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Fundamental information in technical trading strategies

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Fundamental Information in Technical Trading Strategies

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Look deeper

Fundamental Information in Technical Trading Strategies

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Fundamental Information in Technical Trading Strategies

Abstract

Technical trading strategies assume that past changes in prices help predict future changes. This makes sense if the past price trend reflects fundamental information that has not yet been fully incorporated in the current price. However, if the past price trend only reflects temporary pricing pressures, the technical trading strategy is doomed to fail. We demonstrate that this failure can be avoided by using financial statements as additional sources of information.

We implement a trading strategy that invests in stocks with high past returns and high operating cash flows. This combination strategy yields a 3-factor alpha of 15% per year, which is much higher than that of the pure momentum strategy that invests in stocks with high past returns without considering operating cash flows. The combination strategy outperforms the momentum strategy in almost all years. The outperformance can be traced back to a higher probability of picking outperforming stocks. These are stocks that yield high future cash flows and hardly ever delist due to poor performance. The combination strategy is easily implemented: the information used is publicly available, the stocks chosen are liquid, and even high transaction costs do not erode the outperformance.

JEL Classification: *G11, G12, G14*

1. Introduction

Technical trading strategies are controversial in the literature. Advocates argue that stock prices are determined simultaneously by various, and to some extent unobservable factors. Since the net impact of these factors on prices is hard to calculate, they suggest looking not directly at the factors but at past stock price changes. This makes sense only if past price changes reflect new information that has not yet been fully incorporated in the current price. However, if past price changes only reflect temporary pricing pressure, then they have no predictive power for future returns, and technical trading strategies are doomed to failure. Looking only at technical trading information does not allow the investor to distinguish between these two cases.

We suggest solving this problem by taking fundamental information into account. We show that a trading strategy that uses technical and fundamental information at the same time clearly outperforms a pure technical trading strategy. The fundamental information allows the investor to distinguish between price changes due to temporary pricing pressure and price changes due to new information. Therefore, the investor achieves a higher probability of picking stocks that will outperform in the future.

We use a long-only version of the well-known momentum strategy suggested by Jegadeesh and Titman (1993) as our pure technical trading strategy. To simplify the implementation, we focus on a long-only strategy, which invests in past winners but does not sell short past losers. We refine this strategy by investing only into past winners that also have a high operating cash flow. We use operating cash flow as fundamental information for several reasons, including the following. (i) It is easily available to the investors and does not reflect stock market effects. (ii) The inflow that a company generates by its operating activities is a good indicator of its overall well-being and its available funds for future investments. (iii) Operating cash flow is less prone to manipulation by managers than alternative measures like accruals or earnings.

Our trading strategy proceeds as follows. We sort stocks independently with respect to their past six-month returns and with respect to their operating cash flow. Then we invest into a portfolio of stocks that belong to the top 20% with respect to momentum and operating cash flow at the same time. We rearrange our portfolio quarterly and run the strategy for 19 years. On average, our trading strategy yields a 3-factor alpha of about 15% per year. This is significantly higher than the alpha of a pure momentum strategy. Our combination strategy outperforms the momentum strategy in 18 of the 19 years of our investment period. This outperformance results from a higher probability of picking stocks with positive future abnormal returns, and only marginally from conditionally higher abnormal returns. In particular, the operating cash flow allows the investor to filter for stocks for

which the price trend reflects enduring economic profits. For this reason, the stocks in our combination portfolio yield higher future cash flows than the stocks in the pure momentum strategy. That these stocks generate higher future returns is in line with Fama and French (2008). We show that our combination strategy is easily implemented: a sufficient number of stocks meet the selection criteria, and the stocks are more liquid than the average stock in our sample. The performance of the strategy remains significant even when we account for round-trip transaction costs of 300 basis points. We finally show that our results are neither driven by extreme realizations of our criteria, nor by well-known accounting based market anomalies like the earnings surprise or the accrual effect.

Although we are the first to show the above results, our work is related to a still small set of papers that have analyzed trading strategies based on several sources of information. Piotroski (2000) combines several types of fundamental information to improve the success of a value strategy but ignores technical trading information. In contrast, Lee and Swaminathan (2000) look only at technical information. They analyze the impact of trading volume on price momentum. Chan, Jegadeesh, and Lakonishok (1996) are the first to sort stocks simultaneously based on technical and fundamental information. They show that the momentum effect is partly due to the market's underreaction to past earnings news. Figelman (2007) provides evidence that companies with poor past returns and high return on equity tend to manipulate their earnings. Their future returns are worse than the returns of stocks with poor past returns and low return on equity. Sagi and Seasholes (2007) provide a real option model and show that return autocorrelation depends on firm-specific attributes. Their empirical study supports the hypotheses derived from their model: the traditional momentum strategy, i.e., buying winners and selling losers, works better for firms with high revenue growth volatility, low costs, or valuable growth options.

Our paper is organized as follows: in Section 2 we describe the data. Section 3 provides the basic result, i.e., the combination strategy outperforms the pure momentum strategy. In Section 4, we show the sources of the outperformance of the combination strategy. In Section 5, we analyze several potential implementation problems, and in Section 6, we rule out alternative explanations for our results. Section 7 concludes.

2. Data

Our investigation period spans the period from March 1989 to December 2007. From the merged CRSP and Compustat databases, we take monthly returns of all NYSE, AMEX, and NASDAQ companies as well as information on quarterly operating cash flows. We exclude the 1% extreme outliers in terms of current returns, past six-month returns, and operating cash flows. This leaves us with 1,100,451 monthly returns and 366,817 quarterly observations of the financial statements.

We assign each company to three different portfolios. First, we sort all companies according to their past cumulative six-month stock return (measured with one month lag) and assign them into the quintile portfolios *Mom1* to *Mom5*.[1] The top 20% of companies are assigned to portfolio *Mom5*, and the bottom 20% are assigned to portfolio *Mom1*. Second, we sort all companies according to their relative operating cash flow (operating cash flow divided by average quarterly assets) into the quintile portfolios *Cfo1* to *Cfo5*. Our sorting is based on the cash flow of the fiscal quarter that ends at least three months before the sorting date. This lag ensures that the financial statements are published when the investment decision is taken. The sorting relies on operating cash flows belonging to the same fiscal quarter to ensure comparability. The five pure momentum portfolios (*Mom1* - *Mom5*) and the five pure cash flow portfolios (*Cfo1* - *Cfo5*) serve as our benchmarks to judge the profitability of the combination strategy. To implement this strategy, we form 25 portfolios based on the companies' momentum and cash flow. The portfolio we focus on is *Combi55* and includes all companies that belong to the top 20% with respect to their momentum (*Mom5*) and to the top 20% with respect to their cash flow (*Cfo5*) at the same time. All portfolios are equally weighted and are rebuilt every three months (March, June, September, and December).[2]

To measure performance, we use abnormal returns and 3-factor alphas. To compute a firm's monthly abnormal return we follow Daniel and Titman (1997) and compute the difference between its return and the value-weighted return of all firms belonging to the same quintiles in terms of size and book-to-market. To calculate monthly portfolio 3-factor alphas, we regress the monthly time series of portfolio returns on the three Fama-French-factors (market, firm size, value).[3]

If a firm delists, we follow a procedure similar to Beaver, McNichols, and Price (2007): if CRSP gives the delisting return, we use this delisting return as the monthly return of the stock. In other cases, we use the mean delisting return of all companies with the same 1st digit of the delisting code provided by CRSP. For the remaining holding period, we assume an investment into the value-

[1] We use a one-month lag to exclude possible short term reversal effects. However, we get very similar results when measuring momentum without a time lag.

[2] When we replicate our analysis using a value-weighted portfolios, we obtain very similar results.

[3] We obtain size and book-to-market decile breakpoints and portfolio returns, as well as the factor return series from Kenneth R. French's data library at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

weighted market portfolio from CRSP. The mean monthly raw return in our sample is 1.18%, implying a return of 15.12% per annum. The mean ratio of operating cash flows to average assets is 0.74%. The mean abnormal return is close to zero with a value of 0.04%.

3. Performance of the Combination Strategy

The combination strategy is expected to perform well if the momentum and cash flow are complementary information for predicting stock returns. To test this condition, we run a Fama-MacBeth-regression with the stock return on the left hand side and momentum (*mom*), operating cash flow (*cfo*), firm size (*size*), and book-to-market (*bm*) as explanatory variables. We leave out market beta as an explanatory variable as it has no significant explanatory power for expected returns after accounting for size and book-to-market.[4] For momentum and operating cash flow, we use deciles scaled from zero to one to make the coefficients easier to interpret.[5] For each point of time *t*, we run the following regression:

$$(1) \qquad ret_{i,t+\tau} = \alpha + \beta_t^1 \cdot mom_{i,t} + \beta_t^2 \cdot cfo_{i,t} + \beta_t^3 \cdot \ln(size)_{i,t} + \beta_t^4 \cdot \ln(bm)_{i,t} + \varepsilon_{i,t+\tau}$$

We calculate the regression results for non-overlapping cumulative future three-month returns ($\tau = 3$), which correspond to the quarterly portfolio rebalancing of our trading strategy, and for future monthly stock returns ($\tau = 1$). The mean estimated coefficients (aggregated across time) are presented in Table 1.

Table 1

Determinants of Future Returns

	constant	mom	cfo	ln(size)	ln(bm)
$ret_{i,t+1}$	-0.005	0.012 ***	0.014 ***		
$ret_{i,t+3}$	0.011	0.027 **	0.026 ***		
$ret_{i,t+1}$	-0.006	0.012 ***	0.012 ***	0.001	0.002 ***
$ret_{i,t+3}$	0.037	0.034 ***	0.033 ***	-0.006 ***	0.006 *

This table presents the results of Fama-MacBeth-regressions based on Model (1). The independent variable is the future return of the following month ($ret_{i,t+1}$) or the cumulative future return over the next three months ($ret_{i,t+3}$). We run monthly regressions based on $ret_{i,t+1}$ and quarterly regressions based on $ret_{i,t+3}$. The explanatory variables are momentum and operating cash flow, which are measured in deciles scaled from 0 to 1. The natural logarithm of the market capitalization and the natural logarithm of the ratio of book-to-market value are added as control variables. The investigation spans the period from March 1989 until December 2007. ***(**, *) denotes significance at the 1%- (5%-, 10%-) level based on a two-tailed test.

[4] See, for example, Daniel and Titman (1997).

[5] We obtain very similar results when using the actual values for momentum and cash flow instead of the deciles.

Table 1 shows that both momentum and operating cash flow have a highly significant impact on future stock returns – in addition to size and book-to-market. This holds for returns over the next month as well as for returns over the next three months. This result suggests that both types of information are valuable for predicting future returns, and that a trading strategy making use of them might perform well.

We test this conjecture by comparing the profits of three trading strategies: we focus on the combination strategy (*Combi55*) that chooses stocks with high momentum and high cash flow at the same time. As benchmarks we use (i) a pure momentum strategy that invests in all stocks with high momentum (top 20%) irrespective of their cash flow, and (ii) a pure cash flow strategy that invests in all stocks with high cash flow (top 20%) irrespective of their momentum. Table 2 lists the monthly abnormal returns (Panel A) and monthly 3-factor alphas (Panel B) for all strategies.

Table 2

Performance of the Trading Strategies

Panel A: Abnormal Returns

		low mom				high mom	
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	pure cfo
high cfo	*Cfo5*	0.25	0.35 *	0.41 ***	0.52 ***	1.16 ***	0.58 ***
	Cfo4	-0.35	0.13	0.12	0.15	0.87 ***	0.21 ***
	Cfo3	-0.46	-0.22	-0.12	0.07	0.61 ***	-0.01
	Cfo2	-0.65	-0.37 *	-0.26 **	-0.26 **	0.46 ***	-0.25 *
low cfo	*Cfo1*	-0.70	-0.55 **	-0.45 **	-0.14	0.43 **	-0.35
pure momentum		-0.46	-0.14	-0.03	0.10	0.73 ***	

Panel B: 3-Factor Alphas

		low mom				high mom	
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	pure cfo
high cfo	*Cfo5*	-0.07	0.35 **	0.55 ***	0.69 ***	1.20 ***	0.62 ***
	Cfo4	-0.54 *	0.18	0.34 ***	0.43 ***	1.00 ***	0.35 ***
	Cfo3	-0.65 **	-0.15	0.12 *	0.35 ***	0.80 ***	0.13 *
	Cfo2	-0.93 ***	-0.36 **	-0.06	-0.04	0.53 ***	-0.23 *
low cfo	*Cfo1*	-1.14 **	-0.71 **	-0.43 *	-0.10	0.24	-0.59 **
pure momentum		-0.79 **	-0.15	0.14 *	0.33 ***	0.80 ***	

This table presents the monthly risk-adjusted returns of portfolios based upon quarterly rankings of momentum and operating cash flow. Rows *Cfo1* to *Cfo5* reflect quintile portfolios sorted by operating cash flow. Columns *Mom1* to *Mom5* reflect quintiles sorted according to momentum. Panel A presents abnormal returns in % per month, where abnormal returns are the difference between a firm's return and the value-weighted return of firms belonging to the same quintiles in terms of size and book-to-market. Panel B presents 3-factor alphas in % per month. The investigation spans the period from March 1989 until December 2007. *** (**, *) denotes significance at the 1%- (5%-, 10%-) level based on a two tailed test.

Table 2 provides clear evidence that an investor can increase profits by simultaneously taking momentum and cash flow into account. This basic result of our paper holds irrespective of the performance measure used. Within each momentum quintile, the trading profit increases with the cash flow of the stocks. The same is true within each cash flow quintile: the higher the momentum of the stocks chosen, the higher the performance. Therefore, the combination strategy (*Combi55*) that selects stocks with high momentum and high cash flow yields the maximum profit. Its average monthly abnormal return is 1.16%, and its 3-factor alpha is 1.20%. Both are highly significant. If the investor follows a pure momentum strategy or a pure cash flow strategy, the profit is much lower. The pure momentum strategy yields an abnormal return of 0.73% per month and a 3-factor alpha of 0.80%. The respective numbers for the pure cash flow strategy are 0.58%, and 0.62%. The differences in performance between the combination strategy and the pure strategies are significant at the 1% level. The t-values of the differences between the combination strategy and the pure momentum strategy are 5.00 (abnormal returns) and 4.51 (3-factor alphas). The t-values of the differences between the combination strategy and the pure cash flow strategy are 3.53 (abnormal returns) and 4.69 (3-factor alphas).

The superiority of the combination strategy is extremely stable. Figure 1 shows the profits of the strategies on a year by year basis. The combination strategy outperforms the pure momentum and the pure cash flow strategy in almost all years – no matter which performance measure we use. This finding strengthens our overall result: it is valuable to pick stocks based on momentum and operating cash flow at the same time.

Figure 1

Performance of the Trading Strategies on a Year-by-Year Basis

Figure 1 A: Abnormal Returns

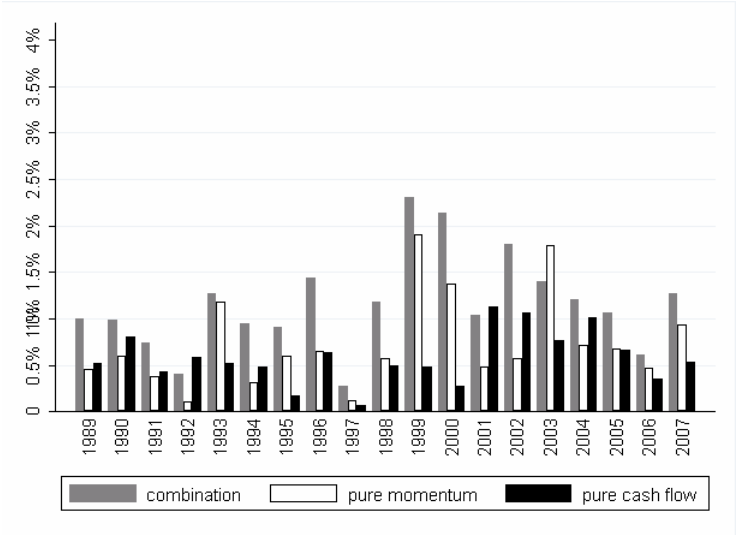
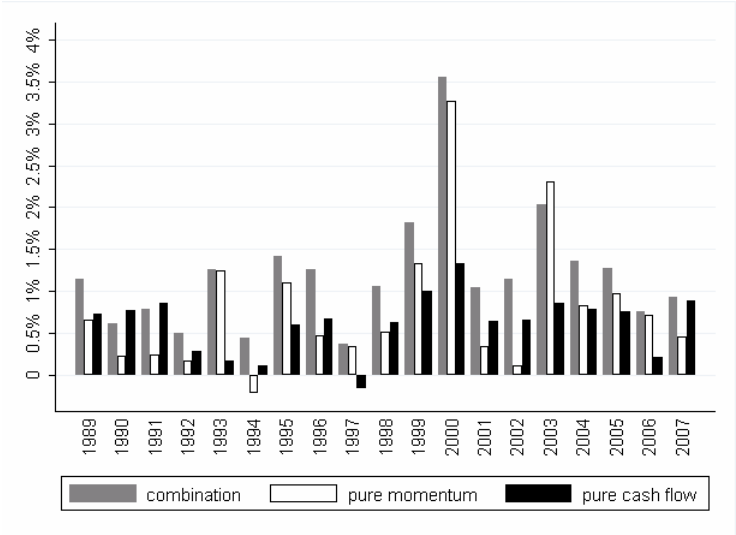


Figure 1 B: 3-Factor Alphas



This figure presents the monthly risk-adjusted returns of the combination strategy, the pure momentum strategy, and the pure cash flow strategy on a year-by-year basis. The pure momentum strategy invests in the 20% of stocks with the highest momentum. The pure cash flow strategy invests in the 20% of stocks with the highest operating cash flow. The combination strategy invests in stocks that belong to both the top 20% with respect to momentum and the top 20% with respect to cash flow. Figure 1 A presents mean abnormal returns in % per month, where abnormal returns are defined as the difference between a firm's return and the value-weighted return of firms belonging to the same quintiles in terms of size and book-to-market. Figure 1 B presents mean 3-factor alphas in % per month. The time period of our investigation is 1989 to 2007.

4. Sources of the Performance

Performance Decomposition

The outperformance of the combination strategy over the pure strategies might result from a higher probability of picking stocks with positive performance or from conditionally better performance of the stocks picked. We now analyze the contribution of these two sources to the outperformance of the combination strategy.

We first check the probability of choosing stocks with positive performance. In the pure momentum strategy, on average 50.63% of the stocks chosen deliver mean positive abnormal returns in the following three months. A similar number (50.59%) is obtained for the pure cash flow strategy. The proportion is much higher when applying the combination strategy. 53.51% of all stocks held deliver mean positive abnormal returns in the following three months. The difference between the proportion in the combination portfolio and that in the pure momentum (pure cash flow) portfolio is statistically significant with a t-value of 6.89 (4.20).

Comparing the conditional mean positive and negative abnormal returns of the strategies shows that the strategies differ with respect to the performance extremeness of the stocks chosen. The pure cash flow strategy is the least extreme strategy. It avoids high negative abnormal returns but gets only fairly low positive abnormal returns. The average numbers are -5.79% and 6.78%, respectively. The momentum strategy is the most extreme one. The average negative abnormal return is -6.30% and the average positive return is 7.56%. The combination strategy takes the middle position. The average negative abnormal return of the combination strategy is only -5.84% and the average positive abnormal return is 7.28%. A rough calculation assuming a 50%-chance of picking stocks with positive and negative abnormal returns shows that the strategies deliver similar unconditional abnormal returns. The respective numbers are 0.50% (pure cash flow strategy), 0.63% (pure momentum strategy), and 0.72% (combination strategy). This result suggests that the outperformance of the combination strategy is mainly driven by its better ability to pick outperforming stocks, not by the better performance of the stocks picked.

We now calculate in detail which part of the outperformance of the combination strategy shown in Table 2 can be attributed to the higher probability of choosing stocks with positive abnormal return (stock picking effect), and which part can be attributed to the effect of the different conditional abnormal returns (conditional performance effect). We describe our procedure by looking at the performance difference between the combination strategy and the momentum strategy.

Let R_t^C be the abnormal return of the combination strategy in period t and R_t^M the abnormal return of the pure momentum strategy. The probabilities of picking a stock with positive performance are denoted by p_t^C and p_t^M, respectively. The conditional mean performances of stocks with positive (negative) performance are denoted by R_t^{C+} (R_t^{C-}) and R_t^{M+} (R_t^{M-}). The performance difference between the strategies can be written as:

$$
\begin{aligned}
R_t^C - R_t^M &= p_t^C R_t^{C+} + (1-p_t^C) R_t^{C-} - \left[p_t^M R_t^{M+} + (1-p_t^M) R_t^{M-} \right] \\
&= \left[p_t^C - p_t^M \right] \left[R_t^{M+} - R_t^{M-} \right] \\
&\quad + \left\{ p_t^M \left[R_t^{C+} - R_t^{M+} \right] + \left(1-p_t^M\right) \left[R_t^{C-} - R_t^{M-} \right] \right\} \\
&\quad + \left\{ \left[p_t^C - p_t^M \right] \left[R_t^{C+} - R_t^{M+} \right] + \left[\left(1-p_t^C\right) - \left(1-p_t^M\right) \right] \left[R_t^{C-} - R_t^{M-} \right] \right\}
\end{aligned}
\tag{2}
$$

where $\left[p_t^C - p_t^M \right] \left[R_t^{M+} - R_t^{M-} \right]$ is the contribution of the better ability to pick outperforming stocks and $\left\{ p_t^M \left[R_t^{C+} - R_t^{M+} \right] + \left(1-p_t^M\right) \left[R_t^{C-} - R_t^{M-} \right] \right\}$ measures the effect of the different conditional performance levels. The remaining part is the cross product, which cannot be attributed to either of the two sources. We decompose the performance difference at each point of time, calculate the performance contribution of the picking ability and the performance contribution due to different conditional performance levels, and then aggregate them over time. The results are provided in Table 3.

Table 3

Decomposition of the Outperformance

	Overall Effect	Stock Picking Effect	Conditional Performance Effect	Cross Product
Combination versus pure Momentum	0.424 ***	0.394 *** 93%	0.044 10%	-0.014 *** -3%
Combination versus pure Cash flow	0.579 ***	0.425 *** 73%	0.112 20%	0.042 *** 7%

This table reports the outperformance of the combination strategy compared to the pure momentum strategy and the pure operating cash flow strategy in % per month. The overall outperformance is split into three parts: The first part is due to a higher ratio of stocks with positive abnormal returns (stock picking effect), the second is due to higher abnormal returns (conditional performance effect), and the third part is the residual cross product. The respective percentages are listed below. The investigation spans the period from March 1989 until December 2007. *** (**, *) denotes significance at the 1%- (5%-, 10%-) level, based on a two tailed test.

Table 3 shows that the combination strategy outperforms the pure momentum strategy almost solely due to its superior ability to select stocks with positive performance. From the total abnormal return difference of 0.424%, about 0.394% (that is a ratio of 93%) can be attributed to the better picking ability. This result suggests that incorporating cash flow information into the momentum strategy increases the probability of choosing stocks with continuing price trends. In contrast, the contribution of the differences in conditional performance is close to zero and not statistically significant.

The results are slightly different when we decompose the performance difference between the combination strategy and the pure cash flow strategy. Still, the higher picking ability of the combination strategy is responsible for a large fraction of 73% of the outperformance, but now the higher conditional performance level also contributes 20% of the outperformance.

Performance and Future Profitability

The findings so far suggest that the combination strategy is particularly successful in picking stocks with high future performance. These are stocks with enduring profits: the stocks chosen by the combination strategy (*Combi55*) yield the highest operating cash flows in the year after portfolio formation. That these stocks consequently also yield the highest future returns is in line with Fama and French (2008). In Table 4, we present mean operating cash flows in the quarter following portfolio formation and in the following four quarters.

Table 4 shows that the highest future operating cash flows occur when following the combination strategy. Operating cash flows per average assets for the stocks in the combination portfolio amount to 3.25% in the following quarter and 3.53% in the following year. These future operating cash flows are statistically higher than those of the pure momentum strategy and the pure cash flow strategy. The t-value is 31.40 (9.25) for the difference between the combination strategy and the pure momentum strategy (pure cash flow strategy).

These higher future cash flows correspond to lower delisting rates due to poor performance. Only 0.11% of the stocks in the combination portfolio delist due to poor performance within the three month investment period. The delisting rates are higher when applying a pure momentum strategy (0.24%) or a pure cash flow strategy (0.35%).

Table 4

Mean Future Operating Cash Flows

Panel A: Next Quarter

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	1.29	2.34	2.82	3.00	3.25	2.64
	Cfo4	1.33	2.14	2.37	2.44	2.49	2.22
	Cfo3	1.08	1.51	1.74	1.83	1.73	1.60
	Cfo2	0.29	0.84	1.08	1.19	1.05	0.87
low cfo	*Cfo1*	-4.58	-2.67	-1.75	-1.73	-2.85	-3.07
pure momentum		-0.88	0.85	1.46	1.62	1.23	

Panel B: Next Year

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	2.02	2.85	3.20	3.43	3.53	3.09
	Cfo4	1.64	2.21	2.46	2.59	2.59	2.36
	Cfo3	1.14	1.57	1.68	1.76	1.71	1.60
	Cfo2	0.18	0.79	0.95	1.01	0.90	0.76
low cfo	*Cfo1*	-3.92	-2.52	-1.84	-1.90	-2.63	-2.78
pure momentum		-0.40	1.04	1.54	1.70	1.37	

This table presents mean future operating cash flows in portfolios based upon quarterly rankings of momentum and operating cash flow. Rows *Cfo1* to *Cfo5* reflect quintile portfolios sorted according to operating cash flow. Columns *Mom1* to *Mom5* reflect quintiles sorted according to momentum. Panel A lists the mean operating cash flow in the next quarter. Panel B lists the mean operating cash flow during the next four quarters. All values are listed in % per average assets. The investigation spans the period from March 1989 until December 2007.

5. Potential Implementation Problems

Several factors might prevent investors from implementing the combination strategy. First, there might be only a few stocks meeting both conditions (high momentum, high cash flows) at the same time, leading to high idiosyncratic risk. Second, the stocks selected by the combination strategy might be illiquid, making it difficult to trade them. Third, the turnover of the strategy might be so high that returns do not suffice to cover transaction costs. We check for these possible difficulties in this section.

Portfolio size

To check the size of the portfolio underlying the combination strategy, we calculate the distribution of stocks across all portfolios every quarter. By construction, each portfolio based on a pure strategy includes 20% of the stocks. For the 25 portfolios sorted on momentum and cash flow, we calculate the fractions of stocks included in each portfolio. If momentum and cash flow were independent, we would expect a fraction of 1/25 = 4% for each portfolio. In Table 5, we report the mean values of these fractions.

Table 5

Portfolio Size

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	3.05	3.70	3.93	4.39	4.92	19.99
	Cfo4	2.84	3.90	4.56	4.70	3.99	20.00
	Cfo3	3.22	4.20	4.58	4.46	3.54	20.00
	Cfo2	4.37	4.37	4.03	3.65	3.58	20.00
low cfo	*Cfo1*	6.55	3.80	2.89	2.80	3.96	20.01
pure momentum		20.03	19.98	20.00	20.00	19.99	

This table reports the mean proportions of stocks in portfolios based upon quarterly rankings of momentum and operating cash flow. Rows *Cfo1* to *Cfo5* reflect quintile portfolios sorted according to operating cash flow. Columns *Mom1* to *Mom5* reflect quintiles sorted according to momentum. All values are listed in % of the whole investment spectrum. The investigation spans the period from March 1989 until December 2007.

The portfolio underlying the combination strategy includes 4.92% of our sample stocks, on average. The minimum fraction for this portfolio is 3.63%, which corresponds to a minimum number of 195 stocks in the portfolio underlying the combination strategy. This suggests that a sufficient number of firms comply with both criteria, making the combined strategy investable.

Stock liquidity

Another potential caveat to the combination strategy is that stocks with high momentum and high operating cash flow might be illiquid. To check for this potential problem when implementing the strategy we calculate two liquidity measures for each stock and then aggregate them to liquidity measures for each portfolio. The first measure is taken from Korajczyk and Sadka (2008). It relates the monthly trading volume to the shares outstanding:

$$(3) \qquad L_{i,t} = \frac{\sum_{d=1}^{days_{i,t}} volume_{i,d}}{shares_{i,t}},$$

where $days_{i,t}$ denotes the number of trading dates for stock i in month t, $shares_{i,t}$ the number of shares of stock i outstanding at the end of month t, and $volume_{i,d}$ the trading volume in shares of stock i at day d. The higher the liquidity measure $L_{i,t}$, is, the higher the liquidity of the stock.

The second measure is taken from Amihud (2002). It captures the illiquidity of a stock by calculating the absolute return per unit of trade volume in dollars:

$$(4) \qquad I_{i,t} = \frac{1}{days_{i,t}} \cdot \sum_{d=1}^{days_{i,t}} \frac{\left| return_{i,d} \right|}{\$volume_{i,d}},$$

where $return_{i,d}$ denotes the return of stock i at day d and $\$volume_{i,d}$ is the trading volume in dollars of stock i at day d. We present mean values for the two measures in Table 6.

Table 6

Portfolio Liquidity

Panel A: Liquidity Measure of Korajczyk and Sadka (2008)

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	0.150	0.110	0.104	0.111	0.178	0.132
	Cfo4	0.137	0.098	0.083	0.093	0.146	0.109
	Cfo3	0.123	0.088	0.078	0.086	0.136	0.099
	Cfo2	0.119	0.084	0.079	0.090	0.145	0.103
low cfo	*Cfo1*	0.136	0.106	0.111	0.131	0.193	0.137
pure momentum		0.132	0.097	0.089	0.100	0.161	

Panel B: Illiquidity Measure of Amihud (2002)

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	0.267	0.301	0.284	0.230	0.202	0.250
	Cfo4	0.247	0.258	0.228	0.196	0.186	0.219
	Cfo3	0.270	0.283	0.242	0.217	0.203	0.240
	Cfo2	0.329	0.389	0.343	0.296	0.256	0.324
low cfo	*Cfo1*	0.335	0.394	0.379	0.345	0.241	0.331
pure momentum		0.292	0.318	0.281	0.242	0.214	

This table reports mean liquidity measures in portfolios based upon quarterly rankings of momentum and operating cash flow. Rows *Cfo1* to *Cfo5* reflect quintile portfolios sorted according to operating cash flow. Columns *Mom1* to *Mom5* reflect quintiles sorted according to momentum. Panel A lists the mean *Liq* measure, based on Korajczyk and Sadka (2008), as reported in Equation (3). Higher values of *Liq* imply higher liquidity. Panel B lists the mean portfolio measure *I* (multiplied by 10^6), based on Amihud (2002), as reported in Equation (4). Higher values of *I* imply lower liquidity. The investigation spans the period from March 1989 until December 2007.

Both measures indicate that the stocks in the combination portfolio are more liquid than the average stock. According to the measure of Korajczyk and Sadka (2008), the portfolio of the combination strategy is the second most liquid of all portfolios. Amihud's illiquidity measure shows a similar picture. The portfolio of the combination strategy is the third most liquid portfolio. In comparison with the portfolios based on the pure strategies, the portfolio of the combination strategy invests in more liquid stocks. Thus, low liquidity seems to be no obstacle for implementing the combination strategy.[6]

Transaction costs

Since the combination strategy uses two criteria for stock selection, its turnover is higher than that of the pure strategies. Therefore, the outperformance (before costs) of the combination strategy might be absorbed by higher transaction costs. We present the mean portfolio turnover rates of the pure and combination strategies in Table 7.

Table 7

Turnover Ratios

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	89.2	91.3	91.0	88.9	81.1	66.8
	Cfo4	91.2	91.9	90.0	88.6	88.1	70.8
	Cfo3	89.2	90.7	89.2	89.0	89.1	70.7
	Cfo2	85.3	90.2	91.2	92.2	89.1	70.4
low cfo	*Cfo1*	72.5	89.7	93.4	93.3	82.5	56.2
pure momentum		56.0	72.5	73.3	72.0	58.9	

This table reports mean turnover ratios of portfolios based upon rankings of momentum and operating cash flow. The mean turnover ratio specifies the fraction of stocks that are newly sorted into the respective portfolios. Rows *Cfo1* to *Cfo5* reflect quintile portfolios sorted according to operating cash flow. Columns *Mom1* to *Mom5* reflect quintiles sorted according to momentum. Ratios are given in % of the complete set of stocks. The investigation spans the period from March 1989 until December 2007.

Table 7 confirms the conjecture: the turnover is lower for pure strategies than for combination strategies. In addition, the table shows that more extreme realizations of momentum and operating cash flow are more likely to persist. Within the 25 combination portfolios, the most extreme portfolios (*Combi11, Combi55*) have the lowest turnover ratios. The same is true for the extreme pure momentum portfolios (*Mom1*, *Mom5*) and the extreme pure cash flow portfolios (*Cfo1, Cfo5*).

[6] In addition, we test whether the combination strategy also works when limiting the investment universe to large companies which should be more liquid. We split our sample by market capitalization into two subsamples and test our trading strategy separately for big (above median size) and small firms (below median size). The strategy works in both subsamples.

To calculate the impact of transaction costs, we take into account the costs when setting up the portfolio for the first time, the portfolio adjustment costs every three months, and the costs of closing the portfolios at the end of December 2007. We assume round-trip transaction costs between 50 and 300 basis points. We report the after-cost performance of the combination strategy, the pure momentum strategy, and the pure cash flow strategy in Table 8. Performance is measured as abnormal returns (Panel A) and 3-factor alpha (Panel B).

Table 8

Performance after Transaction costs

Panel A: Abnormal Return

	Combination	*Pure Momentum*	*Pure Cash Flow*	*Combination - Momentum*	*Combination - Cash Flow*
0 bp	1.16 ***	0.73 ***	0.58 ***	0.42 ***	0.58 ***
50 bp	1.02 ***	0.63 ***	0.47 ***	0.39 ***	0.55 ***
100 bp	0.89 ***	0.54 ***	0.36 ***	0.35 ***	0.53 ***
150 bp	0.75 ***	0.44 ***	0.24 ***	0.32 ***	0.51 ***
200 bp	0.62 ***	0.34 ***	0.13	0.28 ***	0.48 ***
250 bp	0.48 ***	0.24 **	0.02	0.24 ***	0.46 ***
300 bp	0.35 ***	0.14	-0.09	0.21 **	0.44 ***

Panel B: 3-Factor Alpha

	Combination	*Pure Momentum*	*Pure Cash Flow*	*Combination - Momentum*	*Combination - Cash Flow*
0 bp	1.20 ***	0.80 ***	0.62 ***	0.40 ***	0.58 ***
50 bp	1.07 ***	0.70 ***	0.51 ***	0.37 ***	0.56 ***
100 bp	0.93 ***	0.60 ***	0.40 ***	0.33 ***	0.53 ***
150 bp	0.80 ***	0.50 ***	0.29 ***	0.30 ***	0.51 ***
200 bp	0.66 ***	0.40 ***	0.18 **	0.26 ***	0.48 ***
250 bp	0.52 ***	0.30 **	0.06	0.22 ***	0.46 ***
300 bp	0.39 ***	0.20	-0.05	0.19 **	0.44 ***

This table reports monthly after-cost performance and performance differences between the combination strategy, the pure momentum strategy, and the pure cash flow strategy. The pure momentum strategy invests in the 20% of stocks with the highest momentum. The pure cash flow strategy invests in the 20% of stocks with the highest operating cash flow. The combination strategy invests in stocks that belong to both the top 20% with respect to momentum and the top 20% with respect to cash flow. We consider different levels of round-trip transaction costs, from 50 to 300 basis points (bp). Transaction costs include those for portfolio formation, quarterly rearrangements, and closure. The investigation spans the period from March 1989 until December 2007. *** (**, *) denotes significance at the 1%- (5%-, 10%-) level, based on a two tailed test.

Even with high transaction costs, the combination strategy delivers significantly positive performance, no matter how we measure the performance. In contrast, the pure strategies no longer deliver significant profits when the transaction costs are high. This finding is in line with previous research on the performance of the momentum strategy (e.g. Lesmond, Schill, and Zhou 2004), and casts doubt on the profitability of the operating cash flow strategy. The results underline the superiority of the combination strategy. Despite its higher turnover, the combination strategy delivers significantly higher after-cost performance than the pure strategies.

6. Alternative Explanations of the Performance

There are some alternative explanations for the performance of the combination strategy. We check whether these effects drive our results.

Extremity with respect to momentum and operating cash flow

The higher performance of the combination portfolio might simply result from the fact that the stocks in the combination portfolio (*Combi55*) exhibit more extreme momentum or operating cash flows than the stocks in the pure momentum or in the pure cash flow portfolio. Given our results in Table 2, this could lead to the higher performance of the combination strategy. To rule out this possibility, we compute the mean momentum and mean operating cash flow of the various portfolios during portfolio formation. The results are reported in Table 9.

Table 9

Momentum and Operating Cash Flow of the Portfolios

Panel A: Momentum

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	-33.99	-12.15	1.66	17.28	57.26	10.81
	Cfo4	-33.24	-11.81	2.12	16.75	52.95	7.97
	Cfo3	-34.40	-11.69	1.92	16.42	53.56	5.65
	Cfo2	-37.60	-12.61	1.75	17.51	60.17	3.33
low cfo	*Cfo1*	-40.35	-14.30	1.45	19.19	73.25	1.36
pure momentum		-36.83	-12.49	1.81	17.27	59.43	

Panel B: Operating Cash Flows

		low mom				high mom	pure cfo
		Mom1	*Mom2*	*Mom3*	*Mom4*	*Mom5*	
high cfo	*Cfo5*	7.73	7.33	7.15	7.18	7.49	7.36
	Cfo4	3.20	3.17	3.14	3.17	3.20	3.17
	Cfo3	1.37	1.38	1.41	1.41	1.39	1.39
	Cfo2	-0.73	-0.54	-0.45	-0.49	-0.64	-0.57
low cfo	*Cfo1*	-8.16	-7.38	-7.04	-7.03	-7.81	-7.62
pure momentum		-1.00	0.75	1.34	1.56	1.07	

This table reports mean values of momentum and operating cash flow in portfolios based upon quarterly rankings of momentum and operating cash flow. Rows *Cfo1* to *Cfo5* reflect quintile portfolios sorted according to operating cash flow. Columns *Mom1* to *Mom5* reflect quintiles sorted according to momentum. Panel A lists the mean momentum and Panel B lists the mean operating cash flow per average asset. All values are listed in %. The investigation spans the period from March 1989 until December 2007.

Table 9 shows that neither the momentum nor the operating cash flow is extremely high in the combination portfolio (*Combi55*). The momentum of the combination portfolio is even slightly lower than the momentum of the pure momentum portfolio, and the operating cash flow of the combination portfolio is about equal to that of the pure cash flow portfolio. To conclude, the superiority of the combination strategy does not result from choosing stocks with extreme momentum or cash flow, but from choosing stocks with high momentum and cash flow at the same time.

Earnings surprise and accruals effect

Momentum and cash flow might just be proxies for other factors that we have not taken into account. As known from Ball and Brown (1968), Bernard and Thomas (1989), and Sloan (1996), earnings surprises and accruals predict future returns. To control for the impact of these factors, we extend regression (1) and include accruals and standardized unexpected earnings (SUE) as additional control variables. Accruals are the difference between income from continuing operations and the operating cash flow per average assets. SUE is the difference between today's and last year's income from continuing operations, divided by the firm's market capitalization at fiscal quarter end, as in Bernard, Thomas, and Wahlen (1997). In Table 10, we report results for regressions with one-month returns and cumulative three-months returns as dependent variables.

Table 10

Impact of Earnings Surprises and Accruals on Future Returns

	constant	mom		cfo		ln(size)		ln(bm)		accruals		SUE	
$ret_{i,t+1}$	-0.005	0.012	***	0.014	***								
$ret_{i,t+3}$	0.011	0.027	**	0.026	***								
$ret_{i,t+1}$	-0.006	0.012	***	0.012	***	0.001		0.002	***				
$ret_{i,t+3}$	0.037	0.034	***	0.033	***	-0.006	***	0.006	*				
$ret_{i,t+1}$	-0.011	0.009	***	0.017	***	0.000		0.002	**	0.008	***	0.005	***
$ret_{i,t+3}$	0.036	0.024	***	0.025	*	-0.006	***	0.006	*	-0.005		0.029	***

This table presents the results of Fama-MacBeth-regressions based on an extended version of Model (1). The independent variable is the future return of the following month ($ret_{i,t+1}$) or the cumulative future return over the next three months ($ret_{i,t+3}$). We run monthly regressions based on $ret_{i,t+1}$ and quarterly regressions based on $ret_{i,t+3}$. The explanatory variables are momentum and operating cash flow, which are measured in deciles scaled from 0 to 1. The natural logarithm of the market capitalization and the natural logarithm of the ratio of book-to-market value are added as control variables. In addition, we include accruals and standardized unexpected earnings (SUE), which are measured in deciles scaled from 0 to 1, as control variables. The investigation spans the period from March 1989 until December 2007. ***(**, *) denotes significance at the 1%- (5%-, 10%-) level.

The coefficients of both operating cash flow and momentum remain significantly positive even after controlling for all the other factors. In the monthly regression, the estimated coefficient of the momentum implies a return difference of 0.9% between the first and the tenth momentum decile when we control for all the other variables. The coefficient of the operating cash flow implies a difference of 1.7% between the two extreme operating cash flow deciles. The differences between extreme deciles based on cumulative three months returns are 2.4% for momentum and 2.5% for operating cash flow, respectively. Earnings surprise has a significant positive impact on future returns, which corresponds to earlier findings in the literature (e.g., Bernard and Thomas (1989)). Accruals have a significant impact only on future one-month returns, but the positive sign contradicts the findings of Sloan (1996). However, when we re-run the regression and leave out the operating cash flow as explanatory variable, we get the same result as in Sloan (1996). This suggests that in the short term, accruals are just an inverse proxy for operating cash flows, which drive future returns. To conclude, the momentum and operating cash flow effects are not the earnings surprise or the accrual anomaly in disguise. They still predict future returns after controlling for the other known factors.

7. Conclusion

This paper analyzes an enhanced momentum strategy. We show that operating cash flows help the investor to identify ongoing price trends, which are the basis for a successful momentum strategy. The combination strategy making use of momentum and cash flow information outperforms the pure momentum strategy. This holds true not only on average but also in 18 out of 19 single years. The outperformance can be traced back to a higher probability of picking outperforming stocks. These are stocks with high future profitability: the stocks picked earn the highest future operating cash flows and hardly ever delist due to poor performance during the investment period. The combination strategy is easily implemented: the information used is publicly available, the stocks chosen are liquid, and even high transaction costs do not erode the outperformance. Obviously, this makes our strategy highly interesting for investors, but it also raises the question why such high abnormal returns persist over time. This question is left for further research.

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