What Has Worked on Bay Street

The past does not necessarily portend the future, but several factors appear to be powerful predictors of future stock returns.

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Abstract

This article examines the impact of a large number of fundamental and individual stock characteristic variables on stock returns. We identify the variables that have generated the highest and most consistent return payoffs over the past decade, while controlling for the influence of the other variables. In short, our purpose is to determine what has worked on Bay Street.

While it is difficult to make definitive conclusions regarding why stock returns behave as they do, several results from our study stand out. The most statistically powerful and stable predictors of stock returns in Canada over the last decade have been 12-month price momentum, one-month reversals, operating margin, the number of earnings estimate revisions, and stock price. These results demonstrate the importance of technical indicators, profitability measures and stock liquidity on Canadian stock returns. Cash flow yield has also been very important, particularly in 1994 and 1996. Risk variables, when significant, often displayed a negative relationship with stock returns, contrary to what one might expect, while traditional "value" measures varied in sign and levels of significance. Finally, the influence of a number of variables has varied through time and across up and down markets. In particular, we found that liquidity, value and growth measures were more important during down markets, while earnings estimates and profitability factors were more important during up markets.

Introduction

Virtually all money managers analyze company fundamentals and individual stock characteristics to some extent when making their investment decisions. Most of them tend to focus on a small set of these variables where the subset depends on the manager's investment style or, more generally, on their beliefs regarding which specific variables actually work on Bay Street. In addition, the academic and practitioner literatures are now filled with articles that report excess returns by forming portfolios based on various company and stock specific factors. The most widely recognized of these factors are firm size, the book-value-to-price ratio, and price momentum.[1]

A recent article by Haugen and Baker (hereafter HB) appearing in the Journal of Financial Economics (1996) rated a large number of these factors based on their relationship with U.S. stock returns over the 1979 to 1993 period. HB found the following twelve factors, in order of importance had the greatest affect on stock returns (the sign in brackets indicate the nature of the relationship): one-month excess return (-); 12-month excess return (+); trading volume/market cap (-); two-month excess return (-); earnings to price (+); return on equity (+); book to price (+); trading volume trend (-); six-month excess return (+); cash flow to price (+); and, variability in cash flow to price (-). HB also confirm the importance of these variables in explaining stock returns for samples from Japan, the United Kingdom, France and Germany over the 1985 to 1993 period.

This article attempts to determine which of the many possible company fundamental and stock characteristic variables have generated the highest and most consistent return payoffs for Canadian

stocks over the past ten years, while controlling for the influence of each of the other variables. In short, the purpose of this article is to determine what has worked on Bay Street. Notice that the previous sentence said what worked on Bay Street. Any inference about what will work on Bay Street in the future requires the assumption that what has worked on Bay Street correlates highly with what will work on Bay Street. Nevertheless, if what has worked on Bay Street is based on rational economic and investment theory, or is based on inherent and consistent human biases, then the assumption that what worked on Bay Street correlates highly with what will work in the future may be well founded. We leave this for the reader to decide.

The Data

The sample for this study covers the 10-year period from January 1989 to December 1998. This time period includes a recession, bear markets, a stock market crash, a couple of interest rate shocks, extreme bull markets, and some periods of extreme volatility. Thus, it includes most of the conditions that are experienced in the Canadian equity market.

The data is derived from two sources. The first data source is the Standard & Poor's COMPUSTAT database. All fundamental and market data is extracted from COMPUSTAT. The data is monthly in frequency, although only fiscal year fundamental data is used. A minimum five-month accounting release lag is assumed, which is relatively conservative since most TSE-listed companies release financial statement information within three months of their fiscal year-end. In fact, the Ontario Securities Commission requires such information be released within 140 days after the company fiscal year end. For example, if a company has a December fiscal year end, the fundamental financial data is assumed to be observable at the end of May, and is available for use by investors at the beginning of June. Market data such as stock prices, returns, trading volume, and market capitalization is available on a monthly basis.

Unfortunately, the Canadian COMPUSTAT database is survivorship biased as it only includes companies that are operating as of the date the data is extracted from the database. This means that all companies that merged, were taken over, or went bankrupt during the sample period are not included in the analysis. As a result, the sample does not include the high average returns generated from merged or taken-over companies, or the low average returns generated by firms that went bankrupt. This could cause small biases in some of our results. For example, we would expect that many companies in distress would have high levels of risk and be classified as value stocks according to traditional measures. Since our sample excludes the distressed companies that go bankrupt, and includes only those distressed firms that survive, our results may attenuate a positive relationship between returns and these two types of factors.

The second data source for our study is the I/B/E/S historical earnings estimate database. Companies in the COMPUSTAT universe are matched to the companies in the I/B/E/S universe. All consensus earnings estimates, earnings estimate revisions, and earnings surprises are derived from I/B/E/S. This data is also monthly in frequency and is stored by I/B/E/S in the month that the data is available for use by the public. In particular, the I/B/E/S database records all earnings estimates available on the third Thursday of each month, with those being released after the third Thursday being recorded in the following month. Thus, there is no need to assume an arbitrary reporting lag since it is already incorporated in the data. The COMPUSTAT database coverage of Canada is superior to that of I/B/E/S and thus some companies included in this study will not have earnings estimate data, or their associated variables.

To mitigate some of the biases associated with this type of research, certain minimum requirements are placed on companies before they are included in the sample. In each month, only those firms that trade on the Toronto Stock Exchange with a trailing three-month average market capitalization greater than $50 million, a stock price greater than $3, and a monthly trading volume greater than $0.5 million are included in the sample. These screens ensure that the companies examined are of reasonable size and

liquidity throughout the entire sample period.[2] The impact of outlying data points on the analysis is minimized by performing a number of data cleaning routines and truncating the outliers.[3]

In order to maximize the number of companies in the sample, the only data requirements for a firm to be included in the sample are that each firm must possess a month-end stock price for the previous month and possess a trailing earnings figure for the most recently completed fiscal year. All other missing fundamental and market data points are replaced with the cross-sectional mean value for that fundamental or market variable. In this way, the companies with some missing data points remain in the sample, but get no "credit" for a better or worse score on that variable. In addition, companies with less than two I/B/E/S earnings estimates are captured by an analyst coverage dummy variable and all their earnings estimate factors are coded as zero. In this way, companies without analyst coverage remain in the sample, but get only average credit relative to firms with analyst coverage.

We examine the majority of fundamental and stock characteristics typically used to explain stock returns. These were compiled from a review of the academic and practitioner literature, and through conversations with analysts and money managers. Specifically, the study examines 59 distinct fundamental and market-based factors, while controlling for 11 economic sectors. The identity and definition of each variable is listed in the Appendix.

The Methodology

The objective of this study is to determine which of the many possible fundamental and individual stock related company factors have predicted stock returns over the past 10 years. This requires an estimate of the average payoff to each of the firm specific factors. More importantly, it requires a normalized statistical measure of the importance of each factor so that they can be ranked from highest to lowest. This will enable us to determine what has worked on Bay Street.

Many researchers have examined the impact of variables thought to have predictive power for stock returns in isolation through the use of univariate regressions, correlation coefficients, and/or profitability analyses. However, these approaches have limitations because many variables simultaneously influence stock returns, and many of them capture overlapping pieces of information. To account for the interdependencies of these variables, we perform pooled multivariate cross-sectional regressions using ordinary least squares. The multivariate approach we use allows us to determine which factors are the most important, after accounting for the presence of the other factors in existence at that time, and enables us to rank the factors in terms of their true impact on stock returns.

The dependent variable of the factor payoff regressions is monthly excess stock returns, defined as the difference between the total return of a stock and the 90-day Government of Canada Treasury Bill yield. The independent variables are the 59 fundamental and market related variables listed in the Appendix, as well as 11 sector dummy variables that jointly serve as the regression intercept. The independent (fundamental and market related) variables are "demeaned" each month, with respect to the monthly cross-sectional average for that variable in order to account for differences in the absolute level of these variables through time. In addition, all the fundamental and market variables are lagged such that they are observable by all investors at the end of the month prior to the cross section of stock returns being explained. The estimated regression coefficients are the best estimate of the payoff in return to each company or stock characteristic while holding constant all the other characteristics during the regression period. The payoffs are interpreted as the average amount of monthly stock return attributable to a unit of exposure to each of the specific factors over the sample period of the regression.

The fact that the payoff of each company and stock characteristic is estimated while controlling for all the other possible factors is what enables us to determine what has truly worked on Bay Street. For example, there is now a lot of evidence emanating from the U.S. that the book to price ratio is strongly and positively related to future stock returns. However, it is possible that this effect is a result of

changes in stock price only, or it may be due to other correlated factors that measure a similar company attribute such as earnings yield or the sales to price ratio. Another possibility is that the book to price ratio effect is a result of a subset of high book to price stocks that actually have, for example, strong profitability and momentum characteristics. It may be these characteristics, not the high book to price characteristic, which is actually responsible for the observed higher returns. Our multi-factor methodology determines whether the book to price ratio is important while controlling all other factors including stock price, earnings yield, sales to price ratio, profitability, and momentum.

While it is informative to determine the average return payoffs to each company and stock characteristic, it is more interesting to determine which characteristics are the most important in determining Canadian stock returns. To do this, a normalized statistical measure of significance or importance is required. The regression coefficient t-statistic provides such a measure of statistical importance and thus provides a basis for ranking the factor payoffs from highest to lowest. The t-statistic captures not only the mean payoff to each factor, but also the consistency to which it provides the stock returns over the sample period.

Three caveats regarding this methodology should be noted. First, a number of the fundamental and market factors tested in this article are somewhat correlated, introducing a degree of multicollinearity into the factor regressions. Multicollinearity can cause instability in the factor payoff estimates and bias the magnitude of the t-statistics for the correlated factors. The list of included factors was chosen to balance the risk of multicollinearity with the objective of determining what has actually worked on Bay Street, given the effect of all the other possible factors that investors may consider when pricing Canadian stocks.[4] Second, while the company fundamental and stock characteristic factors are lagged such that they are observable by all investors at the beginning of the month for which the return is forecasted, the regressions are estimated over the full sample period thereby using all the historical data. That is, this analysis is in-sample and only captures what has happened during the sample period given the sample itself. Third, this article is by definition a data-mining exercise. The methodology simply mines the data using as many fundamental and market factors as possible that have appeared in the literature or are talked about by professional money managers, whether driven by rational economic theory or not, to determine what has worked in the past. Nevertheless, it is often very useful to determine what has worked in the past because it may provide insights into the manner in which investors make their investment decisions.

Full Sample Period Results

The top 20 company fundamental and stock characteristic factors over the full 10-year sample period from January 1989 to December 1998 are reported in Table 1.[5] The factors are ranked by the absolute value of their t-statistics, which indicate each factor's statistical importance for determining the monthly total returns of TSE stocks when all of the other explanatory variables are also included in the regression. The sign in front of the t-statistic indicates the direction of the payoff to that factor.[6]

There are many familiar variables in the top twenty list reported in Table 1, and all of them are significant at the 10% level, with the variables ranked one through 12 being significant at the 1% level, and the top 19 being significant at the 5% level. Our top-ranked variable is a well-known "value" measure, cash flow yield, which has a t-statistic of +11.90. Its importance is consistent with previous evidence related to the importance of value indicators, and with the evidence of HB.[7]

We also observe three other value related factors among the top 20: sales to price ratio (7th); sales to assets ratio (9th); and earnings yield (12th). Contrary to most previous evidence regarding the existence of a positive relationship between these variables and future stock returns, the coefficients for sales to price and earnings yield are negative. Two other popular value factors, dividend yield and the book to market earnings yield, displayed positive (+0.71) and negative (-1.87) signs respectively. Overall these results imply conflicting signals regarding the performance of value stocks versus growth stocks, after we control for the influence of other factors. While this contradicts much previous evidence, it is

consistent with the performance of value and growth stocks in Canada during our sample period, as measured by popular style indexes. In particular, the average monthly return of 0.72% for the BARRA large cap growth index over the 1989-1998 period was below that of 1.03% for their large cap value index. However, the opposite result was true for their small cap style indexes, where the growth index average return was 0.99%, versus 0.79% for the value index over the July 1990 to December 1998 period.[8] This observation is important with respect to our findings because our regression methodology implicitly treats all returns equally, unlike most indexes (including the BARRA style indexes) that are value-weighted.

There is strong evidence supporting the impact of price momentum on future returns based on the 2nd ranked factor (12-month active returns). This is consistent with a growing body of evidence regarding stock price momentum, and with the results of HB, who also rated this variable second in their U.S. sample. In addition, the 5th ranked factor (one-month active returns) demonstrates that stock returns experience strong one-month mean reversion. HB rated this the most important factor affecting U.S. stock returns, and also documented some very large t-statistics for the other countries they studied during their sample period.[9] As will be shown in the following sections, these two factors are two of the most consistent factors affecting stock returns during the two five-year sub-periods of our sample, and during both "up" and "down" markets. Two other technical indicators related to a stock's trading history are also among the top 20 factors: the 120-day moving average (MA) crossover variable (ranked 11th), and the 60-day MA crossover variable (ranked 17th). While technical factors are difficult to justify economically, especially when controlling for the impact of other fundamental factors, their impact and their coefficient signs are all consistent with previous empirical evidence.

The 6th, 15th, 19th and 20th ranked factors in Table 1 are: the number of revisions in fiscal year EPS estimates, the long term forward PEG ratio inverse, two-year ahead expected EPS growth, and expected quarterly EPS momentum. These factors show that future stock returns are positively related to estimated future EPS growth and earnings revisions, which is intuitive, and is consistent with previous empirical evidence. Factors four and 14 (operating margin and the return on equity (ROE) trend) are also intuitive, since they imply that stock returns are positively related to firm profitability. Curiously, the coefficient for the operating margin trend (our 13th-ranked factor) is negative, contrary to what one would expect intuitively, and based on the signs of the other profitability factors.

There are a few surprises in the top 20 list. First, the 3rd most important factor determining stock returns in Canada over the past 10 years is the natural logarithm of stock price, and the relationship is negative. The higher a stock price, the lower the return, on average. Although the stock price effect is documented in the literature, the importance of the variable is quite surprising because it makes little intuitive or economic sense on the surface. One could argue that the higher returns represent compensation for the higher commissions and bid-ask spreads (percentage wise) associated with smaller priced stocks.[10] Along these lines, our 18th ranked variable, the trading volume to float ratio, also has a negative coefficient, indicating that investors are compensated to a certain extent for stock illiquidity.[11] Whatever the reason, stock price is one of the most consistent predictors of stock returns in our study.

One of the fundamental principles in modern financial theory is that risk and return are positively correlated. That is, the higher the risk of an investment, the higher the return. Thus, it is not surprising to observe three risk-based factors in the top twenty: debt-to-equity ratio (8th), EPS estimate dispersion (10th), and total return risk (16th). However, all three of these risk-based factors are negatively related to future stock returns. Seven of our other nine risk factors also display an inverse relationship between risk and future stock returns, with the lone exceptions being cash flow yield volatility (+1.50) and the debt-to-equity ratio trend (+0.05).[12] While these results may be surprising, they are consistent with the findings of HB, who rated debt to equity, variance of total return, and residual variance among the twelve most important factors across their five-country sample. These risk factors all displayed negative coefficients, with debt to equity being negative and significant in the U.S., Germany, France

and the U.K. The negative relationship between risk and return is also consistent with other recent U.S. research.[13]

A factor that is conspicuous by its absence on the top 20 list is firm size as measured by market capitalization. This factor produced a t-statistic of +0.43, which implies it had a positive, but insignificant impact on stock returns over the entire period. The lack of significance is somewhat surprising, given the abundance of historical evidence suggesting that small firms tend to outperform larger ones. However, this factor was not rated among the top 12 factors by HB either. In addition, this observation is consistent with the performance of small and large cap stocks in Canada during our sample period, which was about equal. For example, the BARRA large cap index average monthly return of 0.91% over the July 1990 to December 1998 period is very similar to the 0.87% average return for their small cap index.

Factor Payoff Stability Tests

The previous section reported what worked on Bay Street over the past ten years. However, the company fundamentals and stock characteristics that are most rewarded in the stock market may vary over different time periods. For example, what influenced stock returns on Bay Street in the late 1980s may not predict stock returns in the late 1990s and vice-versa. Indeed, investment styles come and go, as do investment theories.

The purpose of this section is to determine the stability of the factor payoffs and their relative level of importance between the first half of the sample period and the second half of the period. This is accomplished by estimating a factor payoff regression over the first five years of the sample, January 1989 to December 1993, and estimating another factor payoff regression over the second five years of the sample, January 1994 to December 1998. The results of this analysis are reported in Table 2.[14]

We begin by noting that four factors are among the top 10 during both halves of the sample: stock price, number of revisions in fiscal year EPS estimates, 12-month active returns and operating margin. These factors represent four of the top six in our overall sample, which suggests they have been the most powerful and stable factors for determining future stock returns in Canada over the past decade.[15] Only one other factor (one-month active returns) is among the top 20 in both sub-periods, and for the entire sample period (where it was rated 5th). In short, five of the top six factors overall are in the top 20 in both sub-periods, indicating the importance of these factors. All of the remaining 15 factors in Table 1 make the top 20 list in at least one sub-period except for the sales to assets ratio. Our top-ranked factor in Table 1, cash flow yield, was insignificant during the first sub-period and did not make the top 20 list. Its high rating in the total sample results is driven by its importance during the second sub-period, where it was again the top-rated factor, with a t-statistic of +13.47. While the sub-period results indicate that the rank and importance of the various factors varies through time, there is also a great deal of consistency, especially among five of the top six factors.

To further illustrate the stability, or lack of stability, of the factor payoffs, Figure 1 plots the t-statistics of the top 6 factors for each calendar year of the 10-year sample period. The most interesting result is that the relationship between cash flow yield and stock returns is only strongly positive in two of the ten years - 1994 and 1996. The remaining factors, 12-month active returns, stock price, operating margin, one-month active returns and the number of fiscal year EPS estimate revisions, are far more consistent year-by-year with the sign of the payoff as expected in most years. Nevertheless, it is interesting that price momentum only appears to work in six of the ten years and operating margin has only been associated with a positive return payoff since 1993.

Up Markets and Down Markets

The purpose of this section is to determine the stability of the factor payoffs and their relative level of importance during the months that the market is up and during the months that the market is down. This is accomplished by separating the 10-year sample into two sub-samples: all the months where the

TSE 300 Index had returns that exceeded T-bill returns by 2% or more, and all the months where the TSE 300 Index had returns more than 2% below the T-bill return. Over the January 1989 to December 1998 period there were 37 (30.8%) "up" market months and 29 (24.2%) "down" market months, with the remaining 54 months falling in between. The breakdown through the sub-periods is 14 up market months and 14 down months during the first half of the sample period, and 23 up market months and 15 down months during the second half. The results of this analysis are reported in Table 3.[17]

Only one factor, operating margin, is in the top 10 during both up and down markets. Only three other factors among the top 20 in Table 1 (12-month active returns, one-month active returns, and 120-day MA crossover) are in the top 20 during both up and down markets. These results reinforce our conclusion in the previous section regarding the consistent impact that one-month active returns, 12-month active returns and operating margin have had on Canadian stock returns. In particular, throughout both sub-periods and during both up and down markets, stock returns display a consistently strong positive relationship with 12-month price momentum and operating margin, and a strong negative relationship with one-month active returns. Two of our other top six factors in Table 1 (stock price and the number of fiscal EPS estimate revisions) were rated in the top five in up markets, but were not among the top 20 during down months. Our top-rated factor in Table 1, cash flow yield, was rated number two in down markets, but was insignificant during up markets, with a t-statistic of only +0.09.

Similar to our sub-period results, we observe that 13 of the 16 remaining variables reported in Table 1 show up in either up or down markets. The three exceptions are the sales to assets ratio, EPS estimate dispersion, and two-year ahead expected EPS growth, which do not appear in Table 3. Table 3 also displays six top 20 variables that did not appear in either Table 1 or Table 2: market capitalization and the analyst coverage dummy variable (which make the top 20 in both up and down markets); cash flow yield risk (up markets only); and, the reinvestment rate, the logarithm of sales and sales momentum (down markets only).

It is interesting to note that market capitalization has the largest impact on stock returns during down markets, displaying a significant negative relationship (-2.71). By contrast, market capitalization is rated number 20 during up markets, but has a positive coefficient, with a t-statistic of +1.48. This suggests that large cap stocks performed better than small cap stocks during the up markets in our sample, but worse during down months. This market value effect, as well as the significant negative relationship between stock returns and the trading volume to market float ratio during down markets, is consistent with the notion that lower liquidity during down markets tends to provide some price support.

Overall, there are four technical factors among the top 20 during up markets, and three during down markets, confirming their importance during both kinds of markets. Some of our other factor categories appear to vary in importance in Table 3. There are five earnings estimate factors and four profitability factors among the top 20 during up markets, with the corresponding numbers for down markets being zero, and two. By contrast, there are five value factors and four growth factors in the top 20 during down markets, with only one of each appearing in the top 20 for up markets. Overall, these results suggest that technical factors are important during both up and down markets, while expected earnings and profitability measures are more important during up markets. Finally, liquidity, value and growth measures appear to be more important during down markets.

Conclusions

While it is difficult to make definitive conclusions regarding why stock returns behave as they do, several results from our study stand out. The most statistically powerful and stable predictors of future stock returns in Canada over the last decade have been 12-month price momentum, one-month reversals, operating margin, the number of earnings estimate revisions, and stock price. These results demonstrate the importance of technical indicators, profitability measures and stock liquidity on

Canadian stock returns. Cash flow yield has also been very important, particularly in 1994 and 1996. Risk variables, when significant, often displayed a negative relationship with stock returns, contrary to what one might expect, while traditional value factors varied in sign and levels of significance.

The influence of a number of variables has varied through time, which may be a function of changes in the economic or market conditions in existence during our sample period, changes in the investment styles or theories that were in vogue, or both. In addition, the importance of many factors varied substantially across up and down markets. In particular, we found that liquidity, value and growth measures were more important during down markets, while earnings estimates and profitability factors were more important during up markets.

Obviously, the results of this article are important to the market efficiency debate. They demonstrate that future Canadian stock returns are predictable from easily observable company fundamentals and market characteristics, which may contradict the notion of market efficiency. However, predictability in and of itself does not indicate inefficiency. Indeed, observing significant factor payoffs may simply indicate compensation for incremental risk, which is rational. Thus, the results of this article may, in fact, be consistent with Canadian market efficiency.

However, there are a couple of observations that make this argument difficult to accept. First, among the most important factors are stock price, one-month price reversals, and 12-month price momentum. These factors are difficult to justify economically as rational drivers of future stock returns, especially since we control for the influence of other fundamental factors. Second, the majority of the risk-based factors included in the analysis display a negative payoff, often significantly negative. That is, the higher the risk, the lower the future stock return.

In any event, the main concern for investors is whether the important factors will continue to be important in the future. If the factors are difficult to justify economically, then it seems reasonable to expect investors to arbitrage those payoffs away as they become more widely known. However, it is possible that the so-called "irrational" payoffs are a result of basic behavioral, psychological and cognitive biases, and/or institutional effects. If these biases and effects are consistent and stable through time, then their payoffs may indeed exist into the future.

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Appendix: Company and Market Factors

Risk and Quasi-Risk Factors:

1. Stock Market Beta - Regression coefficient of stock return on TSE 300 return over the trailing 60-month (minimum 36-month) time period
2. Total Return Risk - Standard deviation of the stock return over the trailing 60-month (minimum 36-month) time period
3. Cash Flow Yield Risk - Standard deviation of the cash flow yield over the trailing 60-month (minimum 36-month) time period
4. Debt to Equity Ratio - Total long-term debt-to-equity ratio
5. Debt to Equity Ratio Trend - Regression coefficient of the debt-to-equity ratio on time over the trailing 60-month (minimum 36-month) time period
6. Debt Momentum - Trailing 12-month growth rate in total long-term debt
7. Growth Rate of Debt - The geometric annual average growth rate in total long-term debt over the trailing 48-month time period
8. Interest Coverage - Operating income before depreciation divided by long-term debt interest expenses
9. Working Capital Ratio - Total current assets divided by total current liabilities
10. EPS Predictability - Coefficient of determination for the regression of EPS on time over the trailing 60-month (minimum 36-month) time period
11. Sales Predictability - Coefficient of determination for the regression of total annual sales on time over the trailing 60-month (minimum 36-month) time period
12. EPS Estimate Dispersion - Coefficient of variation of current fiscal year I/B/E/S EPS estimates

Size and Liquidity Factors:

13. Market Capitalization - Natural logarithm of common stock market capitalization
14. Sales - Natural logarithm of net sales
15. Stock Price - Natural logarithm of common stock price
16. Trading Volume to Float Ratio - Trailing 6-month average monthly trading volume divided by market float
17. Trading Volume Trend - Regression coefficient of the trading volume on time over the trailing 60-month (minimum 36-month) time period
18. Analyst Coverage Dummy - Dummy variable equaling one for firms where two or more analysts have given fiscal year estimates

Value Factors:

19. Dividend Yield - Trailing annual dividends to common shareholders divided by stock price
20. Book to Market Value - Common shareholders book value divided by the common stock market capitalization
21. Cash Flow Yield - Trailing annual cash flow from operations divided by the common stock market capitalization of the firm
22. Trend in Cash Flow Yield - Regression coefficient of the cash flow yield on time over the trailing 60-month (minimum 36-month) time period
23. Earnings Yield - Trailing annual primary EPS excluding extraordinary items divided by the stock price
24. Expected Earnings Yield - I/B/E/S current fiscal year consensus EPS divided by stock price
25. Sales to Assets Ratio - Total net sales divided by total assets
26. Sales to Price Ratio - Total net sales divided by common stock market capitalization
27. Sales to Price Ratio Trend - Regression coefficient of the sales to market value ratio on time over the trailing 60-month (minimum 36-month) time period

Growth Factors:

28. Reinvestment Rate - Average net income less dividends divided by the book value of equity over prior 3 years
29. Sales Momentum - Trailing 12-month growth rate in net sales
30. Growth Rate of Sales - The geometric annual average growth rate in net sales over the trailing 48-month time period
31. EPS Momentum - Trailing 12-month growth rate in primary EPS before extraordinary items
32. Growth Rate of EPS - The geometric annual average growth rate in EPS over the trailing 48-month time period
33. Expected Quarterly EPS Momentum - The most recent I/B/E/S consensus 12-month forward EPS estimate divided by the consensus 12-month forward EPS estimate 3-months prior
34. 1-Year Ahead EPS Growth - Current fiscal year I/B/E/S consensus EPS estimate divided by most recent actual EPS
35. Negative EPS Dummy - Zero/one dummy variable indicating non-negative 12-month lagged EPS
36. Lagged PEG Ratio Inverse - Trailing 12-month growth in EPS divided by stock price divided by most recent trailing fiscal year EPS for firms with positive EPS, zero otherwise
37. 1-Year Ahead Negative EPS Dummy - Zero/one dummy variable indicating non-negative one-year ahead I/B/E/S consensus EPS
38. 1-Year Ahead PEG Ratio Inverse - One-year ahead EPS growth (I/B/E/S consensus) divided by stock price divided by current fiscal year EPS (I/B/E/S consensus) for firms with positive consensus EPS, zero otherwise
39. 2-Year Ahead EPS Growth - Next fiscal year I/B/E/S consensus EPS divided by current fiscal year I/B/E/S consensus EPS
40. LT Expected EPS Growth Rate - I/B/E/S consensus five-year ahead growth in EPS
41. LT Forward PEG Ratio Inverse - Five-year ahead EPS growth (I/B/E/S consensus) divided by stock price divided by current fiscal year EPS (I/B/E/S consensus) for firms with positive consensus EPS, zero otherwise

Profitability Factors

42. Return on Equity - Net income before extraordinary items divided by common shareholders book value of equity
43. Trend in Return on Equity - Regression coefficient of the return on equity ratio on time over the trailing 60-month (minimum 36-month) time period
44. Return on Assets - Net income before extraordinary items divided by total assets
45. Operating Margin - Operating income divided by total net sales
46. Trend in Operating Margin - Regression coefficient of the operating margin on time over the trailing 60-month (minimum 36-month) time period

Earnings Estimate Revision and Surprise Factors:

47. Revision in Q1 EPS Estimates - Percentage change in current month I/B/E/S consensus fiscal quarter EPS estimate relative to consensus EPS estimate one month prior
48. Revision in FY1 EPS Estimates - Percentage change in current month I/B/E/S consensus fiscal year EPS estimate relative to consensus EPS estimate three months prior
49. No. of Q1 Estimate Revisions - Number of current month I/B/E/S fiscal quarter EPS estimates raised less number of estimates lowered divided by total number of estimates
50. No. of FY1 Estimate Revisions - Number of current month I/B/E/S fiscal year EPS estimates raised less number of estimates lowered divided by total number of estimates
51. Fiscal Quarter EPS Surprise - Actual fiscal quarter EPS less the I/B/E/S consensus earnings estimate divided by the cross-sectional standard deviation of the earnings estimates for the most recently reported fiscal quarter
52. Fiscal Year EPS Surprise - Actual fiscal year EPS less the I/B/E/S consensus earnings estimate divided by the standard deviation of the earnings estimates weighted for the number of months since surprise for the most recently reported fiscal year

Technical Factors:

53. Alpha - Regression constant of a regression of stock return on the TSE 300 return over the trailing 60-month (minimum 36-month) time period
54. 1-Month Active Return - One-month stock return less the one-month TSE 300 return
55. 3-Month Active Return - Three-month stock return less the three-month TSE 300 return
56. 12-Month Active Return - Twelve-month stock return less the twelve-month TSE 300 return
57. 36-Month Active Return - 36-month stock return less the 36-month TSE 300 return
58. 60-Day MA Cross-Over - Zero/one dummy variable indicating that the current month-end stock price exceeds the average month-end stock prices over the prior two months
59. 120-Day MA Cross-Over - Zero/one dummy variable indicating that the current month-end stock price exceeds the average month-end stock prices over the prior four months

Economic Sector Variables:

60-70. Sector Dummies - Zero/one dummy variable indicating economic sector. Defined sectors are basic materials, consumer cyclicals, consumer staples, health care, energy, financial services, capital goods, technology, communication services, utilities, and transportation.

Table 1

Top 20 Factor Payoffs Over Full Sample Period January 1989 to December 1998

Rank	Factor Name	T-Statistic
1	Cash Flow Yield	11.90
2	12-Month Active Return	6.47
3	Stock Price	-6.27
4	Operating Margin	5.21
5	1-Month Active Return	-5.11
6	No. of FY1 Estimate Revisions	4.72
7	Sales to Price Ratio	-4.15
8	Debt to Equity Ratio	-4.14
9	Sales to Assets Ratio	3.06
10	EPS Estimate Dispersion	-2.84
11	120-Day MA Cross-Over	2.78
12	Earnings Yield	-2.64
13	Operating Margin Trend	-2.50
14	Return on Equity Trend	2.38
15	LT Forward PEG Ratio Inverse	2.27
16	Total Return Risk	-2.21
17	60-Day MA Cross-Over	2.16
18	Trading Volume to Float Ratio	-2.06
19	2-Year Ahead Expected EPS Growth	1.96
20	Expected Quarterly Earnings Momentum	1.92

Table 2

Top 20 Multivariate Factor Payoffs during the First and Second Half of Sample Period January 1989 to December 1998

First Half of Sample January 1989 to December 1993			Second Half of Sample January 1994 to December 1998		
Rank	Factor Name	T-Statistic	Rank	Factor Name	T-Statistic
1	Return on Equity	7.60	1	Cash Flow Yield	13.47
2	Stock Price	-5.42	2	Debt to Equity Ratio	-7.28
3	Dividend Yield	4.54	3	12-Month Active Return	5.96
4	No. of FY1 Estimate Revisions	4.20	4	1-Month Active Return	-4.95
5	Revision in Q1 EPS Estimates	-3.40	5	Operating Margin	4.78
6	Return on Equity Trend	2.85	6	Stock Price	-4.74
7	12-Month Active Return	2.68	7	Earnings Yield	-3.73
8	LT Expected EPS Growth Rate	-2.42	8	Operating Margin Trend	-2.93
9	Revision in FY1 EPS Estimates	2.35	9	120-Day MA Cross-Over	2.63
10	Operating Margin	2.31	10	No. of FY1 Estimate Revisions	2.58

11	Return on Assets	-2.16	11	Expected Quarterly Earnings Momentum	2.18
12	Sales Predictability	2.06	12	Sales to Price Ratio	-1.87
13	Trading Volume to Float Ratio Trend	1.95	13	EPS Estimate Dispersion	-1.84
14	LT Forward PEG Ratio Inverse	1.92	14	Trading Volume to Float Ratio	-1.83
15	60-Day MA Cross-Over	1.91	15	Book Value to Price Ratio	-1.70
16	2-Year Ahead Expected EPS Growth	1.79	16	Return on Equity	-1.59
17	Fiscal Quarter EPS Surprise	1.74	17	Total Return Risk	-1.53
18	1-Month Active Return	-1.72	18	60-Day MA Cross-Over	1.49
19	Growth Rate of EPS	1.60	19	Interest Coverage	1.45
20	Expected Earnings Yield	1.60	20	Negative Expected EPS Dummy	1.43

Table 3

Top 20 Multivariate Factor Payoffs during Up and Down Market Months
January 1989 to December 1998

Up Market Months January 1989 to December 1998			Down Market Months January 1989 to December 1998		
Rank	Factor Name	T-Statistic	Rank	Factor Name	T-Statistic
1	12-Month Active Return	5.56	1	Operating Margin	5.73
2	Stock Price	-4.92	2	Cash Flow Yield	4.70
3	1-Month Active Return	-4.89	3	120-Day MA Cross-Over	4.60
4	Operating Margin	4.05	4	Return on Equity	4.14
5	No. of FY1 Estimate Revisions	2.89	5	Expected Earnings Yield	3.50
6	Return on Equity Trend	2.62	6	Analyst Coverage Dummy	-3.39
7	Return on Assets	2.48	7	Trading Volume to Float Ratio	-3.34
8	Operating Margin Trend	-2.44	8	Reinvestment Rate	-3.05
9	LT Forward PEG Ratio Inverse	2.37	9	Total Return Risk	-2.93
10	60-Day MA Cross-Over	2.36	10	Sales to Price Ratio	-2.89
11	Negative EPS Dummy	2.22	11	Sales	2.87
12	Cash Flow Yield Standard Deviation	2.09	12	Sales Momentum	-2.74
13	Analyst Coverage Dummy	2.01	13	Market Capitalization	-2.71
14	Revision in FY1 EPS Estimates	2.00	14	Dividend Yield	-2.51
15	Negative Expected EPS Dummy	1.79	15	1-Month Active Return	-2.38
16	Revision in Q1 EPS Estimates	-1.71	16	Debt to Equity Ratio	-2.07
17	120-Day MA Cross-Over	1.64	17	12-Month Active Return	2.06
18	Fiscal Quarter EPS Surprise	-1.55	18	Growth Rate of EPS	-1.99

19	Earnings Yield	-1.51	19	Book Value to Price Ratio	-1.80
20	Market Capitalization	1.48	20	Expected Quarterly Earnings Momentum	1.74

Endnotes

1. There are several studies documenting the size and book-value-to-price effects including the U.S. evidence of Fama and French (1992), and the international evidence of Capaul, Rowley and Sharpe (1993), and Fama and French (1998). Price momentum has been shown to exist in U.S. markets by Jegadeesh and Titman (1993), in Canadian markets by Foerster, Prihar and Schmitz (1994/95) and Cleary and Inglis (1998), and in other global markets by Rowenwerst (1998).
2.
3. These screens should also reduce the impact of survivorship bias, since firms going bankrupt may be eliminated from the sample prior to going bankrupt.
4. In particular, the data for the independent variables is truncated at the 1st and 99th percentiles to remove extreme outliers. The data is further truncated at plus and minus four standard deviations. These truncation routines are repeated cross-sectionally each month during the sample period.
5. There is some evidence of multicollinearity in the factor payoff regressions, as some of the factor payoffs do appear somewhat sensitive to the factors included in the analysis, the sample period, and the sample selection criteria. Nevertheless, over the full sample period the correlations between the factors are not excessive for stock factor research. Across all of the 59 factors and their 1,711 unique cross-correlations, only 22 of the correlations exceed 0.50, only 16 exceed 0.60, and only 5 exceed 0.70. In addition, the factors that rank in the top 10 are relatively stable to the included factors, the sample period and the sample selection criteria, and the signs of the payoffs are for the most part consistent with prior expectations and other research. Consequently, while multicollinearity is an issue with this research and may influence some of the results, it is probably does not drive the majority of the results.
6. The sample includes 31,321 firm months of observations. The adjusted R-squared of the regression is 2.20%, with 23 of the 59 factors being statistically significant at the 10% level.
7. Fifty-nine separate regressions were also run using each factor as the sole explanatory variable, other than the industry dummy variables. While it is not as meaningful to rank these variables based on their t-statistics as it is in the multivariate regressions, we provide the top 10 list here in order, along with their t-statistics for the interested reader: number of FY1 estimate revisions (+10.67); 120-day moving average cross-over dummy (+9.88); 12-month active return (+8.55); expected quarterly EPS momentum (+7.93); 3-month active return (+7.16); 60-day moving average cross-over dummy (+6.61); revision in FY1 EPS estimates (+6.28); cash flow yield (+5.62); operating margin (+5.12); and total return risk (-4.42). Notice that eight of these also appear in the top 20 presented in Table 1 for the multivariate regressions, including four of the top six.
8. HB also found this to be an important predictor of stock returns over the 1985-93 period, based on multivariate t-statistics in their samples from: the U.S. (+6.2); Germany (+2.7); France (+5.1); the U.K. (+3.1); and Japan (+1.7).
9. Information for the BARRA small cap indexes is only available as far back as July 1990.
10. HB found 12-month excess returns to be an important predictor of stock returns in the US (+7.8), Germany (+2.8), France (+4.2), the U.K. (+7.3), and Japan (+1.5). In addition, HB found one-month excess returns to be an important factor in the U.S. (-10.8); Germany (-8.8); France (-11.3); the U.K. (-7.6), and Japan (-13.3).
11. To test whether bid-ask bounce could explain any of the price effect, identical multivariate regressions were estimated, except the price factor was lagged an extra month. While the t-statistics and thus significance of the price factor fell very slightly, in most cases the rank of the price factor remained the same. Therefore, it is unlikely that bid-ask bounce explains the power and significance of the price factor. A similar experiment was conducted with the 12-month price momentum factor. Again, implementing an additional lag on the momentum factor did not materially affect the power of this factor.
12. HB found this to be the third most important factor influencing U.S. stock returns, with a t-statistic of -5.25.
13. While the coefficient on interest coverage is positive, a higher value for this ratio indicates lower risk, so the implied relationship between risk and return is negative.
14. For example, see Fama and French (1992), Bauman and Miller (1997), and Haugen (1995).
15. The first half of the sample period includes 10,179 firm months of observations. The adjusted R-squared of the regression is 3.24%, and 18 of the 59 factors are statistically significant at the 10% level. The regression for the second half of the sample period includes 21,142 firm months of observations, reports an adjusted R-squared value of 3.03%, and finds 15 of the 59 factors significant at the 10% level.
16. The momentum effect was first documented in Canada by Foerster, Prihar, and Schmitz (1994/95) using data through 1993. Although their article received a lot of attention due to the strength of their results, it did receive some criticism due to their sample formation methodology. These sub-period results not only confirm those of Foerster, Prihar and Schmitz, they provide out-of-sample support for the Canadian momentum effect, since the second half of the present sample is post-1993. In fact, it actually appears the momentum effect has gotten stronger since 1993.
17. The up market sample includes 10,643 firm months of observations. The adjusted R-squared of the regression is 3.29%,

and 16 of the 59 factors are statistically significant at the 10% level. The regression for the down market sample includes 7,729 firm months of observations, reports an adjusted R-squared value of 7.53%, and finds 20 of the 59 factors significant at the 10% level. Notice that the predictability of returns in down markets is much higher than in up markets.

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