Quality and Piotroski F-Score Screen

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The Piotroski F-Score Screen

For the past ten years or more the Piotroski F-Score has been a part of how I often evaluate stocks.

The F-Scores are provided as fields in the AAII Stock Investor Pro database and have a possible nine points covering various financials of a firm. So a score of eight, for example, would mean that any one of the nine possible criteria was not met. The F-Scores are provided for the last fiscal year and for the prior twelve months. I have found the one for the past twelve months to be more predictive of better returns. The Piotroski screen maintained by AAII uses the F-Score for the prior fiscal year, in addition to price/book value ranking in the lowest 20% and the exclusion of ADR's and Over the Counter stocks. Thus the results of the AAII Piotroski Screen will vary from how I use the F-Score.

The nine criteria are:

1. The return on assets is positive.
2. Cash from operations is positive.
3. The return on assets ratio has improved over the previous period.
4. Cash from operations is greater than income after taxes.
5. The long-term debt to assets ratio has declined from the previous period.
6. The current ratio is greater than the previous period.
7. The average shares outstanding is less than or equal to the previous period.
8. The gross margin is greater than the previous period.
9. Asset turnover is greater than the previous period.

The screen is intended to measure viability of deep value stocks. For stocks that have fallen dramatically in price, it is a tool for distinguishing the odds of which will have a reversal and which are headed for bankruptcy. This is important because the stocks that disappear in the research data for a screen (survivorship bias) are an unknown quantity for evaluating a screen's returns. Its utility as a safeguard is quite different than results of applying the screen to all stocks, such as was done in the study described below.

Of the nine criteria listed above that comprise the F-Score, seven of are dynamic rather than static in that they reflect strengthening of financials from one year or twelve month period to the next. Most variables used in screens are static, such as earnings per share (P/E). The dynamic nature is important in view of the fact that markets are always in motion and seeking equilibrium. Whether a static variable such as P/E is high or low is rather meaningless compared to the direction in which it is moving and the impact of that movement on a stock's price. The fact that a stock is low-priced or high-priced doesn't tell us much when what we really want to know is whether the stock price will go up or down.

The Study

The impetus for the data exploration described below was to find out how higher quality stocks were faring in the recent market compared to low-quality stocks. I have been reviewing research and doing my own research on what are currently called Smart Beta factors or variables which reliably point to

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excess returns or what is called Alpha. Over time, small cap and value stocks are reported to be such factors, although I wonder to what extent the research on both small cap and value stocks takes proper account of survivorship bias, since both smaller cap companies and companies priced cheap relative to their assets, earnings and sales tend to be more likely to also file bankruptcy and thus disappear from the research dataset. Momentum is another factor presumed to produce excess returns, although my research reported elsewhere found a significant exception. Low liquidity is a factor capable of producing excess returns, as reported in a significant article by Roger G. Ibbotson, Zhiwu Chen Daniel Y.-J.Kim and Wendy Y.Hu titled "Liquidity as an Investment Style". (*Financial Analysts Journal*, Vol 69, Number 3, 2013, p. 30-44.)

I have been in the process of confirming for my own satisfaction the potential of these various factors and wanting to also discover the interaction effect between them. In other words, while each factor may produce excess returns by itself, when they are combined is the return greater or less, or do they even overlap in identifying the same stocks?

The two metrics for quality that I have been using for some time are the twelve-month F-Score and Louis Navellier's stock grading which is available free for any stock and any number of stocks on his website. The limitation with the Navellier grades is that access is not provided to historical data. In the past I have constructed two indexes of about one hundred stocks each, one with very low F-Scores and one with high F-Scores. I would then watch the two indexes progress on the same daily chart. In general I found that the quality stocks performed better about two-thirds of the time, but that when the low F-Score index excelled it did so by a wider margin. Only about half of the largest 4,000 stocks have the same F-Score after three months, and it became time-consuming to rebuild the indexes.   I was going to do that here, but then realized I could get a more refined analysis by just staying in Excel.

The Findings

F-Score	0	1	2	3	4	5	6	7	8	9	Total
Count	18	142	321	453	654	805	805	547	203	39	3,987
	0.5%	3.6%	8.1%	11.4%	16.4%	20.2%	20.2%	13.7%	5.1%	1.0%	

Avg%Chg											Total Avg
Week	0	1	2	3	4	5	6	7	8	9	% Chg
8/31/15	-1.17	-1.22	-1.15	-2.16	-1.91	-1.97	-1.97	-2.31	-1.84	-2.10	-1.93
9/7/15	-0.10	2.26	2.17	1.20	0.79	1.06	0.92	1.02	1.12	1.41	1.13
9/14/15	1.88	3.92	2.59	1.65	0.89	0.16	0.33	0.31	0.33	-0.48	0.84
9/21/15	-6.88	-8.15	-8.09	-6.07	-3.76	-2.47	-2.74	-3.04	-3.67	-2.75	-3.96
9/28/15	-4.40	-3.78	-4.00	-1.63	-1.14	-0.20	0.15	0.31	-0.47	-0.56	-0.84
10/5/15	7.96	5.38	6.71	6.81	5.65	5.89	5.20	5.19	4.95	5.73	5.73
10/12/15	-0.49	-0.17	-0.78	-0.43	-0.45	-0.16	-0.29	-0.18	-0.50	-0.94	-0.34
10/19/15	1.02	-2.35	-1.54	-1.69	-0.13	0.66	0.31	0.29	0.49	1.62	-0.14
10/26/15	-1.61	-1.73	-2.17	-1.28	-0.74	-0.46	-0.52	-0.18	-0.97	-0.06	-0.78
11/2/15	4.16	3.46	5.33	4.14	2.59	2.75	1.63	1.46	2.28	3.17	2.69
11/9/15	-2.79	-6.18	-4.46	-5.07	-4.61	-4.28	-4.63	-4.26	-4.40	-4.46	-4.57
11/16/15	-1.92	0.22	-0.31	-0.03	1.59	1.97	1.89	2.30	2.17	1.74	1.45
11/23/15	8.55	5.16	4.04	3.36	2.10	1.56	1.69	1.35	2.00	1.34	2.23
Total	0.32	-0.24	-0.13	-0.09	0.07	0.35	0.15	0.17	0.11	0.28	0.12

The green cells have weekly average percent change greater than 1.0.
The white cells have weekly average percent change between 0 and 1.0.
The yellow cells have weekly average percent change between 0 and -1.0
The red cells have weekly average percent change less than -1.0.

The count for each F-Score forms a rather bell-shaped normal distribution, skewed to the right.

The standard deviation of the F-Score totals (the bottom line) is .20. The standard deviation of the weekly totals (the right-hand column) is 2.75.

The low F-Scores of 1-4 have a pronounced linear pattern and are a more reliable indicator of expected low returns than the high F-Scores are for high returns. Therefore in using F-Scores as a final review of stocks, one might want to ignore high scores while using low scores to rule out selections.

If the Piotroski metrics of quality in and of themselves produced higher returns, one would expect the left-hand side of the table to be red with gradual moving to yellow, then white and then green on the right-hand side. Obviously that is not how the chart looks. If the table did look that way and financials did predict stock price, maybe more fundamental analysts and fund managers would beat the market.

The next table below shows the standard deviations for the same clusters or data cells shown above with the average weekly percent change.

Standard Deviation of Percent Change											Total SD
Week	0	1	2	3	4	5	6	7	8	9	%Chg
8/31/15	4.24	9.92	6.85	6.01	5.05	3.83	4.14	4.24	4.19	3.54	5.05
9/7/15	5.86	7.43	9.42	9.06	5.02	5.46	4.88	4.80	3.03	4.00	6.11
9/14/15	4.89	12.56	9.26	8.14	6.27	4.55	4.52	4.06	4.07	2.26	6.23
9/21/15	6.38	8.77	10.00	8.65	6.46	5.77	5.06	5.26	5.38	4.27	6.85
9/28/15	7.52	15.56	8.98	8.51	6.38	5.23	6.13	4.12	3.95	3.23	6.94
10/5/15	9.40	11.68	15.15	11.03	9.59	7.55	6.11	6.12	6.56	8.51	8.93
10/12/15	6.78	8.68	9.45	5.94	5.94	6.29	4.58	4.98	4.79	3.28	6.06
10/19/15	17.88	7.99	14.18	7.42	5.78	6.99	5.55	5.94	5.73	5.64	7.42
10/26/15	8.93	9.11	8.92	8.64	6.26	5.65	5.92	5.83	5.72	4.43	6.70
11/2/15	8.43	9.41	11.68	10.47	7.54	8.48	7.41	6.48	6.09	4.28	8.41
11/9/15	9.08	8.53	11.54	8.82	6.60	5.44	5.47	4.71	5.75	4.86	6.83
11/16/15	10.96	12.96	9.24	8.89	5.78	5.07	5.68	4.40	4.27	2.95	6.62
11/23/15	24.57	9.81	7.68	8.84	4.56	3.88	4.01	3.73	3.36	1.91	5.74
Total	11.58	11.17	11.17	9.26	6.87	6.34	5.89	5.55	5.51	5.04	7.33

The standard deviation of the F-Score totals (the bottom line) is 2.66. The standard deviation of the weekly totals (the right-hand column) is 1.05. Note that this is just the opposite of what we found with the averages, as shown in the two by two table below.

	Avg	StDev
By Week	2.75	1.05
By F-Score	0.20	2.66

To interpret, the returns by week are very inconsistent (SD 2.75). While there is a wide range of returns each week for each F-Score, the average returns for each F-Score do not vary that much (SD .20). The range and variation of returns each week are quite consistent (SD 1.05). The range and variation within the cluster for each F-Score are inconsistent, with the low F-Scores having twice the standard deviation as the high scores (SD 2.66).

Volatility is much more predictable than price. (Which is part of the Black Scholes formula.)

Even if we had found an F-Score with predictably high returns, the variations of returns within each such cluster do not bode well for picking stocks with high returns. Note the linear relationship on the bottom line of the table. The F-Score does much better at predicting standard deviation or consistency of findings than it does at predicting the actual returns. While the interaction effect would need to be confirmed, the Piotrowski F-Score might be a valuable way to increase the reliability of findings within a screen selected by using other variables.

At a weekly level, the Twelve Month F-Score was not a very reliable predictor of positive returns. It is the nature of science that if something holds true ten times, we still don't know it that it is true as it may fail on the next test. However, is something is false once, we know that it is not true. We came up with a false.

I converted the above table of average weekly percent change to a table of rankings of each F-Score for each week and then summed the rankings. The results looked even more chaotic that the table of average returns.

As a final adaptation, I went back to the F-Scores at the end of May or three months prior to the F-Scores used in these data. I then calculated the change in F-Score over the three months to see if a trend in changing F-Score would point to a consequent trend in stock price. I have posted the data below for your review, although I don't find anything of merit in the results.

F-Score Chg	-6	-4	-3	-2	-1	0	1	2	3	4	5	6	
Count	1	7	52	219	681	1,816	784	199	50	20	4	2	3,987
Count %	0.03%	0.18%	1.30%	5.49%	17.08%	45.55%	19.66%	4.99%	1.25%	0.50%	0.10%	0.05%	
Avg%Chg													
Week	-6	-4	-3	-2	-1	0	1	2	3	4	5	6	Total
8/31/15	-6.18	-4.74	-2.76	-2.03	-1.82	-2.10	-1.88	-1.93	-0.62	0.22	-5.64	-1.10	-0.55
9/7/15	-6.35	0.28	0.32	0.11	1.10	1.36	1.01	0.59	-0.10	2.56	0.54	-4.24	2.08
9/14/15	-6.52	1.71	0.10	0.45	1.01	0.88	0.72	0.97	0.40	1.82	7.84	-0.07	0.73
9/21/15	-24.90	-5.01	-5.56	-5.26	-4.23	-3.64	-3.72	-4.34	-5.38	-5.20	-9.48	-0.85	-3.97
9/28/15	-7.29	0.59	-0.90	0.30	-0.74	-0.72	-1.33	-0.37	-0.36	0.52	0.10	-3.67	-2.92
10/5/15	3.34	12.76	8.99	7.91	6.14	5.46	5.57	5.48	5.57	3.28	5.77	6.91	3.98
10/12/15	4.56	0.47	-0.80	-0.74	-0.22	-0.34	-0.29	-0.14	-0.39	1.91	-4.86	0.03	-0.88
10/19/15	-2.36	-2.09	-0.17	-0.36	-0.80	0.28	-0.21	0.10	0.56	-1.58	2.94	-0.74	-1.72
10/26/15	0.19	-3.93	-1.34	-1.22	-0.80	-0.63	-0.88	-1.05	-0.87	-0.40	-1.61	10.10	-0.88
11/2/15	11.15	1.92	1.57	3.37	2.45	2.74	3.05	1.80	2.88	2.89	0.96	-0.64	2.03
11/9/15	11.71	-1.74	-5.78	-4.30	-4.86	-4.51	-4.77	-3.82	-6.40	-2.95	-6.34	-6.42	-3.79
11/16/15	4.79	1.34	-0.45	1.54	1.62	1.54	1.55	1.50	1.25	1.04	1.41	-0.04	-0.16
11/23/15	2.14	1.31	1.57	1.16	2.57	2.25	2.36	2.56	1.84	0.99	-1.66	3.46	1.68
Total	-1.21	0.22	-0.40	0.07	0.11	0.20	0.09	0.10	-0.13	0.39	-0.77	0.21	-0.34

Summary

Standard deviations are more predictable than prices.

The variation in returns by week exceeded the variation in returns by F-Score. (I usually find this for any variable. It says a lot about what drives stock prices.)

The Piotroski Twelve Months F-Score by itself is not useful in selecting stocks with higher returns, at least over this period. However, low F-Scores foretell lower and negative returns making this a valuable tool in eliminating stocks otherwise appearing to have merit.

The tool was designed as a way to assure that deeply valued stock selections survive. It may very well be a valuable tool for that purpose in conjunction with high return screens that point to down-trending stocks that reverse.