Quantitative Strategies for Selecting Stocks

By Richard Tortoriello

A few years ago, I was asked to develop a series of quantitative stock-selection models for the equity research department of Standard & Poor’s.

In preparation for this project, we backtested more than 1,200 different investment strategies to determine which were predictive of future “excess returns.” (A backtest is simply a statistical look at historical data to determine whether employing a given investment factor, such as selecting stocks with low price-earnings ratios, results in excess returns over time; i.e., returns above a stock market benchmark.)

My goal was to determine the basic factors that drive future stock market returns, from an empirical point of view, using only historical data as our raw material (balance sheet, income statement, cash flow statement, and pricing data). In short, I set out to create a quantitatively drawn “road map” of the equity markets. To do our research, we used a sophisticated data-analysis program and Standard & Poor’s Point in Time database, which contains more than 20 years of “as originally reported” (unrestated) data for about 150 data items and 25,000 individual companies.

This data-intensive approach to investment analysis yielded clear results. Certain strategies consistently outperformed the market over the two-decade test period, while others consistently underperformed. The results of this research are published in the book “Quantitative Strategies for Achieving Alpha” (McGraw-Hill, 2009). In it, I present a wide variety of investment strategies that predict excess returns, and I show investors how to combine individual investment strategies into more complex screens and models. These can be used to generate strong potential investment ideas, create quantitative portfolios, or simply help investors better understand the market from a quantitative point of view.

Looking for Factors

In structuring our backtests, we kept in sight one basic principle: Numbers can lie. If a backtest is not constructed carefully, or if too few years of data are used, backtest results will be unreliable. Statistical bias can cause the results to be flawed. The two most common are look-ahead bias and survivorship bias. Look-ahead bias is when information that would not have been known or available during the period is analyzed. For example, reported fourth-quarter earnings are not available for most companies as of December 31 of any given calendar year. Because strong companies tend to survive and weak companies are often acquired at a discount or go out of business, a database that includes only the survivors will likely yield much stronger results for a backtest than if “non-survivors” were included. (Our database protected our tests from both look-ahead and survivorship bias.)

Returns must be calculated consistently—we used a stock’s annual price change plus dividends and cash-equivalent distributions of value (such as spinoffs). And a clear backtest universe must be defined: Our universe consisted of the largest 2,200 stocks in our database selected by market capitalization, with a minimum share price constraint ($2, to keep out volatile penny stocks).

Each test divided the companies in our backtest universe into quintiles (five equally sized groups) based on their rank on one or more investment factors. For example, a price-earnings ratio test put the 20% of companies with the lowest price-earnings ratios into the first quintile, the next 20% into
the second quintile, all the way down to the 20% of companies with the highest price-earnings ratios, which would be put into the fifth quintile. Portfolios were formed every quarter over our test period, and the holding period for each portfolio was 12 months.

Returns for all portfolios in each quintile were then calculated, averaged over the 20-year test period, and compared to the average return over the same period for the overall universe. A strategy was said to have investment value if the top (first) quintile significantly outperformed the universe, the bottom (fifth) quintile significantly underperformed, and the outperformance/underperformance was consistent over time.

**Combining Indicators**

I like to use the idea of a mosaic to describe the results of our quantitative tests. A mosaic is a picture or pattern made by putting together many small-colored tiles. In a real mosaic, each tile is meaningless when viewed alone. However, when put together by an artist, a beautiful pattern emerges. In our investment mosaic, each “tile” is a strategy that has investment value (it consistently outperformed or underperformed the market) and is understood by the investor (we know why it worked).

The second point is critical. Data mining—the search for correlations between items in a database—can uncover investment strategies that work fabulously during the test period and fail to work thereafter. By basing the investment strategies we tested on sound investment theory, we ensured that the results represent fundamental principles and tendencies in the investment markets and not statistical anomalies. The goal was to put various investment strategies together to identify what characteristics to look for or to avoid in the stocks in which we plan to invest.

**The Seven Basics**

So, what can investors learn from quantitative analysis? One important discovery we made was that most investment strategies that are predictive quantitatively fall into seven major categories. I call these categories the basics, precisely because they are fundamental to achieving excess returns in the stock market. They consist of profitability, valuation, cash flow, growth, capital allocation, price momentum, and red flags (risk). There are likely more basics than the seven we identified (and the seventh, red flags, is somewhat of a catchall), but investors looking for primary market drivers need look no further than these.

From a quantitative point of view, valuation, cash-flow generation, profitability, and price momentum are the most important basics. In particular, valuation and cash-flow factors should be included in almost all quantitative models, screens and analysis. The relative valuation tests we used were simple (e.g., price to earnings or price to sales), but showed that low valuations generated strong excess returns that were consistent over time. It seems obvious, but investors often forget to check the price they are paying for an asset.

**EV-to-EBITDA Strategy**

One of the strongest valuation ratios we tested is enterprise value to EBITDA. Enterprise value (EV) is the theoretical price it would cost to buy the entire corporation. We calculated it as the market value of common stock (price times shares outstanding) plus the book value of long-term debt minus cash and equivalents. EBITDA stands for earnings before interest, taxes, depreciation, and amortization. Roughly speaking, it represents operating income not predictive. There are two possible reasons for this: 1) high growth rates are very difficult to maintain, and 2) investors tend to overpay for growth. The growth/value combination helps investors avoid the second pitfall and our research shows that it works.

- If the screening tool that you are using does not allow sophisticated screening, substitute less sophisticated ratios for more sophisticated ones. For example, the price-earnings ratio can be substituted for enterprise value to EBITDA, and relative strength for 52-week price range.
- When screening, use values for each ratio that provide a sufficient number of results, but be more restrictive with valuation ratios than with other ratios. Quantitatively, valuation ratios are most predictive and provide the strongest results.

**Practical Tips**

Here are a few suggestions for screening or analyzing a stock:

- Make sure you understand each ratio you are using. Ideally, you should understand not only what the ratio represents, but how predictive it is.
- Certain ratios work better than others with particular industries, so a more focused sector-based analysis may yield better results than a screen or analysis designed for use on the entire stock universe.
- Avoid screening or conducting analysis on a single factor. It will provide too narrow a view of a company and its stock. Instead prefer complementary factors, particularly those that combine valuation with profitability, price momentum, cash flow, and/or growth.
- Never look at growth without also considering valuation! Our research found that growth factors alone are
before depreciation. To calculate it, begin with 12-month income from continuing operations and add back the items listed above.

Generally speaking, companies with EV-to-EBITDA ratios of 8x or lower outperformed over our 20-year test period, and companies with EV-to-EBITDA ratios of 11x or higher underperformed. General Electric’s (GE) CEO Jeff Immelt affirmed our observation when he opined at an investor meeting: “I think if you pay beyond 10x EBITDA [for an acquisition] it is hard to make it pay.” GE had learned from hard experience what our test results found.

Figure 1 shows the average excess returns (i.e., returns above or below the return for the entire universe) by quintile for the EV-to-EBITDA strategy over our 20-year test period. Companies in the first quintile have the lowest EV-to-EBITDA ratios, while companies in the bottom quintile have the highest ratios.

**Cash ROIC Strategy**

Cash flow tests also generated strong and consistent excess returns. (Cash flow was defined as cash generated by operating activities, instead of cash generated by financing or investing activities, all of which can be found on a company’s cash flow statement.) Why is cash flow so important? One reason is that cash represents a reality—purchasing power—while accounting earnings are at least one step removed from that reality. Another is that a company with excess cash has financial flexibility; it can use that cash to expand its business, pay dividends, repurchase shares, acquire other businesses, and so on.

One way to measure cash flow is to compare the so-called “free cash flow” a company generates in a year to the capital invested in the business. Cash return on invested capital (cash ROIC) compares free cash flow (12-month cash generated by operating activities less 12-month capital expenditures) to invested capital (total stockholders’ equity plus long-term debt). Companies with cash ROIC of 12% or more outperformed over the 20-year test period, while those with cash ROIC ratios of 4% or less underperformed.

Figure 2 shows average excess returns by quintile for the cash ROIC strategy. Companies in the first quintile have the highest cash ROIC ratios, while companies in the fifth quintile have the lowest.

**Return on Equity Strategy**

When looking for stocks likely to outperform, the investor should also favor profitability factors. A company’s level of profitability provides investors with a measure of the quality of the company’s productive assets (whether those assets are manufacturing facilities, a strong brand name, an excellent customer list, or a talented work force). A good profitability ratio, and one that’s easy to calculate, is return on equity (income from continuing operations over the past 12 months divided by stockholders’ equity). Investors should favor companies that can generate return on equity of 16% or more, and avoid those with return on equity of 8% or less.

Figure 3 shows average excess returns by quintile for the return on equity strategy.

**52-Week Price Range Strategy**

Finally, investors should consider a stock’s price momentum. Price momentum simply refers to the speed with which a stock goes up or down over a given period of time. To quote William O’Neil, founder of Investor's Business

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**Figure 1. EV-to-EBITDA Strategy**

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<th>Quintile</th>
<th>Average Excess Returns vs. Universe</th>
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<tr>
<td>1st</td>
<td>5.3%</td>
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<tr>
<td>2nd</td>
<td>1.9%</td>
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<tr>
<td>3rd</td>
<td>0.3%</td>
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<tr>
<td>4th</td>
<td>-2.3%</td>
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<tr>
<td>5th</td>
<td>-4.9%</td>
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**Figure 2. Cash ROIC Strategy**

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Average Excess Returns vs. Universe</th>
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<tr>
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Daily, “The great paradox in the stock market is that what seems too high and risky to the majority usually goes higher and what seems low and cheap usually goes lower.” Our research certainly found this to be true.

A simple way to measure price momentum is to consider the proximity of a stock to its 52-week high or low. The formula I used for this was current price minus 52-week low divided by 52-week high minus 52-week low. Stocks that score 82% or higher on this formula tend to outperform, while stocks that score 41% or lower tend to underperform. Figure 4 shows average excess returns by quintile for the 52-week price range strategy.

**Conclusions**

One major conclusion of our study was that fundamentals matter, valuations matter, and technicals (i.e., price momentum measures) matter. The investor looking to achieve strong stock market returns over a six-month to an 18-month investment horizon would do well to consider all three of these factors.

The seven aforementioned basics presented provide investors with strategies that work in all three of these important areas. Another important conclusion is that quantitative analysis, qualitative analysis, and technical analysis were not only far from being unrelated subject areas, but form mutually complementary disciplines. Investors who learn the lessons taught by each are apt to increase their ability to make money consistently in stocks.

To put this all together, I suggest running a screen that incorporates the four individual investment factors mentioned in this article. These four factors cover the basics of valuation, cash flow, profitability, and price momentum. They also consider key data points from a company’s income statement, balance sheet, and cash flow statement, as well as its market price. The four screening criteria would be:

1. Enterprise Value to EBITDA $\leq 8$
2. Cash ROIC $\geq 12$
3. Return on Equity $\geq 18$
4. 52-Week Price Range $\geq 82$

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Richard Tortoriello is the aerospace and defense analyst in the equity research division of Standard & Poor’s and has conducted numerous quantitative investment studies for the company. This article is based on material in his book “Quantitative Strategies for Achieving Alpha” (McGraw-Hill, 2009). Find out more about Richard at [www.aaii.com/journal/authors/tortoriello.cfm](http://www.aaii.com/journal/authors/tortoriello.cfm).