both strategies are concentrated around subsequent earnings announcements. However, other features of the evidence defy a mispricing explanation. Much of

the concentration of returns at earnings announcements is attributable to low-priced stocks and the anomaly documented by Chari, Jagannathan and Ofer (1988) (i.e., abnormal returns around earnings announcements of small firms are positive on average even when the earnings news is neutral). Moreover, when the strategies are implemented using zero investment perfectly hedged positions, we document considerable [35]variability in returns and a high frequency of quarterly losses. For the Ou/Penman strategy, the high frequency of losses arises in conjunction with a substantial reduction in the mean return, suggesting a lack of robustness to methodological perturbations.

The evidence on the remaining two strategies—the Holthausen/Larcker Pr effect and the earnings/price effect—is most consistent with these anomalies reflecting a failure to control for risk. The strategies do not predict future earnings changes and there is no concentration of abnormal returns around subsequent earnings announcement. If these strategies capture market mispricing, price corrections must occur through information events other than earnings announcements. Even if this is the case, there is little question that both strategies are very risky in our zero investment portfolio tests: there is considerable time-series volatility in the profits earned by the strategies and losses are observed frequently.

TABLE 1
Summary statistics for factors underlying six stock price anomalies*

Panel A: Correlation among quintiles for factors (only fourth quarter data)

Quintiles based on	Standardized unexpected earnings	Announcement quarter returns	Ou/Penman Pr	Holthausen/ Larcker Pr	Book/ market ratio	Earnings/ price ratio
Standardized unexpected earnings (SUE)	1.00					
Announcement quarter abnormal returns	0.23	1.00				
Ou/Penman Pr	-0.13	-0.05	1.00			
Holthausen/Larcker Pr	0.08	0.04	0.03	1.00		
Book/market ratio	-0.04	-0.03	0.37	-0.04	1.00	
Earnings/price ratio	0.16	0.05	-0.20	0.03	0.43	1.00
Size	0.00	-0.03	0.26	-0.18	0.35	0.09

Panel B: Difference in mean cumulative abnormal returns for extreme quintiles based on factors

	Quarters after forming portfolios			
Quintiles based on	1	2	3	4
Standardized unexpected earnings (SUE)	5.90%	7.64%	7.73%	6.75%
Announcement quarter abnormal returns	0.26%	1.85%	4.00%	6.32%
Ou/Penman Pr	1.68%	2.39%	2.78%	4.78%
Holthausen/Larcker Pr	0.91%	3.01%	3.88%	3.48%
Book/market ratio	2.38%	3.60%	3.18%	8.85%
Earnings/price ratio	2.15%	3.53%	4.66%	7.64%
Size	1.73%	2.60%	1.60%	7.29%

* Six factors that might generate abnormal returns are considered. The first two, SUE and announcement quarter returns, are based on quarterly data, and the remaining four are based on annual data. SUE equals seasonally differenced quarterly earnings before extraordinary items and discontinued operations, scaled by market value at the end of the fiscal quarter. Announcement quarter abnormal returns equal the excess of the cumulative returns over the value-weighted NYSE/AMEX index return for the period between the prior quarter's and this quarter's earnings announcements. The first two annual strategies are computer-generated predictions of future earnings and price movements as described in Ou and Penman (1989) and Holthausen and Larcker (1992). The book-to-market and earnings-to-price ratios represent the book value of stockholders' equity and annual earnings before extraordinary items and discontinued operations scaled by market value of equity at fiscal year end. Only positive values are considered for these two ratios. Firms are placed into quintiles for each strategy, based on the corresponding distribution for that strategy for announcements in the prior calendar year, and the lowest (highest) quintile is predicted to generate the most negative (positive) future returns. For comparison purposes, results are also reported for the size effect: all fourth quarter announcements are grouped into quintiles based on market capitalization (size) for all NYSE/AMEX firms as of January 1 of that year. The smallest (largest) quintile is ranked the highest (lowest) based on the magnitude of expected future returns. For panel B, cumulative abnormal returns (in excess of the value-weighted NYSE/AMEX index return) are computed for each quintile as of the next four quarterly earnings announcements and the difference between the means for the two extreme quintile portfolios is reported.

Table 2

Mean quarterly earnings changes for portfolios based on six anomalies:[a]
Portfolios include long (short) position in highest (lowest) quintile of factor

	Quarter relative to quarter of portfolio formation (quarter 0)											
quintiles based on	-3	-2	-1	0	1	2	3	4	5	6	7	8
standardized unexpected earnings (SUE)	0.32%	2.56%	5.22%	15.15%	6.26%	3.92%	1.48%	-3.91%	-1.21%	-1.03%	-0.89%	-0.82%
announcement quarter abnormal returns	0.09%	0.36%	1.36%	3.63%	3.34%	2.87%	2.01%	-0.01%	-0.11%	-0.30%	-0.37%	-0.42%
Ou/Penman Pr	-3.26%	-3.86%	-3.35%	-4.96%	0.44%	1.32%	2.60%	4.74%	1.30%	1.03%	0.53%	1.24%
Holthausen/Larcker Pr	0.38%	1.15%	1.62%	4.12%	0.77%	0.43%	0.58%	-0.21%	0.15%	-0.26%	-0.51%	0.44%
book/market ratio	-1.09%	-1.36%	-1.46%	-1.94%	-1.18%	-1.23%	-1.16%	-1.90%	-0.09%	0.13%	0.28%	0.48%
earnings/price ratio	1.67%	1.80%	1.58%	1.60%	-0.38%	-1.03%	-1.32%	-1.45%	-0.62%	-0.56%	-0.13%	-0.52%
size	0.74%	0.86%	0.68%	0.90%	0.16%	0.18%	-0.09%	-0.38%	-0.15%	0.11%	-0.06%	-0.15%

[a] See table 1 for an explanation of the six anomalies and the comparison strategy based on size. Seasonally differenced quarterly earnings, scaled by end-of-quarter price, are calculated for the highest (lowest) quintiles of these factors, and the difference between the two extreme quintiles is reported here for each of eight quarters after portfolio formation. To minimize the effect of extreme values, all quarterly change values greater (less) than 100% (-100%) are Winsorized to 100% (-100%).

Table 3
Mean cumulative abnormal returns based on six anomalies:[a]
Computed as of the end of announcement and non-announcement windows for 8 subsequent quarters

quintiles based on	Quarters after forming portfolios															
	1		2		3		4		5		6		7		8	
	non-ann	announ	non-ann	announ	non-ann	announ	non-ann	announ	non-ann	announ	non-ann	announ	non-ann	announ	non-ann	announ
standardized unexpected earnings (SUE)	4.57%	5.90%	7.07%	7.64%	7.72%	7.73%	7.34%	6.75%	6.80%	6.56%	7.44%	7.13%	7.77%	7.67%	8.33%	8.15%
announcement quarter returns	-0.49%	0.26%	1.36%	1.85%	3.69%	4.00%	6.48%	6.32%	4.94%	4.67%	4.35%	3.93%	3.58%	3.34%	4.21%	4.13%
Ou/Penman Pr	0.79%	1.68%	1.67%	2.39%	1.54%	2.78%	4.15%	4.78%	5.04%	5.52%	4.94%	5.36%	4.48%	4.73%	6.70%	6.99%
Holthausen/Larcker Pr	0.56%	0.91%	2.95%	3.01%	3.87%	3.88%	3.65%	3.48%	3.39%	3.34%	4.19%	3.98%	4.56%	4.49%	5.48%	5.27%
book/market B/M ratio	2.05%	2.38%	2.96%	3.60%	2.54%	3.18%	7.91%	8.85%	10.53%	11.21%	12.17%	12.78%	11.91%	12.53%	15.83%	16.51%
earnings/price E/P ratio	2.25%	2.15%	3.56%	3.53%	4.64%	4.66%	7.41%	7.64%	8.52%	8.48%	10.04%	10.10%	9.59%	9.81%	12.60%	13.07%
size	1.02%	1.73%	1.93%	2.60%	0.47%	1.60%	6.09%	7.29%	8.68%	9.51%	9.90%	10.47%	9.11%	10.23%	14.49%	15.57%

[a] See Table 1 for an explanation of the six factors and the comparison strategy based on size. The cumulative abnormal returns (in excess of the value-weighted NYSE/AMEX index return) earned by portfolios based on these six factors are computed as of each of the eight earnings announcements subsequent to portfolio formation. The period between adjacent earnings announcements is split into announcement windows (the two days before and day of earnings announcement) and non-announcement windows (the remaining days) when cumulating returns. At each quarterly earnings announcement for the two quarterly strategies and each fourth quarter earnings announcement for the four annual strategies, portfolios are formed that are long in the highest quintile and short in the lowest quintile for each strategy, and held for the next eight quarterly earnings announcements. The difference between the mean cumulative abnormal returns earned by the long and short portfolios is reported as of the end of each window. For the size portfolios, the holding period begins at fourth quarter earnings announcements, and the long (short) position is in the smallest (largest) firm quintile.

TABLE 4
Quarter-by-quarter return differences between hedged long and short positions held in extreme quintile portfolios based on six stock price anomalies*

Panel A: Distribution of average quarterly returns for all 76 quarters between 73:III and 92:II.

Range of average quarterly return	Quintiles based on						
	Standardized unexpected earnings (SUE)	Announce-ment quarter returns	Ou/ Penman Pr	Holthausen/ Larcker Pr	Book/ market ratio	Earnings/ price ratio	Size
< -17.5%	0	2	0	1	0	0	2
-17.5% to -15%	0	0	0	0	0	0	0
-15% to -12.5%	0	0	1	0	1	0	1
-12.5% to -10%	0	1	2	1	1	0	1
-10% to -7.5%	0	1	1	1	3	1	6
-7.5% to -5%	1	0	11	1	5	3	10
-5% to -2.5%	2	2	6	2	9	6	11
-2.5% to 0%	5	19	15	12	13	17	9
0% to 2.5%	25	25	15	29	19	26	9
2.5% to 5%	28	16	10	17	12	12	9
5% to 7.5%	14	8	10	6	3	7	4
7.5% to 10%	1	1	2	4	2	4	3
10% to 12.5%	0	0	2	2	5	0	4
12.5% to 15%	0	0	0	0	2	0	3
15% to 17.5%	0	1	0	0	0	0	0
17.5% to 20%	0	0	1	0	0	0	0
> 20%	0	0	0	0	1	0	4
mean	2.81%	0.97%	0.27%	1.52%	1.13%	1.09%	0.86%
std. dev.	2.40%	4.72%	5.46%	5.05%	6.07%	3.60%	9.54%
% loss quarters	10.53%	32.89%	47.37%	23.68%	42.11%	35.53%	52.63%

TABLE 4 (Continued)

Panel B: Distribution of average quarterly returns for 19 first quarters between 73:III and 92:II.

Range of average quarterly return	Quintiles based on						
	Standardized unexpected earnings (SUE)	Announce-ment quarter returns	Ou/ Penman Pr	Holthausen/ Larcker Pr	Book/ market ratio	Earnings/ price ratio	Size
< -17.5%	0	2	0	1	0	0	0
-17.5% to -15%	0	0	0	0	0	0	0
-15% to -12.5%	0	0	0	0	0	0	0
-12.5% to -10%	0	1	0	1	0	0	0
-10% to -7.5%	0	1	0	1	0	0	0
-7.5% to -5%	1	0	0	1	0	0	0
-5% to -2.5%	2	2	0	0	1	2	0
-2.5% to 0%	0	5	1	3	1	4	0
0% to 2.5%	8	7	3	5	5	7	2
2.5% to 5%	5	1	5	4	2	1	6
5% to 7.5%	3	0	6	3	2	3	2
7.5% to 10%	0	0	1	0	1	2	1
10% to 12.5%	0	0	2	0	4	0	2
12.5% to 15%	0	0	0	0	2	0	2
15% to 17.5%	0	0	0	0	0	0	0
17.5% to 20%	0	0	1	0	0	0	0
> 20%	0	0	0	0	1	0	4
mean	1.77%	-2.85%	5.55%	-1.17%	6.70%	2.04%	10.98%
std. dev.	3.30%	6.63%	4.27%	7.97%	6.33%	3.80%	9.88%
% loss quarters	15.79%	52.63%	5.26%	36.84%	10.53%	31.58%	0.00%

TABLE 4 (Continued)

- See Table 1 for an explanation of the factors underlying the six anomalies and the comparison strategy based on size. Each day, zero investment portfolios are initiated for each strategy based on stocks announcing earnings that day. A total of $1 is invested long (short) in firms that fall in the top (bottom) quintiles for each strategy. If at least one opposite position announcement is not available on the date a long or short position is initiated, that position is deferred until such a match is obtained. Upon obtaining a match, positions are held for 100 trading days for the SUE strategy and held for 260 trading days for the remaining strategies. For stocks that are delisted during this holding period, the proceeds at delisting are reinvested in the value-weighted NYSE/AMEX index until the end of the holding period. Although positions are held for 100/260 trading days, returns for these long and short positions are reported by calendar quarter. At the beginning of each calendar quarter, return cumulation is initiated for all outstanding long and short positions (those that haven't yet reached 100/260 trading days) and return cumulation ceases at the earlier of the end of the quarter or the end of the 100/260 day holding period. Return cumulation is also initiated for new zero investment portfolios generated by earnings announcements occurring within that quarter. The average of all zero investment portfolio returns held in each calendar quarter is used to construct the table below.

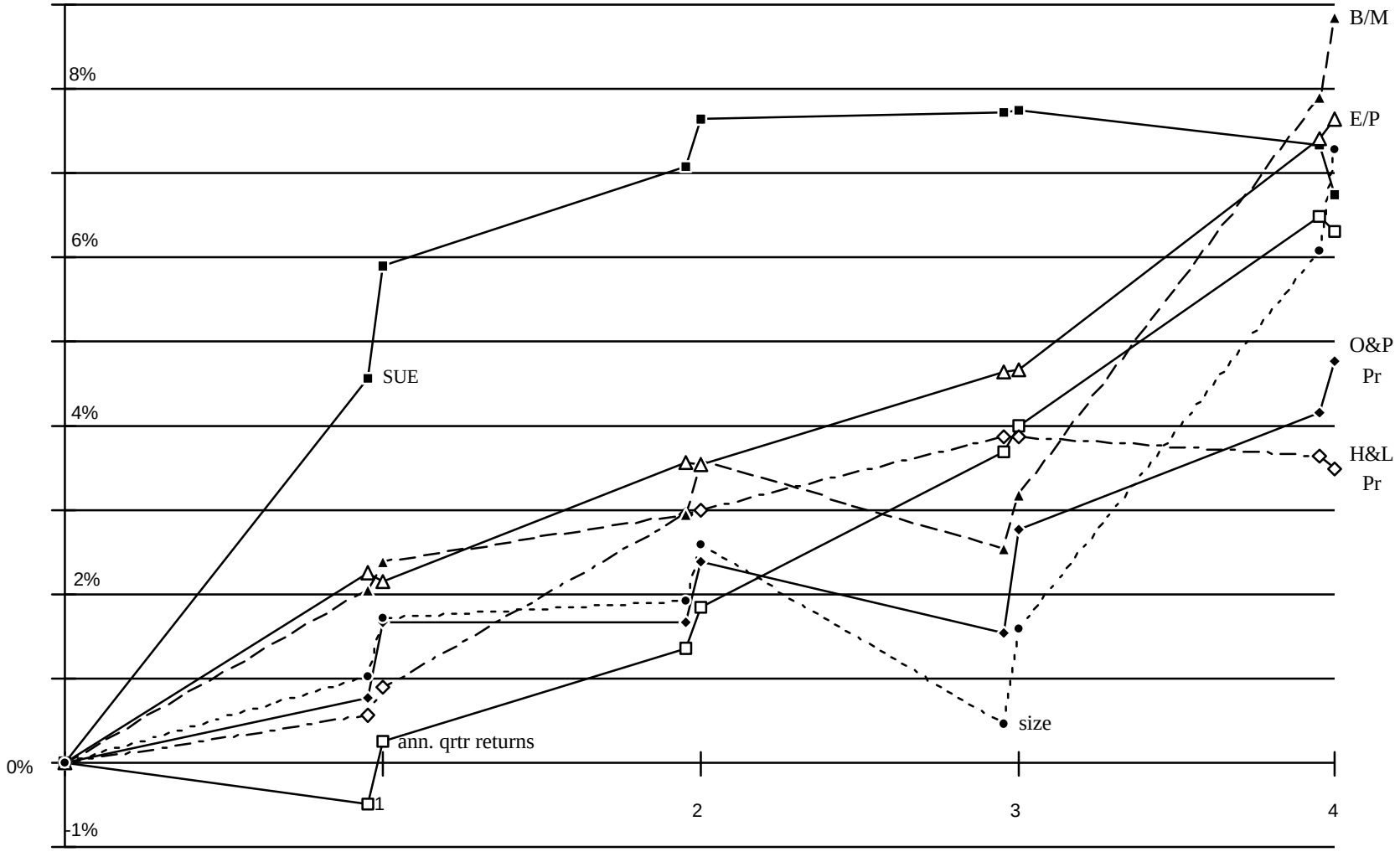
Table 5

Summary of results[a]

Strategy	Earnings announcement window abnormal returns				correl. with size effect?	quarter-by-quarter profits		
	concentrated	magnitude	correlation with earnings surprise	correlation with non-ann. window AR		Mean	variance	# of losses
standardized unexpected earnings (SUE)	yes	high	yes	yes	no	high	low	low
announcement quarter returns	yes	medium	yes	yes	no	**low**	**high**	**high**
Ou/Penman Pr	yes	high	yes	**no**	**yes**	**low**	**high**	**high**
Holthausen/Larcker Pr	**no**	**low**	**no**	yes	no	medium	**high**	medium
book/market B/M ratio	yes	high	no	**no**	**yes**	medium	**high**	**high**
earnings/price E/P ratio	**no**	**low**	**no**	yes	no	medium	medium	**high**

[a] See Table 1 for an explanation of the six factors. The cells with underlined entries indicate evidence not consistent with mispricing. The results for earnings window abnormal returns are summarized from table 3, except for the column relating to correlation with earnings surprise, which is from figure 2. The results for correlation with size effect are based on table 1, panel B, various indicators in other tables, and other analyses not reported, and the quarter-by-profits are based on Table 4.

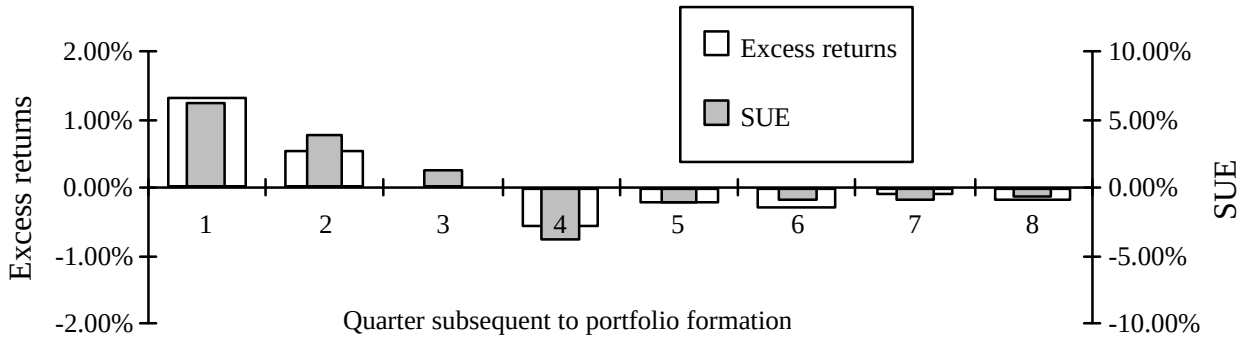
Figure 1
Profitability of taking long and short positions in extreme quintiles[a]



[a] See Table 1 for an explanation of the six factors and the comparison strategy based on size, and table 3 for a description of the data underlying this plot.

Figure 2. Comparison of subsequent quarter earnings surprises and excess returns at earnings announcements for long and short positions in extreme quintiles†

Panel A: Standardized unexpected earnings (SUE) strategy



Panel B: Announcement quarter abnormal returns strategy

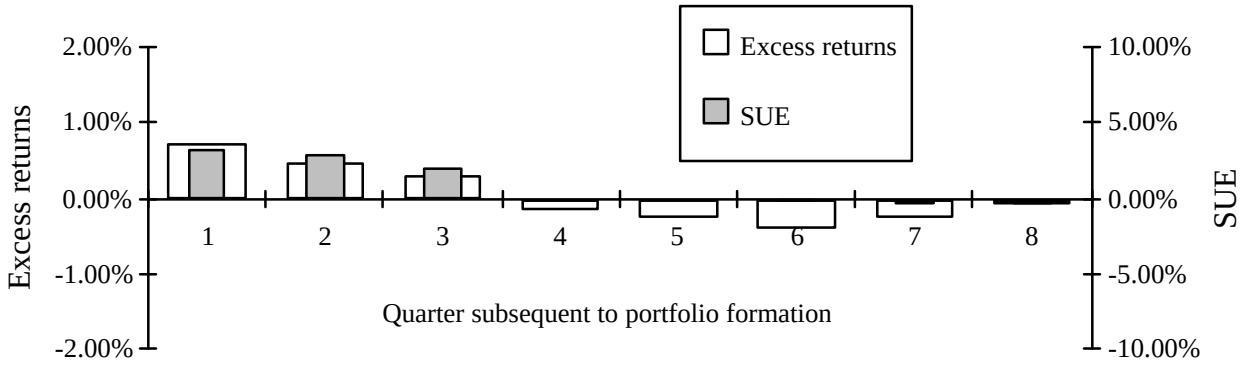
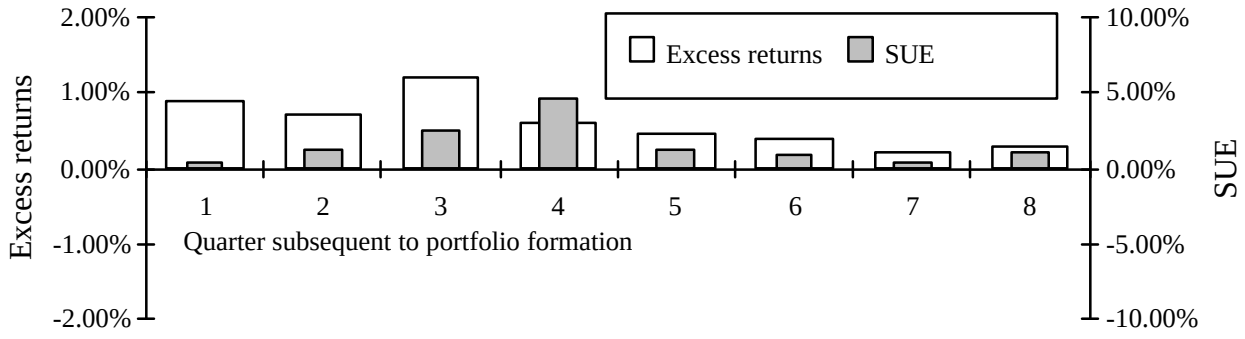
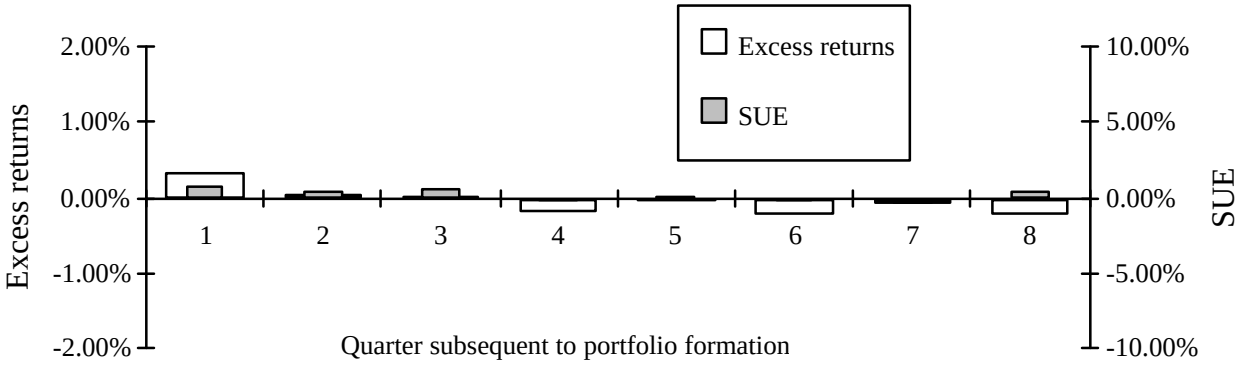


Figure 2 (continued)

Panel C: Ou and Penman Pr strategy



Panel D: Holthausen and Larcker Pr strategy



Panel E: Book-to-market strategy

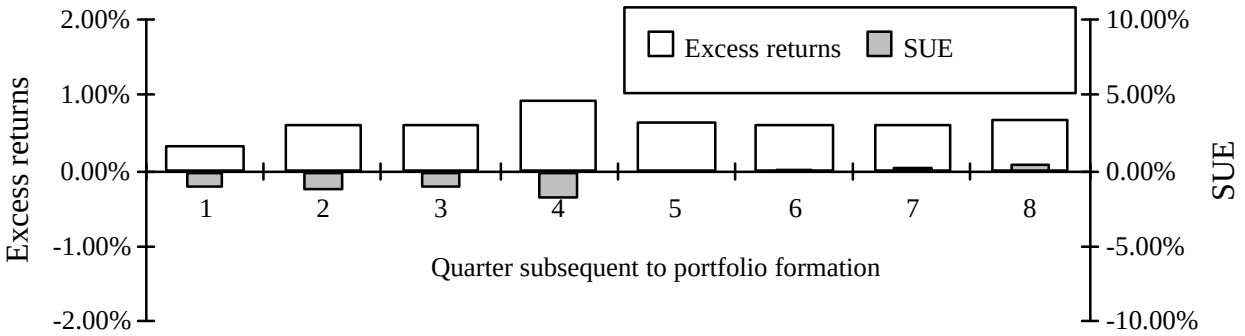
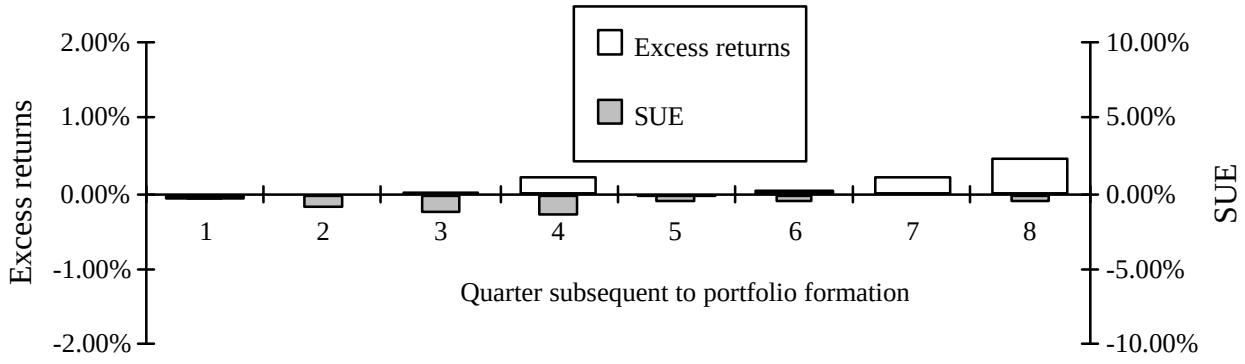
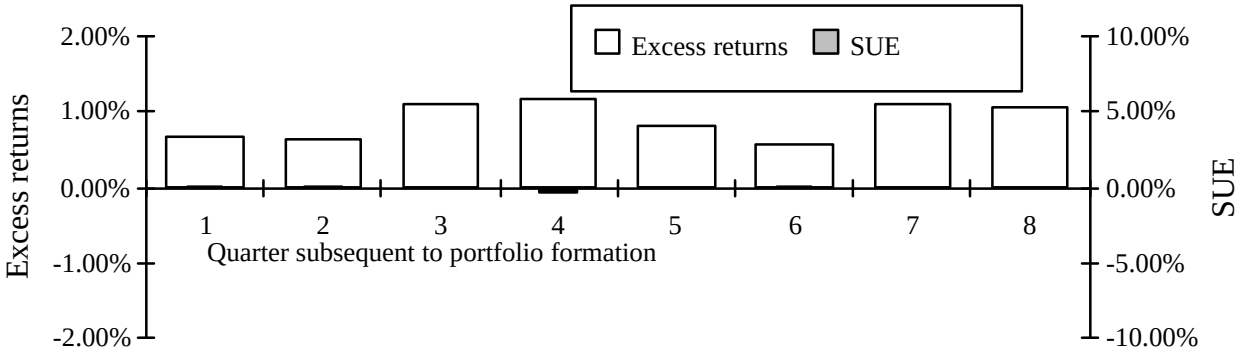


Figure 2 (continued)

Panel F: Earnings-to-price strategy



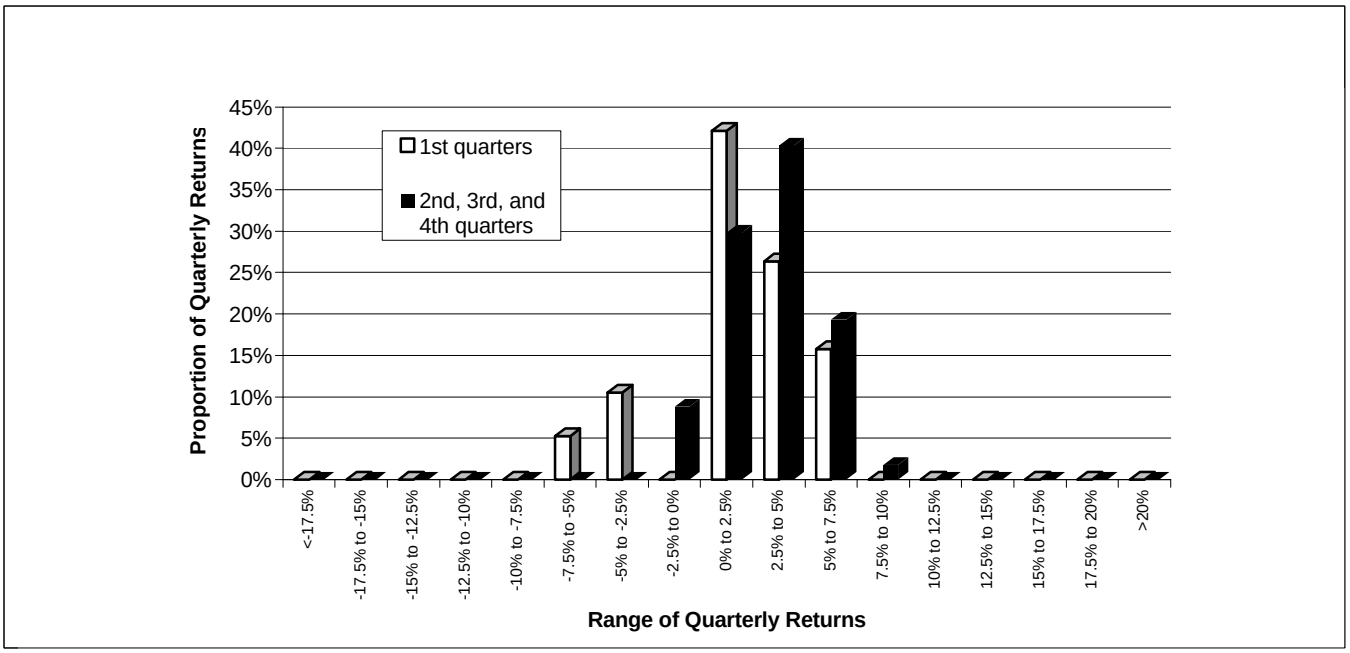
Panel G: Size strategy



† See Table 1 for an explanation of the six strategies and the comparison strategy based on size, and Tables 2 and 3 for the data underlying these plots. Firms are placed into quintiles at earnings announcements based on each strategy, and the earnings surprises (SUE) and the three-day announcement period returns (in excess of the value-weighted NYSE/AMEX index return) are computed for the next eight earnings announcements. SUE is the seasonally differenced quarterly earnings, scaled by end-of-quarter price. The difference between the highest and lowest quintile mean values for SUE and excess returns are reported here. To minimize the effect of extreme values, all SUE values greater (less) than 100 (-100) percent are Winsorized to 100 (-100) percent.

Figure 3. Distributions of quarterly returns on hedged long and short positions held in extreme quintile portfolios based on six stock price anomalies†

Panel A: Standardized unexpected earnings (SUE) strategy



Panel B: Announcement quarter abnormal returns strategy

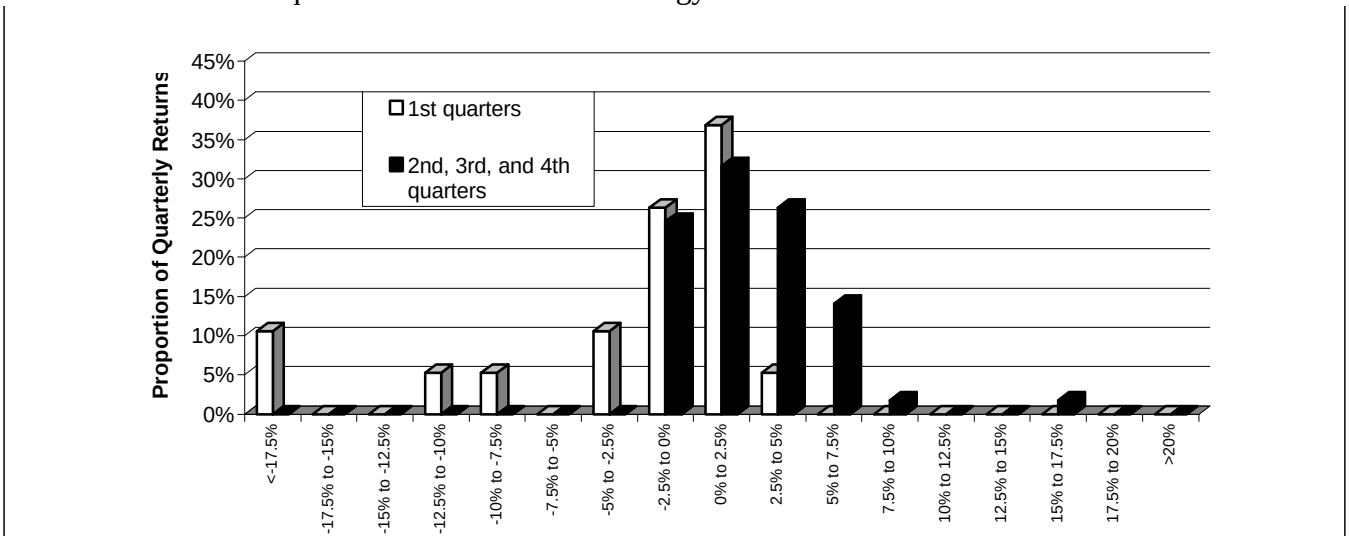
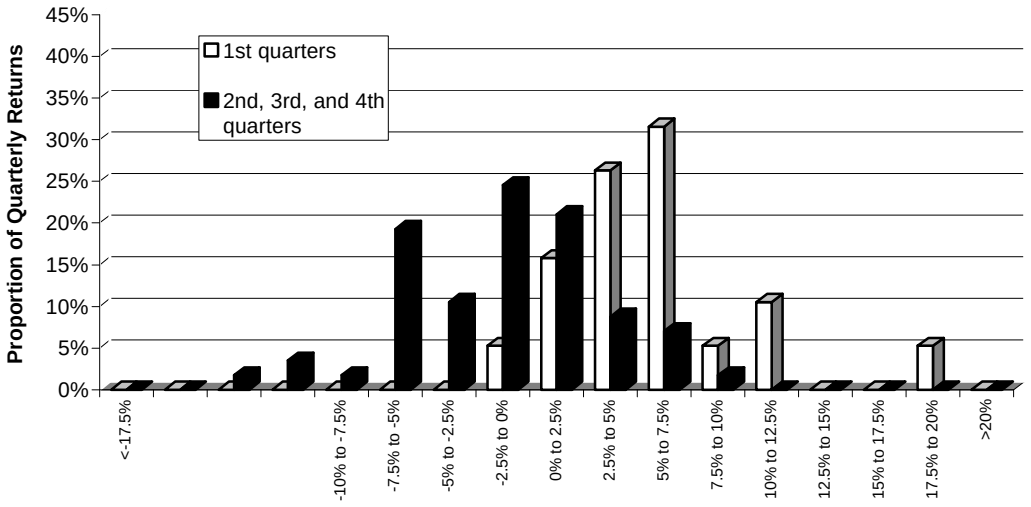


Figure 3 (continued)

Panel C: Ou/Penman Pr strategy



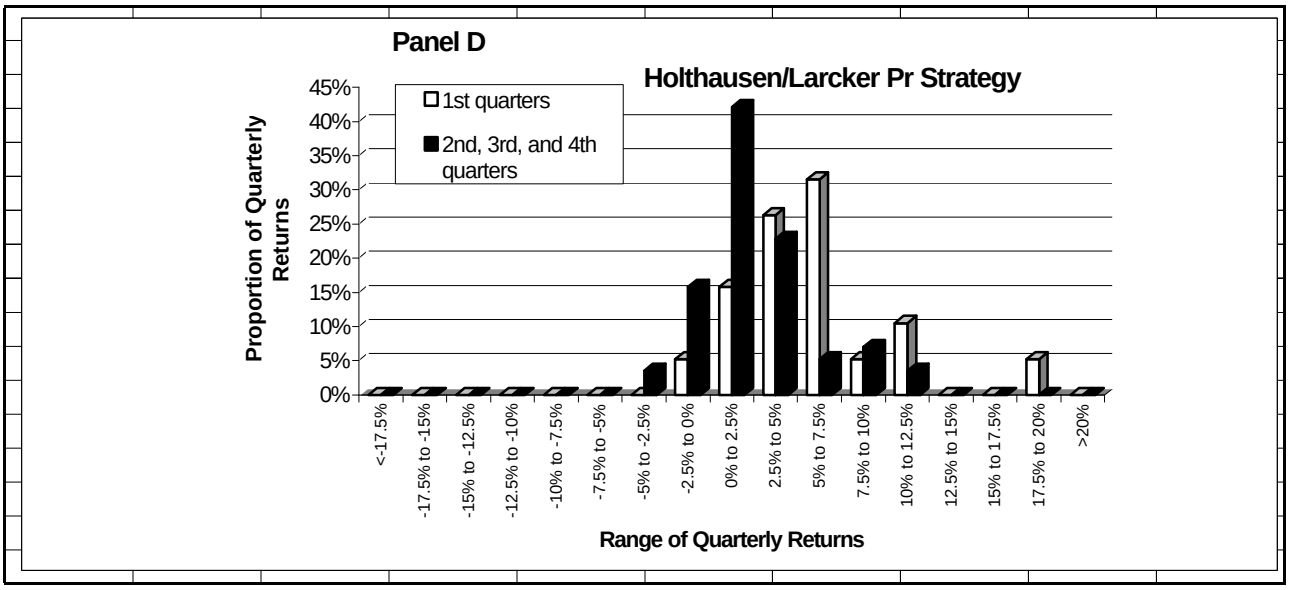
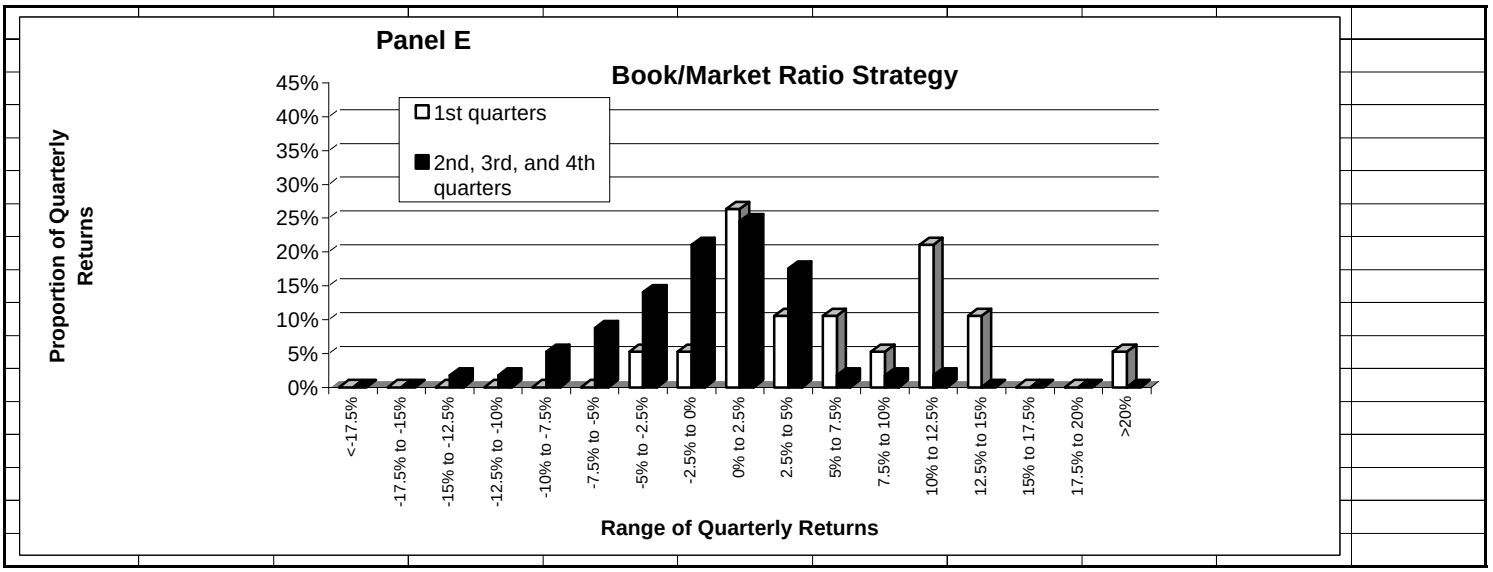


Figure 3 (continued)



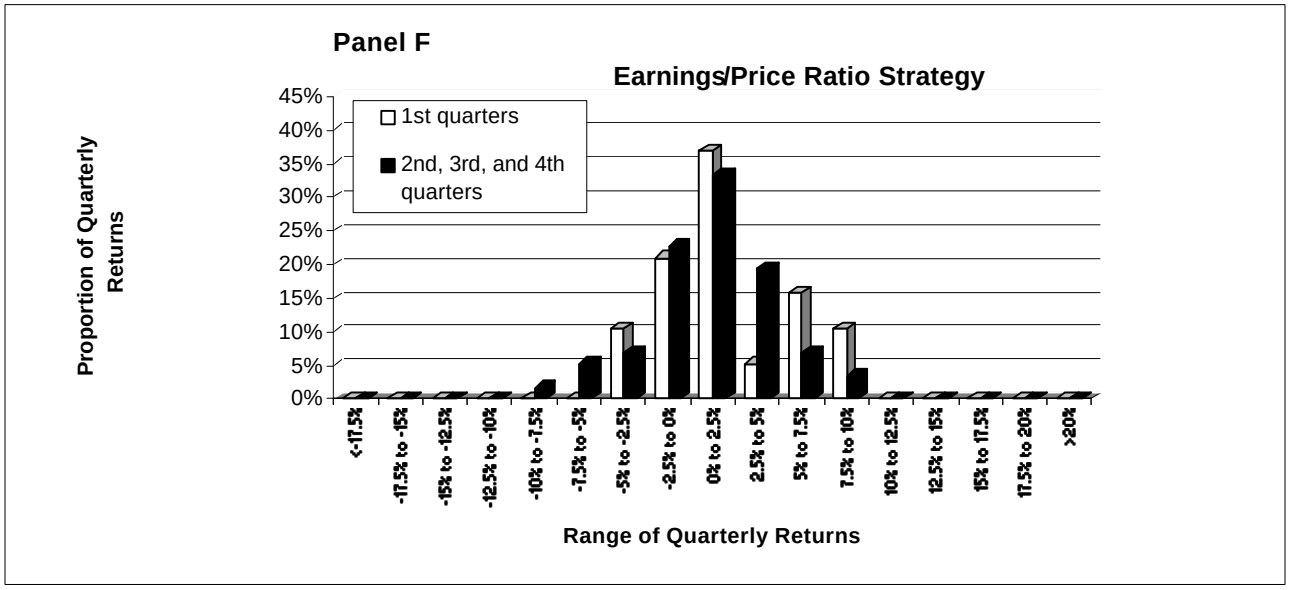
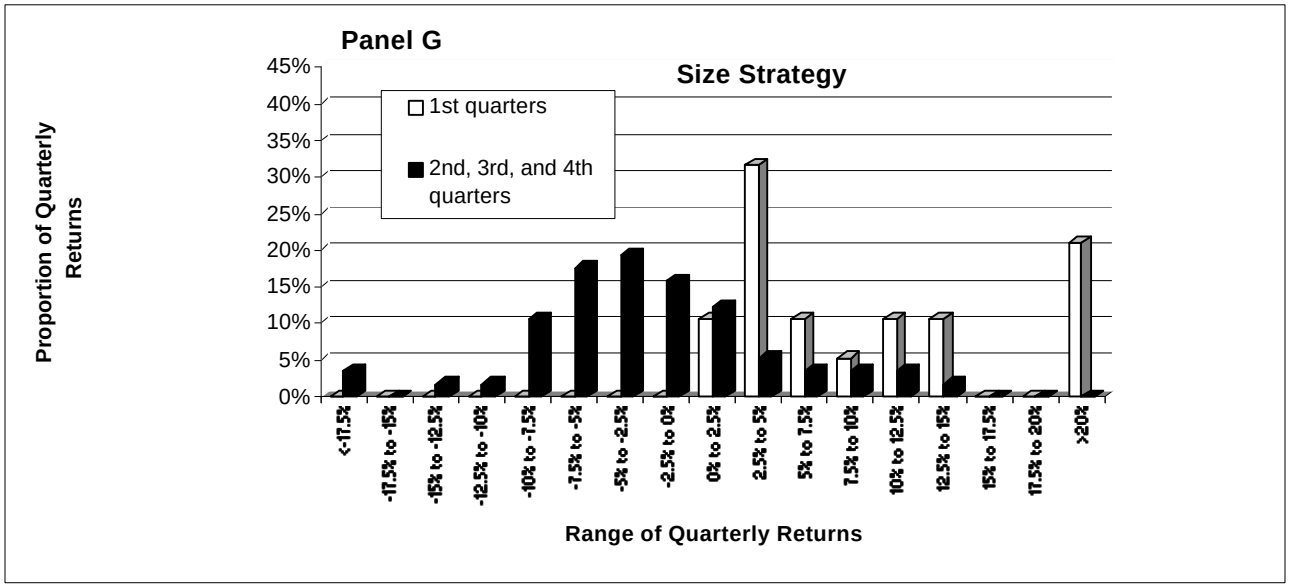


Figure 3 (continued)



† See Table 1 for an explanation of the six strategies and the comparison strategy based on size, and Table 4 for the data underlying these plots.

References

Abarbanell, J., and V. Bernard. Tests of analysts overreaction/underreaction to earnings information as an explanation for anomalous stock price behavior. *Journal of Finance* (1992), 1181-1208.

Ball, R. The earnings-price anomaly. *Journal of Accounting and Economics* (1992), 319-346.

Ball, R., and P. Brown. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* (1968), 159-178.

Ball, R., and S. P. Kothari. Security returns around earnings announcements. *The Accounting Review* (1991), 718-739.

Ball, R., S. P. Kothari, and Jay Shanken. Problems in measuring portfolio performance: An application to contrarian investment strategies. *Journal of Financial Economics* (1995), 79-107.

Basu , S. Investment performance of common stocks in relation to their price-earnings ratios: A test of the efficient markets hypothesis. *Journal of Finance* (1977), 663-682.

Basu, S. The effect of earnings yield on assessments of the association between annual accounting income numbers and security prices. *The Accounting Review* (1978), 599-625.

Basu, S. The relationship between earnings' yield, market value, and return for NYSE common stocks: Further evidence. *Journal of Financial Economics* (1983), 129-156.

Banz, R. The relationship between return and market value of common stocks. *Journal of Financial Economics* (1981), 3-18.

Beaver, W. H., and W. R. Landsman. Note on the behavior of residual security returns for winner and loser portfolios. *Journal of Accounting and Economics* (1981), 243-52.

Bernard, V. Stock price reactions to earnings announcements: A summary of recent anomalous evidence and possible explanations. *Advances in Behavioral Finance*. Russell Sage Foundation, New York, 1992.

Bernard, V., and J. Thomas. Post-earnings-announcement drift: Delayed price response or risk premium?. *Journal of Accounting Research* (1989 Supplement), 1-36.

Bernard, V., and J. Thomas. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics* (1990), 305-341.

Bernard, V., J. Thomas, and J. Abarbanell. How sophisticated is the market in interpreting earnings news? *Journal of Applied Corporate Finance* (1993), 54-63.

Blume, M., and R. Stambaugh. Biases in computed returns: An application to the size effect. *Journal of Financial Economics* (1983), 387-404.

Breen, W. J., and R. A Korajczyk. On selection biases in book-to-market based tests of asset pricing models. Working paper # 167. Northwestern University, 1994.

Brown, S., and P. Pope. Post-Earnings Announcement Drift? Working paper. Lancaster University, Lancaster, U.K., 1995.

Chan, L.K.C., N. Jegadeesh, and J. Lakonishok. Momentum strategies. Working paper. University of Illinois, Urbana-Champaign, IL, 1995.

Chari, V. V., R. Jagannathan, and A. Ofer. Seasonalities in Security Returns: The Case of Earnings Announcements. *Journal of Financial Economics* (1988), 101-121.

Chopra, N., J. Lakonishok, and J. Ritter. Measuring abnormal performance: Do stocks overreact? *Journal of Financial Economics* (1992), 235-268.

DeBondt, W.F.M., and R.H. Thaler. Does the stock market overreact? *Journal of Finance* (1985), 793-805.

DeBondt, W.F.M., and R. Thaler. Further evidence of investor overreaction and stock market seasonality. *Journal of Finance* (1987), 557-582.

Fama, E. Efficient capital markets: A review of theory and empirical work. *Journal of Finance* (1970), 383-417.

Fama, E. Efficient markets II. *Journal of Finance* (1991), 1575-1617.

Fama, E., and K. French. The cross-section of expected stock returns. *Journal of Finance* (1992), 427-465.

Fama, E., and K. French. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* (1993), 3-56.

Fama, E., and K. French. Size and book-to-market factors in earnings and returns. *Journal of Finance* (1995), 131-155.

Foster, G. Quarterly accounting data: Time series properties and predictive-ability results. *The Accounting Review* (1977), 1-21.

Foster, G., C. Olsen, and T. Shevlin. Earnings releases, anomalies, and the behavior of security returns. *The Accounting Review* (1984), 574-603.

Frankel, R., and C. M. C. Lee. Accounting valuation, market expectation, and the book-to-market effect. Working paper. University of Michigan, Ann Arbor, MI, 1995.

Grieg, A. Fundamental analysis and subsequent stock returns. *Journal of Accounting and Economics* (1992), 413-442.

Holthausen, R. Abnormal returns following quarterly earnings announcements. *Proceedings of the CRSP Seminar on the Analysis of Security Prices*. University of Chicago, Chicago, IL., 1983, 37-59.

Holthausen, R., and D. Larcker. The prediction of stock returns using financial statement information. *Journal of Accounting and Economics* (1992), 373-412.

Jaffe, J., D. Keim, and R. Westerfield. Earnings yields, market values and stock returns. *Journal of Finance* (1989), 135-48.

Jegadeesh, N., and S. Titman. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* (1993), 65-92.

Jensen, M. Some anomalous evidence regarding market efficiency. *Journal of Financial Economics* (1978), 95-101.

Jones, C. P., and R. H. Litzenberger. Quarterly earnings reports and intermediate stock trends. *Journal of Finance* (1970), 143-148.

Keim, D. B. Size-related anomalies and stock return seasonality: Further empirical evidence. *Journal of Financial Economics* (1983), 13-32.

Kothari, S. P., J. Shanken, and R. G. Sloan. Another look at the cross-section of expected stock returns. *Journal of Finance* (1995), 185-224.

Lakonishok, J., A. Shleifer and R. Vishny. Contrarian investment, extrapolation, and risk. *Journal of Finance* (1994), 1541-78.

La Porta, R. Survivorship bias and the predictability of stock returns in the COMPUSTAT sample. Working paper. Harvard University, Boston, MA, 1995a.

La Porta, R. Expectations and the cross-section of stock returns. Working paper. Harvard University, Boston, MA, 1995b.

La Porta, R., Lakonishok, J., A. Shleifer and R. Vishny. Good news for value stocks: Further evidence on market efficiency. Working paper. Harvard University, Boston, MA, 1995.

Penman, S. H. Earnings reporting and the return on the stock market. Working paper. University of California-Berkeley, Berkeley, CA, 1990.

Ou, J., and S. Penman. Financial statement analysis and the prediction of stock returns. *Journal of Accounting and Economics* (1989), 295-330.

Rendleman, R.J., C.P. Jones, and H. A. Latane. Empirical anomalies based on unexpected earnings and the importance of risk adjustment. *Journal of Financial Economics* (1982), 269-287.

Roll, R. On computing mean returns and the small firm premium. *Journal of Financial Economics* (1983), 371-386.

Rosenberg, B., K. Reid, and R. Lanstein. Persuasive evidence of market inefficiency. *Journal of Portfolio Management* (1985), 9-17.

Stattman, D. Book value and stock returns. *The Chicago MBA: A Journal of selected papers*. University of Chicago, Chicago, IL., 1980, 25-45.

Summers, L. H. Does the stock market rationally reflect fundamental values. *Journal of Finance* (1986), 591-600.

Stober, T. Summary financial statement measures and analysts' forecasts of earnings. *Journal of Accounting and Economics* (1992), 347-372.

Watts, R. Systematic abnormal returns after quarterly earnings announcements. *Journal of Financial Economics* (1978), 127-50.