

Quantitative Research

Expert Insights

Enhanced Value Investing



The Credit Suisse Academic series of reports provides insights to portfolio managers from leading academic journals. We deliver academic knowledge to portfolio managers to use in their day to day investment process.

The “value anomaly” is the well documented tendency for stocks with high book-to-market ratio to outperform. As high book to market is also an indicator of financial distress, we find that less than half of high book-to-market firms achieve positive abnormal returns. The value anomaly is mainly due to the outperformance of high quality, high book-to-market firms. To identify these stocks, Professor Joseph D. Piotroski of the University of Chicago devised a metric called the F_SCORE. The F_SCORE is calculated using a firm’s profitability, financial leverage/liquidity, and operating efficiency. This is the fourth report in our Academic Series of reports.

- **High F_SCORE Firms Outperform:** Within the high book-to-market universe (Russell 1000 Value in our case), firms with an F_SCORE of 9 (the maximum value) had an annualized return of 14.0% and those with a score of 8 returned 12.8% over our 32-year observation period. Low F_SCORE firms (those with scores of 3 or lower) returned 7.5% during the same period. The annualized return for the Russell 1000 Value is 11.8%.
- **Stocks with High and Low F Scores:** We provide a selected list of stocks from Russell Value indexes and covered by CS Analysts.

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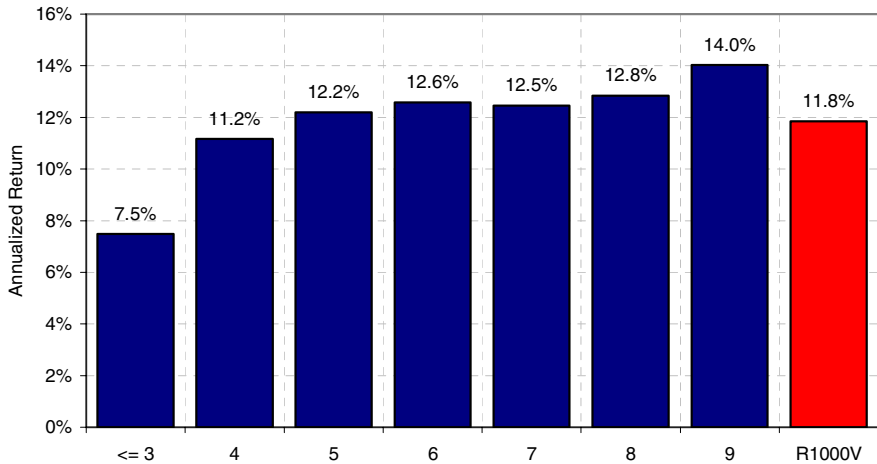
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Exhibit 1: F_SCORE Portfolios

Universe: Russell 1000 Value, 3/1980–3/2012, Annualized Returns



Source: Credit Suisse Quantitative Equity Research.

DISCLOSURE APPENDIX CONTAINS IMPORTANT DISCLOSURES, ANALYST CERTIFICATIONS, INFORMATION ON TRADE ALERTS, ANALYST MODEL PORTFOLIOS AND THE STATUS OF NON-U.S ANALYSTS. FOR OTHER IMPORTANT DISCLOSURES, visit www.credit-suisse.com/researchdisclosures or call +1 (877) 291-2683. U.S. Disclosure: Credit Suisse does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the Firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Academic Series

This report is a part of the Credit Suisse Quantitative Research Academic Series. The Credit Suisse Academic Series is designed to provide insights to portfolio managers from leading academic research. Our goal is to keep portfolio managers in touch with the academic world, highlighting the latest alpha signals before they become beta signals.

Please feel free to suggest academic journals or research papers for our Academic Series analysis. Potential focus papers currently include:

Messod D. Beneish, *The Detection of Earnings Manipulation*, June 1999

Our first report in this series was published in January 2012. We received very positive feedback from clients.

Academic Series Reports

(1) Trading Around Earnings, January 13, 2012

(This report was based on Zhipeng Yan, CFA, and Yan Zhao, *When Two Anomalies Meet: The Post-Earnings Announcement Drift and the Value-Glamour Anomaly*, Financial Analysts Journal, Volume, 67–Number 6, 2011.)

We publish a list of stocks that meet criteria based on our report during earnings season to enable portfolio managers interested in utilizing this research in their investment process.

(2) Equity Duration, February 29, 2012

Applies the fixed income risk measure of duration to the equity asset class.

(This report was based on Patricia Dechow, Richard Sloan, and Mark Soliman, *Implied Equity Duration: A New Measure of Equity Risk*, Review of Accounting Studies, 9, 197-228, 2004.)

(3) The Potential of Price Momentum, June 29, 2012

Focuses on the momentum anomaly.

(This report was based on Narasimhan Jegadeesh and Sheridan Titman, *Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency*, The Journal of Finance, Volume XLVIII, No. 1, March 1993.)

The Value Investing Anomaly

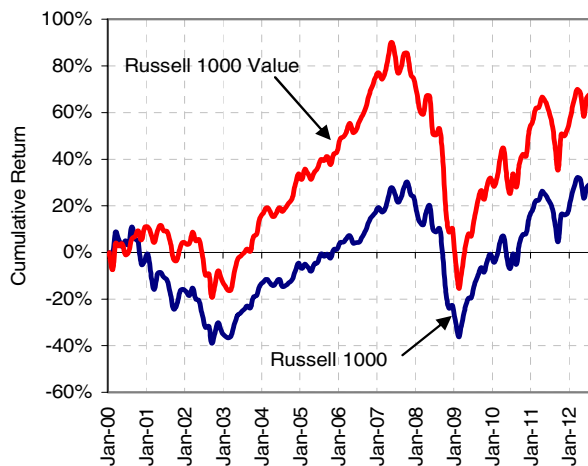
Evidence in Industry

The “value anomaly” in finance refers to the propensity for value stocks, as defined by stocks with high book-to-market ratios to outperform growth stocks. We tested this anomaly over a period of 32 years beginning in January 1980.

The following chart displays the cumulative return of the Russell 1000 and Russell 1000 Value indices, normalized by their starting values for comparison purposes. To date, the Russell 1000 Value has a greater cumulative return than the Russell 1000. The Russell 1000 Value includes firms with greater book-to-price ratios. Russell uses book to price for value and forecast long-term earnings growth and historical growth of sales per share for growth to classify into growth and value indexes.

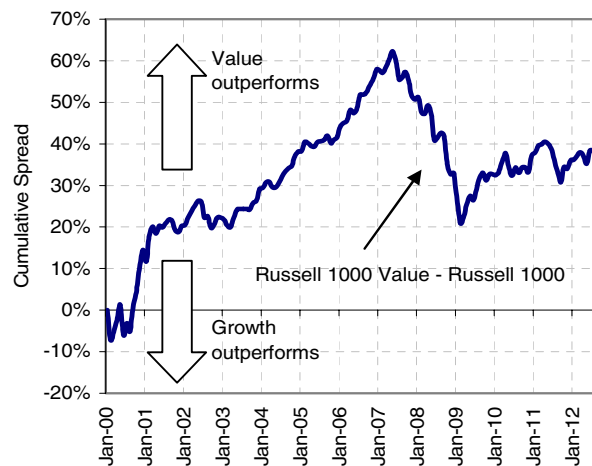
We use the book-to-market ratio as a component of our Traditional Value factor

Exhibit 2: Russell 1000 Value vs. Russell 1000
Cumulative Return, January 2000–Present



Source: Credit Suisse Quantitative Equity Research.

Exhibit 3: Russell 1000 Value vs. Russell 1000 Spread
Cumulative Spread, January 2000–Present



Source: Credit Suisse Quantitative Equity Research.

Evidence in Academia

The value anomaly has been well documented in academic literature, including in Fama French 1992. In the paper, *The Cross-Section of Expected Stock Returns*, Professors Eugene Fama and Kenneth French find that the book-to-market ratio explains the cross sectional variation in stock returns along with the market beta and firm size.

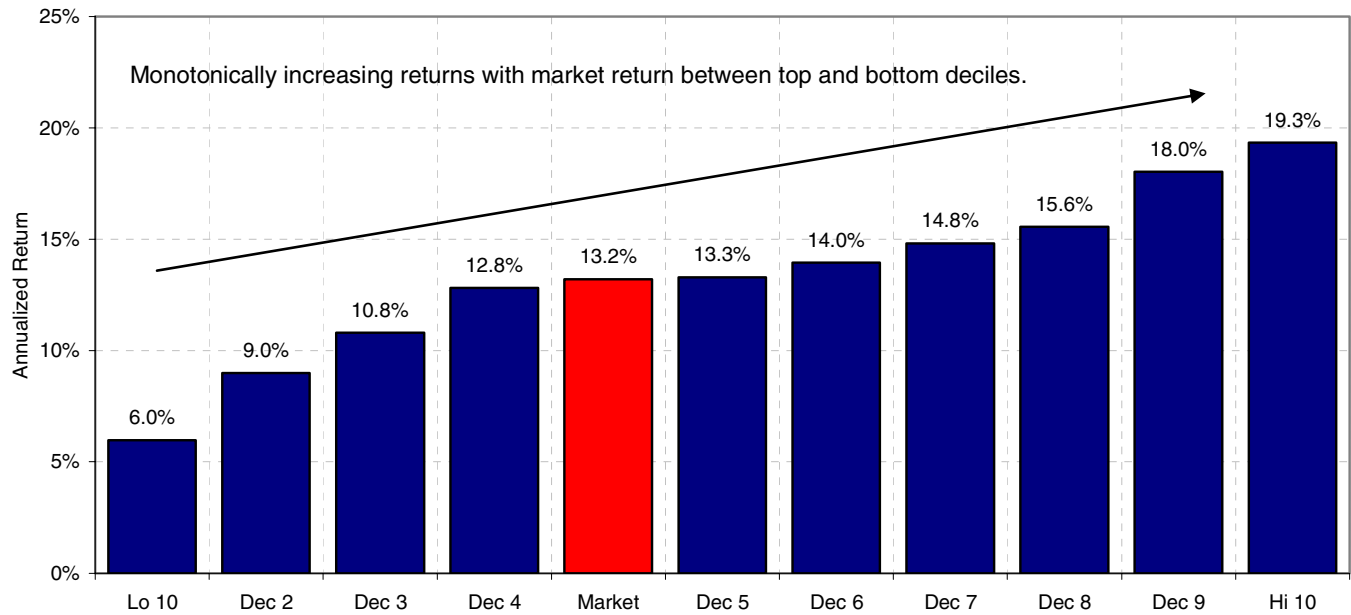
Professor French provides the return series for these factors on his website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). Specifically, he provides decile returns based on the book-to-market ratio for firms with positive book value. The monthly return series data spans from July 1926 to December 2011 and includes all NYSE, AMEX, and NASDAQ firms with available data.

Professor Kenneth French confirms the value anomaly

Using the monthly return series, we calculate the annualized rate of return for each decile. We find the returns monotonic in nature. Firms with high book-to-market ratios tend to have greater annualized returns. In addition, we calculated the return for Professor French’s stock universe. This market return lies between deciles 4 and 5. Stocks with low book-to-market ratios underperform the market, while those with high book-to-market ratios outperform the market in Professor French’s data.

Exhibit 4: Book-to-Market Deciles, Annualized Return

Universe: NYSE, AMEX, and NASDAQ stocks, July 1926–December 2011, Compound Annual Return

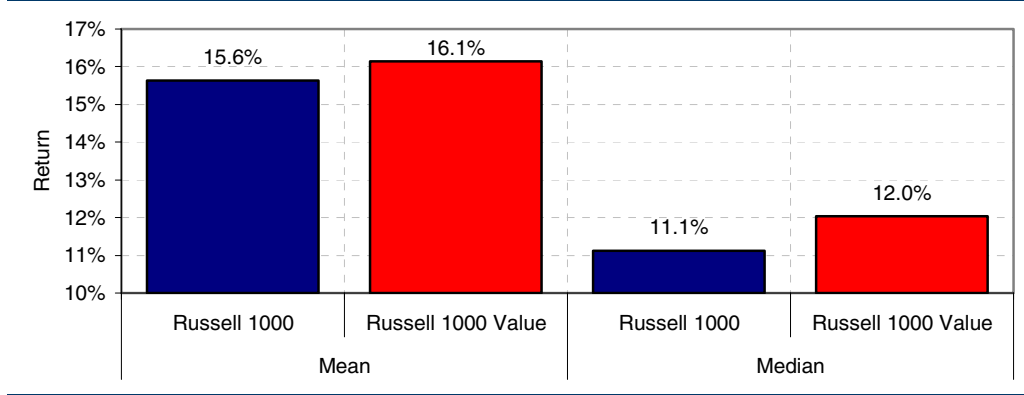


Source: Professor Kenneth French - Tuck School of Business at Dartmouth University, Credit Suisse Quantitative Equity Research.

Wiggle Room in Value Investing

Can the efficacy of the book-to-price ratio as an alpha factor be improved further? Professor Joseph D. Piotroski of the University of Chicago's business school certainly thinks so, for a reason related to the returns of high book-to-market stocks. The mean and median return of Russell 1000 Value stocks are greater than that of Russell 1000 stocks. This is not surprising, given the aforementioned value anomaly. We measure annual returns starting in March of 1980.

Exhibit 5: Mean and Median Stock Returns in High B/M Universe
Russell 1000 index, Value, Mean and Median Stock Return, Annually, 3/1980–Present



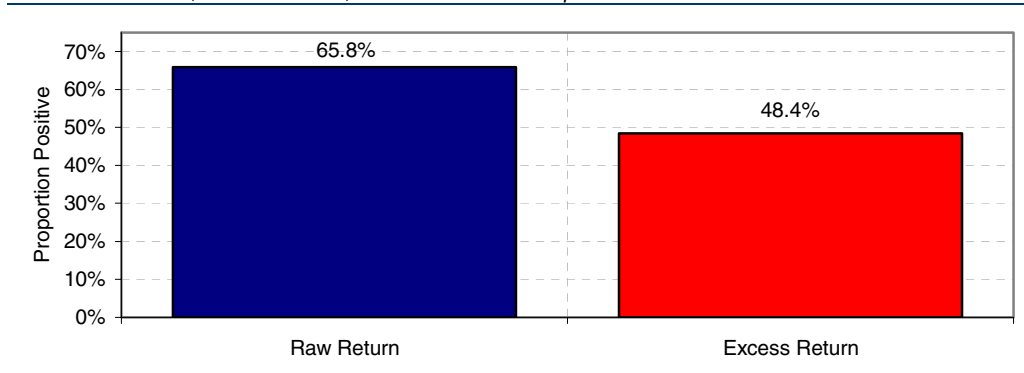
The mean and median value stock returns are higher than the universe mean and median

Source: Credit Suisse Quantitative Equity Research.

Although the Russell 1000 Value typically outperforms the Russell 1000, less than 50% of Russell 1000 Value stocks have positive excess returns. This seems to produce conflicting information. On one hand, the average and median returns are greater than the benchmark level, on the other hand, more than one-half of the high book-to-market stocks have negative excess returns.

From these results, we can infer that there is some wiggle room in the high book-to-market universe; there has to be a subset of high book-to-market stocks that are responsible for driving up the group's returns, while the majority of high book-to-market stocks drag down returns. High book-to-market ratios can be an indicator of financially distressed stocks. If we can isolate the class of high-quality stocks from the distressed stocks, we would have a set of assets which enjoy the value anomaly, are relatively underpriced with respect to their balance sheet equity value, and are high quality. Professor Piotroski has found a way to do this using a metric he calls the F_SCORE.

Exhibit 6: Proportion of High Book-to-Market Stocks with Positive Returns
Russell 1000 Value, 3/1980–3/2012, Positive return decomposition



More than half the value stocks have negative excess returns

Source: Credit Suisse Quantitative Equity Research.

What Is the F_SCORE?

Professor Piotroski created a metric called the F_SCORE to differentiate between higher quality and financially distressed firms with high book-to-market ratios. The signal is the sum of nine binary factors aimed to measure a company's profitability, financial leverage and liquidity, and operating efficiency. As some of the components of the F_SCORE can be ambiguous in determining the quality of a firm with a random state, it is specifically meant to be applied to firms facing financial distress. The nine factors of the F_SCORE are defined in the following table. The F_SCORE is calculated as the sum of these nine factors.

Exhibit 7: Components of the F_SCORE

Binary signals in the F_SCORE as defined by Professor Piotroski

Type	Factor	Definition	Value
Profitability	ROA	Net income before extraordinary items / beginning of the year total assets.	If positive 1, 0 otherwise.
	CFO	Cash flow from operations / beginning of the year total assets.	If positive 1, 0 otherwise.
	ΔROA	Current year's ROA factor - previous year's ROA factor.	If positive 1, 0 otherwise.
	ACCRUAL	ROA – CFO.	If negative 1, 0 otherwise.
Leverage, Liquidity, Source of Funds	ΔLEVER	Current year's debt to asset ratio - previous year's ratio.	If negative 1, 0 otherwise.
	ΔLIQUID	This year's current ratio - last year's current ratio.	If positive 1, 0 otherwise.
	EQ_OFFER	Whether common equity has been issued in the given year.*	If no issuance 1, 0 otherwise.
Operating Efficiency	ΔMARGIN	Current year's gross margin - previous year's gross margin.	If positive 1, 0 otherwise.
	ΔTURN	Current year's total assets / total sales - previous year's total assets / total sales.	If positive 1, 0 otherwise.

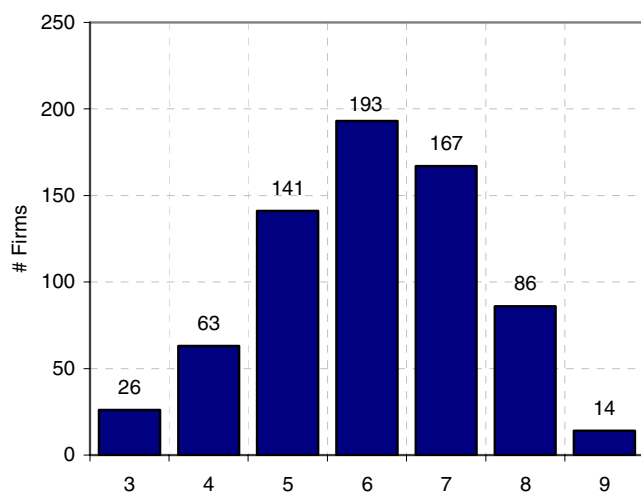
Source: Piotroski (2002)

* - A 10% or greater split-adjusted share increase is used as proxy for common equity issuance.

The distribution of the F_SCORE is skewed to the left. In other words, relatively few companies have a low F_SCORE compared with the number of firms with higher scores. As such, in most of our tests we create a low F_SCORE basket, which contains firms whose score is less than or equal to three.

Exhibit 8: Current F_SCORE Distribution

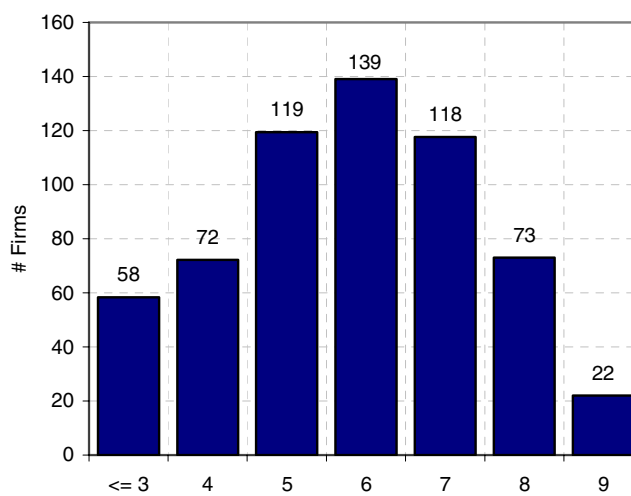
Russell 1000 Value, As of August 2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 9: Average F_SCORE Distribution

Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Portfolio managers using a value index as their stock picking universe can further narrow down their list stock by focusing on buy candidates with high F_SCOREs. Stocks already in their portfolio with low F_SCOREs should be carefully evaluated and may potentially become sell candidates. Ideally, they should be replaced with high F_SCORE stocks in the same industry. This process can be used as an overlay to the existing investment process for a portfolio manager.

Exhibit 10: F_SCORE Process

1. Start with investment universe (Russell 1000)



2. Select high book-to-market stocks (Russell 1000 Value)



3. Calculate F_SCORE



4. Serve high F_SCORE stocks



Source: Credit Suisse Quantitative Equity Research.

F_SCORE as a Quality Detector

Professor Piotroski find the F_SCORE to be a particularly successful differentiator of high- and low-quality stocks with high book-to-market ratios. We run similar tests with assumptions more reasonably used in practice. It is typical for academics to test the largest sample of stocks they have available to achieve a high confidence in their results.

Practitioners, on the other hand, must be careful with their sample selection. Highly illiquid stocks, stocks absent from common benchmarks, and stocks with very low market cap may be omitted, for example, to mimic asset manager’s selection universes. In testing long-short strategies in practice, stocks with particularly high borrow costs may also be omitted. Exhibit 11 outlines the differences in our initial conditions from Professor Piotroski’s.

Exhibit 11: Initial Conditions for Testing the F_SCORE

Differences in testing methodology between Professor Piotroski and Credit Suisse

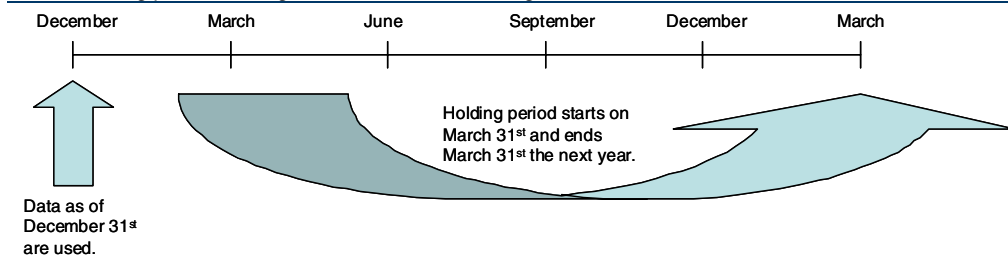
Parameter	Professor Piotroski	Credit Suisse
Universe	All COMPUSTAT securities with data	Russell 1000
Sample Period	1976 - 1996	1980 - 2012
Formation Period	5 month lag after fiscal year end	3 month lag after calendar year end
Return (Long/Short)	23.5%	8.3%(Arithmetic), 6.2% (Geometric)
T -Statistic	5.6	1.8
Holding Period	1 year, 2 years	1 year
High B/M Definition	Top quintile of universe	Russell 1000 Value
Constraints	None	We omit stocks with > 200% annual return
Paper Length	39 Pages	16

Source: Credit Suisse Quantitative Equity Research.

Fundamental data used for construction of the F_SCORE components in our tests comes from COMPUSTAT. Bottom line Operating Activities – Net Cash Flow is available starting 1987; however, our sample period begins in 1980. When not available, trailing-12-month cash flow from operations is proxied by annual available constituents from the Statement of Cash Flows.

Exhibit 12: Rebalance Frequency and Holding Period for Credit Suisse Tests

Annual holding period starting at end of Q1, 3 month lag in data used



Source: Credit Suisse Quantitative Equity Research.

The tests run test the efficacy of the F_SCORE as a differentiator between high book-to-market stocks. They are primarily concerned with assessing the performance differences between a high F_SCORE portfolio and a low F_SCORE portfolio within the high book-to-market universe, and the high F_SCORE portfolio and the high book-to-market universe as whole.

Professor Piotroski’s results include an orderly monotonically increasing relationship between F_SCORE and return distributions. Using our practical assumptions, the results of our tests are not perfectly monotonic but do tell the same story.

We use practical testing parameters that incorporate constraints used by money managers

The F_SCORE is used to differentiate high-quality stocks conditional on a firms in financial distress

A Note on Return Calculations

The returns we present to summarize our results are calculated in a manner realizable by actual investors. We provide an annualized return number by computing the Compound Annual Growth Rate (CAGR), the geometric average rate of return. These calculations treat the segmentation of stocks by F_SCORE each year as equal weighted portfolios. These portfolios can actually be constructed and held by investors.

We also provide the distribution of annual returns for each F_SCORE portfolio. In this sense, the portfolio return for each year is the random variable whose distribution we wish to analyze. This makes practical sense as the portfolio management process is concerned with continuously constructing portfolios and holding them to generate returns between rebalance points.

Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers takes a different approach to analyzing returns. This paper aggregates returns by F_SCORE value regardless of portfolio formation year. The distribution of stock returns within each of these F_SCORE groups is then analyzed. The issue with this is that these returns are not actually realizable. A portfolio manager cannot realize the returns of high F_SCORE stocks during two different holding periods simultaneously.

The author boasts a return of 23.5% on average with a t-statistic of 5.6 for a portfolio that buys high F_SCORE stocks (those rated 8 or 9) and sells low F_SCORE stocks (those rated 0 or 1). In contrast, in our test, which is restricted to the Russell 1000 universe to limit difficult to trade names and considers annual returns as the random variable, we achieve an arithmetic long/short return of 8.3% and annualized geometric return of 6.2%. As we recognize only 33 observations (one for each year in our sample), our t-statistic is much lower at 1.8. The following table shows the author's results for raw returns over a one-year holding period.

Exhibit 13: Summary of Returns From Academic Paper

Table 3, Panel B from Piotroski (2002)

Panel B: 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
Low F_Score	0.078	-0.589	-0.300	-0.027	0.270	0.773	0.460	396
High F_Score	0.313	-0.267	-0.074	0.166	0.484	0.955	0.672	1448
High—All	0.074	0.124	0.076	0.061	0.046	0.053	0.062	—
t-stat/(p-value)	3.279	—	—	(0.000)	—	—	(0.000)	—
Bootstrap Rslt (p-value)	1/1000 (0.001)	0/1000 (0.000)	0/1000 (0.000)	0/1000 (0.000)	16/1000 (0.016)	110/1000 (0.110)	— —	— —
High—Low	0.235	0.322	0.226	0.193	0.214	0.182	0.212	—
t-stat/(p-value)	5.594	—	—	(0.000)	—	—	(0.000)	—
Bootstrap Rslt (p-value)	0/1000 (0.000)	0/1000 (0.000)	0/1000 (0.000)	0/1000 (0.000)	0/1000 (0.000)	28/1000 (0.028)	— —	— —

Source: Piotroski (2002).

In practice, performance is considered over time

Sometimes academics consider returns as one large sample, disregarding in which period they occurred. These returns are not realizable in practice

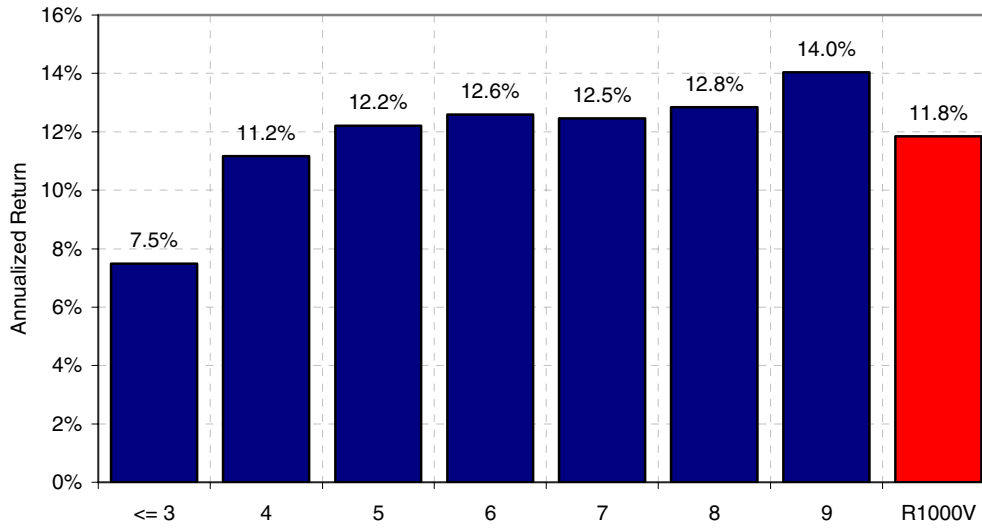
The Efficacy of the F_SCORE

We find, as Professor Piotroski finds, that the F_SCORE can differentiate between high- and low-quality stocks with high book-to-market ratios. Analyzing the annual returns for each F_SCORE group, we observe that the low F_SCORE portfolio has the lowest mean geometric return (7.5%), while the portfolio with F_SCORE = 9 has the greatest (14.0%). We also observe that portfolios with lower F_SCORE values have lower returns than portfolios with greater F_SCORE values.

Exhibit 14: F_SCORE Portfolios

Universe: Russell 1000 Value, 3/1980–3/2012, Annual returns

High F_SCORE stocks outperform low F_SCORE stocks

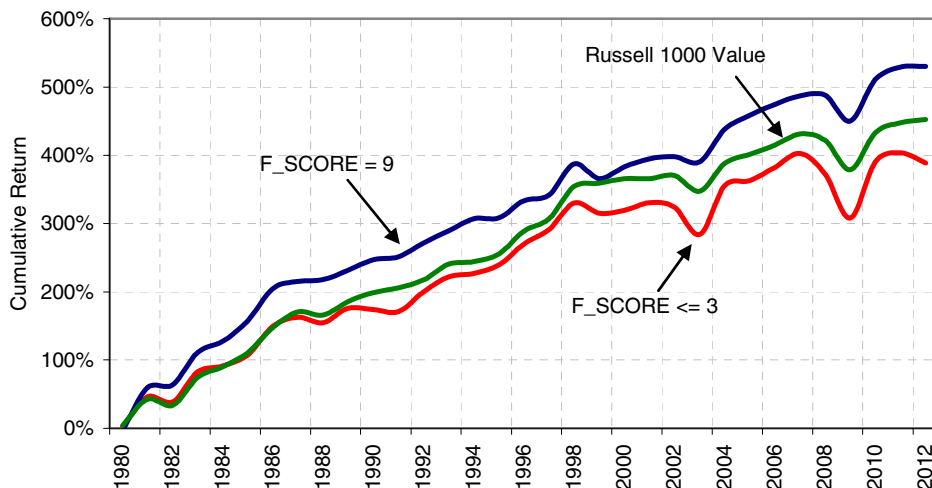


Source: Credit Suisse Quantitative Equity Research.

Exhibit 15: Cumulative Return for Selected F_SCORE Portfolios

Universe: Russell 1000 Value, 3/1980–3/2012, Portfolios for F_SCORE <= 3 and F_SCORE = 9

High F_SCORE stocks outperform high book-to-market stocks



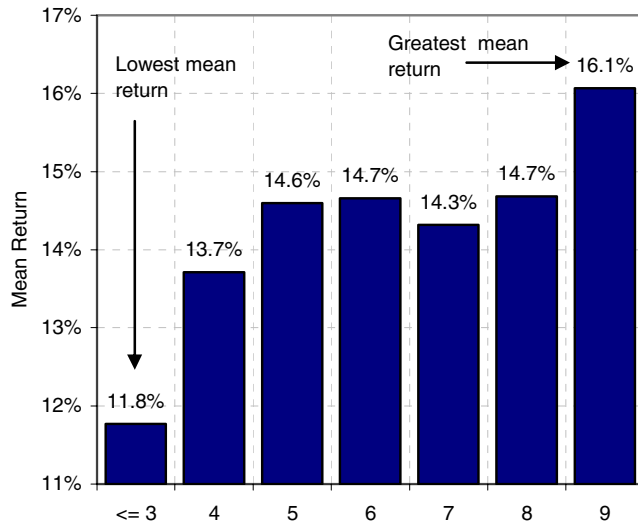
Source: Credit Suisse Quantitative Equity Research.

In addition to outperforming the low F_SCORE portfolio, the high F_SCORE portfolio also outperforms our high book-to-market universe, the Russell 1000 Value index. The annualized for the high F_SCORE portfolio is 14.0%, while the return for the Russell 1000 Value is 11.8%.

Analyzing distributions of raw and excess returns yields similar results. The portfolios with F_SCORE = 9 and F_SCORE = 8 have mean returns of 16.1% and 14.7%. The portfolios with F_SCORE <= 3 and F_SCORE = 4 have mean returns of 11.8% and 13.7%.

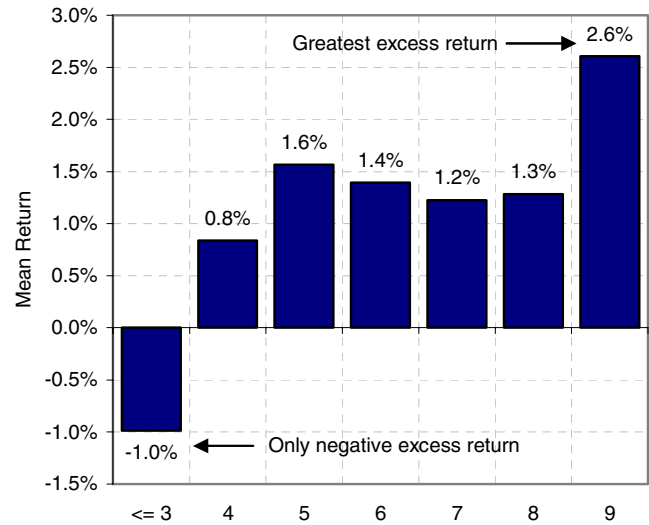
The portfolio with F_SCORE = 9 has the greatest mean excess return of 2.6%, while the portfolio with F_SCORE <= 3 has the only negative mean excess return of -1.0%.

Exhibit 16: F_SCORE Portfolios
Mean Annual Returns, Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 17: F_SCORE Portfolios
Mean Annual Excess Returns, Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

The following table shows the raw and excess return distributions for each F_SCORE portfolio and the Russell 1000 Value index.

Exhibit 18: Return Distributions for F_SCORE Portfolios
Universe: Russell 1000 Value by F_SCORE Portfolios, 3/31/1980–3/31/2012, Annual Return Distribution

Return Type	Percentile	<= 3	4	5	6	7	8	9	R 1000 V
Raw Return	25%	-3.2%	1.1%	1.0%	2.8%	3.5%	1.7%	3.2%	4.4%
	50%	12.4%	12.6%	13.9%	15.1%	13.6%	12.6%	15.2%	13.2%
	75%	22.0%	28.8%	22.4%	23.5%	24.4%	20.2%	20.1%	22.6%
Excess Return	25%	-10.5%	-7.6%	-5.9%	-4.5%	-3.4%	-3.9%	-3.7%	
	50%	0.3%	-0.5%	0.6%	1.4%	1.6%	1.1%	2.4%	
	75%	4.3%	4.2%	6.6%	6.4%	5.3%	7.7%	10.9%	

Source: Credit Suisse Quantitative Equity Research.

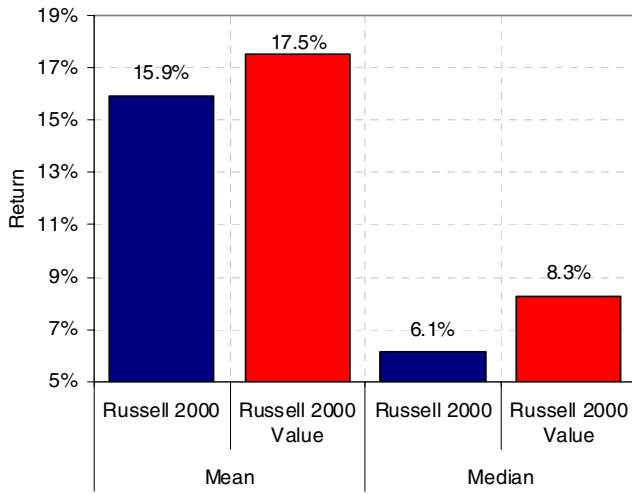
F_SCORE in Size Partitions

To ensure the robustness of the F_SCORE, Professor Piotroski attempts to eliminate the small size anomaly by testing the factor in subsamples which discriminate on size. We take a similar approach but test out of sample in a small-cap universe; namely the Russell 2000 using the Russell 2000 Value as our proxy for high book-to-market stocks.

To lay the groundwork in the small-cap universe, we confirm the potential for quality discrimination in a high book-to-market universe. The mean and median returns of stocks in the Russell 2000 Value are greater than stocks in the Russell 2000, but only 46% of Russell 2000 Value stocks generate positive excess returns.

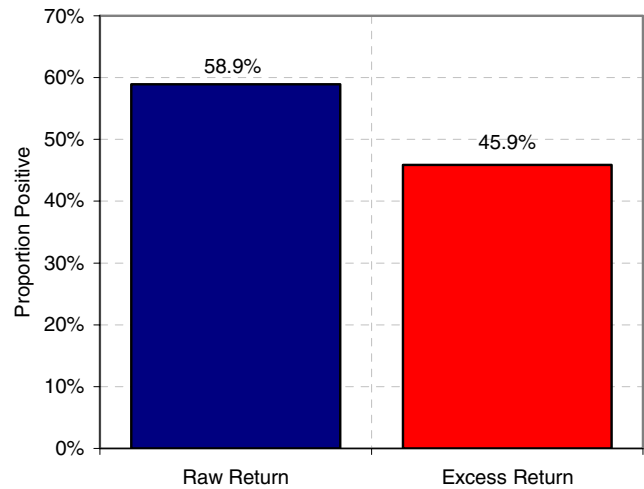
There is room for differentiation of high book-to-market stocks in the small-cap universe

Exhibit 19: Superior Returns of Value Stocks on Average
Russell 2000/Value, Annually, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 20: High B/M Stocks with Positive Returns
Russell 2000 Value, 3/1980–3/2012, Positive return decomposition

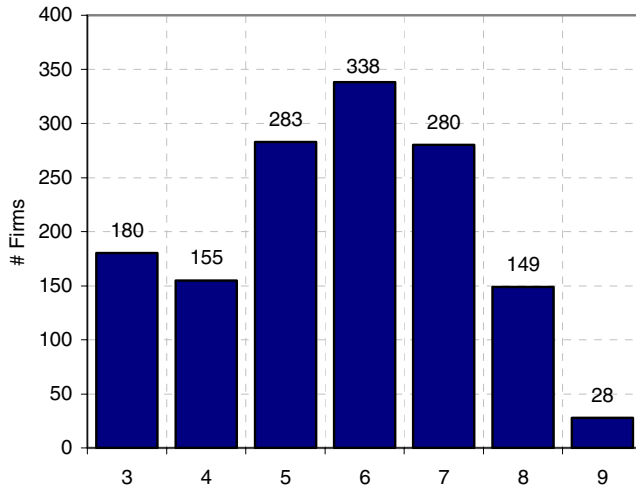


Source: Credit Suisse Quantitative Equity Research.

We notice that there is a much greater percentage of low F_SCORE firms in the small-cap universe than the large-cap universe. On average, there are 259 Russell 2000 Value firms in the low F_SCORE portfolio and 38 in the high F_SCORE portfolio.

Exhibit 21: Current F_SCORE Distribution

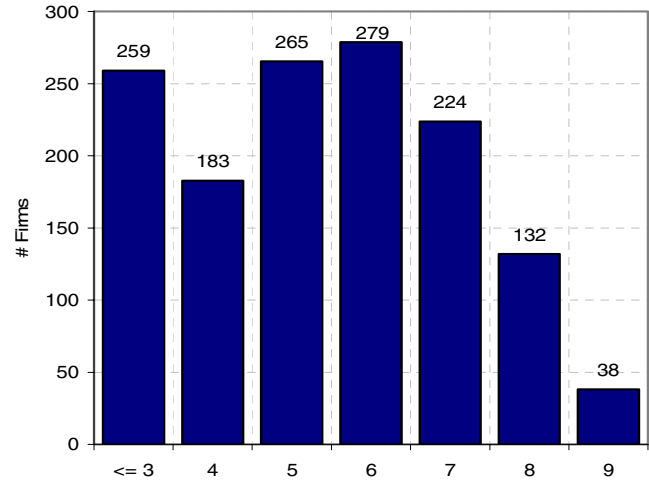
Russell 2000 Value, As of August 2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 22: Average F_SCORE Distribution

Russell 2000 Value, 3/1980–3/2012

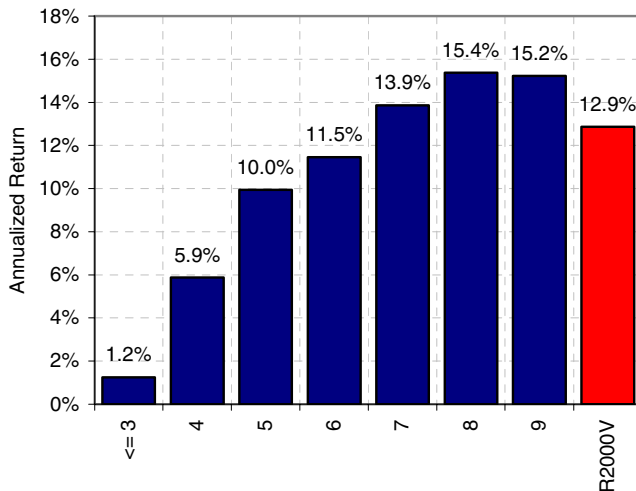


Source: Credit Suisse Quantitative Equity Research.

The performance results in the small-cap universe are similar to those in the large-cap universe. High F_SCORE firms outperform low F_SCORE firms, although the small-cap sample firms with F_SCORE = 8 had a slightly higher annualized return (15.4%) than firms with an F_SCORE = 9 (15.2%). We note, however, both of these portfolios outperformed firms with an F_SCORE <= 3 (1.2%) and with an F_SCORE = 4 (5.9%). High F_SCORE firms also outperformed the high book-to-market portfolio, which had an annualized return of 12.9%.

Exhibit 23: F_SCORE Portfolios

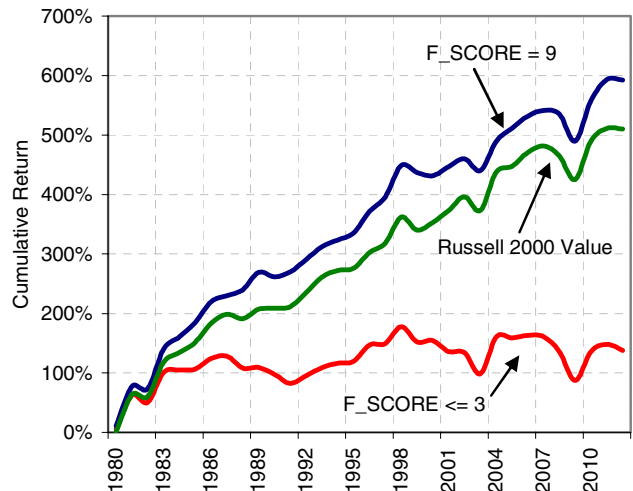
Universe: Russell 2000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 24: Cumulative Return for Selected F_SCOREs

Universe: Russell 2000 Value, 3/1980–3/2012, F_SCORE <= 3, = 9



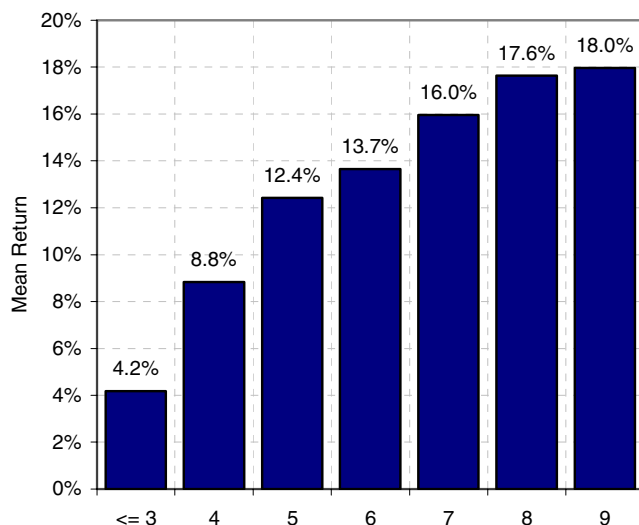
Source: Credit Suisse Quantitative Equity Research.

Although the high F_SCORE portfolio did not achieve the greatest annualized returns, the higher F_SCORE portfolios have greater mean returns than the lower F_SCORE portfolios. The mean excess returns were monotonic with the F_SCORE <= 3 portfolio having the lowest returns and the F_SCORE = 9 portfolio having the greatest positive returns.

Small-cap high F_SCORE stocks outperform small-cap low F_SCORE stocks

Exhibit 25: F_SCORE Portfolios

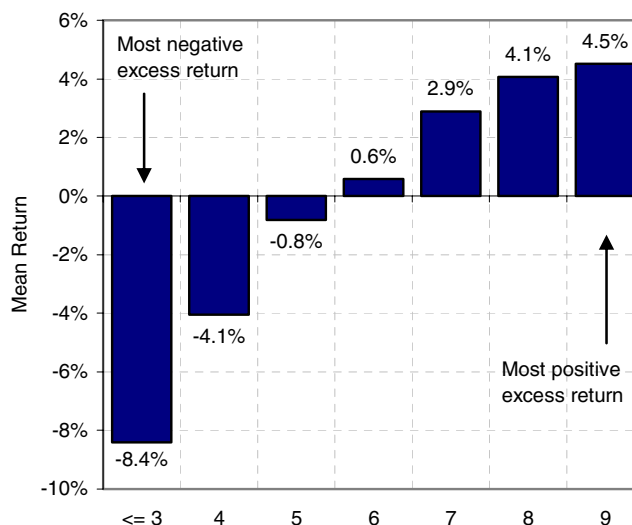
Mean Annual Returns, Russell 2000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 26: F_SCORE Portfolios

Median Annual Excess Returns, Russell 2000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

The following table shows the raw and excess return distributions for each F_SCORE portfolio and the Russell 2000 Value index.

Exhibit 27: Return Distributions for F_SCORE Portfolios

Universe: Russell 2000 Value by F_SCORE Portfolios, 3/31/1980–3/2012, Annual Return Distribution

Return Type	Percentile	<= 3	4	5	6	7	8	9	R 2000 V
Raw Return	25%	-11.5%	-3.8%	-0.1%	4.7%	7.0%	8.0%	8.3%	2.3%
	50%	2.5%	8.2%	11.4%	12.2%	15.3%	19.3%	15.6%	15.8%
	75%	13.4%	20.1%	22.5%	23.3%	23.7%	25.0%	29.1%	23.8%
Excess Return	25%	-12.0%	-8.9%	-7.6%	-3.3%	-0.9%	1.2%	-0.7%	
	50%	-8.9%	-4.3%	-0.2%	-0.4%	2.2%	3.5%	5.9%	
	75%	-2.6%	-0.4%	4.2%	3.6%	4.5%	9.7%	10.8%	

Source: Credit Suisse Quantitative Equity Research.

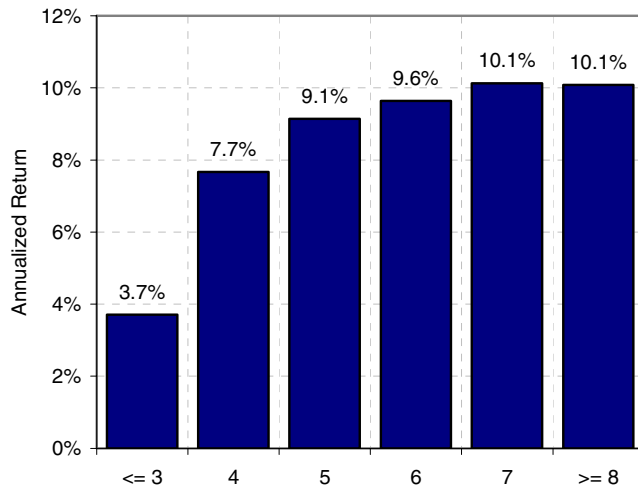
F_SCORE in Price Partitions

To determine whether the outperformance of high F_SCORE firms is driven by low-priced stocks, the universe is partitioned by stock price. Professor Piotroski uses small, medium, and large price groups based on the price distribution of all COMPUSTAT firms. We subdivide Russell 1000 firms into two size partitions using a stock price of \$20. Because F_SCORE portfolios have fewer firms within each price partition, we let stocks with a score of 8 or 9 be included in our high F_SCORE portfolio.

High F_SCORE stocks with high prices outperform low F_SCORE stocks with high prices. The same is true in a low-priced price partition

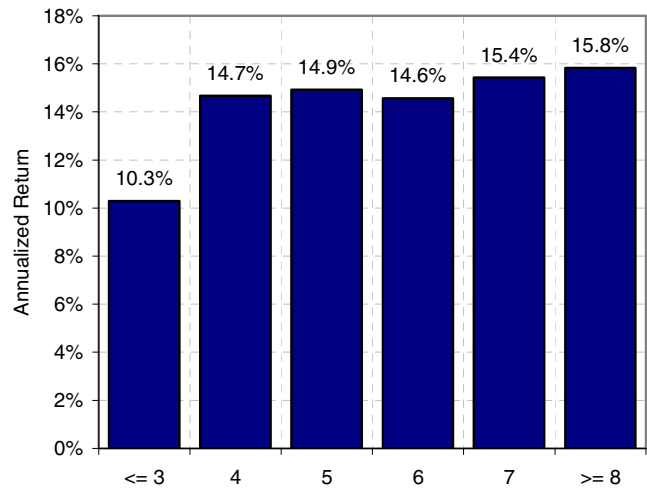
In the large-cap universe, stocks with higher F_SCOREs produce greater returns than lower F_SCORE firms in the high and low price divisions. The following charts show the annualized returns for each F_SCORE portfolio in their respective price groups.

Exhibit 28: High Price F_SCORE Portfolios
Russell 1000 Value, 3/1980–3/2012, Price > \$20



Source: Credit Suisse Quantitative Equity Research.

Exhibit 29: Low Price F_SCORE Portfolios
Russell 1000 Value, 3/1980–3/2012, Price <= \$20



Source: Credit Suisse Quantitative Equity Research.

The following table summarizes the distribution annual returns in portfolios defined by F_SCORE and price partition over our sample period.

Exhibit 30: Distribution of Returns by Price Segment

Universe: Russell 1000 Value, Price Division: \$20, Annual Portfolio Returns, 3/1980–3/2012

Return Type	Price Segment	Percentile	<= 3	4	5	6	7	>= 8
Raw	High	25%	-6.6%	-0.9%	1.4%	1.4%	2.7%	3.1%
		50%	8.9%	8.4%	8.4%	12.1%	11.9%	8.0%
		75%	17.9%	26.1%	17.2%	20.7%	18.4%	19.6%
	Low	25%	0.4%	5.0%	8.8%	4.8%	5.8%	5.5%
		50%	16.7%	17.6%	17.2%	19.4%	14.6%	16.0%
		75%	33.9%	29.0%	27.3%	27.0%	26.1%	29.3%
Excess	High	25%	-11.3%	-11.0%	-6.1%	-6.8%	-7.0%	-8.9%
		50%	-5.5%	-2.9%	-2.7%	-1.7%	-0.9%	-0.7%
		75%	1.1%	1.2%	2.3%	4.8%	3.1%	3.7%
	Low	25%	-10.9%	-6.7%	-6.4%	-3.2%	-1.3%	-3.6%
		50%	2.1%	3.9%	3.9%	3.2%	3.3%	4.6%
		75%	11.7%	8.4%	10.3%	9.5%	10.5%	12.1%

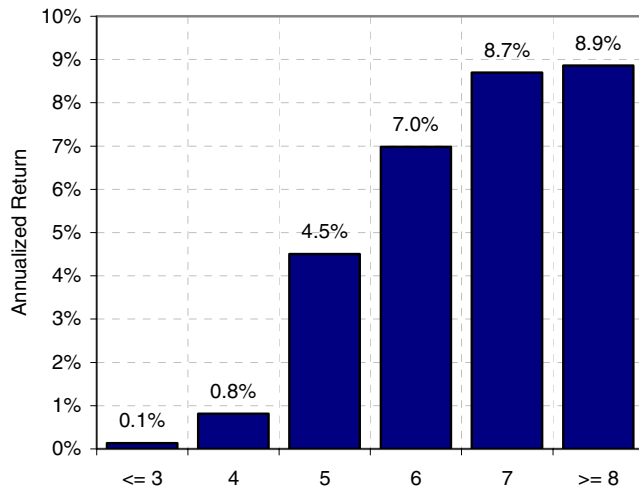
Source: Credit Suisse Quantitative Equity Research.

For robustness, we repeat the same exercise in the small-cap universe. We partition on price using a value of \$15. In addition to the high F_SCORE portfolio outperforming the low F_SCORE portfolio, we find the results to be more monotonic in the small-cap universe.

F_SCORE is a strong indicator in the small-cap universe regardless of price level.

Exhibit 31: High Price F_SCORE Portfolios

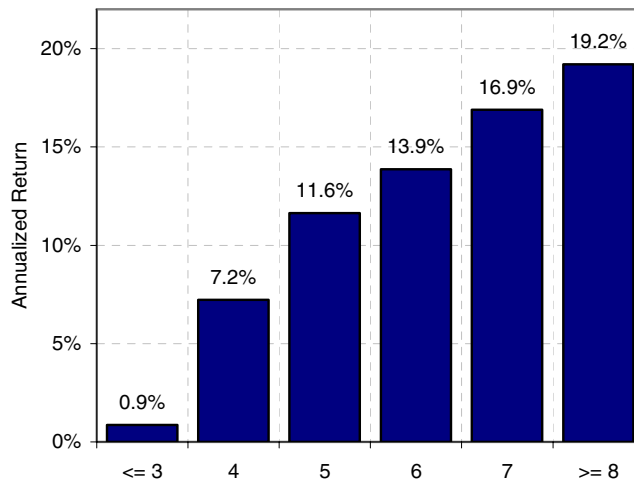
Russell 2000 Value, 3/1980–3/2012, Price > \$15



Source: Credit Suisse Quantitative Equity Research.

Exhibit 32: Low Price F_SCORE Portfolios

Russell 2000 Value, 3/1980–3/2012, Price <= \$15



Source: Credit Suisse Quantitative Equity Research.

Exhibit 33: Distribution of Returns by Price Segment

Universe: Russell 2000 Value, Price Division: \$15, Annual Portfolio Returns, 3/1980–3/2012

Return Type	Price Segment	Percentile	<= 3	4	5	6	7	>= 8
Raw	High	25%	-12.3%	-8.9%	-5.6%	-0.9%	1.6%	-0.3%
		50%	5.3%	-0.7%	5.1%	8.6%	9.3%	7.8%
		75%	12.0%	18.8%	15.7%	18.5%	18.6%	22.1%
	Low	25%	-11.1%	-1.9%	-0.2%	4.9%	9.8%	9.6%
		50%	2.0%	12.7%	14.4%	15.9%	18.2%	21.7%
		75%	13.6%	19.3%	26.4%	25.9%	26.4%	32.7%
Excess	High	25%	-11.3%	-11.0%	-6.1%	-6.8%	-7.0%	-8.9%
		50%	-5.5%	-2.9%	-2.7%	-1.7%	-0.9%	-0.7%
		75%	1.1%	1.2%	2.3%	4.8%	3.1%	3.7%
	Low	25%	-10.9%	-6.7%	-6.4%	-3.2%	-1.3%	-3.6%
		50%	2.1%	3.9%	3.9%	3.2%	3.3%	4.6%
		75%	11.7%	8.4%	10.3%	9.5%	10.5%	12.1%

Source: Credit Suisse Quantitative Equity Research.

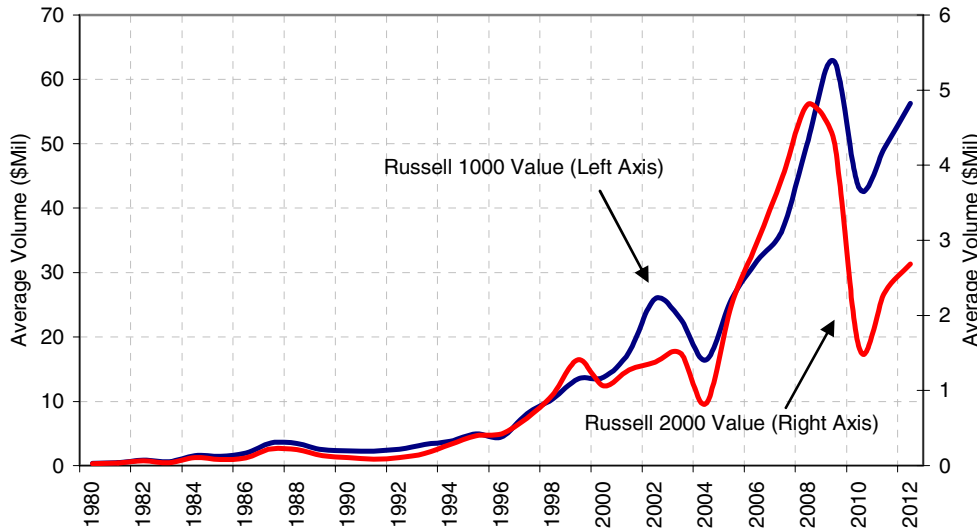
F_SCORE in Volume Partitions

Professor Piotroski also partitions his sample into three groups by trading volume. We partition for volume as well. As trading volume varies with time, we do not use a fixed cutoff like was used with the price partitions. Instead, we use the median of the average 20-day dollar volume for each high book-to-market universe before portfolio creation.

Exhibit 34: Median Dollar Trading Volume

Russell 1000 Value, Russell 2000 Value, Median of Avg 20-Day Dollar Volume, 3/1980–3/2012, Annually

Median trading volume for large caps is greater than that for small caps

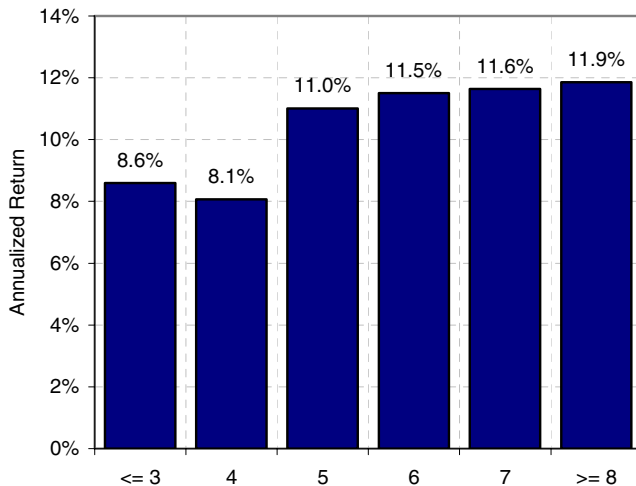


Source: Credit Suisse Quantitative Equity Research.

As with the price partitions, the high F_SCORE portfolio outperforms the low F_SCORE portfolio, but there is little monotonicity in way of intermediate F_SCORE portfolios.

Exhibit 35: High Volume F_SCORE Portfolios

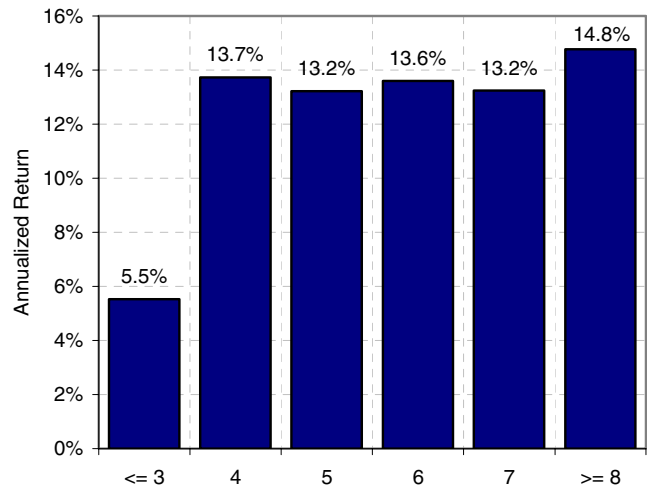
Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 36: Low Volume F_SCORE Portfolios

Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 37: Distribution of Returns by Volume Segment

Universe: Russell 1000 Value, Volume Division by Median Volume, Annual Portfolio Returns, 3/1980–3/2012

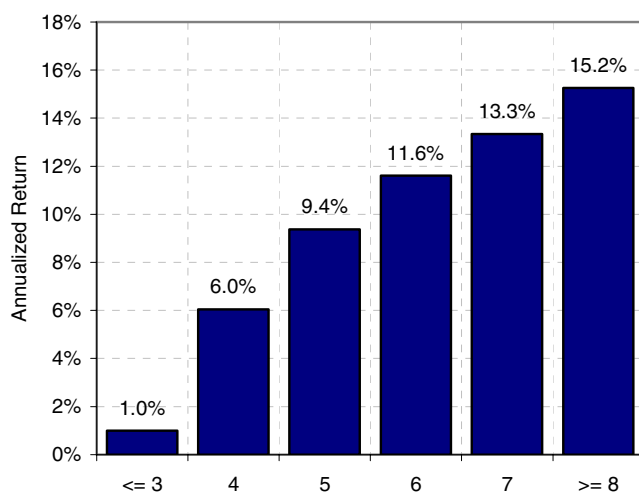
Return Type	Volume Segment	Percentile	<= 3	4	5	6	7	>= 8
Raw	High	25%	3.0%	-1.5%	1.8%	3.2%	0.7%	3.6%
		50%	9.7%	6.7%	11.0%	14.3%	12.0%	9.9%
		75%	25.8%	27.2%	24.2%	23.8%	23.3%	22.0%
	Low	25%	-4.2%	1.1%	3.1%	2.2%	4.8%	7.5%
		50%	13.8%	17.2%	12.9%	16.1%	14.4%	15.4%
		75%	25.3%	27.2%	23.3%	23.1%	22.4%	24.3%
Excess	High	25%	-9.5%	-10.1%	-5.6%	-4.6%	-4.0%	-5.0%
		50%	-2.1%	-2.4%	0.3%	-0.6%	1.8%	0.7%
		75%	7.2%	3.7%	5.5%	5.6%	4.4%	6.0%
	Low	25%	-9.9%	-5.6%	-5.7%	-4.5%	-7.1%	-6.4%
		50%	1.2%	0.1%	0.8%	0.8%	0.7%	3.1%
		75%	5.1%	9.4%	7.6%	7.1%	7.8%	11.3%

Source: Credit Suisse Quantitative Equity Research.

Again, we confirm this trend exists in the small-cap universe. We observe that, not only does the trend exist, but it is monotonic within small caps.

Exhibit 38: High Volume F_SCORE Portfolios

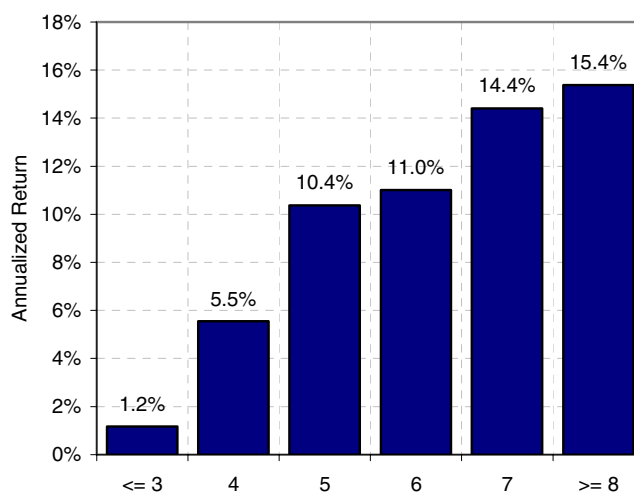
Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 39: Low Volume F_SCORE Portfolios

Russell 1000 Value, 3/1980–3/2012



Source: Credit Suisse Quantitative Equity Research.

Exhibit 40: Distribution of Returns by Volume Segment

Universe: Russell 2000 Value, Volume Division by Median Volume, Annual Portfolio Returns, 3/1980–3/2012

Return Type	Volume Segment	Percentile	<= 3	4	5	6	7	>= 8
Raw	High	25%	-10.1%	-5.7%	1.4%	6.4%	7.8%	5.0%
		50%	2.4%	7.2%	8.6%	12.4%	15.7%	14.7%
		75%	12.8%	20.3%	23.8%	27.1%	21.9%	30.1%
	Low	25%	-6.6%	-1.7%	-1.7%	1.4%	6.1%	3.5%
		50%	2.2%	6.9%	11.2%	14.2%	16.0%	18.0%
		75%	11.7%	21.3%	22.6%	20.4%	24.7%	26.8%
Excess	High	25%	-13.3%	-9.2%	-5.4%	-2.0%	-0.7%	0.4%
		50%	-8.6%	-3.5%	-1.5%	0.8%	2.4%	4.7%
		75%	-4.1%	0.0%	2.9%	3.5%	5.6%	9.9%
	Low	25%	-14.5%	-10.6%	-8.0%	-5.1%	-0.9%	-2.4%
		50%	-8.6%	-2.2%	-0.4%	1.6%	1.6%	3.5%
		75%	-0.6%	2.1%	4.9%	4.9%	8.2%	8.9%

Source: Credit Suisse Quantitative Equity Research.

High F_SCORE Stock List

We provide a selected list of stocks from the Russell 1000 Value universe. Please contact us if you wish to us calculate the F_SCOREs for your portfolio or your investment universe.

Exhibit 41: Current High F_SCORE Stocks, Large-Cap

Universe: Russell 1000 Value, F_SCORE >= 8, Rated Outperform & Neutral by CS Analysts

F_SCORE	Ticker	Company	Market Cap (\$Mil)	Sector	Rating
9	MMC	MARSH & MCLENNAN COS INC	18,742	Financials	Neutral
9	TSO	TESORO CORP	6,022	Energy	Neutral
9	EFX	EQUIFAX INC	5,685	Industrials	Neutral
8	MRK	MERCK & CO INC	138,485	Health Care	Outperform
8	DIS	DISNEY WALT CO	92,656	Consumer Discretionary	Outperform
8	BA	BOEING CO	52,273	Industrials	Outperform
8	MET	METLIFE INC	36,467	Financials	Outperform
8	SCCO	SOUTHERN COPPER CORP	29,328	Materials	Outperform
8	ALL	ALLSTATE CORP	19,436	Financials	Outperform
8	M	MACY'S INC	15,570	Consumer Discretionary	Outperform

Source: Credit Suisse Quantitative Equity Research.

Exhibit 42: Current High F_SCORE Stocks, Small-Cap

Universe: Russell 2000 Value, F_SCORE >= 8, Rated Outperform & Neutral by CS Analysts

F_SCORE	Ticker	Company	Market Cap (\$Mil)	Sector	Rating
9	ODP	OFFICE DEPOT INC	662	Consumer Discretionary	Neutral
9	WNR	WESTERN REFNG INC	2,417	Energy	Neutral
8	DK	DELEK US HLDGS INC	1,520	Energy	Neutral
8	AYR	AIRCASTLE LTD	840	Industrials	Neutral
8	HGG	HHGREGG INC	235	Consumer Discretionary	Neutral
8	PMC	PHARMERICA CORP	375	Health Care	Neutral
8	PNK	PINNACLE ENTMT INC	771	Consumer Discretionary	Neutral
8	SKS	SAKS INC	1,570	Consumer Discretionary	Neutral
8	CAB	CABELAS INC	3,842	Consumer Discretionary	Outperform
8	HOS	HORNBECK OFFSHORE SVCS	1,270	Energy	Outperform

Source: Credit Suisse Quantitative Equity Research.

Low F_SCORE Stock List

Exhibit 43: Current Low F_SCORE Stocks, Large-Cap

Universe: Russell 1000 Value, F_SCORE <= 3, Rated Underperform & Neutral by CS Analysts

F_SCORE	Ticker	Company	Market Cap (\$Mil)	Sector	Rating
3	NOW	SERVICENOW INC	4,497	Information Technology	Neutral
3	HPQ	HEWLETT PACKARD CO	33,680	Information Technology	Neutral
3	JCP	PENNEY J C INC	5,162	Consumer Discretionary	Neutral
3	KMX	CARMAX INC	6,549	Consumer Discretionary	Neutral
2	PSX	PHILLIPS 66	29,102	Energy	Neutral

Source: Credit Suisse Quantitative Equity Research.

Exhibit 44: Current Low F_SCORE Stocks, Small-Cap

Universe: Russell 2000 Value, F_SCORE <= 3, Rated Underperform & Neutral by CS Analysts

F_SCORE	Ticker	Company	Market Cap (\$Mil)	Sector	Rating
3	EDMC	EDUCATION MGMT CORP NEW	377	Consumer Discretionary	Underperform
3	IDIX	IDENIX PHARMACEUTICALS	572	Health Care	Underperform
3	LHCG	LHC GROUP INC	338	Health Care	Underperform
2	EVER	EVERBANK FINL CORP	1,607	Financials	Neutral
2	FIVE	FIVE BELOW INC	2,038	Consumer Discretionary	Neutral
2	ANAD	ANADIGICS INC	99	Information Technology	Neutral
2	SPWR	SUNPOWER CORP	541	Information Technology	Neutral
2	MTG	MGIC INVT CORP WIS	370	Financials	Underperform
2	SQNM	SEQUENOM INC	398	Health Care	Underperform
1	ADNC	AUDIENCE INC	116	Information Technology	Underperform

Source: Credit Suisse Quantitative Equity Research.

References

Piotroski, Joseph D., *Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers*, The University of Chicago Graduate School of Business, January 2002.

Eugene F. Fama and Kenneth R. French, *The Cross-Section of Expected Stock Returns*, The Journal of Finance, Volume XLVII, No. 2, June 1992

Companies Mentioned (Price as of 04 Oct 12)

Aircastle Ltd. (AYR, \$11.65, NEUTRAL, TP \$14.00)
 Allstate Corp. (ALL, \$40.82, OUTPERFORM, TP \$43.00)
 ANADIGICS, Inc. (ANAD, \$1.34, NEUTRAL [V], TP \$2.00)
 Audience, Inc. (ADNC, \$5.74, UNDERPERFORM [V], TP \$6.80)
 Boeing (BA, \$69.94, OUTPERFORM, TP \$87.50)
 Cabela's (CAB, \$55.97, OUTPERFORM [V], TP \$58.00)
 CarMax, Inc. (KMX, \$28.85, NEUTRAL, TP \$32.00)
 Delek US Holdings, Inc. (DK, \$26.02, NEUTRAL [V], TP \$32.00)
 Education Management Corp. (EDMC, \$3.36, UNDERPERFORM [V], TP \$3.00)
 Equifax, Inc. (EFX, \$48.76, NEUTRAL, TP \$50.00)
 EverBank Financial Corp. (EVER, \$13.73, NEUTRAL [V], TP \$12.00)
 Five Below, Inc. (FIVE, \$38.17, NEUTRAL [V], TP \$35.00)
 Hewlett-Packard (HPQ, \$14.94, NEUTRAL, TP \$15.00)
 hhgregg, Inc. (HGG, \$6.97, NEUTRAL [V], TP \$7.50)
 Hornbeck Offshore Services, Inc. (HOS, \$35.10, OUTPERFORM [V], TP \$46.00)
 Idenix Pharmaceuticals, Inc. (IDIX, \$4.30, UNDERPERFORM [V], TP \$4.50)
 JC Penney (JCP, \$23.77, NEUTRAL, TP \$25.00)
 LHC Group, Inc. (LHCG, \$18.13, UNDERPERFORM, TP \$18.00)
 Macy's, Inc. (M, \$39.67, OUTPERFORM, TP \$43.00)
 Marsh & McLennan Companies (MMC, \$34.55, NEUTRAL, TP \$34.00)
 Merck & Co., Inc. (MRK, \$46.12, OUTPERFORM, TP \$48.00)
 MetLife, Inc. (MET, \$35.02, OUTPERFORM, TP \$44.00)
 MGIC Investment Corp. (MTG, \$1.80, UNDERPERFORM [V], TP \$1.50)
 Office Depot, Inc. (ODP, \$2.46, NEUTRAL [V], TP \$2.25)
 PharMerica Corp. (PMC, \$12.76, NEUTRAL, TP \$12.00)
 Phillips 66 (PSX, \$45.39, NEUTRAL, TP \$53.00)
 Pinnacle Entertainment, Inc. (PNK, \$11.73, NEUTRAL, TP \$10.00)
 Saks, Inc. (SKS, \$10.61, NEUTRAL, TP \$10.50)
 Sequenom, Inc. (SQNM, \$3.34, UNDERPERFORM [V], TP \$4.00)
 ServiceNow, Inc. (NOW, \$37.15, NEUTRAL, TP \$24.00)
 Southern Copper Corp. (SCCO, \$35.22, OUTPERFORM, TP \$43.00)
 SunPower Corp. (SPWR, \$4.69, NEUTRAL [V], TP \$5.00)
 Tesoro Corp. (TSO, \$44.15, NEUTRAL [V], TP \$53.00)
 Walt Disney Company (DIS, \$52.63, OUTPERFORM, TP \$58.00)
 Western Refining, Inc. (WNR, \$26.74, NEUTRAL [V], TP \$34.00)

Disclosure Appendix

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