Distinguished Lecture Series
School of Accountancy
W. P. Carey School of Business
Arizona State University

Laura Wellman
of
School of Accountancy
W.P. Carey School of Business
Arizona State University
will discuss

"Value Investing: The Use of Historical Financial Statement Information to Separate Winners form Losers"

on

August 26, 2011

1:30pm in BA 286

Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers

Originally by Joseph D. Piotroski
Journal of Accounting Research, Vol. 38, Supplement 2000, pp. 1-41

Replicated by Laura Wellman
Arizona State University
Summer Project 2011

Abstract

This paper replicates Piotroski (2000) which examines whether a simple accounting-based heuristic, when applied to a portfolio of high book-to-market (*BM*) firms, can shift the distribution of returns earned by an investor. Similar to Piotroski, I find that investors are able to improve on a general high *BM* investment strategy by 7.2% annually after using simple fundamental screens to select those firms with strong future prospects from the complete high *BM* portfolio. Also consistent with Piotroski, I find that, an investment strategy that buys expected winners and shorts expected losers generates a 24% annual return between 1976 and 1996. Considering other sources of cross-sectional variation in returns, I find that, after controlling for size and book-to-market differences, a one-point improvement in the aggregate *F_SCORE* (i.e., one additional positive signal) is associated with an approximate 2.8% to 3.5% increase in the one-year market-adjusted return earned subsequent to portfolio formation. More importantly, *F_SCORE* is also robust to other know patterns in realized returns. I also document the success of the fundamental investment strategy over time, and provide evidence that poses a formidable challenge to market efficiency. Hostage

1. *Introduction*

This paper replicates Piotroski (2000) which examines whether a simple accounting-based heuristic, when applied to a portfolio of high book-to-market (*BM*) firms, can shift the distribution of returns earned by an investor. Prior research documents considerable returns to a general high *BM* investment strategy (Fama and French, 1992; and Lakonishok et al., 1994).[1] Lakonishok et al. (1994) argue that most investors have shorter time horizons than are required for value strategies to consistently pay off, and that the contrarian strategy relies on the success of a few firms, while tolerating the deterioration of many.[2] Consistent with Piotroski, I document that less than 46% of all high *BM* firms earn positive market-adjusted returns in the two years following portfolio formation, suggesting that investors may benefit from any additional discrimination, *ex-ante*, between eventual strong and weak performers among high *BM* firms.

Fundamental analysis is ideal in this setting for several reasons. First, value firms are generally "ignored" stocks, thinly followed by the analyst community and commanding little investor attention. Also, given poor recent performance, the investment community may not view voluntary disclosure made by these value firms as credible. As such, value firms tend to operate in a weak information environment, making it likely that the annual financial statements are the most relevant and reliable information available. Second, value firms tend to be financially distressed (Fama and French, 1992; Chen and Zhang, 1998). Valuation of financially

[1]Fama and French (1992) find that stocks with high relative book-to-market values of equity outperform the market and argue that because high *BM* firms are fundamentally riskier, their higher average returns are simply compensation for risk. Lakonishok et al. (1994) ascribe the *BM* effect to mispricing.

[2]I define the contrarian strategy similar to the "value" versus "glamour" strategy documented by Lakonishok et al. (1994), where a value strategy that bets against those investors who extrapolate past performance too far into the future produces superior returns.

distressed firms is centered around fundamental benchmarks such as leverage, liquidity, profitability trends, and cash flow adequacy, all of which can be readily calculated from the annual financial statements (Piotroski 2000).

Piotroski explicitly states that the goal of the accounting-based heuristic is to shift the distribution of the returns earned by value investors. First, similar to Piotroski, I find that investors are able to improve on a general high *BM* investment strategy by 7.2% annually after using simple fundamental screens to select those firms with strong future prospects from the complete high *BM* portfolio. Second, I find a significant positive shift over six different portfolio return measures after applying the simple fundamental screens: mean returns, median returns, 10^{th} percentile, 25^{th} percentile, 75^{th} percentile, and 90^{th} percentile returns. Similar to Piotroski, I find that, an investment strategy that buys expected winners and shorts expected losers generates a 24% annual return between 1976 and 1996.[3]

I also find that the success of the fundamental investment strategy remains significant after controlling for alternative investment strategies. Consistent with Piotroski, I find that the positive market-adjusted return earned by a generic high *BM* investment strategy diminishes in rapid information environments (large firms, firms with analyst following, high share-turnover firms). Specifically, I find that the success of the fundamental investment strategy is greatest in slow information dissemination environments.

Finally, I document the success of the fundamental investment strategy over time, and provide evidence that poses a formidable challenge to market efficiency. Notably, taking a long position in a portfolio where the majority of signals are good (Strong *F_SCORE*), and a short

[3]This annual return is based on a modified portfolio, see section 3.3 for a more detailed discussion. Piotroski (2000) documents that an investment strategy that buys expected winners and shorts expected losers generates a 23% annual return between 1976 and 1996. I have included Table 3B as a reference of the original study.

position in a portfolio where the majority of signals are bad (Weak *F_SCORE*) I document a positive average market-adjusted return difference of 11% over the 21 year sample period (statistically significant at the 1% level). Furthermore, the hedge return to the fundamental investment strategy is positive in 20 out of the 21 years included in the sample period.

The remainder of the paper is organized as follows: Section 2 discusses prior research on the *BM* effect, fundamental analysis, and financial performance signals used to differentiate high *BM* firms. Section 3 presents the research design and empirical tests employed in the paper, while Section 4 presents returns to the fundamental analysis strategy. Section 5 attempts to distinguish between a risk-based and mispricing-based explanation for the fundamental analysis strategy. Section 6 presents evidence on the source and timing of the portfolio returns. Section 7 extends Piotroski through the current time period and Section 8 concludes.

2. Literature Review

2.1 The BM Effect

Fama and French (1992) and Lakonishok et al. (1994), among others, document a strong positive correlation between the *BM* ratio of a firm and future stock performance. Both studies find that, on average, low *BM* firms earn significant negative excess returns, while high *BM* firms earn significant positive excess returns. While Fama and French (1992) suggest a risk-based explanation for the observed abnormal returns, Lakonishok et al. (1994) argue that mispricing is at the core of the *BM* effect.[4]

[4]Fama and French (1992) find that size (*MVE*) and *BM* capture the cross-sectional variation in average stock returns for the 1963-1990 period. Assuming that assets are priced rationally, they argue that stock risks are multidimensional and that *MVE* and *BM* capture two important dimensions of risk. Consistent with the related literature, Piotroski (2000) performs an array of robustness meant to discriminate between mispricing and risk (see section 5 and 6 for a detailed discussion).

Additional studies provide further evidence of mispricing, documenting the predictive ability of specific indicators of future abnormal returns (i.e. Sloan, 1996, in the context of accruals; and Laporta, 1996; and Dechow and Sloan, 1997 in the context of analysts' forecasts). This literature suggests that the market overreacts to indicators of firm value, but eventually corrects itself over a long horizon. Market participants are said to naively fixate on reported numbers and over-extrapolate past performance. The opportunity to earn abnormal returns arises in inconsistencies between the market's initial reaction to reported earnings (or other indicators) and a firm's intrinsic value. Piotroski's fundamental trading strategy discriminates between winners and losers among high *BM* firms and generates above-normal returns by exploiting information about earnings. Piotroski concludes that his findings are likely driven by market inefficiency with respect to financial statement information.

2.2 Fundamental Analysis

Considerable research examines the relationship between firm performance and various screens designed to capture the difference between a firm's fundamental value and market value (Ou and Penman, 1989; Abarbanelll and Bushee, 1997, 1998; Frankel and Lee, 1998). More complex approaches to fundamental analysis include Ou and Pennman's (1989) study where they condense a large set of financial attributes into one summary measure used to predict future earnings changes. More refined studies motivate the use of fewer financial statement signals to differentiate, *ex ante*, between firms with strong and weak future prospects (Lev and Thiagarajan,1993; Abarbanell and Bushee 1997, 1998). Where Lev and Thiagarajan (1993) and Abarbanell and Bushee (1997, 1998) are successful in applying fundamental screens to a large portfolio of firms, Piotroski applies fundamental analysis to the value portfolio specifically, and further differentiates himself from these prior studies by considering context-specific

fundamental signals in an environment where the most reliable information available are the annual financial statements.

2.3 Financial performance signals used to differentiate high BM firms

Piotroski develops a comprehensive financial signal, conditioned to financially distressed firms, that proxy for three constructs relevant to a firm's financial condition: profitability, financial leverage/liquidity, and operating efficiency. Pitoroski's summary measure, the *F_SCORE*, is the sum of nine binary signals related to these constructs. The context-specific fundamental screens are chosen because they are both easy to interpret and implement.

Piotroski motivates signals related to profitability by emphasizing the importance for a firm to generate cash flow internally through positive profits and earnings trends, especially among a group of firms with recent poor historical earnings performance. As such, Piotroski considers performance related factors such as return on assets (*ROA*), cash flow from operations (*CFO*), change in *ROA*, and the relationship between earnings and cash flow levels (e.g., the extent to which earnings are driven by accruals).[5]

Again, conditioned on the fact that the average value firm is financially distressed, Piotroski considers additional signals that proxy for leverage and liquidity. Specifically, increasing financial leverage or deterioration of liquidity is particularly troubling for a financially constrained firm. Also, seeking external financing may suggest inability to generate funds internally. Signals related to leverage, liquidity and source of funds consider changes in the firm's long-term debt levels (Δ*LEVER*), changes in the firm's current ratio (Δ*LIQUID*), and

[5]For detailed variable definitions, see Appendix B.

additional equity offerings (*EQ_OFFER*)[6]. To asses the operating efficiency of sample firms, Piotroski decomposes *ROA* into gross margin ratio (Δ*MARGIN)* and asset turnover ratio (Δ*TURN)*. Each fundamental screen is a binary signal set equal to one if the signal suggests strong future performance, and set equal to zero if the signal suggests weak future performance.

2.4 Composite Score

The composite *F_SCORE* is the sum of the nine individual binary signals, or *F_SCORE* = *F_ROA* + *F_*Δ*ROA* + *F_CFO* + *F_ACCRUAL* + *F_*Δ*MARGIN* + *F_*Δ*TURN* + *F_*Δ*LEVER* + *F_*Δ*LIQUID* + *EQ_OFFER*. By construction, the *F_SCORE* can range in value from 0 to 9, where a low (high) *F_SCORE* represents a firm with weaker (stronger) future prospects. Piotroski's explicit hypothesis argues that to the extent current fundamentals predict future fundamentals, *F_SCORE* should be positively associated with changes in future firm performance and stock returns. Finally, Piotroski argues that the composite score should be more powerful than each of the signals individually.

3. Research Design

3.1 Sample Selection

Following Piotroski, each year between 1976 and 1996, I identify firms with sufficient stock price and book value data on *Compustat*.[7] For each firm, I calculate the market value of equity (*MVE*) and *BM* ratio at fiscal year-end. Firms with sufficient data are ranked each fiscal

[6]Similar to an increase in long-term debt, financially distressed firms that raise external capital could be signaling their inability to generate sufficient internal funds to service future obligations (e.g., Myers and Mjluf, 1984; and Miller and Rock, 1985).

[7]Piotroski (2000) does not provide any explicit detail in regards to missing observations. I require non-missing data for the variables used to construct *MVE* and *BM* ratio. I also require non-missing data for total assets (AT) and one (two) year raw and market-adjusted returns from *CRSP*. See Appendix B for variable definitions and *Compustat* mnemonics.

year to identify book-to-market quintile and size (*MVE*) tercile cutoffs.[8] The prior year *MVE* and *BM* distributions are used to classify firms into *BM* quintiles and *MVE* terciles.[9] After forming *BM* quintiles, I retain firms within the highest *BM* quintile (i.e. value firms) that have sufficient financial statement data necessary for calculating the financial statement ratios.[10] This process yields a sample of 10,472 firm-year observations (Piotroski's final sample includes 14,043 high *BM* firms across the same 21 year period).

3.2 Calculation of Returns

Following Piotroski, I calculate firm-specific returns as one-year (two-year) buy-and-hold returns earned from the beginning of the fifth month after the firm's fiscal year-end through the earliest subsequent date: one year (two years) after return compounding began or the last day of *CRSP* traded returns. If a firm delists, I assume the delisting return is zero. I choose the fifth month to ensure that the necessary annual financial information is available to investors at the time of portfolio formation. I define market-adjusted returns as the buy-and-hold return less the value-weighted market return over the corresponding time period.[11]

---

[8] *MVE* terciles are calculated independently of *BM* quintiles.

[9] Since each firm's book-to-market ratio is calculated at a different point in time (i.e., due to different fiscal year-ends), observations are grouped by and ranked within financial report years. For example, all observations related to fiscal year 1986 are grouped together to determine the FY86 size and book-to-market cutoffs. Any observation related to fiscal year 1987 (regardless of month and date of its fiscal year-end) is then assigned to a size and *BM* portfolio based on the distribution of those FY86 observations. This approach guarantees that the prior year's ratios and cutoff points are known prior to any current-year portfolio assignments (Piotroski, 2000).

[10] Because Piotroski (2000) does not explicitly define "sufficient data", I alter my assumptions about missing observations from the extreme of deleting any observations with missing data, to setting all variables to zero when missing. The final results presented (which appear to be closest to Piotroski's results) require data for total assets *(AT), MVE, BM* ratio, and one (two) year raw and market-adjusted returns, and assume a value of zero for other missing *Compustat* variables. The variable most affected by this assumption is *EQ_OFFER*, which was poorly populated for the sample period.

[11] Because Piotroski (2000) does not offer any guidance on the estimation period for the market model, for this, I rely on the research design used by Lev and Thiagarajan (1993) and Abarbanell and Bushee (1997, 1998). I estimate the market model: $R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt}$, where R_{jt} is the rate of return for firm *j* in month *t*, R_{mt} is the return for the value-weighted market portfolio in month *t*, the coefficient estimates $\hat{\alpha}$ and $\hat{\beta}$ are market model parameter estimates from a 36-month estimation period.

3.3 Description of the empirical tests (main results section)

Following Piotroski, the primary methodology of this paper is to form portfolios based on the firm's composite *F_SCORE*. Firm-year observations with *F_SCORE* of 0 or 1 (8 or 9) are classified as low (high) *F_SCORE*. My replication of Piotroski generates fewer firm-year observations than Piotroski's original sample, where the discrepancies between my replicated sample and Piotroski's sample appear to be concentrated in the extreme portfolios. As such, I have calculated a modified low *F_SCORE*, which includes all firm-year observations with *F_SCORE* of 0, 1 or 2.[12] Firms with the lowest (highest) aggregate signals are expected to have the worst (best) subsequent stock performance. The empirical tests employed are meant to test whether the high *F_SCORE* portfolio outperforms other portfolios of firms drawn from the high *BM* portfolio.

First, the high *F_SCORE* portfolio is compared to the entire portfolio of high BM firms. Second, the high *F_SCORE* portfolio is compared to the low *F_SCORE* portfolio (including the modified low *F_SCORE* portfolio that I calculate). The primary results are tested using traditional *t*-statistics.

[12]In untabulated results, Piotroski considers a low portfolio similar to my modified low portfolio. Specifically, the ex-post distribution of firms across *F_SCORE* portfolios in Piotroski's sample results in 396 observations included in the low *F_SCORE* portfolio (as compared to 1,448 observations included in the high *F_SCORE* portfolio). As such, he includes observations with *F_SCORE* equal to 2 in his low portfolio in supplemental analysis and reports that results are qualitatively similar to his tabulated results.

4. Empirical Results

4.1 Descriptive evidence about high BM firms

Table 1A presents descriptive statistics for my sample firms.[13] Panel A shows the financial characteristics of the high book-to-market portfolio of firms. Notably, the average (median) high *BM* firm has a *BM* ratio of 2.047 (1.808) and an end-of-year market capitalization of 236.275 (14.853) million dollars.[14] Consistent with Piotroski (2000), the descriptive statistics suggest that portfolio of high *BM* firms consists of poor performing firms. Particularly, the average *ROA* realization is negative, and the average and median firms show declines in both *ROA* (-0.08802 and -0.00445, respectively) and gross margin (-0.00037 and -0.00276, respectively). Also consistent with Piotroski, the average high *BM* firm shows an increase in leverage. Generally, the descriptive evidence I present is consistent with Piotroski, although the average firm in my sample appears to have slightly higher performance overall.

Turning to Panel B, one-year and two-year buy-and-hold returns for the complete high *BM* portfolio are presented, along with the proportion of firms with positive returns over the respective investment horizon. Consistent with evidence presented by Fama and French (1992) and Lakonishok et al. (1994), the overall high *BM* portfolio generates positive abnormal-returns over the one-year and two-year periods following portfolio formation. However, less than 46% of these firms earn positive returns, suggesting that investors may benefit from any additional discrimination, *ex-ante*, between eventual strong and weak performers among high *BM* firms.

[13]As a reference, I have included the descriptive statistics from Piotroski (2000) in Table 1B, as well as the main result from Piotroski (2000) in Table 3B.

[14]Piotroski's (2000) final sample had a mean (median) *BM* ratio of 2.44 (1.721) and end of year market capitalization of 188.50 (14.37) million dollars. As an additional point of reference, Mohanram (2005) extends Piotroski (2000) and provides descriptives for high *BM* firms for a sample period of 1979 through 2001 where the mean (median) *BM* ratio is 2.004 (0 .246) and the mean (median) market capitalization is 187.4 (145.2) million dollars.

4.2 Descriptive evidence about high BM firms

Table 2 presents the correlations between the nine fundamental signals and return measures for the sample of high *BM* firms. As expected, the composite *F_SCORE* is highly correlated with the one-year and two-year buy-and-hold market-adjusted returns (0.116 and 0.125, respectively). On a disaggregated basis, *ROA* and *CFO* are the fundamentals with the next highest correlation to return measures (0.103 and 0.114, respectively). This preliminary evidence suggests that *F_SCORE* will likely outperform a simple strategy based on *ROA* or *CFO* alone.

Turning to the main result, Table 3 presents returns to the fundamental investment strategy. Similar to Piotroski, I focus my discussion of the main result and subsequent analysis on the results presented in Panel B for one-year market-adjusted returns. However, the conclusions drawn from evidence provided in Panel B are consistent with the results for raw returns (Panel A) and two-year market-adjusted returns (Panel C).

The majority of firm-year observations are clustered between *F_SCORE* 3 through 7, suggesting that many high *BM* firms have conflicting performance signals. Focusing on the extreme portfolios, the high *F_SCORE* firms (scores of 8 or 9) consists of 1,164 observations, while 165 and 658 observations are classified as low *F_SCORE* firms (scores of 0 or 1), and modified low *F_SCORE* firms (scores of 0, 1 or 2), respectively. These extreme portfolios are used to assess the success of the fundamental investment strategy to discriminate between winners and losers among high *BM* firms. Returns are generally increasing with *F_SCORE* partitions, where the high *F_SCORE* portfolio significantly outperforms the complete high *BM* portfolio (mean market-adjusted returns of 0.160 versus 0.086, respectively). The mean return

difference between the high *F_SCORE* and the complete high *BM* portfolio of 7.3% is significant at the 1% level.[15]

Additional evidence demonstrates the success of the fundamental investment strategy to discriminate between winners and losers, where the high *F_SCORE* portfolio outperforms both the low *F_SCORE* portfolio (mean market-adjusted returns of 0.160 and -0.029, respectively) with a mean return difference of 18.9% at the 1% level, and the modified low *F_SCORE* portfolio (mean market-adjusted returns of 0.160 and -0.078, respectively) with a mean return difference of 23.7% at the 1% level.[16] Finally, the effect of the fundamental investment strategy on the properties of the entire return distribution is documented in Panel B, where we see that the high *F_SCORE* portfolio outperforms the low (modified low) *F_SCORE* portfolio, as well as the complete high *BM* portfolio over six different portfolio return measures: mean returns, median returns, 10^{th} percentile, 25^{th} percentile, 75^{th} percentile, and 90^{th} percentile returns, indicating a potential shift in the distribution of returns earned by an investor.

4.3 Returns conditional on firm size

Piotroski considers whether the returns to the fundamental investment strategy can be attributed to the size effect, where firms with lower market capitalization (MVE) are associated with higher returns. Following Piotroski, I annually rank all firms into three size portfolios (based on the prior year distribution of market capitalization). The majority of sample firms fall into the bottom third of market capitalization (60.13%), while 2,669 (27.81%) and 1,506 (14.38%) fall into the upper two-thirds of market capitalization. Applying the fundamental screens to these size partitions, I find that the benefit of the fundamental investment strategy is

[15]This is comparable to the return difference documented by Piotroski (2000) of 7.5% (significant at the 1% level).
[16]Piotroski (2000) documents a mean return difference between the high *F_SCORE* (1,448 observations) and low *F_SCORE* (396 observations) portfolios of 23%, which is also significant at the 1% level.

concentrated in the small-firm portfolio. Focusing on return differences between the high and modified low *F_SCORE* portfolios, the greatest benefit of the fundamental investment strategy is concentrated in the small firm portfolio, where the return difference between high and modified low *F_SCORE* is 29%, significant at the 1% level. Turning to the medium and large-firm portfolios, return differences are 15% between the high and modified low *F_SCORE* portfolios, significant at either the 1% or 5% level. Finally, the high *F_SCORE* portfolio consistently outperforms the complete high *BM* portfolio across all size partitions, where return differences are statistically significant at either the 5% or 10% level.

4.4 Alternative partitions

Similar to Piotroski, I find that abnormal returns to the fundamental investment strategy are concentrated in smaller firms. One immediate concern that follows from these results is whether the trading strategy can actually be implemented. As such, following Piotroski, I consider alternate partitions that address liquidity concerns: share price and trading volume. Similar to size partitions, I rank companies on share price and trading volume based on the prior year's cutoffs from the complete *Compustat* sample (independent of *BM* quintile assignment). Consistent with the market capitalization partitions, more than 59% of firms have small share prices, while just over 40% of firms have low trading volume. Table 5 examines the success of the fundamental investment strategy over these alternate partitions.

4.4.1 Relationship between share price, share turnover, and gains from fundamental analysis

Similar to Piotroski, I find that the greatest return differences are concentrated in firms with small share price and low trading volume; however returns to the fundamental investment

strategy are statistically significant at the 1% level across all partitions, with the exception of firms with large share prices (see Table 5, panels A and B).

4.4.2 Relationship between Analyst Following and Gains from Fundamental Analysis

A primary motivation for the use of fundamental analysis in this setting is that little other information is available for these neglected stocks, making financial statement information the most relevant and reliable information available. Piotroski argues that the greatest gains to the fundamental investment strategy should be concentrated in weak information environments. If this is the case, I should find that the most dramatic gain to the fundamental investment strategy is concentrated in firms with no analyst coverage. In general, the complete high *BM* portfolio has no analyst coverage (57%). Consistent with the conjecture that gains to the fundamental investment strategy are magnified in a setting with information processing limitations, I find that the greatest return difference between the high and modified low *F_SCORE* portfolios (30%, significant at the 1% level) is within the firms with no analyst following.

5. Other sources of cross-sectional variation in returns

One source of the observed return pattern could be a result of different risk characteristics across *F_SCORE* rankings. In addition, the observed return pattern could be a result of other known return patterns, such as momentum, accrual reversal, or the effects of seasoned equity offerings.

The main results in Table 3 document a significant return differential between high and low *F_SCORE* portfolios. If *F_SCORE* serves as a proxy for, *ex ante*, financial and operating risk, a risk-based explanation to the return differential we observe in Table 3 is unlikely, particularly because the strongest return performance is associated with least risky stocks (high *F_SCORE*).

Turning to descriptive statistics provided in Table 6, preliminary evidence shows little variation in size and *BM* ratio between the high and low *F_SCORE* portfolios within the complete high *BM* portfolio.

It is possible that *F_SCORE* may be correlated with other known systematic patterns in realized returns. First, prior research documenting the success of momentum strategies are similarly driven by a systematic underreaction from the market to historical information and financial events (Chan, Jegadeesh, and Lakonishok, 1996). Second, *F_SCORE* considers the relationship between earnings and cash flow, and therefore, is likely correlated with the accrual anomaly documented by Sloan (1996). Following Piotroski, I estimate the following cross-sectional regression to demonstrate the effectiveness of the fundamental investment strategy over and above these other documented trading strategies:

$$MA\_RET_{it} = \alpha + \beta_1 F\_SCORE_{it} + \beta_2 log(MVE_{it}) + \beta_3 log(BM_{it}) + \beta_4 MOMENT_{it} + \beta_5 ACCRUAL_{it} + \beta_6 EQ\_OFFER_{it} + \varepsilon,$$

where *MA_RET* is the one-year market-adjusted return prior to portfolio formation, *ACCRUAL* equals the firm's total accruals scaled by total assets, and *EQ_OFFER* equals one if the firm issued seasoned equity in the preceding fiscal year, zero otherwise.[17] The remaining variables have been previously defined (see Table 1). I present results based on a pooled regression in Table 7.

Similar to Piotroski, I find that the coefficients on *F_SCORE* indicate that, after controlling for size and book-to-market differences, a one-point improvement in the aggregate score (i.e.,

[17]Similar to Piotroski (2000), equity offerings were identified through the firm's statement of cash flows (through Compustat) for the year preceding portfolio formation. This variable was poorly populated for the sample period, where over 65% of the sample had missing values.

one additional positive signal) is associated with an approximate 2.8% to 3.5% increase in the one-year market-adjusted return earned subsequent to portfolio formation. More importantly, *F_SCORE* remains statistically significant after controlling for other known patterns in realized returns.

Finally, I examine the robustness of the fundamental investment strategy over time. Due to small sample sizes in any given year, consistent with Piotroski, I compare firms with mostly good news signals (*F_SCORE* of greater than 5) to firms with mostly bad news signals (*F_SCORE* of 4 or less). Appendix A and Figure 1 document the success of the fundamental investment strategy over time, and provide evidence that poses a formidable challenge to market efficiency. Notably, taking a long position in a portfolio where the majority of signals are good (Strong *F_SCORE*), and a short position in a portfolio where the majority of signals are bad (Weak *F_SCORE*) generates a positive average market-adjusted return difference of 11% over the 21 years (statistically significant at the 1% level). Furthermore, the market-adjusted return difference by year is positive in 20 out of 21 years. If *F_SCORE* represents, *ex-ante*, operating and financial risk, we would expect to see that the firms with the weakest fundamental signals would have the strongest subsequent return performance, but the findings in Appendix A are inconsistent with this risk explanation. Furthermore, if *F_SCORE* represents an unidentified risk factor, we would expect to see a more equitable distribution of positive and negative returns to the *F_SCORE* hedge portfolio across time. Specifically, we would expect risk to periodically reveal itself in the form of losses.[18]

[18]For example, Fama and MacBeth (1973) present returns on zero-investment, unit-beta portfolios for the period 1935-68. While the mean annualized return was 10% over the sample period, the returns to the zero-investment portfolio were negative 39% of the time.

6. Subsequent earnings announcement returns conditional on the fundamental signals

In this section I consider information-based explanations for the observed return patterns. As discussed earlier, Lakonishok et al. (1994) find that the market over-extrapolates from current strong performance, resulting in overly optimistic expectations about future performance. As optimism unravels over time, these "glamour" (low *BM*) firms earn negative excess returns. La Porta (1996) argues that the returns to the contrarian strategy documented by Lakonishok et al. (1994) arise because prices reflect analysts' long-term earnings growth forecasts. Consistent with La Porta (1996), Dechow and Sloan (1997) find that over half of the returns to the contrarian strategy are a result of the market's naïve reliance on analysts' growth forecasts.

Piotroski documents that the success of the fundamental investment strategy is reliant on the ability to predict future firm performance, in addition to the inability for the market as a whole to recognize these predictable patterns. Piotroski provides evidence that the market is systematically "surprised" by future earnings announcements of both the weakest and strongest firms among the complete high *BM* portfolio.[19]

Following Piotroski, I measure announcement-period returns as the sum of the three-day market reactions around the subsequent four quarterly earnings announcements. This additional analysis is preformed on a subsample of firm-year observations, as only 6,609 (out of the 10,472) high *BM* firms have quarterly announcement dates available on *Compustat* (Piotroski's tests include 12,426 firm-year observations out of 14,043 high *BM* firms with available announcement dates). Inconsistent with Piotroski (in untabulated results), I find that the return differences

[19]Kothari (2000) argues the importance of recognizing that long-horizon event studies suffer from three main problems: risk misestimation, data problems, such as survival bias, and the lack of theory of market inefficiency as the null hypothesis. Because of these issues, Kothari argues that it is difficulty to conclude that the market is grossly inefficient.

between "winners" and "losers" are not statistically significant from zero around the subsequent four quarterly earnings announcements dates.[20]

7. Extended sample period through 2010

Piotroski suggests that one limitation of his study is the existence of a potential data-snooping bias, which may adversely affect the out-of-sample predictive ability of the strategy. As such, I extend Piotroski's sample period through 2010. Table 8 presents the returns to the fundamental investment strategy for the extended sample period (1976 through 2010). Focusing on one-year buy-and-hold market-adjusted returns, I find that high *F_SCORE* portfolio does not significantly outperform the complete high *BM* portfolio. While the mean return difference of 8% between the high and modified low *F_SCORE* portfolio is marginally significant at the 10% level, the mean return difference of 11% between the high and low *F_SCORE* portfolio is statistically insignificant from zero.[21]

8. Conclusion

This paper replicates Piotroski which examines whether a simple accounting-based heuristic, when applied to a portfolio of high book-to-market (*BM*) firms, can shift the distribution of returns earned by an investor. First, similar to Piotroski, I find that investors are able to improve on a general high *BM* investment strategy by 7.2% annually after using simple fundamental screens to select those firms with strong future prospects from the complete high *BM* portfolio.

[20]As a reference, I do find that the one-year buy-and-hold market-adjusted return difference between the high and low *F_SCORE* portfolio are statistically significant at the 1% level and are similar in magnitude to the results documented in Table 3A, Panel B.

[21]In untabulated results, I also consider the sample period beginning with 1997 and extending through 2010 and find that one-year buy-and-hold market-adjusted return difference for the high versus low, modified low and complete high BM portfolio are statistically insignificant from zero.

Similar to Piotroski, I find that, an investment strategy that buys expected winners and shorts expected losers generates a 24% annual return between 1976 and 1996.

Examining alternate partitions, I find that the greatest benefit to the fundamental investment strategy is concentrated in small and medium-sized firms, firms with small share price and firms with low share turnover. Also, consistent with the conjecture that gains to the fundamental investment strategy are magnified in a setting with information processing limitations, I find that the greatest return differences are concentrated in firms with no analyst following.

Considering other sources of cross-sectional variation in returns, I find that, after controlling for size and book-to-market differences, a one-point improvement in the aggregate *F_SCORE* (i.e., one additional positive signal) is associated with an approximate 2.8% to 3.5% increase in the one-year market-adjusted return earned subsequent to portfolio formation. More importantly, *F_SCORE* is also robust to other know patterns in realized returns. I also document the success of the fundamental investment strategy over time, and provide evidence that poses a formidable challenge to market efficiency. Notably, I demonstrate that the fundamental investment strategy is robust over time and is successful, generating positive one-year buy-and-hold market-adjusted returns, in 20 out of the 21 years included in the sample period.

Finally, to address Piotroski's concern regarding a possible limitation of his study, I consider the out-of-sample predictive ability of the fundamental investment strategy. Table 9 presents the returns to the fundamental investment strategy for the extended sample period (1976 through 2010). Focusing on one-year buy-and-hold market-adjusted returns, I find limited evidence on the out-of-sample predictive ability of the fundamental investment strategy.

REFERENCES

Abarbanell, J. S. and B. J. Bushee (1997). "Fundamental analysis, future earnings, and stock prices." *Journal of Accounting Research* 35(1): 1-24.

Abarbanell, J. S. and B. J. Bushee (1998). "Abnormal returns to a fundamental analysis strategy." *The Accounting Review* 73(1): 19-45.

Barber, B. M. and J. D. Lyon (1997). "Detecting long-run abnormal stock returns: The empirical power and specification of test statistics." *Journal of Financial Economics* 43(3): 341-372.

Bernard, V. L. and J. K. Thomas (1989). "Post-earnings-announcement drift: delayed price response or risk premium?" *Journal of Accounting Research* 27: 1-36.

Chen, N. and F. Zhang (1998). "Risk and return of value stocks." *Journal of Business:* 501-535.

Dechow, P. M. and R. G. Sloan (1997). "Returns to contrarian investment strategies: Tests of naive expectations hypotheses." *Journal of Financial Economics* 43(1): 3-27.

Fama, E. F. and K. R. French (1992). "The cross-section of expected stock returns." *Journal of Finance* 47(2): 427-465.

Fama, E. F. and K. R. French (1995). "Size and book-to-market factors in earnings and returns." *Journal of Finance* 50(1): 131-155.

Fama, E. and J. MacBeth. “Risk, Return, and Equilibrium: Empirical Tests.” *Journal of Political Economy* (May/June 1973): 607-36.

Foster, G., C. Olsen, et al. (1984). "Earnings releases, anomalies, and the behavior of security returns." *The Accounting Review* 59(4): 574-603.

Frankel, R. and C. Lee (1998). "Accounting valuation, market expectation, and cross-sectional stock returns." *Journal of Accounting and Economics* 25(3): 283-319.

Kothari, S. P. and J. B. Warner (1997). "Measuring long-horizon security price performance." *Journal of Financial Economics* 43(3): 301-339.

Kothari, S.P. (2001). “Capital Markets Research in Accounting.” *Journal of Accounting and Economics* 31: 105-231.

Lakonishok, J.; A. Shleifer; and R. Vishny (1994). "Contrarian Investment, Extrapolation, and Risk." *Journal of Finance* 49(5): 1541-1578.

La Porta, R. (1996). "Expectations and the cross-section of stock returns." *The Journal of Finance* 51(5): 1715-1742.

La Porta, R.; J. Lakonishok; A. Shleifer; and R. Vishny (1997). “Good News for Value Stocks: Further Evidence on Market Efficiency.” *Journal of Finance* 52: 859-74.

Lev, B. and S. R. Thiagarajan (1993). "Fundamental information analysis." *Journal of Accounting Research* 31(2): 190-215.

Miller, M., and K. Rock. “Dividend Policy under Asymmetric Information.” *Journal of Finance* 40 (1985): 1031-51.

Myers, S., and N. Majlue. “Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have.” Journal of Financial Economics 13 (1984): 187-221.

Ou, J. A. and S. H. Penman (1989). "Accounting measurement, price-earnings ratio, and the information content of security prices." *Journal of Accounting Research* 27: 111-144.

Piotroski, J. D. (2000). "Value investing: The use of historical financial statement information to separate winners from losers." *Journal of Accounting Research* 38: 1-41.

Skinner, D. J. and R. G. Sloan (2002). "Earnings surprises, growth expectations, and stock returns or don't let an earnings torpedo sink your portfolio." *Review of Accounting Studies* 7(2): 289-312.

Sloan, R. G. (1996). "Do stock prices fully reflect information in accruals and cash flows about future earnings?" *The Accounting Review* 71(3): 289-315.

Sweeney, A. P. (1994). "Debt-covenant violations and managers' accounting responses." *Journal of Accounting and Economics* 17(3): 281-308.

TABLE 1A

Financial and Return Characteristics of High Book-to-Market Firms
(10,472 Firm-Year Observations between 1976 and 1996)

Panel A: Financial Characteristics

Variable	Mean	Median	Standard Deviation	Proportion with Positive Signal
MVE [a]	236.27482	14.85250	1158.68000	n/a
ASSETS [b]	830.06093	58.38950	3842.12000	n/a
BM [c]	2.04694	1.80836	1.11570	n/a
ROA [d]	-0.00004	0.01687	0.10498	0.6548
Δ*ROA* [e]	-0.08802	-0.00445	3.47557	0.4374
Δ*MARGIN* [f]	-0.00037	-0.00276	1.37696	0.4580
CFO [g]	0.05037	0.05617	0.13530	0.7698
Δ*LIQUID* [h]	0.06475	-0.02443	10.29982	0.4285
Δ*LEVER* [i]	0.00710	-0.00090	0.12159	0.5962
Δ*TURN* [j]	0.06230	0.00749	0.55853	0.5290
ACCRUAL [k]	-0.05040	-0.04785	0.11418	0.7820

Panel B: Buy-and-Hold Returns froma High Book-to-Market Investment Strategy

Returns[l]	Mean	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	Percentage Positive
One-Year							
Raw	0.2941	-0.3651	-0.1120	0.1538	0.5000	0.9900	0.6470
Market-Adj	0.0864	-0.5587	-0.3072	-0.0468	0.2842	0.7541	0.4544
Two-Year							
Raw	0.5493	-0.4655	-0.1176	0.2922	0.8000	1.6205	0.6790
Market-Adj	0.1498	-0.8723	-0.5196	-0.1101	0.4115	1.2305	0.4372

[a] *MVE* = market value of equity at the end of fiscal year t. Market value is calculated as the number of shares outstanding at fiscal year-end times closing share price

[b] *ASSETS* = total assets reported at the end of fiscal year t.

[c] *BM* = book value of equity at the end of fiscal year t, scaled by MVE

[d] *ROA* = net income before extraordinary items for the fiscal year preceding portfolio formation scaled by total assets at the beginning of year t.

[e] Δ*ROA* = change in annual *ROA* for the year preceding portfolio formation. Δ*ROA* is calculated as *ROA* for year t less the firm's *ROA* for year t-1.

[f] Δ*MARGIN* = gross margin (net sales less cost of good sold_ for the year preceding portfolio formation, scaled by net sales for the year, less the firm's gross margin (scaled by net sales) from year t-1.

[g] *CFO* = cash flow from operations scaled by total assets at the beginning of year t.

[h] Δ*LIQUID* = change in the firm's current ratio between the end of year t and year t-1. Current ratio is defined as total current assets divided by total current liabilities.

[i] Δ*LEVER*= change in the firm's debt-to-assets ratio between the end ofyear t and year t-1. The debt-to-asset ratio is defined as the firm's total long-term debt (including the portion of long-term debt classified as current) scaled by average total assets.

[j] Δ*TURN* = change in the firm's asset turnover ratio between the end of year t and year t-1. The asset turnover ratio is defined as net sales scaled by average total assets for the year.

[k] *ACCRUAL* = net income before extraordinary items less cash flow from operations, scaled by total assets at the beginning of year t.

[l] One-Year (Two-Year) Raw Return equals the 12- (24-) buy-and-hold return of the firm starting at the beginning of the fifth month after fiscal year-end. Return compounding ends the earlier of one year (two years) after return compounding started on the last day of CRSP reported trading. If the firm delisted, the delisting return is assumed to be zero.

Market-Adjusted Return equals the buy-and-hold return of the firm less the buy-and-hold return on the value-weighted market index over the same investment horizon.

TABLE 1B - Piotroski (2000)

Financial and Return Characteristics of High Book-to-Market Firms
(14,043 Firm-Year Observations between 1976 and 1996)

Panel A: Financial Characteristics

Variable	Mean	Median	Standard Deviation	Proportion with Positive Signal
MVE [a]	188.500	14.365	1015.39	n/a
ASSETS [b]	1043.990	57.561	6653.48	n/a
BM [c]	2.444	1.721	34.66	n/a
ROA [d]	-0.0054	0.0128	0.1067	0.632
Δ*ROA* [e]	-0.0096	-0.0047	0.2171	0.432
Δ*MARGIN* [f]	-0.3240	-0.0034	1.9306	0.454
CFO [g]	0.0498	0.0532	0.1332	0.755
Δ*LIQUID* [h]	-0.0078	0.0000	0.1133	0.384
Δ*LEVER* [i]	0.0024	0.0000	0.0932	0.498
Δ*TURN* [j]	0.0119	0.0068	0.5851	0.534
ACCRUAL [k]	-0.0552	-0.0481	0.1388	0.780

Panel B: Buy-and-Hold Returns froma High Book-to-Market Investment Strategy

Returns[l]	Mean	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	Percentage Positive
One-Year							
Raw	0.239	-0.391	-0.150	0.105	0.438	0.902	0.610
Market-Adj	0.059	-0.560	-0.317	-0.061	0.255	0.708	0.437
Two-Year							
Raw	0.479	-0.517	-0.179	0.231	0.750	1.579	0.646
Market-Adj	0.127	-0.872	-0.517	-0.111	0.394	1.205	0.432

[a] *MVE* = market value of equity at the end of fiscal year t. Market value is calculated as the number of shares outstanding at fiscal year-end times closing share price

[b] *ASSETS* = total assets reported at the end of fiscal year t.

[c] *BM* = book value of equity at the end of fiscal year t, scaled by MVE

[d] *ROA* = net income before extraordinary items for the fiscal year preceding portfolio formation scaled by total assets at the beginning of year t.

[e] Δ*ROA* = change in annual *ROA* for the year preceding portfolio formation. Δ*ROA* is calculated as *ROA* for year t less the firm's *ROA* for year t-1.

[f] Δ*MARGIN* = gross margin (net sales less cost of good sold_ for the year preceding portfolio formation, scaled by net sales for the year, less the firm's gross margin (scaled by net sales) from year t-1.

[g] *CFO* = cash flow from operations scaled by total assets at the beginning of year t.

[h] Δ*LIQUID* = change in the firm's current ratio between the end of year t and year t-1. Current ratio is defined as total current assets divided by total current liabilities.

[i] Δ*LEVER*= change in the firm's debt-to-assets ratio between the end ofyear t and year t-1. The debt-to-asset ratio is defined as the firm's total long-term debt (including the portion of long-term debt classified as current) scaled by average total assets.

[j] Δ*TURN* = change in the firm's asset turnover ratio between the end of year t and year t-1. The asset turnover ratio is defined as net sales scaled by average total assets for the year.

[k] *ACCRUAL* = net income before extraordinary items less cash flow from operations, scaled by total assets at the beginning of year t.

[l] One-Year (Two-Year) Raw Return = 12- (24-) buy-and-hold return of the firm starting at the beginning of the fifth month after fiscal year-end. Return compounding ends the earlier of one year (two years) after return compounding started on the last day of CRSP reported trading. If the firm delisted, the delisting return is assumed to be zero.

Market-Adjusted Return = buy-and-hold return of the firm less the buy-and-hold return on the value-weighted market index over the same investment horizon.

) are measured using buy-and-hold return starting in April of the 0-year market-adju

) for the nine fundamental signals was eliminated for succinct

-0.224 1.000

0.166 -0.017 1.000

0.309 -0.078 -0.008 1.000

-0.239 -0.046 -0.065 0.227 1.000

0.319 0.012 -0.075 -0.022 0.054 1.000

0.528 0.067 0.648 0.010 -0.152 0.094 1.000

0.496 -0.003 -0.024 0.056 -0.034 0.086 0.170 1.000

0.621 -0.040 -0.130 0.304 -0.016 0.145 0.229 0.456 1.000

0.466 0.118 -0.272 0.041 -0.091 0.163 0.436 0.241 0.451 1.000

0.125 -0.038 0.018 0.022 -0.049 0.046 0.110 0.046 0.054 0.108

0.116 -0.034 0.024 0.020 -0.042 0.055 0.117 0.042 0.048 0.103

0.123 -0.042 0.022 0.024 -0.040 0.04504 0.114 0.047 0.053 0.103

F_SCORE EQ_OFFER ACCRUAL ΔTURN ΔLEVER ΔLIQUID CFO ΔMARGIN ΔROA ROA

a

Signal (F_SCORE) for High Book-to-Market Firms

Spearman

TABLE 2

TABLE 3A

Buy-and-Hold Returns to a Value Investment Strategy Based on Fundamental Signals

This table presents buy-and-hold returns to a fundamental investment strategy based on purchasing high BM firms with strong fundamental signals. *F_SCORE* is equal to the sum of nine individual binary signals, or *F_SCORE = F_ROA + F_ΔROA + F_CFO + F_Accrual + F_ΔMARGIN + F_ΔTURN + F_ΔLEVER + F_ΔLIQUID + EQ_OFFER,* where each binary signal equals one (zero) if the underlying realization is a good (bad) signal about future firm performance. A *F_SCORE* equal to zero (nine) means the firm possesses the least (most) favorable set of financial signals. The Low *F_SCORE* portfolio consists of firms with an aggregate score of 0 or 1; the Modified Low *F_SCORE* portfolio consists of firms with an aggregate score of 0, 1 or 2; the High F_SCORE portfolio consists of firms with a score of 8 or 9.

Panel A: One-Year Raw Returns[a]

	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.294	-0.365	-0.112	0.154	0.500	0.999	0.647	10,472
F_SCORE								
0	0.303	-0.681	-0.304	0.014	0.818	1.789	0.500	18
1	0.150	-0.553	-0.154	0.048	0.359	0.786	0.585	147
2	0.113	-0.569	-0.294	0.021	0.383	0.760	0.519	493
3	0.194	-0.500	-0.247	0.058	0.423	0.931	0.538	1,078
4	0.260	-0.417	-0.008	0.107	0.456	1.011	0.612	1,806
5	0.312	-0.340	-0.100	0.163	0.504	0.960	0.660	2,161
6	0.304	-0.294	-0.071	0.182	0.517	0.979	0.674	2,073
7	0.383	-0.256	-0.031	0.216	0.521	1.026	0.708	1,532
8	0.370	-0.226	-0.034	0.202	0.557	1.092	0.713	935
9	0.347	-0.275	-0.040	0.206	0.558	1.003	0.716	229
Low Score	0.167	-0.553	-0.238	0.043	0.414	0.889	0.576	165
Modied Low	0.127	-0.565	-0.286	0.030	0.385	0.808	0.533	658
High Score	0.366	-0.231	-0.037	0.203	0.557	1.062	0.714	1,164
High-All	0.072	0.134	0.075	0.049	0.057	0.063	0.067	-
t-Statistic/	2.77	-	-	-	-	-	-	-
(*p*-Value)	(0.01)	-	-	-	-	-	-	-
High-Low	0.1991	0.322	0.201	0.160	0.143	0.173	0.138	-
t-Statistic/	2.97	-	-	-	-	-	-	-
(*p*-Value)	(0.00)	-	-	-	-	-	-	-
High - M. Low	0.2391	0.334	0.248	0.173	0.172	0.254	0.180	-
t-Statistic/	6.27	-	-	-	-	-	-	-
(*p*-Value)	(0.00)	-	-	-	-	-	-	-

Panel B: One-Year Market-Adjusted Returns[b]								
	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.086	-0.559	-0.307	-0.047	0.284	0.754	0.454	10,472
F_SCORE								
0	0.072	-0.958	-0.420	-0.229	0.653	1.524	0.389	18
1	-0.042	-0.710	-0.404	-0.108	0.182	0.620	0.388	147
2	-0.094	-0.771	-0.495	-0.165	0.137	0.601	0.363	493
3	-0.013	-0.704	-0.425	-0.144	0.218	0.724	0.384	1,078
4	0.063	-0.624	-0.353	-0.070	0.271	0.794	0.430	1,806
5	0.103	-0.520	-0.284	-0.050	0.281	0.748	0.452	2,161
6	0.093	-0.489	-0.270	-0.018	0.294	0.737	0.480	2,073
7	0.167	-0.473	-0.240	0.000	0.344	0.787	0.492	1,532
8	0.163	-0.421	-0.234	0.009	0.359	0.805	0.511	935
9	0.146	-0.478	-0.227	0.031	0.336	0.809	0.533	229
Low Score	-0.029	-0.717	-0.404	-0.109	0.187	0.721	0.388	165
Modied Low	-0.078	-0.756	-0.478	-0.157	0.153	0.636	0.369	658
High Score	0.160	-0.430	-0.233	0.014	0.354	0.806	0.515	1,164
High-All	0.073	0.129	0.074	0.061	0.070	0.052	0.061	-
t-Statistic/	2.88	-	-	-	-	-	-	-
(*p*-Value)	(0.00)	-	-	-	-	-	-	-
High-Low	0.189	0.287	0.171	0.124	0.167	0.085	0.128	-
t-Statistic/	2.88	-	-	-	-	-	-	-
(*p*-Value)	(0.00)	-	-	-	-	-	-	-
High - M. Low	0.2377	0.326	0.244	0.171	0.201	0.170	0.146	-
t-Statistic/	6.35	-	-	-	-	-	-	-
(*p*-Value)	(0.00)	-	-	-	-	-	-	-

Panel C: Two-Year Market-Adjusted Returns[C]								
	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.150	-0.872	-0.520	-0.110	0.411	1.230	0.437	10,472
F_SCORE								
0	0.688	-1.249	-0.810	-0.551	0.808	3.593	0.333	18
1	0.015	-1.055	-0.716	-0.321	0.317	1.381	0.340	147
2	-0.150	-1.119	-0.780	-0.339	0.179	0.884	0.306	493
3	-0.013	-1.055	-0.247	1.299	0.423	0.931	0.366	1,078
4	0.202	-0.944	-0.582	-0.162	0.404	1.265	0.416	1,806
5	0.168	-0.849	-0.507	-0.096	0.424	1.286	0.442	2,161
6	0.122	-0.791	-0.460	-0.086	0.381	1.074	0.448	2,073
7	0.233	-0.718	-0.409	-0.015	0.492	1.274	0.490	1,532
8	0.283	-0.675	-0.375	0.013	0.519	1.315	0.513	935
9	0.174	-0.745	-0.441	-0.024	0.463	1.378	0.480	229
Low Score	0.089	-1.055	-0.725	-0.351	0.317	1.386	0.339	165
Modied Low	-0.090	-1.097	-0.770	-0.343	0.209	1.003	0.315	658
High Score	0.262	-0.681	-0.387	0.006	0.508	1.317	0.507	1,164
High-All	0.112	0.192	0.132	0.116	0.096	0.086	0.070	-
t-Statistic/	1.85	-	-	-	-	-	-	-
(*p*-Value)	(0.07)	-	-	-	-	-	-	-
High-Low	0.1731	0.374	0.338	0.357	0.191	-0.070	0.167	-
t-Statistic/	1.16	-	-	-	-	-	-	-
(*p*-Value)	(0.25)	-	-	-	-	-	-	-
High - M. Low	0.3517	0.416	0.382	0.349	0.299	0.314	0.192	-
t-Statistic/	4.42	-	-	-	-	-	-	-
(*p*-Value)	(0.00)	-	-	-	-	-	-	-

[a]A raw return is calculated as the 12-month buy-and-hold return of the firm starting the fifrth month after fiscal year-end. Return compounding ends the earlier of one year after return compounding starts or the last day of reported trading. If a firm delisted, the delisting return is assumed to be zero.

[b]A market-adjusted return equals the firm's 12-month buy-and-hold return (as defined in Panel A) less the buy-and-hold return on the value-weighted market index over the same investment horizon.

[c]A two-year raw return is calculated as the 24-month buy-and-hold return of the firm starting the fifth month after fiscal year-end. Return compounding ends the earlier of two years after return compounding starts or the last day of *CRSP* reported trading. If the firm delisted, the delisting return is assumed to be zero. A two-year market-value-adjusted return equals the firm's 24-month buy-and-hold return less the buy-and-hold return on the value-weighted market index over the same investment horizon.

TABLE 3B - Piotroski (2000)

Buy-and-Hold Returns to a Value Investment Strategy Based on Fundamental Signals

This table presents buy-and-hold returns to a fundamental investment strategy based on purchasing high BM firms with strong fundamental signals. *F_SCORE* is equal to the sum of nine individual binary signals, or *F_SCORE = F_ROA + F_ΔROA + F_CFO + F_Accrual + F_ΔMARGIN + F_ΔTURN + F_ΔLEVER + F_ΔLIQUID + EQ_OFFER,* where each binary signal equals one (zero) if the underlying realization is a good (bad) signal about future firm performance. A *F_SCORE* equal to zero (nine) means the firm possesses the least (most) favorable set of financial signals. The Low *F_SCORE* portfolio consists of firms with an aggregate score of 0 or 1; the Modified Low *F_SCORE* portfolio consists of firms with an aggregate score of 0, 1 or 2; the High F_SCORE portfolio consists of firms with a score of 8 or 9.

Panel A: One-Year Raw Returns[a]

	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.239	-0.391	-0.150	0.105	0.438	0.902	0.610	14,043
F_SCORE								
0	0.112	-0.638	-0.302	0.000	0.511	1.051	0.491	57
1	0.073	-0.590	-0.298	-0.042	0.253	0.741	0.454	339
2	0.159	-0.512	-0.278	0.024	0.369	0.898	0.520	859
3	0.159	-0.513	-0.250	0.034	0.368	0.867	0.535	1,618
4	0.202	-0.412	-0.181	0.070	0.412	0.875	0.573	2,462
5	0.234	-0.375	-0.146	0.114	0.447	0.900	0.616	2,787
6	0.294	-0.333	-0.107	0.143	0.470	0.908	0.651	2,579
7	0.304	-0.294	-0.070	0.164	0.487	0.941	0.681	1,894
8	0.304	-0.265	-0.066	0.163	0.483	0.922	0.675	1,115
9	0.341	-0.272	-0.102	0.167	0.506	1.200	0.661	333
Low Score	0.078	-0.589	-0.300	-0.027	0.270	0.773	0.460	396
High Score	0.313	-0.267	-0.074	0.166	0.484	0.955	0.672	1,448
High-All	0.074	0.127	0.076	0.061	0.046	0.053	0.062	-
t-Statistic/	3.279	-	-	-	-	-	-	-
(*p*-Value)	(0.000)	-	-	-	-	-	-	-
High-Low	0.235	0.322	0.226	0.193	0.214	0.182	0.212	-
t-Statistic/	5.594	-	-	-	-	-	-	-
(*p*-Value)	(0.000)	-	-	-	-	-	-	-

Panel B: One-Year Market-Adjusted Returns[b]

	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.059	-0.560	-0.317	-0.061	0.255	0.708	0.437	14,043
F_SCORE								
0	-0.061	-0.710	-0.450	-0.105	0.372	0.766	0.386	57
1	-0.102	-0.796	-0.463	-0.203	0.087	0.490	0.307	339
2	-0.020	-0.686	-0.440	-0.151	0.198	0.732	0.374	859
3	-0.015	-0.691	-0.411	-0.142	0.186	0.667	0.375	1,618
4	0.026	-0.581	-0.351	-0.100	0.229	0.691	0.405	2,462
5	0.053	-0.543	-0.307	-0.059	0.255	0.705	0.438	2,787
6	0.112	-0.493	-0.278	-0.024	0.285	0.711	0.471	2,579
7	0.116	-0.466	-0.251	-0.011	0.301	0.747	0.489	1,894
8	0.127	-0.462	-0.226	0.003	0.309	0.710	0.504	1,115
9	0.159	-0.459	-0.265	-0.012	0.327	0.885	0.486	333
Low Score	-0.096	-0.781	-0.460	-0.200	0.107	0.548	0.318	396
High Score	0.134	-0.462	-0.236	0.000	0.316	0.757	0.500	1,448
High-All	0.075	0.098	0.081	0.061	0.061	0.049	0.063	-
t-Statistic/	3.14	-	-	-	-	-	-	-
(*p*-Value)	(0.000)	-	-	-	-	-	-	-
High-Low	0.230	0.319	0.224	0.200	0.209	0.209	0.182	-
t-Statistic/	5.59	-	-	-	-	-	-	-
(*p*-Value)	(0.000)	-	-	-	-	-	-	-

Panel C: Two-Year Market-Adjusted Returns[c]

	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.127	-0.872	-0.517	-0.111	0.394	1.205	0.432	14,043
F_SCORE								
0	0.064	-0.939	-0.772	-0.288	0.151	1.785	0.298	18
1	-0.179	-1.066	-0.772	-0.368	0.090	0.796	0.277	147
2	0.038	-1.031	-0.752	-0.278	0.329	1.139	0.367	493
3	0.002	-1.022	-0.658	-0.230	0.286	1.117	0.365	1,078
4	0.096	-0.903	-0.558	-0.158	0.338	1.145	0.404	1,806
5	0.130	-0.855	-0.513	-0.108	0.395	1.193	0.439	2,161
6	0.164	-0.778	-0.464	-0.060	0.428	1.183	0.460	2,073
7	0.195	-0.717	-0.391	-0.025	0.466	1.319	0.486	1,532
8	0.309	-0.665	-0.376	0.012	0.507	1.459	0.509	935
9	0.213	-0.773	-0.388	-0.011	0.616	1.342	0.493	229
Low Score	-0.145	-1.059	-0.772	-0.367	0.108	0.829	0.280	165
High Score	0.287	-0.690	-0.377	0.006	0.532	1.414	0.505	1,164
High-All	0.112	0.182	0.140	0.117	0.138	0.209	0.073	-
t-Statistic/	2.639	-	-	-	-	-	-	-
(*p*-Value)	(0.000)	-	-	-	-	-	-	-
High-Low	0.432	0.369	0.395	0.373	0.424	0.585	0.225	-
t-Statistic/	5.749	-	-	-	-	-	-	-
(*p*-Value)	(0.000)	-	-	-	-	-	-	-

[a] A raw return is calculated as the 12-month buy-and-hold return of the firm starting the fifrth month after fiscal year-end. Return compounding ends the earlier of one year after return compounding starts or the last day of reported trading. If a firm delisted, the delisting return is assumed to be zero.

[b] A market-adjusted return equals the firm's 12-month buy-and-hold return (as defined in Panel A) less the buy-and-hold return on the value-weighted market index over the same investment horizon.

[c] A two-year raw return is calculated as the 24-month buy-and-hold return of the firm starting the fifth month after fiscal year-end. Return compounding ends the earlier of two years after return compounding starts or the last day of *CRSP* reported trading. If the firm delisted, the delisting return is assumed to be zero. A two-year market-value-adjusted return equals the firm's 24-month buy-and-hold return less the buy-and-hold return on the value-weighted market index over the same investment horizon.

TABLE 4

One-Year Market-Adjusted Buy-and-Hold Returns to a Value Investment Strategy Based on Fundamental Signals by Size Partition[a]

	Small Firms			Medium Firms			Large Firms		
	Mean	Median	n	Mean	Median	n	Mean	Median	n
All Firms	0.127	-0.059	6,297	0.031	-0.046	2,669	0.014	-0.025	1,506
F_SCORE									
0	0.144	-0.251	10	0.026	-0.102	7	-0.331	-0.331	1
1	-0.054	-0.131	99	0.008	-0.055	38	-0.105	-0.064	10
2	-0.104	-0.189	327	-0.080	-0.140	131	-0.056	-0.025	35
3	0.004	-0.158	696	-0.069	-0.147	269	0.014	-0.068	113
4	0.088	-0.083	1,139	0.038	-0.055	418	-0.014	-0.049	249
5	0.153	-0.072	1,231	0.045	-0.034	589	0.023	-0.024	341
6	0.145	-0.016	1,176	0.026	-0.030	524	0.021	-0.016	373
7	0.255	-0.001	890	0.072	-0.017	405	0.000	-0.021	237
8	0.208	0.014	580	0.103	0.021	235	0.067	-0.011	120
9	0.189	0.044	149	0.046	0.026	53	0.101	-0.053	27
Low Score	-0.036	-0.153	109	0.011	-0.071	45	-0.126	-0.093	11
Modified Low	-0.087	-0.181	436	-0.057	-0.121	176	-0.073	-0.030	46
High Score	0.204	0.022	729	0.092	0.022	288	0.073	-0.012	147
High - All	0.0769	0.081	-	0.061	0.068	-	0.0589	0.013	-
t-Statistic/	2.01			1.73			1.8		
(p-Value)	(0.044)			(0.084)			(0.072)		
High - Low	0.2399	0.175	-	0.0817	0.092	-	0.1989	0.081	-
t-Statistic/	2.56			0.89			1.7		
(p-Value)	(0.011)			(0.374)			(0.096)		
High - M. Low	0.2909	0.203	-	0.1491	0.143	-	0.1459	0.018	-
t-Statistic/	5.51			2.67			2.27		
(p-Value)	(0.000)			(0.008)			(0.024)		

[a]Each year, all firms on *Compustat* with sufficient size and *BM* data are ranked on the basis of the most recent fiscal year-end market capitalization. The 33.3 and 66.7 percentile cutoffs from the prior year's distribution of firm size (*MVE*) are used to classify the high *BM* firms into small, medium, and large firms each year. All other definitions and test statistics are described in table 3.

TABLE 5

One-Year Market-Adjusted Buy-and-Hold Returns to a Value Investment Strategy Based on Fundamental Signals by Share Price, Trading Volume, and Analyst Following Partitions

Panel A: Share Price[a,d]

	Small Price			Medium Price			Large Price		
	Mean	Median	*n*	Mean	Median	*n*	Mean	Median	*n*
All Firms	0.120	-0.067	6233	0.053	-0.024	2971	0.000	-0.036	1268
Low Score	-0.028	-0.158	124	-0.014	-0.029	36	-0.179	-0.323	5
Modified Low	-0.091	-0.191	486	-0.043	-0.073	146	-0.025	-0.133	26
High Score	0.217	0.033	671	0.102	0.001	342	0.036	-0.034	151
High-Low Difference	0.245	0.191	-	0.116	0.029	-	0.214	0.288	-
t-Statistic/(*p*-Value)	2.65	(0.008)	-	1.30	(0.193)	-	1.39	(0.166)	-
High-M. Low Difference	0.308	0.224	-	0.145	0.073	-	0.061	0.098	-
t-Statistic/(*p*-Value)	5.84	(0.000)	-	2.80	(0.005)	-	0.76	(0.449)	-

Panel B: Trading Volume[b,d]

	Low Volume			Medium Volume			High Volume		
	Mean	Median	*n*	Mean	Median	*n*	Mean	Median	*n*
All Firms	0.073	-0.049	4368	0.116	-0.049	2849	0.079	-0.040	3255
Low Score	-0.008	-0.184	77	-0.063	-0.131	39	-0.035	-0.070	49
Modified Low	-0.102	-0.159	291	-0.068	-0.164	186	-0.049	-0.140	181
High Score	0.178	0.014	460	0.175	0.039	340	0.124	0.000	364
High-Low Difference	0.186	0.197	-	0.238	0.170	-	0.159	0.070	-
t-Statistic/(*p*-Value)	1.96	(0.051)	-	1.48	(0.139)	-	1.62	(0.107)	-
High-M. Low Difference	0.27958	0.17293	-	0.243	0.203	-	0.173	0.140	-
t-Statistic/(*p*-Value)	5.16	(0.000)	-	3.02	(0.003)	-	2.68	(0.008)	-

Panel C: Analyst Following[c]

	With Analyst Following			No Analyst Following		
	Mean	Median	*n*	Mean	Median	*n*
All Firms	0.144	-0.025	4531	0.043	-0.062	5941
Low Score	-0.099	-0.109	99	0.075	-0.142	66
Modified Low	-0.081	-0.130	383	-0.074	-0.192	275
High Score	0.093	-0.032	563	0.223	0.040	601
High-Low Difference	0.191	0.077	-	0.147	0.182	-
t-Statistic/(*p*-Value)	4.27	(0.000)	-	4.52	(0.000)	-
High-M. Low Difference	0.173	0.099	-	0.297	0.232	-
t-Statistic/(*p*-Value)	4.27	(0.000)	-	3.00	(0.003)	-

[a]Share price equals the firm's price per share at the end of the fiscal year preceding portfolio formation.

[b]Trading volume represents share turnover, defined as the total number of shares traded during the prior fiscal year scaled by the average number of shares outstanding during the year.

[c]Analyst following equals the number of forecasts reported on *I/B/E/S* during the last statistical period of the year preceding portfolio formation.

[d]Firms are classified into share price and trading volume portfolios in a manner similar to firm size (see table 4).

TABLE 6

Descriptive Statistics for the Portfolios of High, Low and Modified Low F_SCORE Firms and the Complete High Book-to-Market Portfolio

High, low and modified low *F_SCORE* firms are as defined in table. Differences in mean (median) realizations between the high *F_SCORE* firms and low *F_SCORE* firms are measured; *t*-statistics for differences in means (*p*-values for medians) from two-sample *t*-tests (signed rank Wilcoxon tests) are presented.

Variable	All Firms	High *F_SCORE* Firms	Low *F_SCORE* Firms	Modified Low Firms	High - Low Difference	*t*-Statistic (*p*-Value)	High - M. Low Difference	*t*-Statistic (*p*-Value)
MVE[a]								
Mean	236.30	272.44	89.97	80.31	182.46	1.26	192.13	2.64
Median	14.86	13.51	14.93	12.96	-1.42	(0.207)	0.55	(0.008)
BM Ratio[b]								
Mean	2.05	2.05	2.02	2.04	0.03	0.45	0.02	0.34
Median	1.81	1.88	1.82	1.78	0.06	(0.654)	0.10	(0.733)
LEVERAGE[c]								
Mean	0.22	0.19	0.24	0.23	-0.05	-3.98	-0.04	-4.77
Median	0.22	0.18	0.23	0.21	-0.05	(0.000)	-0.03	(0.000)
MOMENTUM[d]								
Mean	0.03	0.15	-0.11	-0.08	0.26	6.49	0.23	9.05
Median	-0.03	0.07	-0.18	-0.15	0.25	(0.000)	0.22	(0.000)
ACCRUAL[e]								
Mean	-0.05	-0.07	0.04	0.01	-0.11	-12.31	-0.08	-15.08
Median	-0.05	-0.06	0.03	0.01	-0.09	(0.000)	-0.07	(0.000)

[a]*MVE* = market value of equity at the end of fiscal year t. Market value is calculated as the number of shares outstanding at fiscal year-end times closing share price.

[b]*BM* = book value of equity at the end of fiscal year t, scaled by MVE.

[c]*LEVERAGE* = debt-to-assets ratio at the end of year t. The debt-toasset ratio is defined as the firm's total long-term debt (including the portion of long-term debt classified as current) scaled by average total assets.

[d]*MOMENTUM* = six-month market-adjusted buy-and-hold return over the six months directly preceding the date of portfolio formation.

[e]*ACCRUAL* = net income before extraordinary items less cash flow from operations, scaled by beginning-of-the-year total assets.

TABLE 7

Cross-Sectional Regression

This table presents coefficients from the following cross-sectional regression:[a] $MA\_RET_i = \alpha + \beta_1 \log(MVE_i) + \beta_2 \log(BM_i) = \beta_3 MOMENT_i + \beta_4 ACCRUAL_i + \beta_5 EQ\_OFFER_i$. This table presents coefficients from a pooled regression (n= 10,472).

	Intercept	Log(*MVE*)	Log(*BM*)	Moment	Accrual	*EQ_OFFER*	*F_SCORE*	Adj. R^2
(1)	0.023	-0.021	0.209					0.0142
	(-4.86)	(-5.31)	(8.19)					
(2)	-0.153	-0.023	0.202				0.035	0.0198
	(-4.53)	(-5.31)	(8.19)				(7.77)	
(3)	0.105	-0.021	0.190	0.164	0.180	0.000		0.0237
	(0.58)	(-4.67)	(7.67)	(9.91)	(2.57)	(0.68)		
(4)	-0.123	-0.023	0.186	0.149	0.116	0.000	0.028	0.0271
	(-3.62)	(-5.10)	(7.53)	(8.92)	(1.64)	(0.87)	(6.17)	

[a]*MA_RET* = one-year market-adjusted return and equals the firm's 12-month buy-and-hold return less the buy-and-hold return on the value-weighted market index over the same investment horizon. *MVE* = market value of equity at the end of fiscal year t. Market value is calculated as the number of shares outstanding at fiscal year-end times closing share price. *BM* = book value of equity at the end of fsical year t, scaled by *MVE*. *MOMENT* = six-month market-adjusted buy-and-hold return over the six months directly preceding the date of portfolio formation. *ACCRUAL* = net income before extraordinary items less cash flow from operations, scaled by beginning-of-the-year total assets. *EQ_OFFER* = indicator variable equal to one if the firm raised equity capital during hte prior fiscal year, zero otherwise. *F_SCORE* = sum of nine individual binary signals, or *F_SCORE* = *F_ROA* + *F_ΔROA* + *F_CFO* + *F_ACCRUAL* + *F_ΔMARGIN* + *F_ΔTURN* + *F_ΔLEVER* + *F_ΔLIQUID* + *EQ_OFFER*, where each binary signal equals one (zero) if the underlying realization is a good (bad) signal about future firm performance.

TABLE 8

Buy-and-Hold Returns to a Value Investment Strategy Based on Fundamental Signals
Sample Period is 1976 through 2010

This table presents buy-and-hold returns to a fundamental investment strategy based on purchasing high BM firms with strong fundamental signals. *F_SCORE* is equal to the sum of nine individual binary signals, or *F_SCORE = F_ROA + F_ΔROA + F_CFO + F_Accrual + F_ΔMARGIN + F_ΔTURN + F_ΔLEVER + F_ΔLIQUID + EQ_OFFER,* where each binary signal equals one (zero) if the underlying realization is a good (bad) signal about future firm performance. A *F_SCORE* equal to zero (nine) means the firm possesses the least (most) favorable set of financial signals. The Low *F_SCORE* portfolio consists of firms with an aggregate score of 0 or 1; the Modified Low *F_SCORE* portfolio consists of firms with an aggregate score of 0, 1 or 2; the High F_SCORE portfolio consists of firms with a score of 8 or 9.

Panel A: One-Year Raw Returns[a]

	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.304	-0.449	-0.174	0.125	0.500	1.083	0.609	18,803
F_SCORE								
0	0.154	-0.681	-0.333	-0.043	0.317	1.632	0.463	41
1	0.205	-0.676	-0.370	0.002	0.464	1.020	0.515	272
2	0.249	-0.632	-0.350	0.018	0.438	1.178	0.511	985
3	0.279	-0.583	-0.276	0.045	0.496	1.151	0.531	2,239
4	0.298	-0.495	-0.207	0.099	0.495	1.141	0.590	3,528
5	0.310	-0.435	-0.150	0.143	0.508	1.070	0.624	4,000
6	0.291	-0.400	-0.136	0.148	0.498	1.000	0.632	3,559
7	0.344	-0.340	-0.103	0.164	0.517	1.083	0.658	2,497
8	0.351	-0.319	-0.084	0.164	0.524	1.062	0.665	1,381
9	0.360	-0.302	-0.079	0.177	0.555	1.071	0.694	301
Low Score	0.198	-0.681	-0.370	0.000	0.458	1.100	0.508	313
Modied Low	0.237	-0.644	-0.356	0.012	0.438	1.132	0.510	1,298
High Score	0.352	-0.317	-0.084	0.168	0.526	1.065	0.671	1,682
High-All	0.049	0.132	0.090	0.043	0.026	-0.019	0.062	-
t-Statistic/	1.81	-	-	-	-	-	-	-
(p-Value)	(0.070)	-	-	-	-	-	-	-
High-Low	0.154	0.364	0.286	0.168	0.067	-0.035	0.163	-
t-Statistic/	2.18	-	-	-	-	-	-	-
(p_Value)	(0.029)	-	-	-	-	-	-	-
High - M. Low	0.115	0.327	0.272	0.156	0.087	-0.068	0.161	-
t-Statistic/	2.56	-	-	-	-	-	-	-
(p_Value)	(0.011)	-	-	-	-	-	-	-

Panel B: One-Year Market-Adjusted Returns[b]

	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.159	-0.548	-0.299	-0.025	0.341	0.901	0.477	18,803
F_SCORE								
0	0.013	-0.742	-0.420	-0.233	0.230	1.431	0.366	41
1	0.089	-0.701	-0.480	-0.154	0.268	0.933	0.393	272
2	0.116	-0.695	-0.430	-0.116	0.260	0.966	0.407	985
3	0.143	-0.651	-0.389	-0.082	0.338	0.952	0.439	2,239
4	0.162	-0.587	-0.324	-0.033	0.360	0.962	0.471	3,528
5	0.164	-0.518	-0.276	-0.016	0.347	0.887	0.484	4,000
6	0.143	-0.490	-0.265	-0.011	0.320	0.856	0.489	3,559
7	0.187	-0.468	-0.236	0.000	0.364	0.893	0.500	2,497
8	0.188	-0.461	-0.244	0.016	0.369	0.792	0.665	1,381
9	0.196	-0.469	-0.225	0.032	0.387	0.853	0.542	301
Low Score	0.079	-0.702	-0.478	-0.174	0.243	0.955	0.390	313
Modied Low	0.107	-0.699	-0.437	-0.127	0.258	0.966	0.403	1,298
High Score	0.189	-0.462	-0.240	0.023	0.371	0.810	0.523	1,682
High-All	0.031	0.085	0.058	0.048	0.030	-0.091	0.046	-
t-Statistic/	1.16	-	-	-	-	-	-	-
(p-Value)	(0.245)	-	-	-	-	-	-	-
High-Low	0.110	0.239	0.237	0.197	0.128	-0.145	0.133	-
t-Statistic/	1.58	-	-	-	-	-	-	-
(p_Value)	(0.114)	-	-	-	-	-	-	-
High - M. Low	0.082	0.236	0.196	0.151	0.113	-0.156	0.120	-
t-Statistic/	1.85	-	-	-	-	-	-	-
(p_Value)	(0.064)	-	-	-	-	-	-	-

Panel C:Two-Year Market-Adjusted Returns[c]								
	Mean	10%	25%	Median	75%	90%	%Positive	*n*
All Firms	0.257	-0.786	-0.045	-0.037	0.499	1.358	0.477	18,803
F_SCORE								
0	0.207	-0.815	-0.684	-0.266	0.213	1.051	0.293	41
1	0.047	-0.932	-0.655	-0.330	0.276	0.933	0.320	272
2	0.132	-0.977	-0.596	-0.209	0.383	1.326	0.391	985
3	0.193	-0.918	-0.586	-0.132	0.446	1.444	0.433	2,239
4	0.296	-0.807	-0.475	-0.041	0.532	1.480	0.475	3,528
5	0.247	-0.759	-0.043	-0.004	0.504	1.325	0.498	4,000
6	0.283	-0.709	-0.397	-0.026	0.479	1.257	0.482	3,559
7	0.293	-0.676	-0.358	0.020	0.528	1.407	0.515	2,497
8	0.295	-0.658	-0.362	0.050	0.531	1.336	0.531	1,381
9	0.272	-0.704	-0.395	0.006	0.539	1.534	0.505	301
Low Score	0.068	-0.902	-0.658	-0.325	0.271	1.300	0.316	313
Modied Low	0.117	-0.972	-0.623	-0.236	0.362	1.309	0.373	1,298
High Score	0.291	-0.666	-0.368	0.042	0.534	1.358	0.526	1,682
High-All	0.033	0.119	-0.323	0.078	0.035	-0.001	0.049	-
t-Statistic/	0.55	-	-	-	-	-	-	-
(p-Value)	(0.581)	-	-	-	-	-	-	-
High-Low	0.223	0.236	0.290	0.367	0.264	0.058	0.210	-
t-Statistic/	2.21	-	-	-	-	-	-	-
(p_Value)	(0.028)	-	-	-	-	-	-	-
High - M. Low	0.174	0.306	0.255	0.278	0.172	0.049	0.153	-
t-Statistic/	2.85	-	-	-	-	-	-	-
(p_Value)	(0.004)	-	-	-	-	-	-	-

[a]A raw return is calculated as the 12-month buy-and-hold return of the firm starting the fifrth month after fiscal year-end. Return compounding ends the earlier of one year after return compounding starts or the last day of reported trading. If a firm delisted, the delisting return is assumed to be zero.

[b]A market-adjusted return equals the firm's 12-month buy-and-hold return (as defined in Panel A) less the buy-and-hold return on the value-weighted market index over the same investment horizon.

[c]A two-year raw return is calculated as the 24-month buy-and-hold return of the firm starting the fifth month after fiscal year-end. Return compounding ends the earlier of two years after return compounding starts or the last day of *CRSP* reported trading. If the firm delisted, the delisting return is assumed to be zero. A two-year market-value-adjusted return equals the firm's 24-month buy-and-hold return less the buy-and-hold return on the value-weighted market index over the same investment horizon.

APPENDIX A

One-Year Market-Adjusted Returns toa Hedge Portfolio Taking a Long position in Strong F_SCORE Firms and a Short Position in Weak F_SCORE Firms by Calendar Year

This appendix documents one-year market-adjusted returns by calendar year to a hedge portfolio taking a long position in firms with a strong *F_SCORE* (*F_SCORE* greater than or equal to 5) and a short position in firms with a poor *F_SCORE* (*F_SCORE* less than 5). Returns are cumulated over a one-year period starting four months after fiscal year-end. A market-adjusted return is defined as the firm's 12-month buy-and-hold return less the buy-and-hold return on the value-weighted market index over the same investment horizon.

Year	Strong F_SCORE Market-Adjusted Returns	Weak F_Score Market-Adjusted Returns	Strong - Weak Return Difference	Number of Observations
1976	0.394	0.371	0.022	340
1977	0.222	0.125	0.097	459
1978	0.035	-0.105	0.140	413
1979	0.181	0.062	0.118	449
1980	0.190	0.023	0.166	450
1981	0.343	0.277	0.066	554
1982	0.316	0.249	0.067	366
1983	0.097	-0.261	0.358	197
1984	-0.106	-0.250	0.144	654
1985	0.038	-0.113	0.150	342
1986	0.084	0.063	0.021	420
1987	-0.019	-0.096	0.077	741
1988	-0.074	-0.224	0.150	449
1989	-0.088	-0.092	0.004	544
1990	0.230	0.121	0.109	927
1991	0.410	0.205	0.205	409
1992	0.298	0.271	0.027	452
1993	0.122	0.137	-0.015	408
1994	0.015	-0.046	0.061	735
1995	0.009	-0.140	0.149	537
1996	0.081	-0.045	0.126	626
Average	0.124	0.013	0.110	-
t-Statistic			6.47	
(*p*-Value)			(0.000)	

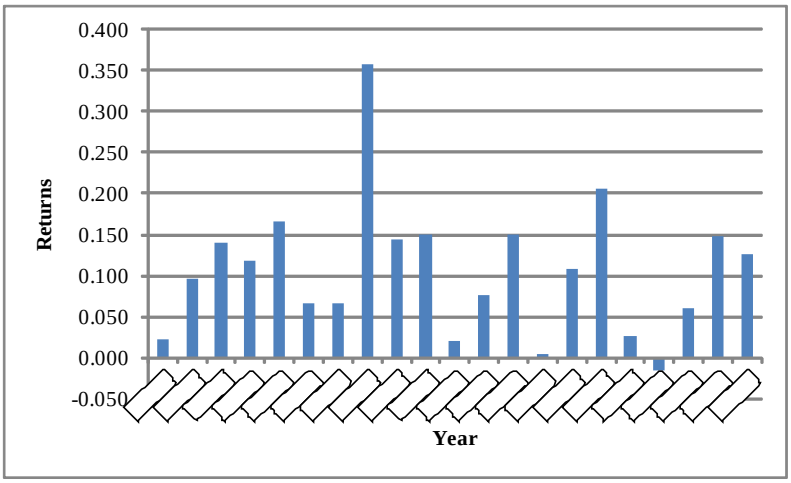

Fig. 1. - One-year market-adjusted returns to a hedge portfolio based on a fundamental analysis strategy by calendar year. This figure documents one-year market-adjusted returns by calendar year to a hedge portfolio taking a long position in firms with a strong F_SCORE (F_SCORE greater than or equal to 5) and a short position in firms with a weak F_SCORE (F_SCORE less than 5). Returns are cumulated over a one-year period starting four months after fiscal year-end. A market-adjusted return is defined as the firm's 12-month buy-and-hold return less the buy-and-hold return on the value-weighted market index over the same investment horizon.

APPENDIX B

Variable Definitions for BM ratio and Individual F_Score Signals

MVE	Market value of equity at the end of fiscal year t. Market value is calculated as the number of shares outstanding (CSHO) at fiscal year-end times closing share price (PRCC_F).
ASSETS	Total assets (AT) reported at the end of fiscal year t.
BM	Book value of equity at the end of fiscal year t, scaled by *MVE*.
	Book value is equal to the book value of stockholders' equity (SEQ) + balance sheet deferred taxes and investment tax credit, if available (TXDITC) - book value of preferred stock based on redemption value (PSTKRV). Where the redemption value (PSTKRV) is missing, book value of preferred stock is estimated by liquidation value (PSTKL), or par value (UPSTK). Finally, if redemption (PSTKRV), liquidation (PSTKL) or par value (UPSTK) are not available then book value is equal to book value of stockholders' equity (SEQ) + balance sheet deferred taxes and investment tax credit (TXDITC).[a]
ROA	Net income before extraordinary items (IB) for the fiscal year preceding portfolio formation scaled by total assets (AT) at the beginning of year t. If *ROA* > 0 then *F_ROA* = 1.
Δ*ROA*	Change in annual *ROA* for the year preceding portfolio formation. Δ*ROA* is calculated as *ROA* for year t less the firm's *ROA* for year t-1. If Δ*ROA* > 0 then *F_*Δ*ROA* = 1.
Δ*MARGIN*	Gross margin is equal to net sales (SALE) less cost of good sold (COGS) for the year preceding portfolio formation, scaled by net sales (SALE) for the year, less the firm's gross margin (scaled by net sales (SALE)) from year t-1. If Δ*MARGIN* > 0 then *F_* Δ*MARGIN* = 1.
CFO	Cash flow from operations scaled by total assets at the beginning of year t. If *CFO* > 0 then *F_CFO* = 1. Cash flow from operations is equal to incoem before extraordinary items (IB) less: the change in current assets (ACT) from year t-1 to year t, the change in cash and cash equivalents (CSHE) from year t-1to year t, the change current liabilities (LCT) from year t-1 to year t, the change in debt included in current liabilities (DLC) from year t-1 to year, the change in deferred tax and investment tax credit (TXDITC) from year t-1 to year t, and depreciation (DP).[b]
Δ*LIQUID*	Change in the firm's current ratio between the end of year t and year t-1. Current ratio is defined as total current assets (ACT) divided by total current liabilities (LCT). If Δ*LIQUID* < 0 then *F_* Δ*LIQUID* = 1.
Δ*LEVER*	Change in the firm's debt-to-assets ratio between the end ofyear t and year t-1. The debt-to-asset ratio is defined as the firm's total long-term debt (DLTT) (including the portion of long-term debt classified as current (DDL)) scaled by average total assets (AT). If Δ*LEVER* < 0 then *F_*Δ*LEVER* = 1.
Δ*TURN*	Change in the firm's asset turnover ratio between the end of year t and year t-1. The asset turnover ratio is defined as net sales (SALE) scaled by average total assets (AT) for the year. If Δ*TURN* > 0 then *F_*Δ*TURN* = 1.
ACCRUAL	Net income before extraordinary items (IB) less cash flow from operations, scaled by total assets (AT) at the beginning of year t. If *CFO* > *ROA* then *F_ACCRUAL* = 1.
EQ_OFFER	If a firm does not issues common equity (SSTK) in the year preceding portfolio formation, *F_EQ_OFFER* = 1.
R_RET	One-Year (Two-Year) Raw Return = 12- (24-) buy-and-hold return of the firm starting at the beginning of the fifth month after fiscal year-end. Return compounding ends the earlier of one year (two years) after return compounding started on the last day of *CRSP* reported trading. If the firm delisted, the delisting return is assumed to be zero.
MA_RET	Market-Adjusted Return = buy-and-hold return of the firm less the buy-and-hold return on the value-weighted market index over the same investment horizon.

[a] This specification is taken from Kenneth R. French's research website, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. I also consider an alternative measure of book value, book value per share (BKVLPS) times closing share price (CSHO), which was similar to the specification outlined above, but resulted in lower book-to-market ratios, and therefore, generated results further from Piotroski (2000).

[b] I also consider an alternative measure of cash flow from operations (OANCF). This Compustat variable was poorly populated for the sample period. As such, I relied on the above specification.