A PRIZE AT THE Right Price

Using four value ratios and momentum measures, the authors create and test a stock-picking method for self-financing portfolios.

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Researchers and practitioners have extensively documented that value-oriented and momentum-oriented strategies exhibit good average performance over long time horizons. However, both strategies suffer from relatively long non-overlapping periods of underperformance: value-oriented strategies generally post good results when momentum-oriented strategies do not, and vice-versa (Desrosiers, L'Her and Plante [2004]). A model benefiting from the low correlation across those styles, without betting on whether one strategy will outperform the other, is thus a promising avenue of research.

While there exists a large body of tests on the U.S. market which have documented the relations between future returns and a group of potential predictive variables, there is no such literature on the Canadian stock market. To our knowledge, this study is the first to implement multivariate tests examining the combined capacity of value-oriented and momentum-oriented variables to predict future returns.[1]

In this article, we do not perform a comprehensive test of all the potential variables that can help explain cross-sectional differences in stock returns. Rather, we focus on a parsimonious model that considers four documented return-forecasting variables simultaneously (two value-oriented variables and two momentum-oriented variables). These variables are the book-to-market ratio, the forward earnings-to-price ratio, the price momentum, and the analysts' earnings revisions (the earnings momentum). The intent behind the model is to exploit the diversification benefits of the different information signals.

A disciplined self-financing portfolio based on the ranking of returns projected through a multivariate regression model using the four aforementioned forecasting variables over three-month horizons posts a significant monthly average raw return of 2.51% for the 1988-2001 period. When we control for risk factors (market, size and book-to-market) the risk-adjusted return of the strategy is 2.53% per month on average, and significantly greater than zero. The loadings on the market risk factor, size factor and book-to-market ratio are in fact not significantly different from zero. Further, we provide evidence that results from this strategy are robust to different sensitivity tests such as changing the forecast horizon, discarding Nortel Networks Inc. from the sample, setting a minimum number of financial analysts' coverage, and accounting for realistic transaction costs.

Firm Characteristics

While the relations between ahead returns and firm characteristics have been systematically examined in the U.S., fewer corresponding studies have been conducted on the Canadian stock market. The following is a brief review of what has been done recently in Canada.

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Price-to-earnings ratio: Bartholdy (1993) and Bourgeois and Lussier (1994) find a negative relation between future stock returns and price-to-earnings ratio. Their findings are similar to those in the U.S. (Jaffe, Keim and Westerfield [1989]). To our knowledge, no study examines the forward earnings-to-price ratio in Canada.

Book-to-market ratio: Elfakhani, Lockwood and Zaher (1998) document a positive and slightly significant relation between returns and book-to-market ratios over the 1975-1989 period. High book-to-market firms outperform low book-to-market firms even after controlling for size effects. However, the book-to-market effect seems confined to 1984-1989, a period corresponding to lower capital gains taxes. Berkowitz and Qiu (2001) find a positive (0.426% monthly return) but non-significant HML (high book-to-market stocks minus low book-to-market stocks) premium over the 1982-1999 period. Over the 1963-2001 period, L'Her, Masmoudi and Suret (2003) find a positive and significant HML premium (average monthly return of 0.42%).

Price momentum: Foerster, Priar and Schmitz (1994) scrutinized the profitability of momentum strategies in the TSE 100 stock universe over the 1977 to 1992 period.[2] They ranked stocks quarterly in decile portfolios based on a weighted average of the preceding four quarters of returns and considered quarterly holding periods. The top decile portfolio posted a 47.4% annual return on average, while the bottom decile posted a 10% annual return on average. Accounting for transaction costs and market risk, they also verified the profitability of this momentum strategy. Using a similar strategy, but controlling for the survivorship bias, Kan and Kirikos (1996), as well as Cleary and Inglis (1998), find less profitable returns (see also Foerster [1996]).[3]

Earnings momentum: L'Her and Suret (1996) show that a self-financing portfolio (P1-P5) based on financial analysts' earnings forecasts posts a significant performance over the 1985-1994 period. O'Brien (1990) shows that because financial analysts' forecasts lack synchronism, the consensus measured by Institutional Broker's Estimate System (IBES) uses recent forecasts as well as forecasts which have not been revised for a long time. This problem can be avoided and future tendencies in market earnings can be predicted by using variables which measure the number, rather than the magnitude, of forecast revisions (Desrosiers, L'Her and Tnani [2000]): number of upward revisions minus number of downward revisions/number of revisions.

Sample Description and Measure of Variables

End-of-month stock prices, book values, market capitalizations, and total returns including dividends come from Standard & Poor's Compustat. Earnings forecasts, number of financial analysts and earnings revisions are obtained from the IBES database. The availability of variables allows us to obtain a sample beginning in January 1988 and finishing in December 2001. The data sample varies from a minimum of 123 to a maximum of 463 companies over the 1988-2001 period. The value-weighted index computed from the sample is correlated at 98% with the TSE 300 index. The four retained predictive variables are constructed as follows:

BM: The book-to-market ratio. While the book equity is computed once a year and available typically in June for a December fiscal year, the market equity is measured each month.

EP: The forward earnings-to-price is the fiscal year-two earnings forecast divided by the current price. The fiscal year-two earnings forecast is used instead of the fiscal year-one earnings forecast in order to alleviate problems of misalignment due to different firm fiscal year-ends.[4]

PM: The price momentum is calculated directly from the previous six-month total return.

EM: The earnings momentum is measured by computing the following ratio: number of upward earnings revisions minus number of downward earnings revisions/total earnings revisions for fiscal year two made by financial analysts for a company during a given month.

Data provided by IBES and Compustat comprise active and inactive companies, thus reducing the survivorship bias. However, our study may suffer from less representativeness at the beginning of the period considered than at the end. Further, as we retain only firms present in both databases, this may also induce a selection bias.

In Table 1, we provide descriptive statistics on the retained variables for all the firms in the sample over the period 1998-2001. We also report the average size of firms, as measured by market capitalization in millions of Canadian dollars, and the average number of financial analysts following the firms.

We also found the average correlations within each group of variables (fundamental and technical) were low, and there was no evidence of multicolinearity issues. Further, the negative correlations between both groups of variables confirm our intuition that significant diversification benefits could be obtained from combining both groups of variables.

Methodology

The first objective of this study is to investigate the ability of the retained variables to predict future stock returns in the Canadian market by testing the following equation:

$$R_{i,t\ to\ t+h} = \gamma_0 + \sum_{k=1}^{4} \gamma_k X_{i,k,t} + \varepsilon_{i,t}$$

where $R_{i,t\ to\ t+h}$ is the return of firm i from time t to time $t+h$; $X_{i,k,t}$ = ln(BM), ln(EP), PM and EM stands for the firm characteristic that we examined; γ_k stands for the risk premium associated with each firm characteristic; $\varepsilon_{i,t}$ equals the residual; i is equal to 1,...,I and stands for the firms; t is equal to 1,...,T and stands for months, and ln(.) is the logarithmic transformation.

To estimate the relation between ahead returns and firm characteristics, we use the Fama and MacBeth (1973) two-pass procedure. First, we estimate cross-sectional coefficients periodically with ordinary least squared regression (OLS). Second, we calculate the average firm characteristic coefficients for the whole sample period. More precisely, we first obtain a time series of estimates from January 1988 to December 2001.

Then, we calculate the average coefficients and test their statistical significance. We estimate the above equation over three forecast horizons: one, three and six months.

Empirical Results

Table 2 reports the parameter estimates and their t-statistics for three different horizons over the 1988-2001 period. As expected, the coefficients for the fundamental variables are positive and statistically significant, except the EP coefficient for the six-month horizon. These results are consistent with those reported by Fama and French (1992). Further, the coefficients for the momentum variables present the expected (positive) sign, and are significant at the 1% level for both one and three-month forecast horizons, and at the 5% level for the six-month forecast horizon.

Overall, the results shown in Table 2 corroborate past studies of stock return behaviour: those stocks which have experienced strong past performance (with high return over the preceding six months), positive earnings revisions, and high book-to-market and earnings-to-price ratios can be expected to outperform. The estimated parameters for the momentum-oriented variables tend to be more significant than the value-oriented ones.

TABLE 1: DESCRIPTIVE STATISTICS ON PREDICTIVE VARIABLES OF AHEAD STOCK RETURNS OVER THE 1988-2001 PERIOD

Variable	Mean	Median	Standard Deviation
BM	0.96	0.63	4.41
EP	0.10	0.08	0.38
PM	5.68%	2.37%	43.85%
EM	-0.78%	0.00%	25.14%
Market Cap (M$)	1,324.7	233.8	5,705.4
Number of analysts	5.4	4.0	5.1

TABLE 2: ESTIMATED AVERAGE COEFFICIENTS FROM THE TWO-STEP FAMA AND MACBETH PROCEDURE (1993-2001 PERIOD)

	Mean	t-statistic	% of months the expected sign
Forecast Horizon: one month			
Intercept	0.0191**	4.08	
Ln(BM)	0.0043**	2.75	58.3%
Ln(EP)	0.0034*	2.16	55.8%
PM	0.0249**	5.16	69.9%
EM	0.0198**	6.13	68.7%
Average adjusted R^2	4.5%		
Forecast Horizon: three months			
Intercept	0.0604**	3.80	
Ln(BM)	0.0159**	2.67	64.8%
Ln(EP)	0.0113*	2.38	57.4%
PM	0.0759**	4.63	72.2%
EM	0.0361**	3.24	72.2%
Average adjusted R^2	6.0%		
Forecast Horizon: six months			
Intercept	0.0706	1.33	
Ln(BM)	0.0334*	2.40	66.7%
Ln(EP)	0.0018	0.09	59.3%
PM	0.1526**	4.13	81.5%
EM	0.0527*	2.12	77.8%
Average adjusted R^2	7.8%		

** significant at 1% * significant at 5%

Portfolio Strategy/Methodology

The second objective of this study is to examine whether an investment strategy which capitalizes on the predictive power of the above firm characteristics can be implemented successfully and be economically profitable.

Our methodology is based on a cumulative estimation window. First, we use the first 60-month window

(January 1988 through December 1992) to estimate the average coefficients associated with each forecasting variable. We then use the average coefficients to project future returns. This procedure is repeated for all subsequent months, using a cumulative estimation window.[5]

For each estimated month (starting with January 1993), stocks are ranked and partitioned into ten decile portfolios based on their projected returns. The self-financing strategy has a long position in stocks with the highest projected returns (P1), and a short position in stocks with the lowest projected returns (P10). Within each portfolio, stocks are value-weighted and then held for n months corresponding to the forecast period (the forecast and holding periods are of equal length: n=one, three and six months). This procedure is repeated every month following the widely used momentum methodology developed by Jegadeesh and Titman (1993). Each month, n overlapping portfolios are simultaneously held. Each monthly return is an equal-weighted return of the n portfolios. This methodology involves rebalancing 1/n of the holdings each month.

Empirical Results

Table 3 presents the raw returns on the long portfolio (P1), the short portfolio (P10) and the long-short portfolio (P1-P10) for the three holding periods. In the analysis that follows, we will focus only on the three-month forecast and detention period. We use the following notation for the long and short portfolios and the three-month forecast and holding period: P1,3 (P10,3). The self-financing portfolio posts on average a significant performance over the whole out-of-sample period (1993-2001). The average monthly return of the long (short) portfolio is 2.01% (-0.50%), and the average monthly return of the self-financing portfolio is 2.51%.

Table 3 also reports the equal- and value-weighted index (EWI, VWI) returns for the stocks in the sample. The P1,3 portfolio outperforms the value-weighted index by 0.73% per month, while the P10,3 portfolio underperforms the value-weighted index by 1.78% per month. It is clear that portfolio P10,3 has a large contribution to the self-financing strategy performance. Overall, the hedge strategy posts positive returns for more than 64% of out-of-sample months.

To examine the risk-adjusted performance of our strategy, we retained the three risk factors documented by Fama and French (1996) that are important in explaining security returns. These factors are the market premium (market excess return; Rm-Rf), the size

TABLE 3: **SELF-FINANCING INVESTMENT STRATEGY PERFORMANCE (MONTHLY RETURNS, 1993-2001)**

	P1	P10	P1-P10	EWI[1]	VWI[2]
Holding Period: one month					
Arithmetic Mean	2.41%**	-0.72%	3.13%**	1.03%*	1.30%*
Standard Deviation	6.46%	9.77%	9.71%	4.30%	5.02%
% of months > 0	66%	46%	69%	63%	62%
Holding Period: three months					
Arithmetic Mean	2.01%**	-0.50%	2.51%**	0.92%*	1.28%*
Standard Deviation	6.18%	9.58%	8.64%	4.26%	5.03%
% of months > 0	58%	47%	64%	63%	63%
Holding Period: six months					
Arithmetic Mean	2.07%**	-0.82%	2.89%**	0.95%*	1.30%*
Standard Deviation	6.74%	8.78%	7.50%	4.21%	5.05%
% of months > 0	65%	49%	65%	65%	63%

1 EWI is the return on the equal-weighted index of all stocks in the sample
2 VWI is the return on the value-weighted index of all stocks in the sample
** significant at 1% * significant at 5%

premium (difference in returns between a portfolio of small capitalization firms and big capitalization firms, also known as SMB, or small minus big), and the book-to-market premium (difference in returns between a portfolio of high book-to-market and small book-to-market firms, also known as HML, or high minus low).

For portfolios P1, P10 (P1-P10), we estimated a regression of the portfolio excess (raw) returns on a constant and the three Fama-French factors. Our objective here is to examine how much of the abnormal performance reported in Table 3 can be explained by market, size and book-to-market factors.

$$R_{p,t} = \alpha + b\,(R_M\text{-}Rf)_t + s(SMB)_t + h(HML)_t + \varepsilon_t$$

Table 4 presents the results from the regression. The alpha of the self-financing portfolio is about the same as the raw return, and significantly different from zero at the 1% level. The risk-adjusted performance of the strategy is statistically profitable. In addition, the long and short portfolios present an alpha coefficient significantly different from zero. Further, the short portfolio contributes significantly to the abnormal return of the self-financing portfolio.

Table 4 also presents the factor loadings of these portfolios to the three Fama-French factors. The results indicate, for the long-short portfolio, that the loadings on the market, size and book-to-market ratio risk factors are not significantly different from zero. However,

TABLE 4: **RISK-ADJUSTED PERFORMANCE OF THE SELF-FINANCING STRATEGY (MONTHLY RETURNS, 1993-2001)**

	P1	P10	P1-P10
Holding Period: one month			
Alpha	1.10%*	-1.78%*	2.88%**
Market	1.01**	1.27**	-0.26
SMB	0.29*	-0.28	0.57
HML	0.15	-0.30	0.45
Adjusted R^2	50%	49%	7%
Holding Period: three months			
Alpha	0.91%*	-1.62%*	2.53%**
Market	0.95**	1.27**	-0.321
SMB	0.20	0.18	0.02
HML	0.01	-0.11	0.12
Adjusted R^2	58%	49%	2%
Holding Period: 6 months			
Alpha	0.77%*	-1.92%**	2.69%**
Market	1.05**	1.19**	-0.14
SMB	0.21*	0.33*	-0.12
HML	-0.22*	0.00	-0.22
Adjusted R^2	78%	55%	-2%

portfolio P10,3 is more sensitive to the market factor than portfolio P1,3 (1.27 versus 0.95).

Robustness Tests and Transaction Costs

We run many tests to ensure that our results are robust. In

the analysis that follows we concentrate on some of them.

The first robustness test investigates the extent to which performance is driven by tech stocks, since our out-of-sample test period coincides with the tech bubble (1993-2001). To this end, we rerun our regressions and rebuild our strategy without Nortel Networks, a single stock which accounted for more than 30% of the Canadian market at the peak of the bubble in the late-1990s. The exclusion of Nortel Networks has a significant impact on the self-financing strategy's raw return (cut by about 1%); however the strategy is still profitable with an alpha of 1.9%, significant at the 5% level.

The second robustness test investigates the sensitiveness of our results to the stock coverage by financial analysts. To illustrate this point, we repeat our tests and investment strategy by only including in the sample stocks that are covered by three or more analysts. This is consistent with the notion that wider analysts' coverage is generally associated with a better quality of earnings forecasts and earnings revisions. We found setting a minimum number for analysts' coverage does not change the overall conclusions: the strategy still displays a significant alpha over the period 1993-2001.

Finally, since our investment strategy requires frequent trading, we examined the extent to which transaction costs could affect the recorded performance. If we consider for instance the three-month holding period strategy, each month we rebalance one-third of the entire portfolio. We first estimate the average monthly turnover of the long and short portfolios. The turnover ratio of the long portfolio is 67.5%, while the short portfolio's turnover is slightly lower, at 65.4%. To better reflect the turnover ratio in executing the strategy, we rebalance (1/3 x turnover ratio) of the overall portfolio each month. Since the investment strategy requires opening and closing positions in both the long and short positions, the strategy's total transaction cost is simply the sum of the respective portfolio's transaction costs.

Further, we performed a sensitivity analysis to find the maximum transaction-costs for which the risk-adjusted performance of our strategy remains significant at the 5% level. We find a maximum transaction cost of about 1.6% per month. Institutional investors can surely face lower transaction costs when executing their trades. Even if we consider explicitly the rebalancing rules and a reasonable transaction-costs estimate, our investment strategy still posts significant risk-adjusted return.

Conclusion

We examine the relation between future returns and four firm characteristics: the book-to-market ratio, the forward earnings-to-price ratio, the price momentum, and the earnings revisions made by financial analysts over the 1988-2001 period. Using the Fama-MacBeth two-step procedure, we find that over the entire period the four variables help predict future returns on the Canadian equity market. All the coefficients associated with the four variables have the expected (positive) sign and are significant.

We then test the profitability of an investment strategy based on these four firm characteristics. Each month, we estimate over a cumulative window the relative weights associated with these forecasting variables, and then project the expected returns. We examine the profitability of a self-financing portfolio (a long position in the stocks with the highest expected returns and a short position in the stocks with the lowest expected return) over different forecast horizons (one, three, and six months). This self-financing portfolio (three-month forecast and holding horizon) posts an average 2.51% monthly raw return over the 1993-2001 period. When we control for common risk factors, the strategy posts a 2.53% risk-adjusted return.

Results from this strategy are robust to the choice of the forecast horizon (one, three, or six months), the exclusion of Nortel Networks from the sample, financial analysts' coverage, and the inclusion of realistic transaction costs. Results of this study seem promising for stock picking, but it leaves space for further research. First, other promising predictive variables, such as the firm's seasoned equity offerings or stock repurchases (Baker and Wurgler [2000]), could be explored. Second, more robust calibration methods could be used to deal with the nonlinear structures between stock returns and firm characteristics. ∎

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Notes

1. Recently, Cavaglia and Moroz (2003) document a similar multivariate model for the country-sector allocation in the U.S.
2. Imposing these conditions contributes to a reduction in the size and liquidity biases.
3. Cleary and Inglis (1998) find that neither a size effect nor a random walk can account for the profitability of the momentum strategy. Allowing time variation in expected returns by estimating conditional covariances, they conclude that risk premiums that vary through time considerably reduce the abnormal performance of winner portfolios and especially that of loser portfolios. Transaction costs (commission fees and bid-ask spreads) have a more significant impact on the winner portfolios than on the loser portfolios, and make the strategy unprofitable for the average retail investor facing higher transaction costs.
4. Fama and French (1992) document a U-shape relation between earnings-to-price and returns. They use a dummy variable for the negative earnings-to-price. In our study, we discarded observations with negative EP values. However, the strategy still records a significant risk-adjusted performance of 2.30% when negative EP values are considered (no logarithmic transformation).
5. We repeated the same tests using a 60-month rolling window rather than a cumulative one. Our conclusions are almost unchanged, and available upon request.

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