Original Article

Enhancement of value portfolio performance using momentum and the long-short strategy: The Finnish evidence

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Timo H. Leivo

is a junior lecturer of Finance and a PhD candidate at the School of Business at Lappeenranta University of Technology, Finland. His research interests include equity investment strategies and behavioral finance. He has published papers in journals such as *Studies in Economics and Finance*, *the International Research Journal of Finance and Economics*, *the Journal of Money, Investment and Banking*, and *Banking and Finance Letters*.

Eero J. Pätäri

is a professor of finance in the School of Business at Lappeenranta University of Technology, Finland, and a Partner at Confido Capital. His research interests include the performance of equity investment strategies, measurement techniques of portfolio risk and performance measurement, particularly the performance persistence of mutual funds and hedge funds. He has published a large number of papers in journals such as *the Journal of Risk*, *the Journal of Derivatives and Hedge Funds*, *the Journal of Performance Measurement*, *Studies in Economics and Finance*, *the International Research Journal of Finance and Economics*, *the Journal of Money, Investment and Banking*, and *Banking and Finance Letters*. In addition to his academic duties, he has consulted for the management of several institutional investors in the field of risk and performance measurement.

Correspondence: Timo H. Leivo, School of Business, Lappeenranta University of Technology, PO Box 20, Lappeenranta FI-53851, Finland
E-mail: timo.leivo@lut.fi

ABSTRACT This article examines the added value of combining price momentum with various value strategies in the Finnish stock market during the period 1993–2008. The results show that taking into account the price momentum of value stocks enhances portfolio performance. Among the best-performing portfolios, the performance improvement resulting from the inclusion of a momentum indicator is the greatest for value portfolios that are formed on the basis of three-composite value measures. The risk-adjusted performance of the best value winner portfolios can be enhanced further by following the 130/30 long-short strategy. The best long-short portfolios significantly outperform the corresponding long-only value winner portfolios and more than double the average return of the stock market coupled with the volatility decrease.

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INTRODUCTION

Over the past three decades, considerable evidence has been presented against efficient market hypothesis. On the one hand, numerous studies have identified the existence of price momentum on stock

returns (for example see Jegadeesh and Titman, 1993, 2001; Chan *et al*, 1996; Rouwenhorst, 1998; Chan *et al*, 2000; Grundy and Martin, 2001; Lewellen, 2002; Patro and Wu, 2004; Balsara and Zheng, 2006; Gutierrez and Kelley, 2008; Yu and Kim, 2009). There has been debate about whether the momentum is induced by the slow information diffusion or by under- or over-reaction in prices to public information (for example see Barberis *et al*, 1998; Daniel *et al*, 1998; Hirshleifer and Subrahmanyam, 1998; Hong and Stein, 1999), or by an unobserved risk factor (for example see Conrad and Kaul, 1998).[1] On the other hand, ample evidence of a value premium in stock returns all over the world has been documented recently (for example see Bird and Whitaker, 2003; Dimson *et al*, 2003; Chan and Lakonishok, 2004; Fama and French, 2006; Brown *et al*, 2008).

While momentum investing has been found to work best in the short term, value strategies have been documented to perform better when using longer holding periods. For example, Rousseau and van Rensburg (2004) report that the annualized returns of value portfolios formed on the basis of price-to-earnings (P/E) ratios increase as the holding period is extended beyond the most typically used investment horizon of 12 months. Indeed, the authors conclude that it might be more effective to form value portfolios based on past P/E ratios that are 12 months old rather than those based on current P/E ratios, as the currently low P/E stocks are likely to exhibit a negative price momentum. Parallel results are also reported by Bird and Whitaker (2003), who find that the optimal holding period for value portfolios formed on the basis of price-to-book (P/B) ratios or price-to-sales ratios is somewhere between 24 and 36 months for a large sample of European stocks. Using the same portfolio-formation criteria, Bird and Casavecchia (2007a) report a steady expansion of the value premium when the holding period is extended to 36 months, which is the maximum length for portfolio reformation included in their study. The recent results of Leivo and Pätäri (2009) from the Finnish stock market indicate that the outperformance of value portfolios against both the general stock market and comparable glamour portfolios persists even when portfolios are reformed at a 5-year frequency. According to the authors, the yearly reformation of portfolios is not necessarily optimal in order to maximally gain from the value premium, particularly when taxation procedures and transaction costs are taken into account. The above-mentioned results are explained by the fact that value stocks may remain cheap for an extended period of time. Therefore, some scholars have started to examine whether the performance of the value portfolio could be enhanced by including in the portfolio-formation process an additional criterion that is used as a timing indicator for when to purchase value stocks. Bird and Whitaker (2004) report that the added value attributable to each value and momentum strategy is basically uncorrelated, which enables performance improvement by combining these two investment strategies. Interestingly, the authors report further that the best long-only portfolio performance would have been achieved by investing in value-loser stocks when using a 6-month price momentum as a timing indicator and book-to-price (henceforth B/P) as a value indicator. According to the authors, value-loser stocks are late in their negative momentum cycle, to the extent that they will soon turn around and start generating positive abnormal returns. In contrast, Bird and Casavecchia (2007a) report a significant outperformance of value-winner stocks against both the stock market and value-loser stocks when using price momentum as a sentiment indicator and sales-to-price (henceforth S/P) as a value indicator. The authors also examine the added value of a financial heath indicator (2007a) and a combined earnings momentum indicator (2007b) as timing indicators, but find their efficiency to be nowhere near as great as that provided by price momentum indicators.

This article examines the added value of combining price momentum with various value strategies in the Finnish stock market during the period 1993–2008. The Finnish stock market provides an interesting target market for this kind of analysis, as it is exposed to an intermittent 'periphery syndrome' caused by the herding behavior of international institutional investors who cash their equity positions first from the furthest stock markets during turbulent times. Coupled with the relatively low liquidity of the Finnish stock market, the withdrawal process results in drops in stock prices that are steeper than simultaneous drops in larger and more developed stock markets. During the current global financial crisis, the phenomenon has repeated itself. On the other hand, owing to relatively thin trading, stock prices tend to rise more during bullish periods in Finland than they do in the major stock markets. As a consequence, the average stock market volatility is also higher in Finland. Therefore, opportunities to earn abnormal profits through active investment strategies might be better for two reasons. First, it is probable that pricing errors causing the value premium are larger in such conditions. Second, the recent results of Yu (2008) show that the herding behavior of institutional investors stimulates price momentum.

We contribute to the existing literature on equity investment strategies in several ways. To our knowledge, this is the first time in the financial literature when the added value of combining price momentum with composite value measures as a portfolio-formation criterion is examined. Second, we use the EBITDA/EV multiple (that is Earnings Before Interest, Taxes, Depreciations and Amortizations to Enterprise Value) as a basis of value strategies, whereas comparable studies have for the most part concentrated on earnings yield (E/P) and CF/P (cash flow is calculated as the sum of fully diluted EPS excluding extraordinary items and depreciations and amortizations per share) ratios as representatives of earnings multiples. As Enterprise Value also takes into account the debt of a company, the use of the EBITDA/EV multiple might solve the problem of spurious undervaluation stemming from the characteristics of the price-related earnings multiples. As stated by Bird and Casavecchia (2007a), a relatively low valuation can be a reflection of parlous financial health, about which the price-based valuation multiples tell nothing. Our results show that additional dimensions included in EBITDA/EV, as a measure of relative value, can somewhat enhance the performance of portfolios that are formed on the basis of composite value measures. Third, we examine to what degree the outperformance of the best portfolios is explained by differences in the shapes of the return distributions being compared by applying a recently innovated method for this purpose.

The remainder of this article is organized as follows. The next section outlines the data and the research methods employed. The third section reports the results by first comparing the performance of the investment strategies combining price momentum with various value indicators to the performance achieved by following pure value strategies. Second, the added value of using the resulting top and bottom portfolios as the basis of the long-short strategy is examined. The fourth section concludes with suggestions for future research.

DATA AND METHODOLOGY

The portfolios are composed of Finnish non-financial stocks quoted in the main list of the Helsinki Stock Exchange (HEX; later OMX Helsinki) during the period 1993–2008. To avoid survivorship bias, the sample also includes the stocks of the companies that were delisted during the observation period. Adjustments for dividends, splits and capitalization issues are carried out as

appropriate. If an issuer has had two or more stock series listed, only that with higher liquidity is included in the sample. The stocks of the companies whose fiscal year has not ended in December are excluded from the sample. Stock market data, as well as financial statement data, are from Datastream, and the latter are supplemented by collecting data from financial statements of the companies not included in Datastream. The final sample size ranges from 51 companies in the year 1993 to 110 in the year 2007, and the number of companies increases gradually during the sample period. The sample is comprehensive in the sense that it includes all the Finnish non-financial companies quoted in the main list of the Helsinki Stock Exchange during the sample period.

The stocks in the sample are first ranked based on valuation multiples or composite value measures that are calculated on every rebalancing date, that is, the first trading day of May, at a 1-year frequency. The valuation multiples used in forming the three-quintile portfolios at the first stage are E/P, EBITDA/EV, CF/P, dividend yield (D/P), B/P and S/P. Motivated by the recent results of Leong *et al* (2009) and Pätäri and Leivo (2009), according to which the performance of value portfolios could be somewhat enhanced by forming the portfolios based on the composite value measures that are constructed by combining the information content of two or more individual valuation ratios, we also divide stocks into fraction portfolios on the basis of these measures of relative value. All of the composite value measures employed in this article are based on a combination of an earnings multiple and one or several other valuation ratio(s). We use EBITDA/EV as the earnings multiple in two of the composite value measures, and E/P in one of the composite value measures. E/P is the most typical earnings multiple used in value studies, but EBITDA/EV takes the leverage differences between the firms into account better than E/P does, and thus provides one additional dimension to relative valuation. All of these composite value measures are obtained by first standardizing all of the valuation multiples employed by the median of each multiple and then calculating the simple average of these ratios for each stock. The first of the composite value measures is termed 2A and is obtained with the combination of D/P and EBITDA/EV. We also include the composite measures based on three valuation ratios in our research: the first one of these, termed 3A, is based on the combination of B/P, D/P and EBITDA/EV. The third composite measure, 3B, closely resembles 3A, with the exception that EBITDA/EV is replaced by E/P. The choice of these three-composite value measures is motivated by the results of Pätäri and Leivo (2009), who compared the efficiency of several composite value measures in the Finnish stock market and found the three above-mentioned composite value measures to provide the best basis for portfolio-formation criteria.

In the second stage of the study, the stocks are divided into three portfolios based on the resulting ranks. Stock prices are the closing quotes of rebalancing days, and variables from financial statements (for example enterprise value and profitability measures) are chosen from the latest financial statements that have been published before the moment of rebalancing. In the third stage, the stocks in the value and glamour portfolios are further divided into two 1/6 portfolios based on the past 6-month price momentum.[2] As a result, we obtain five fraction portfolios, that is, value winner (P1), value loser (P2), middle (P3), glamour winner (P4) and glamour loser portfolios (P5). In another part of our empirical examination, we test whether the risk-adjusted performance of the long-only portfolios can be enhanced further by following the appropriate 130/30 long-short strategy.

The performance evaluation of each investment strategy is based on a time-series of the monthly returns of each portfolio. The

portfolios are equally weighted at the outset, and the monthly returns are then calculated by taking into account changes in portfolio weights during the 1-year holding period. The intermediate cash flows obtained from delisted stocks within the holding period are reinvested in the remaining stocks of the same portfolio according to prevailing portfolio weights at the beginning of the next month following the date of delisting. Taking into account the implications of rebalancing, continuous stacked time-series of monthly returns for portfolios are generated throughout the sample period for each portfolio-formation criterion. The performance of the portfolios is evaluated based on their average returns and several risk-adjusted performance metrics introduced below.

Test procedures

The performance of long-only portfolios is evaluated based on their average return, the Sharpe ratio and the adjusted Sharpe ratio. To avoid the validity problems stemming from the potential of idiosyncratic risk, we employ only total risk-adjusted performance metrics for the performance evaluation of long-only portfolios. We use the Sharpe ratio as a major representative of performance measures that are based on total risk. However, the Sharpe ratio is often criticized for oversimplifying the concept of risk, as all the deviations from the mean, including positive deviations, have a direct impact on the value of standard deviation. If the return distributions being analyzed are right-skewed, the use of standard deviation as a risk surrogate penalizes for the upside potential, which nevertheless is desirable rather than undesirable from the viewpoint of the investor. Therefore, the use of standard deviation as a measure of investment risk has been questioned by many scholars, and many alternative risk measures aimed to match better with the investor's true perception of risk have been suggested in the financial literature (see for example Eling and Schuhmacher, 2007, and Pätäri, 2008, for a comprehensive summary of alternative dispersion measures). For this purpose, we employ the adjusted Sharpe ratio, whose risk metrics capture the skewness and kurtosis of the return distributions being analyzed.[3] Analogous to the approach taken by Favre and Galeano (2002) in determining the modified Value-at-Risk, the adjusted Z value (that is Z_{CF}) that corresponds to the Z value of normal distribution is calculated first. The so-called Cornish–Fisher expansion is applied to calculate Z_{CF} as follows:

$$Z_{CF} = Z_C + \frac{1}{6}(Z_C^2 - 1)S + \frac{1}{24}(Z_C^3 - 3Z_C)K - \frac{1}{36}(2Z_C^3 - 5Z_C)S^2 \quad (1)$$

where Z_C is the critical value for the probability based on standard normal distribution, and S denotes skewness and K the kurtosis of the return distribution. The formulas for the skewness and kurtosis are given as follows:

$$S = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{r_t - r}{\sigma}\right)^3 \quad (2)$$

$$K = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{r_t - \bar{r}}{\sigma}\right)^4 - 3 \quad (3)$$

where T is the number of outcomes, r is the return of a portfolio and σ is the standard deviation of a portfolio. Next, we calculate the skewness- and kurtosis-adjusted deviation (henceforth SKAD) by multiplying the standard deviation by the ratio Z_{CF}/Z_C. We use the 95 per cent probability level in this article in determining the ratio Z_{CF}/Z_C. Finally, we substitute SKAD for standard deviation as follows:

$$\textit{adjusted Sharpe ratio} = \frac{R_i - R_f}{SKAD_i} \quad (4)$$

where $SKAD_i$ = the skewness- and kurtosis-adjusted deviation of the monthly excess returns of a portfolio i.

The inclusion of higher moments of return distributions in the performance evaluation of value portfolios can also be motivated by the recent results of Rousseau and van Rensburg (2004), who report significant distributional asymmetries and differences in the returns of value and growth portfolios. A parallel conclusion is also drawn by Leivo and Pätäri (2009), although their results do not indicate any relationship between the holding period length and the degree of skewness – unlike the results of Rousseau and van Rensburg (2004).

For the long-short portfolios, we also employ performance metrics that are based on asset pricing models, as long-short portfolios are more diversified, and thus less prone to idiosyncratic risk than corresponding long-only portfolios.[4] To determine whether the potential value premium is explained by the size effect, we compare the single-factor alphas of long-short portfolios based on the standard Capital Asset Pricing Model (CAPM) to two-factor alphas based on the pricing model that also includes the size factor (SMB) as another explanatory variable. The standard CAPM alpha, also known as the Jensen alpha (Jensen, 1969), indicates the abnormal return of the portfolio over that predicted by CAPM, as follows:

$$\alpha_i = R_i - R_f - \beta_i(R_m - R_f) \qquad (5)$$

where α_i = the Jensen alpha, β_i = the beta coefficient of a portfolio i and R_m = the stock market return.

The two-factor model isolates the potential size effect from the alphas. The SMB factor is constructed by classifying the stocks quoted in the main list of the OMX Helsinki Stock Exchange into three-size portfolios based on the market cap of companies included. If the number of companies at the moment of portfolio formation is not divisible by three, the remaining stocks are included in the middle-third portfolio so that small- and large-cap portfolios always have an equal amount of stocks. The monthly return time-series for the SMB factor are generated by subtracting the value-weighted monthly return of the large-cap portfolio from the comparable return of the small-cap portfolio. Respectively, we calculate two-factor 'size-adjusted' alphas as follows:

$$\alpha_i = R_i - R_f - \beta_{i1}(R_m - R_f) - \beta_{i2}SMB \qquad (6)$$

where α_i = the two-factor alpha (the abnormal return over what might be expected based on the two-factor model employed); SMB = the return of the size factor (that is the return difference between small- and large-cap portfolios); and β_{i1}, and β_{i2} are factor sensitivities to stock market and SMB factors, respectively. Knowing that there are more sophisticated pricing models, we restrict our regression tests to these two simple models, as our main aim is to examine the impact of the size effect on portfolio alphas.

Statistical tests and adjustments

The statistical significances of differences between comparable pairs of the Sharpe ratios are given by *P*-values of the Ledoit–Wolf test, which is based on the circular block bootstrap method. Owing to the complexity of the test procedure, we do not describe the test in more detail here, but recommend that interested readers see the original article (Ledoit and Wolf, 2008). A corresponding programming code is freely available at http://www.iew.uzh.ch/chairs/wolf/team/wolf/publications.html#7. We also test the statistical significance of differences between portfolio alphas by the appropriate alpha spread test as follows:

$$t = \frac{\alpha_i - \alpha_j}{\sqrt{SE_{\alpha i}^2 + SE_{\alpha j}^2}} \qquad (7)$$

where α_* is the alpha of portfolio $*$, and $SE_{\alpha *}$ is the standard error of portfolio $*$.

The degrees of freedom for the test statistic are given as follows:

$$v = \frac{\left(SE_{\alpha i}^2 + SE_{\alpha j}^2\right)^2}{\frac{SE_{\alpha i}^4}{v_i} + \frac{SE_{\alpha j}^4}{v_j}} \quad (8)$$

where v_i and v_j are the degrees of freedom determined on the basis of the number of time-series returns in samples i and j ($v = n-1$).

Throughout the study, we use Newey–West (1987) standard errors in statistical tests to avoid problems related to autocorrelation and heteroscedasticity. In addition, we performed the normality test of Jarque and Bera (1980) for regression residuals, but the assumption of their normality is not generally violated, except in a few random cases. We also tested the existence of multicollinearity in regressions of two explanatory variables. In spite of a significant negative correlation between market and SMB factors, the variance inflation factor that is typically used in detecting the degree of multicollinearity (for example see Hair *et al*, 2006) indicates that it is not severe in this case.

RESULTS

The added value of combining a momentum indicator with value measures

The overall results indicate that taking into account the price momentum of stocks improves the performance of value portfolios (Table 1). The inclusion of the momentum criterion in addition to the valuation criterion increases the average returns of all nine basic portfolio-formation criteria examined. The average gain in the annual average return is 2.84 per cent. At the same time, the inclusion of momentum decreases the average volatility in most cases (that is in six out of nine cases) even though the volatility decreases are much smaller than the corresponding increases in average returns, except for the P/B criterion. However, the volatility decreases do not tell the whole truth about portfolio risk because the inclusion of momentum increases the asymmetry of return distributions of the top six-quantile value portfolios in a direction that is undesirable to the investor. This is revealed by comparing the SKAD measures of pure value portfolios with those of corresponding value winner portfolios. This finding is consistent with the results of Harvey and Siddiqque (2000), who show that the intermediate-term momentum portfolios are exposed to negative skewness. However, the risk-adjusted outperformance of value winner portfolios is generally still remarkable after taking into account differences in distributional asymmetries. Among the cases in which the value winner portfolios significantly outperform the stock market on the basis of the Sharpe ratio, the outperformance also remains significant based on the adjusted Sharpe ratio, except for the case of combining momentum with the E/P criterion.

From an investor's viewpoint, the most interesting question is that of what investment strategy would have led to the best performance during the sample period. Among those value portfolios that outperform the stock market portfolio most significantly, the performance improvement stemming from the inclusion of the momentum criterion is greatest for value portfolios that are formed on the basis of three-composite value measures. The best risk-adjusted performance would have been achieved by investing in past winners of the portfolio, which is formed by combining the D/P, B/P and EBITDA/EV criteria (that is 3A criterion). The average annual return over the 15-year sample period would have been nearly 25 per cent, which exceeds the average stock market return by more than 10 percentage points. At the same time, the annualized volatility for the same strategy is 17.87 per cent, which is almost 4 percentage

Table 1: Return, risk and performance metrics of fraction portfolios (1993–2008)

Value indicator	*P*	*Average annual return (%)*		*Annual volatility (%)*		*SKAD (%)*		*SR(sign.) Pi* vs *Market*		*ASR(sign.) Pi* vs *Market*	
		VM	*V*	*VM*	*V*	*VM*	*V*	*VM*	*V*	*VM*	*V*
E/P	P1	21.01	18.29	17.38	17.95	21.07	19.22	0.281 (0.014)	0.237 (0.138)	0.233 (0.149)	0.222 (0.245)
	P2	14.63	17.27	17.89	16.88	17.15	19.06	0.186 (0.642)	0.234 (0.144)	0.194 (0.555)	0.208 (0.363)
	P3	19.42	19.42	16.82	16.82	17.09	17.09	0.266 (0.012)	0.266 (0.012)	0.262 (0.017)	0.262 (0.017)
	P4	12.28	14.32	27.72	26.38	27.45	25.95	0.121 (0.355)	0.143 (0.677)	0.122 (0.352)	0.146 (0.695)
	P5	5.31	4.41	27.83	28.90	25.29	24.99	0.054 (0.026)	0.046 (0.018)	0.059 (0.032)	0.053 (0.024)
EBITDA/EV	P1	21.51	17.55	20.23	18.17	19.05	17.67	0.254 (0.079)	0.224 (0.291)	0.271 (0.043)	0.231 (0.254)
	P2	16.32	19.93	18.35	21.29	17.37	17.18	0.206 (0.423)	0.226 (0.215)	0.218 (0.324)	0.280 (0.026)
	P3	15.75	15.75	18.22	18.22	21.23	21.23	0.200 (0.365)	0.200 (0.365)	0.172 (0.825)	0.172 (0.825)
	P4	15.99	17.36	26.21	21.45	25.58	20.50	0.160 (0.983)	0.196 (0.391)	0.164 (0.971)	0.206 (0.296)
	P5	3.33	2.27	29.54	32.23	24.71	25.93	0.036 (0.028)	0.031 (0.013)	0.043 (0.035)	0.039 (0.018)
CF/P	P1	19.56	18.10	19.58	20.03	21.77	20.11	0.237 (0.117)	0.215 (0.311)	0.214 (0.287)	0.215 (0.330)
	P2	15.35	16.86	18.60	18.76	16.02	18.21	0.190 (0.593)	0.210 (0.356)	0.222 (0.290)	0.217 (0.306)
	P3	19.74	19.78	16.70	16.53	17.50	17.61	0.272 (0.009)	0.275 (0.010)	0.260 (0.022)	0.259 (0.029)
	P4	11.84	13.00	25.95	22.01	27.71	18.99	0.120 (0.358)	0.142 (0.717)	0.113 (0.260)	0.165 (0.953)
	P5	3.95	3.57	28.87	32.09	24.67	29.42	0.041 (0.019)	0.043 (0.006)	0.049 (0.025)	0.047 (0.007)
S/P	P1	19.06	13.03	21.91	22.86	19.99	17.62	0.212 (0.352)	0.139 (0.719)	0.233 (0.200)	0.180 (0.764)
	P2	11.81	17.93	20.89	19.88	18.16	20.48	0.132 (0.641)	0.214 (0.315)	0.152 (0.867)	0.209 (0.386)
	P3	17.68	17.77	18.41	18.34	20.16	20.10	0.224 (0.083)	0.226 (0.079)	0.205 (0.241)	0.207 (0.231)
	P4	11.57	19.27	24.86	18.61	29.92	18.65	0.120 (0.340)	0.244 (0.085)	0.100 (0.141)	0.243 (0.092)
	P5	14.42	7.20	21.77	26.85	20.47	26.38	0.160 (0.996)	0.073 (0.044)	0.171 (0.859)	0.074 (0.044)
B/P	P1	18.56	15.96	18.69	22.67	17.40	13.89	0.232 (0.217)	0.172 (0.861)	0.250 (0.131)	0.281 (0.073)
	P2	12.38	14.53	22.49	19.78	15.70	18.66	0.133 (0.662)	0.172 (0.843)	0.191 (0.654)	0.183 (0.725)
	P3	17.48	17.48	18.03	18.03	19.72	19.72	0.225 (0.123)	0.225 (0.123)	0.206 (0.290)	0.206 (0.290)
	P4	18.97	15.96	24.89	20.21	28.05	21.29	0.195 (0.352)	0.188 (0.558)	0.173 (0.764)	0.179 (0.726)
	P5	8.92	10.75	23.97	27.81	23.47	26.95	0.092 (0.104)	0.107 (0.101)	0.094 (0.107)	0.110 (0.114)
D/P	P1	22.98	22.76	17.55	17.24	19.72	17.88	0.293 (0.008)	0.307 (0.007)	0.262 (0.043)	0.297 (0.012)
	P2	19.96	20.23	16.11	16.68	17.50	19.60	0.269 (0.037)	0.280 (0.021)	0.250 (0.091)	0.239 (0.138)
	P3	15.34	15.34	18.95	18.95	19.48	19.22	0.177 (0.649)	0.188 (0.549)	0.172 (0.763)	0.186 (0.606)
	P4	14.77	13.09	26.00	22.79	26.15	22.17	0.141 (0.777)	0.141 (0.679)	0.140 (0.721)	0.145 (0.721)
	P5	3.36	5.22	29.96	30.98	27.81	26.45	0.031 (0.023)	0.056 (0.024)	0.033 (0.023)	0.065 (0.036)

Composite 2A	P1	23.24	22.05	18.14	17.96	18.70	18.12	0.289 (0.010)	0.288 (0.030)	0.281 (0.018)	0.286 (0.035)
	P2	21.78	22.92	17.37	17.77	19.07	20.21	0.278 (0.034)	0.302 (0.005)	0.256 (0.091)	0.266 (0.037)
	P3	13.50	13.50	18.82	18.82	19.72	18.96	0.152 (0.968)	0.164 (0.943)	0.146 (0.823)	0.163 (0.986)
	P4	11.33	16.06	26.75	21.75	26.41	21.74	0.106 (0.303)	0.180 (0.642)	0.107 (0.288)	0.180 (0.663)
	P5	6.69	0.81	29.38	34.01	25.52	26.12	0.061 (0.092)	0.022 (0.009)	0.070 (0.116)	0.028 (0.012)
Composite 3A	P1	24.82	19.85	17.87	18.73	18.95	16.28	0.313 (0.003)	0.249 (0.128)	0.296 (0.008)	0.287 (0.033)
	P2	19.78	23.90	17.08	16.55	16.33	20.16	0.254 (0.117)	0.335 (0.001)	0.267 (0.083)	0.276 (0.037)
	P3	14.11	14.18	19.13	19.08	19.11	18.38	0.160 (0.922)	0.171 (0.826)	0.160 (0.961)	0.178 (0.741)
	P4	11.98	10.48	27.60	23.76	27.99	20.12	0.111 (0.348)	0.109 (0.342)	0.109 (0.301)	0.129 (0.538)
	P5	3.72	3.87	28.68	32.88	25.91	30.01	0.032 (0.016)	0.046 (0.005)	0.035 (0.016)	0.051 (0.007)
Composite 3B	P1	23.92	21.51	17.77	18.12	21.40	17.08	0.303 (0.004)	0.278 (0.024)	0.253 (0.064)	0.295 (0.011)
	P2	16.97	19.28	17.42	16.47	15.50	19.55	0.210 (0.346)	0.269 (0.045)	0.238 (0.179)	0.227 (0.227)
	P3	17.41	17.41	16.89	16.89	17.74	17.11	0.223 (0.159)	0.236 (0.099)	0.213 (0.252)	0.233 (0.119)
	P4	13.41	10.48	27.86	22.78	29.00	23.07	0.124 (0.472)	0.112 (0.251)	0.119 (0.372)	0.110 (0.224)
	P5	4.43	5.53	28.83	32.88	26.09	30.20	0.039 (0.028)	0.060 (0.024)	0.043 (0.029)	0.066 (0.030)
Momentum	P1	17.26		26.99		31.40		0.170 (0.838)		0.146 (0.712)	
	P2	20.11		20.55		19.53		0.235 (0.082)		0.248 (0.046)	
	P3	17.74		16.05		17.88		0.251 (0.046)		0.226 (0.158)	
	P4	14.85		20.27		16.69		0.173 (0.831)		0.210 (0.401)	
	P5	2.56		26.73		24.83		0.025 (0.012)		0.026 (0.012)	
Market portfolio		14.41		21.76		21.94		0.161		0.160	

Notes: Average annual return, two risk measures (that is, volatility and SKAD) and corresponding performance metrics (the Sharpe ratio (SR) and the adjusted Sharpe ratio (ASR)) are presented for every fraction portfolio formed on the basis of each portfolio-formation criterion. The SR and ASR are followed by significance levels (in parentheses), which indicate performance differences between each fraction portfolio and market portfolio (evaluated by the Ledoit–Wolf test statistics). In the upper part of the table with split columns, the results for the combination of value and momentum indicators (VM) are followed by the results for the sole indicators of relative value (V). The lower part of the table first presents the results for pure 6-month price momentum portfolios, followed by the results for the Finnish stock market portfolio.

points lower than the corresponding market volatility. As a result, the risk-adjusted performance of this particular value winner portfolio (on the basis of both standard and adjusted Sharpe ratios) is significantly superior not only to that of the general stock market, but also to that of the corresponding middle portfolio, to say nothing of its remarkable outperformance over both glamour winner and glamour loser portfolios. In addition, the performance of the combination strategy of momentum and another three-composite value measure (that is 3B) is quite close to that of the best combination strategy, but the comparison of their SKAD measures reveals that the return distribution of the former is more negatively skewed than that of the latter. It is also noteworthy that including the momentum criterion improves the risk-adjusted performance of all top six-quantile value portfolios that are formed on the basis of composite value measures. However, the added value of including the momentum criterion in addition to the best individual valuation criterion (that is the D/P criterion) for this particular sample is negative. In spite of this, the D/P value winner portfolio retains its superiority to all of the other value winner portfolios that are formed on the basis of individual valuation ratios when using the standard Sharpe ratio as a performance metric. Instead, based on the adjusted Sharpe ratios, the EBITDA/EV value winner portfolio is an exception, as its return distribution is positively skewed, unlike that of the corresponding D/P portfolio. Moreover, the return distribution of the corresponding E/P portfolio is negatively skewed, which may partially explain the slightly better performance of the value winner portfolio, which is formed on the basis of the 3A composite value measure, in contrast to the corresponding 3B composite value portfolio.

Table 2 shows the proportion of stocks whose returns have been higher than those of the stock market average for each fraction portfolio. The overall results show that the proportion of outperforming stocks in value winner portfolios is clearly higher than the corresponding proportion in other fraction portfolios. Compared to corresponding proportions when the portfolios are formed solely based on numerical values of valuation multiples, the results show that the inclusion of the momentum indicator in addition to the relative value indicator increases the proportion of outperforming stocks, particularly in value winner portfolios.

The highest proportions are reported for those portfolio-formation criteria that provide the best basis for portfolio formation from the viewpoint of maximal performance. In contrast, the glamour loser portfolios include the lowest proportions of outperforming stocks at the 1-year horizon. Correspondingly, picking the losers among glamour stocks somewhat increases the proportion of stocks that underperform against the stock market average during the following 1-year period. For the sample employed, the average proportion of outperforming stocks in a value winner portfolio is somewhat higher than reported for pure value portfolios in previous studies (for example Piotroski, 2000; Bird and Whitaker, 2003; Bird and Casavecchia, 2007b), while the proportion of outperformers in value loser portfolios is quite in line with the above-mentioned results for pure value portfolios. However, year-to-year comparisons (in Table 3) reveal the considerable differences between the sub-periods. Interestingly, the proportion of outperforming stocks in value winner portfolios is distinctly above average during the period 2000–2003. The highest proportions are reported for the period 2000–2002, which could be characterized as the strongest bear market period in the 15-year sample period from 1993 to 2008. Thus, it seems that the value winner strategy adds the most value to the investor during bearish market conditions. From May 2000 until May 2003, the cumulative average

Table 2: The average proportions of outperforming stocks in fraction portfolios (1993–2008)

	P1 (%)	*P2 (%)*	*P3 (%)*	*P4 (%)*	*P5 (%)*
Panel A					
Momentum & E/P	55.0	46.2	—	42.7	36.6
Momentum & EBITDA/EV	54.3	48.1	—	47.0	34.0
Momentum & CF/P	48.3	46.8	—	43.1	33.0
Momentum & S/P	50.1	41.6	—	42.9	43.9
Momentum & B/P	52.4	42.5	—	49.5	35.8
Momentum & D/P	54.8	52.2	—	46.5	34.5
Momentum & 2A	53.5	52.9	—	41.5	36.1
Momentum & 3A	55.1	51.8	—	40.7	35.6
Momentum & 3B	55.7	49.6	—	41.6	35.1
Average	53.2	48.0	—	43.9	36.1
Panel B					
E/P	49.8	51.1	49.4	44.4	34.7
EBITDA/EV	48.9	55.0	45.3	50.4	28.6
CF/P	48.1	47.0	51.9	41.2	34.9
S/P	44.4	47.0	50.2	49.7	37.3
B/P	46.5	47.8	49.7	45.6	39.4
D/P	54.3	52.8	45.7	44.8	35.9
2A	54.5	51.7	45.5	44.0	33.7
3A	49.2	56.9	45.2	41.3	34.7
3B	53.8	51.4	48.6	37.9	38.4
Average	49.9	51.2	47.9	44.4	35.3
Panel C					
E/P	5.2	−4.9	—	−1.8	1.9
EBITDA/EV	5.4	−6.8	—	−3.4	5.4
CF/P	0.1	−0.2	—	1.9	−1.9
S/P	5.7	−5.4	—	−6.8	6.7
B/P	5.8	−5.2	—	3.9	−3.6
D/P	0.5	−0.6	—	1.7	−1.5
2A	−1.0	1.2	—	−2.5	2.4
3A	5.9	−5.1	—	−0.6	0.9
3B	1.9	−1.8	—	3.7	−3.3
Average	3.3	−3.2	—	−0.4	0.8

Notes: The table shows the average proportions of stocks whose returns have been higher than those of the stock market average for each fraction portfolio. Panel A presents the results based on the combination of momentum and value indicators, while Panel B presents the results for the sole indicators of relative value. Panel C shows the differences (in percentage points) between the corresponding proportions. The positive (negative) sign indicates that the inclusion of the momentum indicator in addition to the value indicator increases (decreases) the proportion of stocks that outperform the stock market average during the year following the portfolio formation. The lowest rows in Panels A and B indicate the average proportions calculated as an arithmetic mean of proportions based on the nine portfolio-formation criteria examined above. The corresponding average differences (in percentages) are shown in the lowest row in Panel C.

return of the value winner portfolio is 29.7 per cent, while that of the stock market is −46.9 per cent. It is also noteworthy that the exceptionally strong outperformance of the value winner portfolio continues for some time after the turn of the stock market trend though deteriorates somewhat in relation to the degree of outperformance during the bear market period. The trend change in the stock market took place in spring 2003, and the average proportion of outperforming stocks in value winner portfolios for the subsequent year is still remarkably above average, that is, 70.8 per cent. In addition, the average annual return of the same portfolios clearly beats the average stock market return during the same 1-year period (56.9 per cent versus 33.0 per cent).

The results for the 130/30 long-short strategies

In addition to the superior performance of the value winner strategy, the previous tests

Table 3: The annual proportions of outperforming stocks in each fraction portfolio

Portfolio formation date	*P1 (%)*	*P2 (%)*	*P3 (%)*	*P4 (%)*	*P5 (%)*
1993	47.6	50.8	43.2	48.2	51.5
1994	24.4	27.3	43.0	31.0	25.5
1995	50.0	55.6	65.6	37.9	37.9
1996	47.4	47.0	48.1	48.4	70.8
1997	26.1	26.6	25.7	40.4	31.4
1998	38.6	14.2	26.2	30.7	30.9
1999	23.7	6.7	16.7	45.6	18.0
2000	94.4	94.4	83.1	15.0	59.5
2001	91.7	82.5	78.0	64.6	26.1
2002	76.0	75.5	66.9	54.0	32.2
2003	70.8	69.2	65.6	71.5	62.4
2004	61.5	56.3	50.5	49.5	20.9
2005	43.7	35.8	31.6	35.3	30.0
2006	62.5	37.8	38.0	36.8	17.8
2007	40.0	40.0	36.9	50.0	26.2

Notes: The table shows the proportion of stocks whose returns have been higher than those of the stock market average each year for each fraction portfolio. The reported proportions are arithmetic averages of proportions of nine portfolio-formation criteria that combine momentum and value indicators.

show that the performance of glamour portfolios, and in particular that of glamour loser portfolios, is remarkably poor.[5] Their underperformance against both the stock market portfolio and the corresponding value winner portfolio is significant on the basis of all valuation criteria except for S/P and B/P (for the latter criterion, the underperformance against the stock market is significant only at the 10.4 per cent level). For all other criteria, the glamour loser portfolios have the lowest return and the highest risk. Therefore, we test whether the risk-adjusted performance can be further improved by means of the 130/30 long-short strategy, in which we leverage the long position on value winner stocks by 30 per cent and finance the leverage by selling glamour loser stocks short with the same amount. The results for 130/30 long-short strategies are shown in Table 4.

Owing to the clear dominance of value winner portfolios over the stock market portfolio, and, in particular, over the glamour loser portfolio, following the 130/30 long-short strategy would have added remarkable value for the investor. Leveraging the value

Table 4: Total risk-adjusted performance of 130/30 long-short portfolios

Portfolio formation criterion	*Average annual return (%)*	*Average annual volatility (%)*	*SKAD (%)*	*SR*	*(sign)*	*ASR*	*(sign)*	*SR (130/30 vs VW) (sign)*	*ASR (130/30 vs VW) (sign)*
Momentum & E/P	24.65	17.71	21.17	0.326	(0.009)	0.274	(0.076)	(0.065)	(0.088)
Momentum & EBITDA/EV	26.24	21.23	19.31	0.297	(0.030)	0.328	(0.009)	(0.041)	(0.008)
Momentum & CF/P	23.33	19.82	22.54	0.281	(0.041)	0.248	(0.144)	(0.037)	(0.103)
Momentum & S/P	19.28	24.35	22.31	0.199	(0.536)	0.218	(0.371)	(0.337)	(0.264)
Momentum & B/P	20.77	20.02	17.63	0.247	(0.217)	0.282	(0.091)	(0.412)	(0.089)
Momentum & D/P	27.78	18.42	20.13	0.355	(0.004)	0.325	(0.015)	(0.066)	(0.048)
Momentum & 2A	27.23	19.16	19.58	0.336	(0.007)	0.330	(0.010)	(0.166)	(0.138)
Momentum & 3A	30.32	18.57	19.87	0.383	(0.001)	0.359	(0.003)	(0.021)	(0.034)
Momentum & 3B	28.94	18.16	21.69	0.374	(0.001)	0.314	(0.019)	(0.019)	(0.038)

Notes: The average annual return, two risk measures (that is volatility and SKAD) and corresponding performance metrics (the Sharpe ratio (SR) and the adjusted Sharpe ratio (ASR)) are presented for each long-short portfolio formed on the basis of each portfolio-formation criterion. The SR and ASR are followed by the significance levels (in parentheses) of performance differences between the market portfolio and each long-short portfolio, respectively. The last two columns show the significances (in parentheses) of performance differences between the 130/30 long-short portfolios and the comparable value winner (VW) long-only portfolios (the reported significances are based on the Ledoit–Wolf test statistics).

winner portfolio by shorting the glamour loser portfolio in the above-mentioned proportion significantly enhances the performance of most of the portfolio-formation criteria. The greatest improvement is achieved for the criterion that is based on the combination of the three-composite measure 3A and the momentum. The average annual return for that particular long-short strategy is 5.5 percentage points higher than that of the corresponding long-only value winner portfolio, while, simultaneously, the resulting increase in annual volatility is less than one percentage point. As a consequence, the above-mentioned 130/30 long-short portfolio significantly outperforms the corresponding long-only value winner portfolio that proved to be the best-performing long-only portfolio in our previous analysis. Even though our comparison does not take into account transaction costs that are higher for the long-short strategy than for the long-only strategy, the return difference is more than enough to compensate the higher transaction costs of the long-short strategy. The relative proportional costs of short sales are generally lower for larger portfolios, and thus the differences in transaction costs between the long-short strategy and the corresponding long-only strategy are relatively smaller for more wealthy investors, such as institutional investors. The overall long-short results show that for most of the portfolio-formation criteria examined, the total risk-adjusted performance of the 130/30 strategy is better than that of the corresponding long-only value winner strategy. The results are significant (at the 10 per cent level) in six out of nine comparable cases on the basis of both the Sharpe ratio and the adjusted Sharpe ratio. The added value of the long-short strategy is greatest by combining the momentum with the 3A, 3B or EBITDA/EV criterion. The significance levels of the results are somewhat dependent on the risk-adjustment method indicating the different degree of skewness in the return distributions being analyzed. However, for the last three criteria mentioned, the performance enhancement is significant on the basis of both the Sharpe ratio and the adjusted Sharpe ratio.

In addition, the results from performance tests based on asset pricing models indicate the significant outperformance of the best long-short strategies; both single-factor and two-factor alphas rank the long-short portfolios in almost the same way as the total risk-adjusted performance metrics (Table 5). Moreover, the size effect does not explain

Table 5: Factor-based performance of 130/30 long-short portfolios

Portfolio-formation criterion	*One-factor alpha (%)*	*(sign)*	*Two-factor alpha (%)*	*(sign)*	*One-factor market beta*	*Two-factor beta(R_m)*	*Two-factor beta(SMB)*	*Change in adj. R2s (%)*
Momentum & E/P	14.41	(0.000)	13.74	(0.000)	0.54	0.67	0.25	9.63
Momentum & EBITDA/EV	16.73	(0.000)	15.99	(0.000)	0.56	0.70	0.27	9.45
Momentum & CF/P	12.25	(0.002)	11.43	(0.003)	0.64	0.80	0.31	12.10
Momentum & S/P	8.16	(0.104)	6.97	(0.152)	0.74	0.98	0.46	18.21
Momentum & B/P	11.40	(0.013)	10.34	(0.007)	0.52	0.73	0.40	19.73
Momentum & D/P	17.62	(0.000)	16.83	(0.000)	0.52	0.67	0.28	11.61
Momentum & 2A	15.08	(0.001)	14.10	(0.000)	0.64	0.83	0.36	14.23
Momentum & 3A	19.88	(0.000)	19.04	(0.000)	0.53	0.68	0.30	12.63
Momentum & 3B	18.51	(0.000)	17.76	(0.000)	0.54	0.67	0.27	10.69

Notes: The table presents the regression coefficients of single-factor and two-factor models for each long-short portfolio. The annual CAPM alphas are shown in the second column, while the corresponding two-factor alphas are shown in the fourth column (significances in parentheses in the third and fifth columns, respectively). The sixth column indicates the market betas of the single-factor model followed by the corresponding betas of the two-factor models in the seventh column. The slopes of the size factor are presented in the eighth column. The last column shows the differences in adjusted R2s between single- and two-factor models in percentages (positive figures indicate the improved explanatory power of the two-factor regression model).

much of the abnormal returns of long-short portfolios, as the single-factor alphas are only marginally greater than the corresponding two-factor alphas. The greatest difference is only 1.19 percentage points in the case of combining the momentum criterion with the S/P criterion. It is also noteworthy that all of the other two-factor alphas, except for this particular case, are statistically significant. Parallel to our previous results from total risk-adjusted performance comparisons, the greatest alphas based on both factor models are generated by the long-short strategy in which portfolios are formed on the basis of the combination of the price momentum and the 3A composite value measure. Its two-factor alpha is as high as 19.04 per cent on an annual basis. Generally, the two-factor market betas are systematically higher than the corresponding single-factor market betas, and the size factors in two-factor models all significantly increase the explanatory power of the factor model.

CONCLUSIONS

This article provides strong evidence that taking into account price momentum in addition to the relative valuation of stocks would have added value to an investor in the Finnish stock market during the 1993–2008 sample period. For the sample employed, the inclusion of the momentum criterion along with the valuation criteria increases the average annual returns of the top six-quantile portfolios by 2.84 percentage points, on average. Although this also leads to a volatility decrease in comparable portfolio returns for six out of the nine portfolio-formation criteria examined, the inclusion of momentum increases the asymmetry of return distributions of top six-quantile value portfolios into a direction that is undesirable to the investor. Thus, the benefits of combining momentum and value criteria without taking a short position on unfavorable stocks are not as outstanding as could be inferred on the basis of standard mean-variance compatible performance metrics, such as the Sharpe ratio. In spite of this, based on the adjusted Sharpe ratio that takes into account differences in distributional asymmetries, the outperformance of value winner portfolios over the stock market portfolio remains significant except for in one case. Among those top six-quantile value portfolios that outperform the stock market portfolio most significantly, the performance improvement stemming from the inclusion of the momentum criterion is greatest for value portfolios that are formed on the basis of three-composite value measures. The best risk-adjusted performance during the 15-year sample period would have been achieved by investing in past winners of the portfolio, that is, formed by the three-composite value measure combining the D/P, B/P and EBITDA/EV valuation criteria. In this case, the average annual return increases by nearly five percentage points, and volatility decreases by 0.86 percentage points.

For the sample employed, the risk-adjusted performance of the best value winner portfolios could have been significantly enhanced by following the 130/30 long-short strategy in which the long position of value winner stocks is leveraged by 30 percentages while simultaneously selling short glamour loser stocks by the same amount. The greatest improvement is achieved for the criterion that is based on the combination of the three-composite measure 3A and the momentum. The average annual return for that particular long-short strategy is 5.5 percentage points higher than that of the corresponding long-only value winner portfolio, while simultaneously the resulting increase in annual volatility is less than one percentage point. As a consequence, the above-mentioned 130/30 long-short portfolio significantly outperforms the corresponding long-only value winner portfolio that proved to be the best-performing long-only portfolio in the preceding comparison. It is also noteworthy that the average annual

return of the best long-short strategy is double that of the stock market average, while at the same time the annual volatility of the former is more than three percentage points lower than the average stock market volatility.

This article suggests several extensions for further research. To our knowledge, this is the first study in which the combination of composite value measures and price momentum as a portfolio-formation criterion is examined. Our results indicate that it might also be worthwhile to examine its efficiency in the major stock markets in order to deduce to what extent our results are generalizable. Moreover, larger samples of stocks would enable the testing of the impact of various quantile divisions on the results. In addition, the results of Bird and Casavecchia (2007b) show that at least for value strategies based on individual valuation ratios, the performance improvement can be increased including not only price momentum, but also the acceleration rate of the price momentum. Although beyond the scope of this article, the above-mentioned extensions might provide interesting topics for further research.

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NOTES

1. For an excellent review of reasons for price momentum, see for example Scowcroft and Sefton, 2005.
2. We choose 6-month past returns as our momentum indicator on the basis of preliminary tests where we evaluate the performance of pure price momentum strategies based on different holding period lengths for the same sample data as employed in this article. In addition, the recent results from other stock markets support the use of 6-month momentum as the momentum indicator (for example see Bird and Casavecchia, 2006; Figelman, 2007).
3. The adjusted Sharpe ratio is developed by Pätäri (2009) and employed in the hedge fund study of Pätäri and Tolvanen (2009), for example.
4. Our long-short portfolios include twice as many stocks as included in long-only portfolios.
5. Parallel to our results, Bird and Casavecchia (2007a) also report the poor performance of glamour loser stocks.

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