Anomalies Enhanced: A Portfolio Rebalancing Approach

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Abstract

Many anomalies are based on firm characteristics and are rebalanced yearly, ignoring any information during the year. In this paper, we provide dynamic trading strategies to rebalance the anomaly portfolios monthly. For eight major anomalies, we find that these dynamic trading strategies substantially enhance their economic importance, with improvements in the Fama and French (2015) five-factor risk-adjusted abnormal return ranging from 0.40% to 0.75% per month. The results are robust to a number of controls. Our findings indicate that many well known anomalies are more profitable than previously thought, yielding new challenges for their theoretical explanations.

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1. Introduction

A fundamental problem in finance is to explain why different assets have different returns. Anomalies are those return patterns that cannot be explained by known theories or risk factors. The study of anomalies is valuable not only for understanding market efficiency and limitations of existing theories, but also for developing new theories and new investment strategies.

One common feature of many anomalies is that they are formed based on low frequency firm information. For example, annual firm characteristics are used to construct eight well known anomalies: the book-to-market ratio anomaly of Fama and French (1996, 2008), the operating profit anomaly of Fama and French (2015), the gross profitability anomaly of Novy-Marx (2013), the asset growth anomaly of Cooper, Gulen, and Schill (2008), the investment growth anomaly of Xing (2008), the net stock issue anomaly of Ritter (1991), the accrual anomaly examined in Sloan (1996), and the net operating assets anomaly of Hirshleifer, Hou, Teoh, and Zhang (2004). These anomalies are also the subjects of recent studies by Fama and French (2008), Stambaugh, Yu, and Yuan (2012, 2014, 2015), Stambaugh and Yuan (2017), and Hou, Xue, and Zhang (2015).[1] However, they have only about half of the average returns compared with the famous momentum anomaly of Jegadeesh and Titman (1993), which is the most studied and most persistent among all anomalies (Schwert, 2003). Can their abnormal returns be improved so that they can be as important as the momentum anomaly?

In this paper, we provide three trading strategies to trade the eight anomalies monthly, so as to make a fair comparison with the momentum as the latter is rebalanced monthly. The first strategy is to apply a volatility-managed portfolio approach (see, e.g., Fleming, Kirby, and Ostdiek, 2001, 2003; Barroso and Santa-Clara, 2015; Daniel and Moskowitz, 2016). With a target of 12% annual volatility for the eight volatility-managed anomalies, we find that the performance is generally much greater than that of the original anomalies. For example, the average returns on six out of the eight anomalies, which are also part of the 11 promising anomalies used by Stambaugh and Yuan (2017) to construct their mispricing factors, have

[1]Other studies using the same set of anomalies include Akbas, Armstrong, Sorescu, and Subrahmanyam (2015), Avramov, Cheng, and Hameed (2016), Chu, Hirshleifer, and Ma (2017), Wang, Yan, and Yu (2017), Engelberg, Reed, and Ringgenberg (2018), Liu, Stambaugh, and Yuan (2018), and Lu, Stambaugh, and Yuan (2018).

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almost been doubled. Averaging across the eight anomalies, the volatility-managed approach yields an average monthly return of 1.11%, which is a significant improvement over the average return of 0.65% averaged across the eight original anomalies.

Our second strategy is based on the popular CAPM alpha.[2] Consider a stock in the long leg of an anomaly. If its average alpha over the previous 2 months is lower than over the previous 12 months, there is clearly a deterioration of its expected return. Hence, we remove it from the long leg, and do the opposite for the short leg. As is the volatility timing strategy, the alpha-managed approach is also consistent with the mean-variance portfolio theory. As expected return worsens, the long position should be reduced and vice versa. The alpha-managed approach performs as well as if not slightly better than the volatility-managed approach, and earns an average of 1.14% per month across the eight anomalies.

Our third strategy is based on the technical analysis that is widely used in practice. We compute and compare a stock's short- and long-term performance by its moving average (MA) prices over the past 50 and 200 days, respectively.[3] If the 50-day MA price is greater than the 200-day MA price, i,e., the short-term trend/expected return is above the long-term trend, we regard the stock as performing well and keep it in the long leg of an anomaly, and we sell it otherwise. We do the opposite for the short leg. Our strategy is an application of the popular technical trading rule, the moving average convergence/divergence (MACD) proposed by Gerald Appel in the late 1970s (see, e.g., Elder, 1993), to anomalies. Brock, Lakonishok, and LeBaron (1992), Lo, Mamaysky, and Wang (2000) and Neely, Rapach, Tu, and Zhou (2014), among others, provide empirical evidence on the value of using similar MA rules, while Barberis, Greenwood, Jin, and Shleifer (2015) and Han, Zhou, and Zhu (2016) provide economic rationales (the presence of behavioral investors who extrapolate prices or technical traders who follow price trends) on why they contain useful information in equilibrium models. Avramov, Kaplanski, and Subrahmanyam (2018) interpret the effectiveness of using the MAs as investors' anchoring on recent performance.

Empirically, we find that the trend-managed dynamic strategy performs the best, earning on average 1.24% per month across the eight anomalies, which is about twice of the average across the original anomalies (0.65%). The improvements over the original anomalies range

[2]Alternatively, we can use the Fama-French three-factor model or other factor models, but the results are similar.

[3]These lag lengths are common in practice, see, e.g., Brock, Lakonishok, and LeBaron (1992). Our results are robust to alternative short- and long-term lags, such as 60 and 252 or 30 and 100.

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from 0.38% for the net stock issue anomaly to 0.74% for the investment growth anomaly. Economically, these improvements represent the highest management fees that investors would be willing to pay to switch from the original anomalies to the trend-managed (enhanced) anomalies. Alternatively, they represent the profits that can be earned by a strategy that longs the trend-enhanced anomalies and shorts the original anomalies. In terms of relative improvement, the percentage gains range from 41.3% to 182.5%. Similar improvements are also observed in the Fama and French (2015) five-factor risk-adjusted abnormal returns (FF5 α) and Carhart (1997) four-factor risk-adjusted abnormal returns (Carhart α). Since the MA signals are widely followed by practitioners, our analysis below will focus on the trend-managed anomalies only.[4]

There are three important implications of our results. First, they show, for the first time, that anomalies based on annual firm characteristics can be as profitable as the well-known momentum anomaly that earns about 1% per month. Hence, annual characteristics-based anomalies are much more important than previously thought, and thus it is important to develop asset pricing theories also to explain them as is done for the momentum anomaly.

Second, market reactions since portfolio formation are important. They provide new information that can be incorporated into trading to make it more profitable.[5] Monitoring and utilizing information about stock volatility, price, and returns after portfolio formation has significant economic value.

Third, we show that technical analysis is surprisingly related to fundamental analysis. A further investigation of the profitability using the trend signal reveals that the stocks removed from the long (short) legs by the trend signals have lower (higher) earning growth rates than the stocks kept. To the best of our knowledge, this is the first evidence that establishes a link between technical analysis and fundamental analysis. This is the economic foundation of our dynamic trading strategy, suggesting that the trend-managed portfolio approach captures fundamental information that is revealed via the stock price in the market.

Our methodology is new except for the volatility-managed portfolio approach. Even for the latter, we apply it to the eight most prominent anomalies, while existing studies focus on

[4]As an example of attention to technical analysis, Bloomberg business news reports on August 4 of 2015, even for the largest stock, that "Apple's share volume Tuesday was one of the highest this year after the stock broke through its 200-day moving average."

[5]This paper focuses on performance enhancement with trading at the popular monthly frequency. Trading daily or intraday can potentially improve further, a subject of future research.

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the momentum and market. Our methodology is different from a double sorting strategy for which no subsequent information is used. It is also different from the momentum strategy of Jegadeesh (1990) that compares stocks cross-sectionally. In contrast, we select stocks based on their own annual characteristics and adjust the positions by their subsequent performance measured using the MA prices. We focus here on short-term time-series trends of individual stocks and our portfolio formation is fundamentally based.

Whether the extra returns from the enhanced anomalies disappear after accounting for transaction costs is an important question, because the dynamic trading strategies require more trading than the original anomalies. We address this question in the following ways. We first track the portion of stocks that are brought or sold in each month between the annual rebalance. Our results indicate that the average turnover rate is quite low, around 15% only. The relative inactive trading, coupled with the large improvement of abnormal returns, suggests that the trend-enhanced anomalies cannot be explained away by transaction costs. This is especially true with decreasing brokerage fees and bid/ask spreads over time. Indeed, when we calculate the break-even costs that either completely eliminate the improvements in average returns or make them no longer significant at 5%, the costs tend to be rather large, around 2% and 1%, respectively.

We then examine how the enhanced anomalies perform among stocks that are more or less liquid. We find that the abnormal returns of the original anomalies are often concentrated on illiquid stocks, whereas those of the trend-enhanced anomalies are equally large and significant for either liquid or illiquid stocks. Furthermore, the best performance is often achieved for more liquid stocks, not for illiquid stocks. These findings support that the trend-enhanced anomalies can survive transaction costs.[6]

What are the stock characteristics that make the enhanced anomalies perform well? We focus on information uncertainty. Intuitively, the more uncertain the information, the less reliable the annual characteristics and hence trend-management is likely more important for the enhancement. Indeed, we find that for stocks with the greatest information uncertainty, the trend-managed strategy improves the original anomalies the most. For example, for stocks with the lowest, medium and the highest information uncertainty, the original asset growth anomaly has an FF5 α of 0.18%, 0.57%, and 0.82% per month, respectively, whereas

[6]Frazzini, Israel, and Moskowitz (2012) argue that transaction costs for institutions can actually be only one tenth of what are usually assumed by academic studies.

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the trend-enhanced anomaly achieves 0.57%, 1.34%, and 1.83% per month, respectively.

Stambaugh, Yu, and Yuan (2012) find that the performance of the original anomalies is stronger when investors' sentiment is high. Interestingly, we find that the trend-managed strategy enhances the original anomalies regardless of the level of investors' sentiment. However, it does improve more during periods of high investors' sentiment.

Finally, we examine the robustness of the trend-managed strategy. We first examine the performance improvement after excluding microcap stocks. Fama and French (2008) and Hou, Xue, and Zhang (2015) find that many anomalies are concentrated in so called "microcap" stocks, defined as stocks whose market caps are below NYSE 20th percentile. We find that all the original anomalies not surprisingly now have much smaller abnormal returns. Nevertheless, we still observe large improvement in performance from the trend-managed strategy. Furthermore, the relative performance enhancement is actually much higher for most anomalies due to much weaker performance for the original anomalies. We then examine the abnormal performance using Carhart (1997) four-factor model. In the internet appendix, we apply other models including Hou, Xue, and Zhang (2015) and Stambaugh and Yuan (2017) four-factor models. Our results show that the performance improvement survives different risk adjustments. Finally, we extend our analysis to a large set of anomalies used by Green, Hand, and Zhang (2017) and find that the trend-managed strategy substantially improves the majority of the anomalies considered.

In short, our paper contributes to the study of anomalies and market efficiency in several ways. First, popular anomalies are constructed with annual characteristics data and ignore subsequent monthly information. We propose simple strategies of using monthly information to improve their performance. The enhanced anomalies have average returns surpassing even the most persistent and well-known momentum anomaly. Second, we provide various economic insights to understand why the trend-managed strategy can substantially improve the performance, and demonstrate a link between technical analysis and fundamental analysis. Third, recent asset pricing models such as Fama and French (2015) and Hou, Xue, and Zhang (2015) have come a long way in explaining existing anomalies, but our enhanced anomalies make the explanations less successful. Hence, our study raises the bar for testing existing asset pricing theories and for developing new models.

The rest of the paper is organized as follows. Section 2 describes our data and methods,

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but leave the detailed discussion of the eight anomalous firm characteristics in the appendix. Section 3 provides the main empirical results on performance enhancement. Section 4 analyzes the turnover generated by the monthly rebalance, estimate the break-even costs, and examines the relation between performance improvement and liquidity of stocks. Section 5 explores the relation between performance improvement and firm characteristics. Section 6 studies the performance improvement under different sentiment periods. Section 7 analyzes the robustness of the results. Section 8 concludes. We provide additional analysis in the internet appendix.

2. Data and Methodology

We consider eight well-documented anomalies largely following Fama and French (2008) and Stambaugh, Yu, and Yuan (2012).[7] We discuss first their constructions, and then provide our methodology for enhancing their performance.

The first anomaly is the book-to-market ratio (BM) of Fama and French (1996, 2008). It is well known that firms with higher book-to-market ratio have higher returns in the future and these returns do not disappear after adjusting risk using the CAPM of Sharpe (1964) and Lintner (1965). The second anomaly is the gross profitability (GP) of Novy-Marx (2013), who shows that firms with higher gross profits have higher future returns. The third anomaly is the operating profit (OP) of Fama and French (2015), who show that firms with higher operating profits have higher future returns. The fourth anomaly is the asset growth (AG) of Cooper, Gulen, and Schill (2008), Hou, Xue, and Zhang (2015), and Fama and French (2015), who show that firms with higher asset growth rates have lower future returns. The fifth anomaly is the investment growth (IK) of Xing (2008), who shows that firms with higher investment have lower future returns. The sixth anomaly is the net stock issue (NS) examined in Ritter (1991), Loughran and Ritter (1995), and Fama and French (2008). Larger the net stock issue, lower the future returns. The seventh anomaly is the accrual (AC) examined in Sloan (1996) and Fama and French (2008). Larger the accruals,

[7]Several recent papers including Harvey, Liu, and Zhu (2016), Hou, Xue, and Zhang (2017), and Green, Hand, and Zhang (2017) investigate a large number of anomalies, but they generally find that most of the anomalies are not or no longer significant. In the robustness section, we apply the trend-managed strategy to about 100 firm characteristics provided by Green, Hand, and Zhang (2017).

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lower the future returns. The last anomaly is the net operating assets (NOA) of Hirshleifer, Hou, Teoh, and Zhang (2004). They show that firms with larger operating assets have lower future returns.

Our sample is from July 1963 to December 2016. We exclude stocks whose prices are less than \$5 at the time of portfolio formation to avoid any microstructure issues. Then, following the definition of the variables (see Appendix A for details) and the original papers, the eight anomalies are constructed. Specifically, for each anomaly, in June of each year t, we sort all stocks into ten equal-weighted portfolios based on one of the eight characteristic variables for the fiscal year ending in calendar year $t-1$. If the variable positively predicts return, we buy the 10th decile and short the first, and reverse the buy and short otherwise. The resulted spread portfolio of the two is the standard anomaly portfolio.

To enhance the performance of a given anomaly, we consider three dynamic trading strategies that utilize monthly performance information since portfolio formation. The first is the volatility-managed portfolio approach (see, e.g., Fleming, Kirby, and Ostdiek, 2001, 2003; Barroso and Santa-Clara, 2015; Daniel and Moskowitz, 2016). We first estimate the realized monthly variance of the spread portfolio using the daily returns,

$$\hat{\sigma}_m^2 = \frac{21}{D_m} \sum_{d=1}^{D_m} r_{d,m}^2, \tag{1}$$

where $r_{d,m}$ is the daily return of the spread portfolio on day d in month m, and D_m is the total number of trading days in month m. We use 21 days to convert the daily variances to the monthly variances. We then scale the monthly returns of the spread portfolio, r_m with a target level of volatility, using the previous-month realized volatility as the estimate of the current-month volatility,

$$\hat{r}_m = \frac{\sigma_{\text{target}}}{\hat{\sigma}_{m-1}} r_m. \tag{2}$$

Following Barroso and Santa-Clara (2015), we set σ_{target} to be 12% annual for the eight volatility-managed anomalies.

For the alpha-managed and trend-managed strategies, we define and apply two performance measures on individual stocks, respectively. Consider first the moving average (MA)

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of prices. Following the literature on technical analysis, we define the MA price of stock i for month m with lag L as

$$MA_{i,m}(L) = \frac{P^m_{i,d-L+1} + P^m_{i,d-L+2} + \cdots + P^m_{i,d-1} + P^m_{i,d}}{L}, \tag{3}$$

where $P^m_{i,d}$ is the closing price for stock i on the last trading day d of month m. Consistent with the common practice in the industry, we use MA(50) as the short-term trend signal and MA(200) as the long-term trend signal. We examine the robustness of our results to alternative MA specifications in the internet appendix. The MA performance measure is the difference between the two MA prices, $MA(50) - MA(200)$. Specifically, at the end of each month m after the formation and before the next re-formation, we compare the short-term trend signal to the long-term trend signal. If

$$MA_{i,m}(50) - MA_{i,m}(200) < 0, \tag{4}$$

the stock underperforms relative to its long-term trend. This is clearly undesirable if the stock is in our long-leg portfolio, and so we sell it and keep the proceeds in the money market. Otherwise, if the difference is positive, we keep it in the long leg. But if the stock is in the short leg, we cover the short position. In a nutshell, we keep only good stocks in the long leg and bad stocks in the short leg and the goodness is measured by the difference $MA(50) - MA(200)$. As we go through each month, the original anomaly portfolio is dynamically traded, resulting our trend-enhanced anomaly.

The same procedure works if we measure the goodness by using the moving average of the popular CAPM alpha. The MA of the alpha is computed similarly to the previous MA of prices. Now, instead of using daily stock prices, we use the monthly CAPM alphas, which is estimated using rolling 60 months of returns. To be comparable to the MA of prices, we use 2-month MA of the alpha as the short-term trend signal, and 12-month MA of the alpha as the long-term trend signal. Their difference determines the good and bad stocks. Then the alpha-enhanced anomaly is similarly constructed.

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3. Enhanced Anomalies

In this section, we present evidence that the three dynamic trading strategies that utilize more performance information since portfolio formation greatly enhance the performance of the firm characteristics-based anomalies. We first compare the summary statistics such as average returns between the original anomalies and the performance-enhanced anomalies. Focusing on the trend-managed strategy, we then compare the risk-adjusted abnormal returns, and in particularly we examine whether the new Fama-French five-factor model and Hou, Xue, and Zhang (2015) four-factor model can explain the improved performance of the trend-enhanced anomalies. Finally we explore the economic foundation of the dynamic trading strategy and link the technical analysis to the fundamental analysis.

3.1. Volatility-managed anomalies

As described in Section 2, we use the daily returns in the previous month to estimate the volatility, but similar to Barroso and Santa-Clara (2015), we estimate the volatility using the average of the squared daily returns, and scale the spread portfolio using the estimated volatility. Similarly, we set the target annual constant volatility to be 12% (about 3.46% per month). The results are reported in Table 1.

Panel A reports the summary statistics of the eight original firm characteristics-based anomalies, book-to-market (BM), gross profit (GP), operating profit (OP), asset growth (AG), investment growth (IK), net stock issue (NS), accrual (AC), and net operating asset (NOA). Consistent with the previous literature (e.g. Fama and French, 2008), all anomalies have statistically significant (at 5% at least) average returns, which vary from 0.40% per month for the accrual (AC) anomaly to 0.94% per month for book-to-market (BM) anomaly.

Panel B reports the summary statistics for the volatility-managed anomalies. For all eight anomalies, the volatility-managed strategy substantially increases the average returns.[8] Panel C reports the exact improvements (return spread) of the volatility-managed anomalies over the original anomalies. Taking the return difference allows us to assess the statistical

[8]The volatility-managed strategy also slightly increases volatilities. This is likely due to the facts that the target constant volatility is often higher than those of the anomalous portfolios and that there are biases using the previous-month volatility to estimate the current-month volatility.

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significance of the performance improvement. Indeed, for all but one anomalies, the improvements are significant. For example, the improvement for the operating profit (OP) anomaly is 0.54% from 0.58% of the original anomaly to 1.12% of the volatility-managed anomaly. Economically speaking, if an investor longs the volatility-managed OP anomaly and short sells the original OP anomaly, she would earn 0.58% a month with lower volatility. Alternatively, the improvement can also be treated as the maximum management fee that an investor is willing to pay to switch from the original OP anomaly to the volatility-managed OP anomaly. The largest percentage performance enhancement is with the accrual anomaly where the average return is increased from 0.40% per month to 0.89% per month, an improvement of 0.50% per month, more than 100% increase. Averaging across the eight anomalies, the average return is increased from 0.65% per month to 1.11% per month, an increase of 0.46% per month (not shown in the table).

3.2. Alpha-managed anomalies

Table 2 reports similar results using the CAPM alpha-managed strategy. Panel A reports the summary statistics for the eight original anomalies. For each anomaly, we also report the summary statistics for the short leg (*Low*) and the long leg (*High*), in addition to the spread portfolio (*High-Low*).[9] In general, all portfolios including those short legs have significant positive average returns. In particular, those short legs often have fairly large average returns. For example, the short leg of the accrual anomaly has an average return of 0.84% per month. Clearly, there is room for improvement at least for the short legs.

Panel B reports the summary statistics for the corresponding alpha-managed anomalies. For all eight anomalies, the alpha-managed strategy substantially improves the average returns of the spread portfolios. Similarly, Panel C reports the magnitude of the improvements. For the long leg and the spread portfolio, the improvement is the return spread between the alpha-managed and the original anomalies, whereas for the short leg, the improvement is the return spread between the original and the trend-enhanced anomalies, instead. All of the improvements are highly significant and large. For example, the investment growth (IK) anomaly yields an average monthly return of 0.45%, whereas the alpha-managed IK anomaly

[9]For BM, GP, and OP anomalies, the long (short) leg is the $10^{th}(1^{st})$ decile, while for AG, IK, NS, AC, and NOA anomalies, the long (short) leg is $1^{st}(10^{th})$ decile.

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delivers 1.00% per month. This is an increase of 0.55%, significant at 1% at least. Economically, an investor would be willing to pay an active management fee of up to 0.55% a month to use the alpha-managed IK anomaly.

Examining both the short and long legs of the anomalies, it is clear that the alpha-managed strategy is successful in reducing the average returns of the short legs and at the same time increasing the performance of the long legs. Taking the IK anomaly as an example again, the average return is reduced from 0.81% to 0.50% per month for the short leg, while it is increased from 1.26% to 1.50% per month for the long leg. Panel C shows that both improvements are highly significant. Finally, we assess the overall improvement by averaging the returns across the eight anomalies. On average the eight alpha-managed anomalies earn 1.14% per month, and thus the overall improvement is 0.49% (1.14% − 0.65%) per month and is significant at 1%.

3.3. Trend-managed anomalies

Table 3 presents the performance of the trend-enhanced anomalies and contrasts it with the corresponding original anomalies. Identical to Table 2 and for ease of comparison, Panel A reports the summary statistics for the eight original firm characteristics-based anomalies, book-to-market (BM), gross profit (GP), operating profit (OP), asset growth (AG), investment growth (IK), net stock issue (NS), accrual (AC), and net operating asset (NOA). For each anomaly, we also report the summary statistics for the short leg (*Low*) and the long leg (*High*), in addition to the spread portfolio (*High-Low*). Again, all portfolios including those short legs have significant positive average returns, an undesirable feature of the original anomalies.

Panel B reports the summary statistics for the corresponding trend-enhanced anomalies. For all eight anomalies, the trend-managed strategy substantially improves the average returns of the spread portfolios, which are increased from a range between 0.40% and 0.94% to a range between 1.06% and 1.49% per month. Evidently, the trend-managed trading strategy greatly improves the performance of the firm characteristics-based anomalies.[10] The

[10]The trend-managed trading strategy tends to increase to some extent the volatility of the spread portfolio but not those of the short and long legs, due to a decrease in the correlation between the short and long legs in the trend-managed anomalies. On average, the correlation between the short and long legs of the original anomalies is about 90%, so, due to near perfect diversification, the spread portfolio has much smaller

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improvements is also substantially larger than those achieved by the first two dynamic trading strategies. For example, for the accrual (AC) anomaly, the original spread portfolio yields a monthly average return of 0.40%, the volatility-managed spread portfolio delivers an average return of 0.89% per month, the alpha-managed spread portfolio earns 0.94% a month on average, and the trend-managed spread portfolio delivers an average return of 1.13% per month. Therefore, in the sequel we will focus on the performance of the trend-managed strategy.

Panel C analyzes the performance improvement between the trend-enhanced anomalies and the corresponding original anomalies. Similar to Table 2, for the long leg and the spread portfolio, the improvement is the return spread between the trend-enhanced and the original anomalies, whereas for the short leg, it is the opposite. Not surprisingly, all anomalies enjoy statistically significant (at 1%) increases in average returns for the spread portfolios. Of course different anomalies perform differently, and the trend-managed trading strategy may have different impact on the performance. The average improvements range from 0.38% per month for the NS anomaly to 0.74% per month for IK anomaly, and the standard deviation of the return spread is usually similar to that of the original anomalies, which means that an investor can make considerable profits buying the trend-enhanced anomalies and short selling the corresponding original anomalies without taking higher risks. Alternatively, this shows the maximum management fees that investors would be willing to pay to gain access to the trend-enhanced trading strategy. For example, investors would be willing to pay as high as 0.73% a month to switch to the trend-enhanced AC anomaly from the original AC anomaly. Similarly, to obtain an overall picture, we estimate the average improvements across the eight anomalies. On average, the trend-enhanced anomalies yield an average return of 1.24% per month, which represents a monthly improvement of 0.59%. That is, investors would be willing to pay as much as 0.59% a month to gain access to the eight trend-enhanced anomalies.

Where does the performance improvement come from? Examining the long and short legs separately in Panel C shows that the performance gains largely come from the short leg, although for many anomalies, the gains also come from the long leg, which is different from the alpha-managed strategy shown in Table 2. All the improvements in the short leg are

volatility than either the short or long leg. However, the dynamic trading strategy weakens the extremely high correlation to about 77%, and subsequently reduces the benefit of diversification.

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statistically significant (at 1%), while five out of eight improvements in the long leg are significant (at 5% or 1%). The improvements in the short leg are also much larger than those in the long leg. It suggests that the trend-managed trading strategy enhances the performance of the anomalies mainly by successfully removing stocks that are about to rebound. It is also worth noting that all the short legs of the original anomalies have significant positive returns, but the short legs of the trend-enhanced anomalies are all insignificant as shown in Panel A and B, respectively. Again the AC anomaly is good example; the trend-managed trading strategy successfully reduces the average return of the short leg from a highly significant 0.84% per month to an insignificant 0.36% per month, and successfully increases the average return of the long leg from 1.24% per month to 1.49% per month.

3.4. Role of Anomalies

To understand the role of the original anomalies in performance enhancement, we analyze the performance of the trend-managed strategy when it applies to all the stocks. In this case, we form a spread portfolio buying stocks that are good, i.e., $MA(50) - MA(200) > 0$, and short selling bad stocks with $MA(50) - MA(200) < 0$. This spread portfolio yields 0.35% per month, which is lower than any of the gains generated using the eight anomalies ranging from 0.38% to 0.74% per month. Therefore, the anomalies themselves are important and contribute to the overall performance enhancement of the trend-managed trading strategy. Moreover, if one trades based on the trend-managed strategy alone, one has to trade 100% of all the stocks. With the anomaly portfolios, one now trades only 20% of stocks and meanwhile earns higher returns.

3.5. Risk-adjusted performance

Table 3 provides convincing evidence for the performance improvement of the trend-enhanced anomalies. However, the increased average return could be due to more risk-taking. It is possible that the trend-managed trading strategy increases the risks of the anomalies. Therefore, in this subsection we examine the risk-adjusted performance.

Table 4 reports the alphas of the anomalies with respect to the Fama and French (1996) three-factor model. Consistent with Stambaugh, Yu, and Yuan (2012), we find that the

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alphas of the High-Low spread portfolios are large and significant for all anomalies (Panel A). The largest alpha is 0.93% with a t-value of 9.22 for the net stock issue (NS) anomaly, and the smallest alpha is 0.43% with a t-value of 6.21 for the investment (IK) anomaly. In contrast to the average returns reported in Table 3, the alphas are all significantly negative and large in magnitude for the short legs, and small and mostly insignificant for the long legs. Therefore, a major part of the risk-adjusted anomalous returns comes from the short leg.

In contrast, both the short and long legs of the trend-enhanced anomalies have significant alphas, but the short legs have much large negative alphas. Therefore, both the short and long legs contribute to the risk-adjusted anomalous returns and the alphas of the spread portfolios are much larger than those for the original anomalies as shown in Panel B. The trend-managed trading strategy delivers a three-factor alpha ranging from 1.14% per month (OP anomaly) to 1.61% per month (NOA anomaly). Panel C lists the improvements in alpha for all the anomalies. The improvements in the short leg are much larger than those in the long leg, indicating that the performance improvement mainly comes form the short leg, consistent with Table 3. However, unlike the results in Table 3, the long leg also contributes significantly to the risk-adjusted performance improvement for all anomalies. As a result, the increases in alpha are much larger than the increases in the average return reported in Table 3. For example, for the BM anomaly, the percentage increase in alpha is $0.74/0.58 \times 100 = 127.6\%$ versus an increase of 0.55% in average return and 58.5% in percentage increase. Even for the NS anomaly, which has the smallest improvement among the eight anomalies, the increase in alpha is 0.52% and the percentage increase is 55.9% versus an increase of 0.38% and a percentage increase of 41.3%. For all other anomalies, the trend-managed trading strategy increases the alphas by around 0.6% to 0.8% per month.

Fama and French (2015) recently propose two new factors, one related to the strength of profitability and the other related to the aggressiveness of investment,[11] and argue that the new five-factor model performs better than the three-factor model and explains many of the anomalies. Panel A of Table 5 presents the five-factor alphas for the original anomalies. Consistent with Fama and French (2015), the alphas of the original anomalies become smaller for all anomalies and some become insignificant. Not surprisingly, the most significant re-

[11] Hou, Xue, and Zhang (2015) propose a similar four-factor model, which we use for robustness in the internet appendix.

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ductions are from the short legs of the anomalies. On the other hand, even though some reductions in alpha are observed for the trend-enhanced anomalies, the alphas are still very large (Panel B) and the increases in alpha relative to the original anomalies are only reduced by 10 to 20 basis points (Panel C). As a result, the percentage increases are actually larger. For example, for the BM anomaly, the percentage increase in alpha is more than 200%; even the NS anomaly now enjoys an increase of 65.6% (0.40%/0.61%). The larger increases in alpha suggest that the trend-managed trading strategy in fact reduces the systematic risks, which is confirmed by the smaller betas (not reported), even though the trend-managed trading strategy slightly increases the volatility relative to the original anomalies (Table 3).

3.6. Trend signals and firm fundamentals

The trend-managed trading strategy uses only the market price information to select stocks. Presumably, there should be no significant differences between stocks kept in and stock dropped out of the extreme decile portfolios in firm fundamentals and other market characteristics. In this section, we explore whether the stocks removed by the trend-managed trading strategy are different from the stocks remained in the portfolios in these characteristics.

Table 6 reports the Fama-MacBeth regression results using the accrual anomaly as an example, other anomalies yield similar and sometimes more significant results.[12] We use a dummy variable to denote the stocks dropped out of the extreme decile portfolios, and therefore the intercepts represent the summary statistics of stocks kept in the portfolios, and the coefficients on the dummy variable represent the differences between stocks removed and stocks kept for the variables of interest. Panel A shows the differences in the market characteristics of the stocks, and Panel B reports the differences in firm's profitability measures. For each panel, we present results for both extreme portfolios.

In Panel A, the differences between stocks kept and stocks removed are all highly significant as measured by the highly significant coefficients on the dummy variable. Stocks removed from Decile Low have higher momentum returns, lower idiosyncratic volatility, lower analyst forecast dispersion, and are also more liquid (lower Amihud measure, proportional

[12]For example, for the BM anomaly, all but one market variable and all the characteristics are significant for Decile High and only three characteristics are insignificant for Decile Low.

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bid-ask spread, and %Zero, and higher trading volume). On the other hand, stocks removed from Decile High are exactly the opposite – they have lower momentum returns, higher idiosyncratic volatility, higher analyst forecast dispersion, and lower liquidity (higher Amihud measure, proportional bid-ask spread, and %Zero, and lower trading volume). These characteristics are consistent with that stocks removed from Decile Low have higher returns and stocks removed from Decile High have lower returns.

More interesting results are shown in Panel B, where the differences in firm profitability measures are reported. Almost all coefficients are statistically significant, indicating significant differences in profitability between stocks kept and stocks removed. For Decile Low, stocks with higher ROE, ROA, and higher growth rate in EPS and Sales are removed by the trend-managed trading strategy, whereas for Decile High, the opposite is true – stocks with lower ROE, ROA, and lower growth rate in EPS and Sales are removed. In addition, stocks removed also have lower EPS and Sales (although not significant) than stocks kept in Decile High, but have higher EPS and Sales than stocks kept in Decile Low.

The surprising results in Table 6 suggest a close link between the trend signals and firm fundamentals. To the best of our knowledge, this is the first evidence that establishes a link between technical analysis and fundamental analysis. These results provide the economic foundation for our trend-managed trading strategy, suggesting that the trend-managed portfolio approach captures fundamental information that is revealed via the stock price in the market.

4. Turnover Rate, Break-even Costs, and Liquidity

It is natural to ask whether the proposed approaches suffer from high trading costs since the portfolios now are traded monthly. While it is difficult to directly answer this question, we first compare the turnover rates of the original and the trend-enhanced anomalies to get a sense of how much more turnovers introduced by the trend-managed trading strategy. We then estimate the break-even costs necessary to eliminate the performance improvement. Finally, we examine the performance for stocks with different liquidity to check whether the performance improvement is concentrated on illiquid stocks.

Figuring out the exact transaction costs for any anomaly is often difficult because there

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is no consensus on how to estimate the transaction costs for individual stocks, and more importantly, the transaction costs depend very much on the type of investors. Institutional investors often enjoy much lower transaction costs than retail investors. In addition, the actual implementation of an anomaly is quite different from how academic papers construct it, presumably to minimize transaction costs. For example, Novy-Marx and Velikov (2016) study the after-trading-cost performance of anomalies and the effectiveness of transaction cost mitigation techniques. Therefore in this section, we will focus on the additional turnovers introduced by the trend-managed trading strategy and break-even costs that are required to eliminate the performance increase.

Table 7 reports the turnover rates and break-even costs. Panel A presents the turnover rates for the original anomalies, while Panel B for the trend-enhanced anomalies. We compute the turnover rates for the rebalance month (e.g., June of each year) and the other months separately since the original anomalies are rebalanced annually. The turnover rate is computed as the average of the buy and sell turnover rates; the buy (sell) turnover rate is the ratio of the number of stocks bought (sold) to the total number of stocks before rebalance. Turnover rates in the rebalance month vary widely across the eight anomalies. Some anomalies, such as the gross profit anomaly, have relatively low turnover rates, 33.2% for the short leg and 26.5% for the long leg. Other anomalies have very high turnover rates. For example, the investment anomaly has about 100% turnover rate for both short and long legs. It is not surprising that there are virtually no turnovers in the other months since portfolios are rebalanced annually, while the very small turnover rates reflect the delisting and newly addition of stocks.

In Panel B, the turnover rates are slightly higher in the rebalance month for the trend-enhanced anomalies. For example, for the NOA anomaly, the turnover rates are 43.8% and 75.7%, respectively, for the short and long legs after trend-managed trading strategy, but are 33.4% and 69.1%, respectively, for the short and long legs without the trend-managed trading strategy. The extra turnovers mainly reflect in the other months as each month the trend-managed trading strategy is applied. On average the extra turnover rate is 15%, which is low compared to the turnover rate in the rebalance month. The relative inactive trading from the trend-enhanced anomalies, together with the large improvement of abnormal returns, should lead one to comfortably conclude that these new abnormal returns shall survive even after taking into account appropriate transaction costs.

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Finally, Panel C reports the break-even costs that offset the performance improvement of the trend-enhanced trading strategy. Following Grundy and Martin (2001) and Barroso and Santa-Clara (2015), we compute two types of break-even costs. The first is the percentage cost per dollar of trading (BE Cost) that one pays so as to completely eliminate the performance improvement, i.e., make the increase in average returns zero, and the second is the cost that reduces the performance improvement to be insignificant at 5% (BE Cost 5%). Across the eight anomalies, BE Costs range from 1.48% to 2.79% and BE Cost 5% range from 0.67% to 1.83%, all of which suggest that the normal transaction costs would not be large enough to eliminate the performance improvement.

Another way to indirectly analyze the potential impact of transaction costs on the performance of the anomalies is to separate stocks into different groups by their liquidity measure and examine the performance of the anomalies for each liquidity group. We examine three different liquidity measures, percentage of zero returns (%Zero, Lesmond, Ogden, and Trzcinka, 1999), proportional bid-ask spread, and Amihud price impact measure, but only report the results using %Zero and leave the other results in the internet appendix. Table 8 reports the performance as measured by the Fama-French five-factor alphas of the anomalies with or without the trend-managed trading strategy for different levels of %Zero. For each anomaly, in Decile High (Low), stocks are further divided into three groups by their levels of %Zero, and then we form the long/short spread portfolio for each %Zero group.[13] By comparing the performance of the long/short spread portfolios under the three different levels of %Zero, we can find out the contribution of liquidity to the abnormal performance of the anomalies. Panel A shows the results for the original anomalies. For almost all anomalies, the performance is strongest for stocks with the highest %Zero, or the most illiquid stocks. Some anomalies such as BM and GP are only significant for the less liquid stocks. On the contrary, the trend-enhanced anomalies (Panel B) often show the strongest performance with the most liquid stocks, which suggests that the performance improvement of the trend-managed trading strategy is unlikely substantially affected by additional transaction costs, In addition, the Fama-French five-factor alphas are significant in all three levels of %Zero. For example, for the AC anomaly, the Fama-French five-factor alpha is 1.69%, 1.33%, and 1.03% per month, respectively, for the three levels of %Zero from the lowest (most liquid) to the highest (most illiquid). Panel C shows the performance improvement under the three

[13]Results are similar if we sort %Zero first or sort independently.

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levels of %Zero. Not surprisingly, the most liquid stocks often show the largest performance improvement. For example, again for AC anomaly, the performance improvement is 1.08%, 0.74%, and 0.60% per month across the three levels of %Zero.

5. Information Uncertainty

Han, Yang, and Zhou (2013) show that the profitability of a simple moving average timing strategy is critically dependent on information uncertainty of stocks. Stocks with high information uncertainty generate higher profits from the MA timing strategy. Han, Zhou, and Zhu (2016) use moving average prices to construct a trend factor and also find that the performance of the trend factor positively related to information uncertainty. In this section, we use idiosyncratic volatility as the proxy for the information uncertainty to examine its impact on the performance enhancement of the trend-managed trading strategy on the anomalies.[14]

Table 9 reports the results of using idiosyncratic volatility to proxy for information uncertainty. The higher the idiosyncratic volatility, the higher the information uncertainty. To gauge the impact of information uncertainty, we further sort stocks into three groups by their idiosyncratic volatility, similar to liquidity analysis in the previous section. Panel A provides the Fama-French five-factor alphas for the original anomalies. All anomalies except for OP show stronger performance for more volatile (more uncertain) stocks. For example, the NOA anomaly yields the Fama-French five-factor alpha of 0.49%, 0.73%, and 1.15% per month, respectively, for the lowest, medium, and highest idiosyncratic volatility stocks, all of which are statistically significant. Panel B lists the Fama-French five-factor alphas for the corresponding trend-enhanced anomalies. For almost all anomalies, performance is monotonically increasing with the level of idiosyncratic volatility (information uncertainty). For example, the trend-enhanced NOA anomaly yields the five-factor alpha of 0.76%, 1.38%, and 2.19% per month, respectively, for the lowest, medium, and highest idiosyncratic volatility (information uncertainty). Therefore, as shown in Panel C, the performance improvement relative to the original anomalies is also almost always monotonically increasing with the increase of the idiosyncratic volatility (information uncertainty). For example, the perfor-

[14]Results of using other proxies, such as firm age, are reported in the internet appendix.

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mance improvement for the NOA anomaly is 0.27%, 0.65%, and 1.04%, respectively, for the lowest, medium, and highest idiosyncratic volatility (information uncertainty).

6. Sentiment

In this section, we examine the performance improvement of the trend-enhanced anomalies under different market conditions. In particular, we explore the impact of investors' sentiment on the performance.[15]

Stambaugh, Yu, and Yuan (2012) find that the performance of the original anomalies is stronger when investors' sentiment is high. In Table 10, we examine the performance improvement of the trend-managed strategy during periods of high and low sentiment. In Panel A, all the original anomalies except for accrual (AC) anomaly perform better during periods of high sentiment, consistent with Stambaugh, Yu, and Yuan (2012). On the contrary, many of the trend-enhanced anomalies perform much better during low sentiment periods than high sentiment periods. Therefore, the performance improvement is present under both high and low sentiment.

7. Robustness

In this section, we examine the robustness of the performance improvement generated by the trend-managed trading strategy in several dimensions. We first explore whether the performance improvement is robust after excluding the microcap stocks. We then report results using the alternative multifactor asset pricing model. Finally, we use the data from Green, Hand, and Zhang (2017) to test the robustness of the trend-managed strategy.

7.1. Excluding microcap stocks

Even though we exclude stocks whose prices are less than \$5, there are still small stocks in our sample. Fama and French (2008) and Hou, Xue, and Zhang (2015) argue that many

[15]The internet appendix examines the impact of the business cycles and market volatility.

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anomalies are concentrated in so called "microcap" stocks, defined as stocks whose market caps are below NYSE 20th percentile. Although microcap stocks make up only 3% of the value of the U.S. stock market, they account for about 60% the total number of stocks. Because value-weighted portfolios can be dominated by a few large stocks, Fama and French (2008), Hou, Xue, and Zhang (2015), Green, Hand, and Zhang (2017), and others suggest to use equal-weighting but exclude microcap stocks from the analysis. In this subsection, we examine the performance of the trend-managed strategy after excluding these microcap stocks.

Table 11 reports the performance improvement with this sample. Not surprisingly, we observe much smaller abnormal returns for all anomalies including both original and trend-managed anomalies. Surprisingly, the original book-to-market anomaly yields a significantly negative abnormal return (after adjusting for Fama-French five factors). Nevertheless, the trend-managed anomalies still perform much better than the original anomalies, and the relative performance for many anomalies is actually higher than what is reported in Table 5 because of the weaker performance of the original anomalies. For example, the investment growth (IK) anomaly, the original anomaly yields an FF-5 alpha of 0.16% per month, whereas the trend-managed anomaly delivers 0.76% per month, an improvement of 0.61% per month, which is about 381.2% increase in performance. In contrast, the performance numbers are 0.33% and 1.05% per month, respectively, for the original and trend-managed anomaly, with a performance increase of 0.72%, which is about 218.2% increase. In addition, a similar observation about the relative contribution of the short and long legs can be made. Despite the exclusion of the microcap stocks, the short leg still contributes the most to the performance improvement.

7.2. Alternative asset-pricing models

In this subsection, we use alternative asset-pricing models to estimate the risk-adjusted abnormal returns for the anomalies. Table 12 presents the Carhart (1997) four-factor alpha for the original anomalies and trend-enhanced anomalies. Compared to the Fama-French three-factor alphas in Table 4, the Carhart four-factor alphas are slightly smaller for the original anomalies, but are substantially smaller for the trend-enhanced anomalies, reduced by 50-60 bps. This is expected because the purpose of the trend-managed trading strategy is to drop

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stocks whose price trends start to reverse. Nevertheless, the performance improvement after adjusting for momentum is still large and significant. For example, the Carhart alpha for the accrual (AC) anomaly increases from 0.38% to 0.81% per month after the trend-managed trading strategy, an increase of 115.8%. Similarly, the performance improvement is mostly contributed by the short leg.

7.3. Alternative anomalies

In this subsection, we use an alternative data set from Green, Hand, and Zhang (2017).[16] There are 73 annual and quarterly predictive firm characteristics excluding dummy variables in their data set. The data is from January, 1980 to December 2016. We sort stocks into deciles by each of the 73 firm characteristics and form the spread portfolios for the original anomalies. We then apply the trend-managed trading strategy to the 73 anomalies and examine their performance.

Table 13 reports the results of the original anomalies, the trend-enhanced anomalies, and the performance improvement of the trend-enhanced anomalies over the original ones. Out of the total 73 anomalies, only 43 original anomalies are significant, but 55 trend-enhanced anomalies are significant. In terms of performance improvement, there are 69 out of 73 anomalies see positive improvement, of which 44 are statistically significant. Out of the 73 anomalies, the trend-managed strategy improves the performance of 59 anomalies by at least 30%, and the performance of 43 anomalies by a minimum of 50%, and the performance of 28 anomalies by more than 100%. The results provide strong and broad support for the superior performance of the trend-managed trading strategy.

8. Conclusion

Many anomalies are constructed based on low frequency information, such as annual attributes. The anomaly portfolios are then assumed to be held at the same low frequency. This completely ignores higher frequency information, such as the monthly performance of

[16]We thank the authors to make the SAS code publicly available. Please refer to their paper for the detailed discussion of the variables.

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the anomaly. In this paper, we provide dynamic trading strategies to incorporate the higher frequency information into trading decisions. We find that there is significant economic value for doing so. For eight major anomalies, we find that the enhanced anomalies can double the average returns while having similar risks. The results are robust to a number of controls and have three important implications. First, annual firm characteristics-based anomalies are at least as important as the famous momentum anomaly since they can even earn greater abnormal returns. Second, higher frequency information is important for trading anomaly portfolios. Third, the economic foundation of our dynamic trading strategy reveals a surprising link between the trend signals and firm fundamental information such as earning growth rates.

While our study here focuses on those original anomalies that are balanced annually, the same idea may be applied to monthly anomalies to rebalance them daily or even intraday. Moreover, the same approach may be also applied to study anomalies in other asset classes, such as bonds, commodities and foreign exchange rates. These are interesting topics for future research.

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Appendices

A. Construction of Anomalies

This appendix presents how we construct the eight characteristics-based anomalies that we examine in the paper. In June of each year t, we rank all stocks based on their characteristics for the fiscal year ending in calendar year $t-1$. Stocks are assigned into one of the deciles. Monthly returns of each portfolio from July of year t to June of year $t+1$ are calculated as the equal-weighted averages of returns on individual stocks in the portfolio. The portfolios are rebalanced at the June of year $t+1$. We delete stocks whose prices are less than \$5 at the time of portfolio formation. Variable definitions are as follows.

1. Book-to-Market (BM). Book equity is stockholders' book equity, plus balance sheet deferred taxes (Compustat item ITCB) and investment tax credit (TXDB) if available, minus the book value of preferred stock. We employ tiered definitions largely consistent with those used by Davis, Fama, and French (2000), Novy-Marx (2013) and Hou, Xue, and Zhang (2015) to construct stockholders' equity and book value of preferred stock. Stockholders equity is as given in Compustat (SEQ) if available, or else common equity (CEQ) plus the book value of preferred stock, or else total assets minus total liabilities (AT - LT). Book value of preferred stock is redemption value (PSTKRV) if available, or else liquidating value (PSTKL) if available, or else par value (PSTK). Book-to-market ratio at year $t-1$ is computed as book equity for the fiscal year ending in calendar year $t-1$ divided by the market capitalization at the end of December of $t-1$. Stocks with missing book values or negative book-values are deleted.

2. Gross Profit to Asset (GP). Following Novy-Marx (2013), we measure gross profits-to-assets at year $t-1$ as gross profit at year $t-1$ (Compustat item GP) divided by total assets at year $t-1$ (AT).

3. Operating Profit (OP). Following Fama and French (2015), we measure operating profit at year $t-1$ as year $t-1$ gross profit (Compustat item GP), minus selling, general, and administrative expenses (XSGA) if available, minus interest expense (XINT) if available, all divided by year $t-1$ book equity. Stocks with missing book value or

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negative book-value are deleted.

4. Asset Growth (AG). Following Cooper, Gulen, and Schill (2008), we compute asset growth at year $t-1$ as total assets (AT) for the fiscal year ending in calendar year $t-1$ divided by total assets for the fiscal year ending in calendar year $t-2$, minus one.

5. Investments (IK). Following Xing (2008), we measure investment growth for year $t-1$ as the growth rate in capital expenditure (CAPX) from the fiscal year ending in calendar year $t-2$ to the fiscal year ending in $t-1$.

6. Net Stock Issue (NS). Following Fama and French (2008), we compute net stock issue at year $t-1$, as the split-adjusted shares outstanding for fiscal year ending in calendar year $t-1$ divided by the split-adjusted shares outstanding for fiscal year ending in calendar year $t-2$, minus one. The split-adjusted shares outstanding are calculated as shares outstanding (CSHO) times the adjustment factor (AJEX).

7. Accrual (AC). Accruals at year $t-1$ are defined following Fama and French (2008), as the change in operating working capital per split-adjusted share from $t-2$ to $t-1$ divided by book equity per split-adjusted share at $t-1$. Operating working capital is computed as current assets (ACT) minus cash and short-term investments (CHE), minus, the difference of current liability (LCT) and debt in current liabilities (DLC) if available.

8. Net Operating Assets (NOA). Following Hirshleifer, Hou, Teoh, and Zhang (2004), we define net operating assets (NOA) at year $t-1$, as operating assets minus operating liabilities at year $t-1$ scaled by total assets at year $t-2$ (Compustat item AT). Operating assets are total assets (AT) minus cash and short-term investment (CHE). Operating liabilities are total assets minus debt included in current liabilities (item DLC, zero if missing), minus long-term debt (item DLTT, zero if missing), minus minority interests (item MIB, zero if missing), minus book value of preferred stocks as described in the definition of book equity (zero if missing), and minus common equity (CEQ).

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References

Akbas, F., Armstrong, W. J., Sorescu, S., Subrahmanyam, A., 2015. Smart money, dumb money, and capital market anomalies. Journal of Financial Economics 118, 355–382.

Avramov, D., Cheng, S., Hameed, A., 2016. Mutual funds and mispriced stocks. Working paper, The Hebrew University of Jerusalem, Queen's University Belfast, National University of Singapore.

Avramov, D., Kaplanski, G., Subrahmanyam, A., 2018. The predictability of equity returns from past returns: A new moving average-based perspective. Working paper, IDC, Bar-Ilan University, and UCLA.

Barberis, N., Greenwood, R., Jin, L., Shleifer, A., 2015. X-CAPM: An extrapolative capital asset pricing model. Journal of Financial Economics 115, 1–24.

Barroso, P., Santa-Clara, P., 2015. Momentum has its moments. Journal of Financial Economics 116, 111–120.

Brock, W., Lakonishok, J., LeBaron, B., 1992. Simple technical trading rules and the stochastic properties of stock returns. Journal of Finance 47, 1731–1764.

Carhart, M. M., 1997. On persistence in mutual fund performance. Journal of Finance 52, 57–82.

Chu, Y., Hirshleifer, D., Ma, L., 2017. The causal effect of limits to arbitrage on asset pricing anomalies. anomalies,Working paper, University of California at Irvine, and University of South Carolina.

Cooper, M. J., Gulen, H., Schill, M. J., 2008. Asset growth and the cross-section of stock returns. Journal of Finance 63, 1609–1651.

Daniel, K., Moskowitz, T. J., 2016. Momentum crashes. Journal of Financial Economics 122, 221–247.

Davis, J. L., Fama, E. F., French, K. R., 2000. Characteristics, covariances, and average returns: 1929 to 1997. Journal of Finance 55, 389–406.

Electronic copy available at: https://ssrn.com/abstract=2624650

Elder, A., 1993. Trading for a Living: Psychology, Trading Tactics, Money Management. Wiley, New York, NY.

Engelberg, J. E., Reed, A. V., Ringgenberg, M. C., 2018. Short-selling risk. The Journal of Finance forthcoming.

Fama, E. F., French, K. R., 1996. Multifactor explanations of asset pricing anomalies. Journal of Finance 51, 55–84.

——— , 2008. Dissecting anomalies. Journal of Finance 63, 1653–1678.

——— , 2015. A five-factor asset pricing model. Journal of Financial Economics 116, 1–22.

Fleming, J., Kirby, C., Ostdiek, B., 2001. The economic value of volatility timing. Journal of Finance 56, 329–351.

——— , 2003. The economic value of volatility timing using " realized" volatility. Journal of Financial Economics 67, 0.

Frazzini, A., Israel, R., Moskowitz, T. J., 2012. Trading costs of asset pricing anomalies. Working paper, University of Chicago.

Green, J., Hand, J. R. M., Zhang, X. F., 2017. The characteristics that provide independent information about average u.s. monthly stock returns. Review of Financial Studies 30, 4389–4436.

Grundy, B. D., Martin, J. S., 2001. Understanding the nature of the risks and the source of the rewards to momentum investing. Review of Financial Economics 14, 29–78.

Han, Y., Yang, K., Zhou, G., 2013. A new anomaly: The cross-sectional profitability of technical analysis. Journal of Financial and Quantitative Analysis 48, 1433–1461.

Han, Y., Zhou, G., Zhu, Y., 2016. A trend factor: Using information over trading horizons. Journal of Financial Economics 122, 352–375.

Harvey, C. R., Liu, Y., Zhu, H., 2016. ...and the cross-section of expected returns. Review of Financial Studies 29, 5–68.

Hirshleifer, D., Hou, K., Teoh, S. H., Zhang, Y., 2004. Do investors overvalue firms with bloated balance sheets? Journal of Accounting and Economics 38, 297–331.

Electronic copy available at: https://ssrn.com/abstract=2624650

Hou, K., Xue, C., Zhang, L., 2015. Digesting anomalies: An investment approach. Review of Financial Studies 28, 650–705.

——— , 2017. Replicating anomalies. Working paper, Ohio State University.

Jegadeesh, N., 1990. Evidence of predictable behavior of security returns. Journal of Finance 45, 881–898.

Jegadeesh, N., Titman, S., 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. Journal of Finance 48, 65–91.

Lesmond, D. A., Ogden, J. P., Trzcinka, C. A., 1999. A new estimate of transaction costs. Review of Financial Studies 12, 1113–1141.

Lintner, J., 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. Review of Economic Studies 47, 13–37.

Liu, J., Stambaugh, R. F., Yuan, Y., 2018. Absolving beta of volatility's effects. Journal of Financial Economics 128, 1–15.

Lo, A. W., Mamaysky, H., Wang, J., 2000. Foundations of technical analysis: Computational algorithms, statistical inference, and empirical implementation. Journal of Finance 55, 1705–1770.

Loughran, T., Ritter, J. R., 1995. The new issues puzzle. Journal of Finance 50, 23–51.

Lu, X., Stambaugh, R. F., Yuan, Y., 2018. Anomalies abroad: Beyond data mining. Working paper, University of Pennsylvania and Shanghai Jiao Tong University.

Neely, C. J., Rapach, D. E., Tu, J., Zhou, G., 2014. Forecasting the equity risk premium: The role of technical indicators. Management Science 60, 1772–1791.

Newey, W. K., West, K. D., 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 55, 703–708.

Novy-Marx, R., 2013. The other side of value: The gross profitability premium. Journal of Financial Economics 108, 1–28.

Novy-Marx, R., Velikov, M., 2016. A taxonomy of anomalies and their trading costs. Review of Financial Studies 29, 104–147.

Electronic copy available at: https://ssrn.com/abstract=2624650

Ritter, J. R., 1991. The long-run performance of initial public offerings. Journal of Finance 46, 3–27.

Schwert, G. W., 2003. Anomalies and market efficiency. In: G. M. Constantinides, M. Harris, and R. M. Stulz (Ed.), Handbook of the Economics of Finance. vol. 1 chap. 15, pp. 939–974 Elsevier Amsterdam, Netherlands.

Sharpe, W. F., 1964. Capital asset prices: a theory of market equilibrium under conditions of risk. Journal of Finance 19, 425–442.

Sloan, R. G., 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? Accounting Review 71, 289–315.

Stambaugh, R. F., Yu, J., Yuan, Y., 2012. The short of it: Investor sentiment and anomalies. Journal of Financial Economics 104, 288–302.

——— , 2014. The long of it: Odds that investor sentiment spuriously predicts anomaly returns. Journal of Financial Economics 114, 613–619.

——— , 2015. Arbitrage asymmetry and the idiosyncratic volatility puzzle. Journal of Finance 70, 1903–1948.

Stambaugh, R. F., Yuan, Y., 2017. Mispricing factors. Review of Financial Studies 30, 1270–1315.

Wang, H., Yan, J., Yu, J., 2017. Reference-dependent preferences and the risk-return trade-off. Journal of Financial Economics 123, 395–414.

Xing, Y., 2008. Interpreting the value effect through the q-theory: An empirical investigation. Review of Financial Studies 21, 1767–1795.

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Table 1: Volatility-Managed Anomalies

This table reports the performance enhancement by the volatility-managed strategy. Panel A, B, and C report the performance of the original anomalies, enhanced anomalies, and the difference between the two, respectively. For each panel, we report the average returns (Avg Ret) and standard deviations (Std Dev) in percentage, and Sharpe ratios for the spread portfolio (High-Low). We also report the percentage increase in the average returns (%Inc) in Panel C. Significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Volatility Managed**			**Panel C: Improvement**			
Variable	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
Book-To-Market	0.94***	4.53	0.21	0.99***	4.59	0.22	0.05	2.59	0.02	5.32
	(5.21)			(5.40)			(0.45)			
Gross Profit	0.53***	2.76	0.19	1.06***	5.10	0.21	0.53***	2.81	0.19	100.0
	(4.87)			(5.29)			(4.82)			
Operating Profit	0.58***	3.09	0.19	1.12***	4.87	0.23	0.54***	2.71	0.20	93.1
	(4.73)			(5.77)			(4.97)			
Asset Growth	0.74***	2.49	0.30	1.23***	4.00	0.31	0.48***	2.10	0.23	64.9
	(7.50)			(7.70)			(5.79)			
Investment Growth	0.45***	1.89	0.24	0.88***	3.67	0.24	0.43***	2.10	0.21	95.6
	(6.03)			(6.05)			(5.15)			
Net Stock Issue	0.92***	2.87	0.32	1.58***	4.15	0.38	0.66***	2.35	0.28	71.7
	(8.02)			(9.55)			(7.06)			
Accrual	0.40***	1.79	0.22	0.89***	3.77	0.24	0.50***	2.16	0.23	125.0
	(5.58)			(5.95)			(5.75)			
Net Operating Asset	0.69***	2.89	0.24	1.12***	4.43	0.25	0.43***	2.17	0.20	62.3
	(5.96)			(6.32)			(4.98)			

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Table 2: Alpha-Managed Anomalies

This table reports the performance enhancement using the CAPM alpha-managed trading strategy. Panel A, B, and C report the performance of the original anomalies, enhanced anomalies, and the difference between the two, respectively. For each panel, we report the average returns (Avg Ret) and standard deviations (Std Dev) in percentage, and Sharpe ratios for the short leg (Low), the long leg (High), and the spread portfolio (High-Low). We also report the percentage increase in the average returns (%Inc) in Panel C. Significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Alpha Enhanced**			**Panel C: Improvement**			
Decile	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
				Book-To-Market						
Low	0.58**	7.20	0.03	0.41	7.57	0.00	0.17***	0.99	0.17	29.3
	(2.02)			(1.35)			(4.37)			
High	1.52***	5.51	0.20	1.65***	5.41	0.23	0.13***	1.15	0.11	8.55
	(6.92)			(7.67)			(2.89)			
High-Low	0.94***	4.53	0.21	1.25***	4.92	0.25	0.30***	1.72	0.18	31.9
	(5.21)			(6.35)			(4.46)			
				Gross Profit						
Low	0.81***	5.64	0.07	0.51**	6.03	0.02	0.30***	1.28	0.24	37.0
	(3.64)			(2.14)			(5.96)			
High	1.34***	5.74	0.16	1.57***	5.45	0.22	0.23***	1.36	0.17	17.2
	(5.92)			(7.31)			(4.29)			
High-Low	0.53***	2.76	0.19	1.06***	3.46	0.31	0.53***	2.17	0.24	100.0
	(4.87)			(7.78)			(6.18)			
				Operating Profit						
Low	0.72***	6.10	0.05	0.47*	6.54	0.01	0.25***	1.24	0.20	34.7
	(2.97)			(1.82)			(5.04)			
High	1.31***	5.95	0.15	1.59***	5.80	0.21	0.29***	1.24	0.23	22.1
	(5.51)			(6.89)			(5.80)			
High-Low	0.58***	3.09	0.19	1.12***	3.99	0.28	0.53***	2.08	0.26	91.4
	(4.73)			(7.04)			(6.46)			
				Asset Growth						
Low	0.57**	7.13	0.02	0.33	7.51	-0.01	0.24***	1.11	0.22	42.1
	(2.01)			(1.10)			(5.44)			
High	1.31***	6.39	0.14	1.55***	6.30	0.18	0.24***	1.36	0.17	18.3
	(5.16)			(6.17)			(4.34)			
High-Low	0.74***	2.49	0.30	1.22***	3.57	0.34	0.48***	2.16	0.22	64.9
	(7.50)			(8.57)			(5.53)			

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	Panel A: Original			Panel B: Alpha Enhanced			Panel C: Improvement			
Decile	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
Investment Growth										
Low	0.81***	6.63	0.06	0.50*	7.02	0.01	0.31***	1.17	0.27	38.3
	(3.06)			(1.77)			(6.71)			
High	1.26***	6.02	0.14	1.50***	6.00	0.18	0.24***	1.42	0.17	19.0
	(5.26)			(6.28)			(4.21)			
High-Low	0.45***	1.89	0.24	1.00***	3.13	0.32	0.55***	2.20	0.25	122.2
	(6.03)			(8.06)			(6.27)			
Net Stock Issue										
Low	0.60**	6.48	0.03	0.40	6.89	0.00	0.20***	1.19	0.17	33.3
	(2.33)			(1.45)			(4.30)			
High	1.52***	5.09	0.22	1.70***	5.06	0.26	0.18***	1.00	0.18	11.8
	(7.50)			(8.42)			(4.47)			
High-Low	0.92***	2.87	0.32	1.30***	3.85	0.34	0.38***	1.88	0.20	41.3
	(8.02)			(8.47)			(5.10)			
Accrual										
Low	0.84***	6.96	0.06	0.56*	7.32	0.02	0.29***	1.19	0.24	34.5
	(3.04)			(1.91)			(6.07)			
High	1.24***	6.39	0.13	1.50***	6.32	0.17	0.26***	1.54	0.17	21.0
	(4.88)			(5.95)			(4.20)			
High-Low	0.40***	1.79	0.22	0.94***	3.25	0.29	0.55***	2.38	0.23	137.5
	(5.58)			(7.30)			(5.76)			
Net Operating Asset										
Low	0.61**	6.60	0.03	0.34	7.09	-0.01	0.26***	1.21	0.22	42.6
	(2.30)			(1.22)			(5.41)			
High	1.29***	5.27	0.17	1.57***	5.44	0.22	0.28***	1.50	0.18	21.7
	(6.15)			(7.23)			(4.61)			
High-Low	0.69***	2.89	0.24	1.22***	4.13	0.30	0.54***	2.23	0.24	78.3
	(5.96)			(7.43)			(6.03)			

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Table 3: Trend-Managed Anomalies

This table reports the performance enhancement using the moving average (MA) trading, which employs both short-term and long-term price trends. Panel A, B, and C report the performance of the original anomalies, trend-enhanced anomalies, and the difference between the two, respectively. For each panel, we report the average returns (Avg Ret) and standard deviations (Std Dev) in percentage, and Sharpe ratios for the short leg (Low), the long leg (High), and the spread portfolio (High-Low). We also report the percentage increase in the average returns (%Inc) in Panel C. Significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**			
Decile	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
				Book-To-Market						
Low	0.58**	7.20	0.03	0.15	7.56	-0.03	0.42***	1.51	0.28	72.4
	(2.02)			(0.51)			(7.04)			
High	1.52***	5.51	0.20	1.64***	5.19	0.24	0.12	2.24	0.06	7.89
	(6.92)			(7.94)			(1.39)			
High-Low	0.94***	4.53	0.21	1.49***	5.16	0.29	0.55***	3.01	0.18	58.5
	(5.21)			(7.25)			(4.58)			
				Gross Profit						
Low	0.81***	5.64	0.07	0.42*	6.36	0.00	0.39***	2.04	0.19	48.1
	(3.64)			(1.67)			(4.86)			
High	1.34***	5.74	0.16	1.48***	5.42	0.20	0.14**	1.87	0.08	10.4
	(5.92)			(6.94)			(1.93)			
High-Low	0.53***	2.76	0.19	1.06***	4.27	0.25	0.53***	3.25	0.16	100.0
	(4.87)			(6.32)			(4.16)			
				Operating Profit						
Low	0.72***	6.10	0.05	0.39	6.66	-0.00	0.33***	1.84	0.18	45.8
	(2.97)			(1.48)			(4.52)			
High	1.31***	5.95	0.15	1.49***	5.65	0.19	0.18**	2.04	0.09	13.7
	(5.51)			(6.61)			(2.22)			
High-Low	0.58***	3.09	0.19	1.09***	4.54	0.24	0.51***	3.19	0.16	87.9
	(4.73)			(6.05)			(4.02)			
				Asset Growth						
Low	0.57**	7.13	0.02	0.03	7.57	-0.05	0.54***	1.46	0.37	94.7
	(2.01)			(0.09)			(9.30)			
High	1.31***	6.39	0.14	1.51***	6.00	0.18	0.19**	2.44	0.08	14.5
	(5.16)			(6.30)			(1.98)			
High-Low	0.74***	2.49	0.30	1.48***	4.43	0.33	0.73***	3.33	0.22	98.6
	(7.50)			(8.37)			(5.53)			

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	Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement			
Decile	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
Investment Growth										
Low	0.81***	6.63	0.06	0.30	7.08	-0.01	0.51***	1.55	0.33	63.0
	(3.06)			(1.06)			(8.22)			
High	1.26***	6.02	0.14	1.50***	5.80	0.19	0.24***	2.34	0.10	19.0
	(5.26)			(6.49)			(2.54)			
High-Low	0.45***	1.89	0.24	1.20***	4.04	0.30	0.74***	3.27	0.23	164.4
	(6.03)			(7.44)			(5.70)			
Net Stock Issue										
Low	0.60**	6.48	0.03	0.25	7.00	-0.02	0.35***	1.58	0.22	58.3
	(2.33)			(0.89)			(5.59)			
High	1.52***	5.09	0.22	1.55***	4.71	0.25	0.03	1.67	0.02	1.97
	(7.50)			(8.27)			(0.45)			
High-Low	0.92***	2.87	0.32	1.30***	4.44	0.29	0.38***	2.68	0.14	41.3
	(8.02)			(7.36)			(3.58)			
Accrual										
Low	0.84***	6.96	0.06	0.36	7.35	-0.00	0.48***	1.56	0.31	57.1
	(3.04)			(1.24)			(7.73)			
High	1.24***	6.39	0.13	1.49***	6.03	0.18	0.25***	2.34	0.11	20.2
	(4.88)			(6.21)			(2.69)			
High-Low	0.40***	1.79	0.22	1.13***	3.98	0.28	0.73***	3.29	0.22	182.5
	(5.58)			(7.11)			(5.58)			
Net Operating Asset										
Low	0.61**	6.60	0.03	0.12	7.13	-0.04	0.48***	1.53	0.31	78.7
	(2.30)			(0.43)			(7.90)			
High	1.29***	5.27	0.17	1.44***	5.23	0.20	0.15	2.27	0.06	11.6
	(6.15)			(6.90)			(1.62)			
High-Low	0.69***	2.89	0.24	1.31***	4.88	0.27	0.63***	3.19	0.20	91.3
	(5.96)			(6.76)			(4.95)			

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Table 4: Fama-French Three-Factor Alpha

This table reports the improvement in Fama-French three-factor alpha based on the trend-managed trading strategy. Portfolios Low, High, and High-Low are the short leg, the long leg, and the spread portfolio, respectively. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. We also report the percentage increase in the alpha (%Inc) in Panel C. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**			
Anomaly	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low	%Inc
Book-To-Market	-0.38***	0.20***	0.58***	-0.86***	0.46***	1.32***	0.48***	0.26***	0.74***	127.6
	(-4.93)	(3.03)	(6.32)	(-8.16)	(4.50)	(9.04)	(7.12)	(2.52)	(5.69)	
Gross Profit	-0.29***	0.25***	0.54***	-0.71***	0.48***	1.18***	0.41***	0.23***	0.65***	120.4
	(-3.24)	(3.26)	(4.41)	(-5.74)	(5.57)	(7.51)	(4.99)	(3.00)	(5.14)	
Operating Profit	-0.36***	0.12	0.48***	-0.73***	0.41***	1.14***	0.36***	0.30***	0.66***	137.5
	(-3.56)	(1.46)	(3.34)	(-5.45)	(4.67)	(6.54)	(5.06)	(3.93)	(5.91)	
Asset Growth	-0.62***	0.04	0.66***	-1.20***	0.36***	1.56***	0.58***	0.32***	0.90***	136.4
	(-6.34)	(0.62)	(6.03)	(-9.35)	(3.59)	(9.01)	(9.42)	(3.92)	(7.95)	
Investment Growth	-0.36***	0.07	0.43***	-0.89***	0.42***	1.31***	0.53***	0.35***	0.88***	204.7
	(-4.86)	(1.24)	(6.21)	(-8.50)	(4.39)	(9.37)	(9.07)	(3.98)	(7.68)	
Net Stock Issue	-0.58***	0.35***	0.93***	-0.95***	0.50***	1.45***	0.37***	0.15***	0.52***	55.9
	(-7.03)	(4.80)	(9.22)	(-8.11)	(6.59)	(9.70)	(5.91)	(2.84)	(5.63)	
Accrual	-0.44***	0.02	0.46***	-0.96***	0.39***	1.35***	0.52***	0.37***	0.89***	193.5
	(-4.73)	(0.30)	(5.52)	(-7.95)	(4.42)	(8.97)	(9.03)	(4.92)	(8.09)	
Net Operating Asset	-0.62***	0.19**	0.81***	-1.15***	0.46***	1.61***	0.53***	0.27***	0.80***	98.8
	(-5.79)	(2.37)	(6.08)	(-8.76)	(4.38)	(8.22)	(8.66)	(3.37)	(7.50)	

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Table 5: Fama-French Five-Factor Alpha

This table reports the improvement in Fama-French five-factor alpha based on the trend-managed trading strategy. Portfolios Low, High, and High-Low are the short leg, the long leg, and the spread portfolio, respectively. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. We also report the percentage increase in the alpha (%Inc) in Panel C. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**			
Anomaly	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low	%Inc
Book-To-Market	-0.16	0.16**	0.32***	-0.62***	0.36***	0.98***	0.46***	0.20*	0.66***	206.2
	(-1.38)	(2.27)	(3.13)	(-3.85)	(3.45)	(5.06)	(6.00)	(1.68)	(4.26)	
Gross Profit	-0.02	0.20**	0.22**	-0.34**	0.41***	0.76***	0.33***	0.21**	0.54***	245.5
	(-0.17)	(2.28)	(2.14)	(-2.09)	(4.76)	(3.82)	(3.05)	(2.03)	(2.89)	
Operating Profit	-0.00	0.03	0.03	-0.30*	0.28***	0.58***	0.30***	0.25***	0.55***	1833.3
	(-0.03)	(0.31)	(0.31)	(-1.85)	(3.34)	(3.02)	(3.29)	(2.62)	(3.47)	
Asset Growth	-0.45***	0.11	0.56***	-0.98***	0.33***	1.31***	0.52***	0.22*	0.75***	133.9
	(-3.70)	(1.36)	(5.38)	(-5.48)	(3.30)	(5.51)	(7.02)	(1.81)	(4.25)	
Investment Growth	-0.20**	0.13*	0.33***	-0.67***	0.38***	1.05***	0.47***	0.25**	0.72***	218.2
	(-2.15)	(1.76)	(4.73)	(-4.36)	(4.01)	(5.22)	(6.06)	(2.12)	(4.16)	
Net Stock Issue	-0.38***	0.23***	0.61***	-0.68***	0.33***	1.01***	0.30***	0.10	0.40***	65.6
	(-3.36)	(3.44)	(6.40)	(-3.93)	(4.85)	(5.23)	(3.84)	(1.47)	(3.15)	
Accrual	-0.39***	0.08	0.47***	-0.85***	0.36***	1.21***	0.45***	0.28**	0.73***	155.3
	(-3.45)	(0.84)	(6.03)	(-5.13)	(3.86)	(5.90)	(6.49)	(2.40)	(4.33)	
Net Operating Asset	-0.54***	0.27***	0.81***	-0.99***	0.50***	1.48***	0.45***	0.22*	0.67***	82.7
	(-4.29)	(3.11)	(6.01)	(-5.91)	(4.37)	(5.93)	(6.58)	(1.86)	(4.12)	

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Table 6: Characteristics of Stocks Removed

This table reports the differences in firm characteristics between the stocks retained (*Kept*) and dropped after the trend-managed trading for the NOA anomaly. The coefficient on the dummy variable represents the difference between stocks dropped and retained. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Market Attributes						
	$r_{t-13,t-2}$	IVol	Dispersion	Amihud	Spread	$\%Zero$	Volume
	Decile Low						
Kept	-0.06***	2.93***	0.34***	15.8***	0.03***	0.27***	7.86***
	(-2.66)	(44.92)	(14.55)	(22.98)	(13.45)	(33.81)	(9.23)
Dummy	0.53***	-0.46***	-0.18***	-3.74***	-0.01***	-0.03***	1.18***
	(37.46)	(-10.77)	(-8.48)	(-7.28)	(-10.63)	(-9.11)	(3.32)
	Decile High						
Kept	0.52***	2.40***	0.23***	13.6***	0.02***	0.23***	9.99***
	(19.56)	(67.27)	(13.81)	(29.29)	(12.71)	(34.72)	(9.36)
Dummy	-0.49***	0.35***	0.14***	4.66***	0.01***	0.04***	-0.52
	(-32.98)	(8.83)	(5.12)	(7.39)	(9.16)	(10.74)	(-1.15)

	Panel B: Profitability						
	ROE	ROA	r_{EPS}	r_{Sales}	EPS	Sales	BM
	Decile Low						
Kept	-2.46	0.05	-6.88***	1.46***	0.22***	118.8***	0.02***
	(-0.76)	(0.40)	(-6.20)	(4.23)	(9.85)	(20.50)	(27.29)
Dummy	7.60**	1.36***	12.2***	3.01***	0.26***	33.8***	-0.00
	(2.12)	(11.83)	(8.98)	(8.09)	(11.98)	(3.90)	(-1.38)
	Decile High						
Kept	5.13***	1.17***	5.09***	3.28***	0.51***	188.9***	0.03***
	(3.55)	(12.91)	(4.80)	(10.37)	(17.95)	(20.35)	(29.48)
Dummy	-39.3	-1.48***	-11.0***	-1.66***	-0.27***	-9.01	0.01***
	(-1.38)	(-11.06)	(-6.92)	(-3.25)	(-11.32)	(-0.98)	(3.54)

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Table 7: Turnover Rate and Break-even Costs

This table reports the trading turnover rates in percentage of the original anomalies (Panel A) and the trend-enhanced anomalies (Panel B). Panel C reports the breakeven costs in percentage that reduce the return improvement to zero (BE Costs) or to insignificant at 5% (BE Costs 5%). The sample period is from July 1963 to December 2016.

Anomaly	Decile	**Panel A: Original**		**Panel B: Trend Enhanced**		**Panel C: Improvement**	
		Rebalance Month	Other Months	Rebalance Month	Other Months	BE Costs	BE Costs 5%
Book-To-Market	Low	47.0	0.32	56.6	13.6	2.17	1.24
	High	45.8	0.40	54.2	14.5		
Gross Profit	Low	33.2	0.39	51.2	15.6	1.86	0.98
	High	26.5	0.36	37.4	16.4		
Operating Profit	Low	39.3	0.37	53.0	14.9	1.82	0.93
	High	32.9	0.39	42.7	16.4		
Asset Growth	Low	82.5	0.46	91.4	15.3	2.79	1.80
	High	80.8	0.35	82.5	13.4		
Investment Growth	Low	95.6	0.42	102.7	15.5	2.79	1.83
	High	95.6	0.37	95.2	13.9		
Net Stock Issue	Low	72.5	0.42	77.5	14.5	1.48	0.67
	High	82.1	0.32	85.0	14.2		
Accrual	Low	86.2	0.47	97.3	15.2	2.72	1.76
	High	81.2	0.41	82.2	14.2		
Net Operating Asset	Low	33.4	0.37	43.8	16.1	2.35	1.42
	High	69.1	0.36	75.7	14.0		

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Table 8: Liquidity: Percentage of Zero Returns

This table reports the improvement in Fama-French five-factor alpha with the trend-managed trading for stocks with different percentage of zero returns. Stocks are further divided into three groups (Low, 2, High) by their percentage of zero returns. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

		Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**		
Anomaly	%Zero	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low
Book-To-Market	Low	-0.00	0.10	0.10	-0.50***	0.46***	0.96***	0.49***	0.37***	0.86***
		(-0.02)	(1.02)	(0.77)	(-2.68)	(2.75)	(4.14)	(4.51)	(2.70)	(4.96)
	2	-0.33***	0.02	0.35***	-0.98***	0.26*	1.24***	0.65***	0.24*	0.89***
		(-3.14)	(0.29)	(2.91)	(-6.00)	(1.78)	(6.33)	(5.56)	(1.68)	(4.64)
	High	-0.37**	0.37***	0.74***	-0.70***	0.53***	1.23***	0.33***	0.16	0.49***
		(-2.03)	(3.19)	(4.45)	(-2.81)	(4.01)	(4.40)	(3.18)	(1.04)	(2.52)
Gross Profit	Low	0.10	0.22**	0.12	-0.30	0.59***	0.88***	0.40**	0.37***	0.77***
		(0.82)	(2.26)	(0.84)	(-1.42)	(4.04)	(3.23)	(2.14)	(2.56)	(2.74)
	2	-0.03	0.24**	0.27*	-0.53**	0.49***	1.02***	0.50***	0.25*	0.75***
		(-0.15)	(2.16)	(1.80)	(-2.32)	(3.93)	(3.87)	(3.54)	(1.82)	(3.42)
	High	-0.01	0.25**	0.26**	-0.22	0.39***	0.61***	0.21*	0.14	0.35*
		(-0.06)	(2.00)	(1.96)	(-1.10)	(3.16)	(2.63)	(1.77)	(1.12)	(1.70)
Operating Profit	Low	0.08	0.01	-0.07	-0.28	0.44**	0.72***	0.36**	0.43**	0.79***
		(0.67)	(0.10)	(-0.47)	(-1.40)	(2.06)	(2.48)	(2.21)	(2.27)	(2.95)
	2	-0.02	-0.08	-0.06	-0.45**	0.33***	0.78***	0.43***	0.41***	0.84***
		(-0.12)	(-0.69)	(-0.41)	(-1.93)	(2.81)	(3.07)	(3.64)	(3.39)	(4.46)
	High	0.01	0.14	0.12	-0.06	0.32***	0.38	0.07	0.18	0.26
		(0.10)	(1.08)	(1.05)	(-0.29)	(2.49)	(1.60)	(0.78)	(1.30)	(1.37)
Asset Growth	Low	-0.34***	0.09	0.42***	-1.13***	0.33	1.45***	0.79***	0.24	1.03***
		(-2.53)	(0.89)	(3.00)	(-5.36)	(1.60)	(4.70)	(6.28)	(1.42)	(4.34)
	2	-0.64***	0.01	0.66***	-1.19***	0.20	1.39***	0.55***	0.18	0.73***
		(-4.26)	(0.13)	(4.64)	(-5.79)	(1.47)	(4.97)	(5.63)	(1.15)	(3.41)
	High	-0.52***	0.24*	0.76***	-0.91***	0.71***	1.63***	0.39***	0.48**	0.87***
		(-2.95)	(1.90)	(5.74)	(-3.91)	(3.46)	(5.43)	(4.30)	(2.20)	(3.45)

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		Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement		
Anomaly	%Zero	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low
Investment Growth	Low	-0.09	0.23**	0.32***	-0.72***	0.52***	1.24***	0.63***	0.29**	0.92***
		(-0.86)	(2.33)	(2.84)	(-4.03)	(3.23)	(5.08)	(5.28)	(1.93)	(4.10)
	2	-0.46***	0.02	0.49***	-0.93***	0.50***	1.43***	0.47***	0.48***	0.94***
		(-3.48)	(0.23)	(4.26)	(-4.42)	(2.56)	(4.75)	(3.78)	(2.44)	(3.72)
	High	-0.17	0.13	0.29***	-0.54***	0.17	0.71***	0.37***	0.04	0.42**
		(-1.21)	(1.06)	(2.78)	(-2.82)	(1.28)	(2.95)	(4.07)	(0.26)	(2.03)
Net Stock Issue	Low	-0.39***	0.12	0.51***	-0.85***	0.29***	1.14***	0.46***	0.18**	0.63***
		(-2.92)	(1.54)	(3.72)	(-3.87)	(2.78)	(4.22)	(3.60)	(1.97)	(3.46)
	2	-0.52***	0.18*	0.70***	-0.78***	0.24**	1.02***	0.26**	0.05	0.31**
		(-3.63)	(1.79)	(5.22)	(-3.66)	(2.32)	(4.39)	(2.26)	(0.64)	(1.94)
	High	-0.30*	0.43***	0.73***	-0.55***	0.47***	1.02***	0.25***	0.05	0.29*
		(-1.86)	(4.12)	(5.45)	(-2.51)	(3.58)	(4.06)	(2.53)	(0.33)	(1.63)
Accrual	Low	-0.45***	0.17	0.61***	-1.23***	0.46***	1.69***	0.79***	0.29***	1.08***
		(-3.36)	(1.55)	(4.57)	(-6.04)	(3.40)	(6.29)	(6.60)	(2.45)	(5.38)
	2	-0.66***	-0.06	0.60***	-1.05***	0.28**	1.33***	0.39***	0.34**	0.74***
		(-4.86)	(-0.43)	(5.41)	(-5.56)	(2.05)	(5.70)	(4.15)	(2.14)	(3.36)
	High	-0.31*	0.13	0.44***	-0.62***	0.41***	1.03***	0.31***	0.28*	0.60***
		(-1.92)	(0.90)	(4.04)	(-2.97)	(2.92)	(4.17)	(3.72)	(1.76)	(2.90)
Net Operating Asset	Low	-0.62***	0.27***	0.89***	-1.10***	0.53***	1.63***	0.48***	0.25	0.74***
		(-4.04)	(2.48)	(4.38)	(-5.50)	(2.75)	(4.65)	(4.24)	(1.53)	(3.19)
	2	-0.71***	0.19	0.90***	-1.05***	0.61***	1.65***	0.34***	0.42*	0.75***
		(-4.12)	(1.41)	(5.33)	(-4.57)	(2.98)	(4.48)	(3.42)	(1.84)	(2.71)
	High	-0.53***	0.31***	0.84***	-0.98***	0.44***	1.41***	0.45***	0.12	0.57***
		(-3.29)	(2.47)	(5.34)	(-4.76)	(3.34)	(5.44)	(5.02)	(1.15)	(3.74)

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Table 9: Information Uncertainty: Idiosyncratic Volatility

This table reports the improvement in Fama-French five-factor alpha with the trend-managed trading for stocks with different idiosyncratic volatility. Stocks are further divided into three groups (Low, 2, High) by their idiosyncratic volatility. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

		Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**		
Anomaly	Idio. Vol.	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low
Book-To-Market	Low	0.03	0.21***	0.18*	-0.26**	0.24**	0.50***	0.29***	0.03	0.32**
		(0.39)	(2.76)	(1.73)	(-2.00)	(2.12)	(2.86)	(3.02)	(0.38)	(2.32)
	2	0.03	0.35***	0.32***	-0.23*	0.53***	0.77***	0.27***	0.18	0.44***
		(0.37)	(4.03)	(3.08)	(-1.80)	(3.97)	(4.29)	(3.06)	(1.44)	(2.70)
	High	-0.72***	-0.12	0.60***	-1.33***	0.30	1.63***	0.61***	0.42	1.03***
		(-4.13)	(-1.03)	(3.95)	(-5.98)	(1.24)	(4.81)	(6.34)	(1.59)	(3.51)
Gross Profit	Low	0.02	0.23***	0.21*	-0.04	0.29***	0.33***	0.07	0.06	0.13
		(0.26)	(3.33)	(1.84)	(-0.43)	(3.47)	(2.55)	(1.01)	(0.96)	(1.30)
	2	0.06	0.37***	0.31***	-0.19	0.53***	0.72***	0.26**	0.15	0.41**
		(0.67)	(3.67)	(2.63)	(-1.23)	(4.28)	(3.53)	(2.41)	(1.40)	(2.28)
	High	-0.55***	-0.09	0.46***	-1.09***	0.72***	1.81***	0.53***	0.81***	1.34***
		(-3.10)	(-0.54)	(2.57)	(-4.35)	(3.43)	(5.64)	(3.35)	(3.50)	(4.36)
Operating Profit	Low	0.02	0.13*	0.11	-0.10	0.23**	0.33**	0.12	0.10	0.22**
		(0.27)	(1.69)	(1.29)	(-0.99)	(2.39)	(2.37)	(1.60)	(1.42)	(2.02)
	2	0.09	0.28***	0.19*	-0.10	0.48***	0.58***	0.19**	0.20*	0.38**
		(0.97)	(2.79)	(1.78)	(-0.73)	(3.83)	(3.23)	(2.10)	(1.83)	(2.42)
	High	-0.42**	-0.37**	0.06	-0.99***	0.53**	1.52***	0.57***	0.89***	1.46***
		(-2.34)	(-2.23)	(0.32)	(-4.09)	(2.08)	(4.75)	(4.07)	(3.66)	(4.86)
Asset Growth	Low	-0.11	0.07	0.18**	-0.40***	0.16*	0.57***	0.29***	0.09	0.38***
		(-1.16)	(0.97)	(2.14)	(-2.93)	(1.77)	(3.80)	(3.18)	(1.49)	(3.22)
	2	-0.24**	0.33***	0.57***	-0.64***	0.70***	1.34***	0.40***	0.37***	0.77***
		(-2.22)	(3.97)	(4.75)	(-4.16)	(5.59)	(6.28)	(5.04)	(3.47)	(5.14)
	High	-0.96***	-0.14	0.82***	-1.63***	0.19	1.83***	0.68***	0.33	1.01***
		(-4.36)	(-0.90)	(4.77)	(-5.86)	(0.95)	(4.77)	(7.04)	(1.45)	(3.67)

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		Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement		
Anomaly	Idio. Vol.	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low
Investment Growth	Low	-0.04	0.07	0.12	-0.25**	0.35***	0.60***	0.21***	0.28**	0.49***
		(-0.53)	(1.01)	(1.60)	(-2.05)	(2.61)	(3.67)	(2.70)	(2.29)	(3.28)
	2	-0.00	0.33***	0.33***	-0.35***	0.60***	0.94***	0.35***	0.26**	0.61***
		(-0.01)	(4.91)	(3.91)	(-2.51)	(5.36)	(5.09)	(4.30)	(2.41)	(3.85)
	High	-0.59***	-0.06	0.53***	-1.25***	0.40**	1.65***	0.65***	0.46**	1.12***
		(-3.52)	(-0.41)	(3.71)	(-5.59)	(2.01)	(5.38)	(6.57)	(2.01)	(4.09)
Net Stock Issue	Low	-0.20**	0.24***	0.44***	-0.26**	0.23***	0.50***	0.06	-0.01	0.05
		(-2.30)	(3.70)	(5.63)	(-2.18)	(2.82)	(4.02)	(0.79)	(-0.21)	(0.56)
	2	-0.26**	0.39***	0.65***	-0.50***	0.47***	0.98***	0.24***	0.09	0.33**
		(-2.25)	(4.65)	(6.57)	(-3.14)	(4.95)	(4.75)	(3.28)	(0.82)	(2.18)
	High	-0.85***	0.15	0.99***	-1.45***	0.49***	1.94***	0.60***	0.34**	0.94***
		(-4.56)	(0.79)	(5.75)	(-5.75)	(2.62)	(6.80)	(5.09)	(2.17)	(4.35)
Accrual	Low	-0.15*	0.13	0.29***	-0.35***	0.26**	0.62***	0.20**	0.13*	0.33***
		(-1.66)	(1.47)	(3.80)	(-2.49)	(2.34)	(4.18)	(2.12)	(1.75)	(2.60)
	2	-0.17	0.30***	0.47***	-0.50***	0.54***	1.03***	0.32***	0.24*	0.56***
		(-1.38)	(3.14)	(4.10)	(-2.97)	(3.54)	(4.33)	(4.01)	(1.86)	(3.30)
	High	-0.77***	-0.22	0.55***	-1.43***	0.39*	1.82***	0.66***	0.61***	1.27***
		(-4.46)	(-1.28)	(3.78)	(-5.84)	(1.88)	(5.27)	(5.98)	(2.66)	(4.37)
Net Operating Asset	Low	-0.26***	0.24***	0.49***	-0.45***	0.31***	0.76***	0.19**	0.08	0.27***
		(-2.85)	(2.49)	(4.76)	(-3.49)	(2.88)	(4.64)	(2.31)	(1.21)	(2.52)
	2	-0.31***	0.42***	0.73***	-0.64***	0.74***	1.38***	0.33***	0.32**	0.65***
		(-2.48)	(4.21)	(4.92)	(-4.12)	(4.82)	(5.28)	(4.94)	(2.22)	(3.68)
	High	-1.13***	0.02	1.15***	-1.85***	0.34	2.19***	0.72***	0.32	1.04***
		(-4.92)	(0.13)	(4.96)	(-6.65)	(1.47)	(5.36)	(6.56)	(1.36)	(3.85)

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Table 10: Investor Sentiment

This table reports the improvement in Fama-French five-factor alpha with the trend-managed trading under different levels of investor sentiment, respectively. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

		Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**		
Anomaly	Investor Sentiment	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low
Book-To-Market	Low	-0.08	0.21**	0.28**	-0.63***	0.29	0.91***	0.55***	0.08	0.63***
		(-0.82)	(2.03)	(2.44)	(-4.00)	(1.56)	(3.46)	(5.30)	(0.39)	(2.50)
	High	-0.26	0.12	0.37**	-0.68***	0.43***	1.11***	0.42***	0.31***	0.74***
		(-1.24)	(1.08)	(2.23)	(-2.52)	(4.98)	(4.13)	(3.99)	(3.23)	(4.44)
Gross Profit	Low	-0.11	0.11	0.21*	-0.23	0.33***	0.56***	0.13	0.22	0.35*
		(-1.00)	(1.07)	(1.67)	(-1.41)	(2.59)	(2.50)	(1.21)	(1.42)	(1.66)
	High	0.09	0.34**	0.25	-0.46*	0.56***	1.02***	0.55***	0.22*	0.77***
		(0.50)	(2.14)	(1.56)	(-1.67)	(4.87)	(3.54)	(3.13)	(1.69)	(2.75)
Operating Profit	Low	0.05	0.01	-0.04	-0.09	0.32***	0.41*	0.14	0.31**	0.45**
		(0.50)	(0.08)	(-0.29)	(-0.57)	(2.55)	(1.82)	(1.19)	(2.09)	(2.13)
	High	-0.05	0.05	0.10	-0.55**	0.25**	0.80***	0.50***	0.20*	0.70***
		(-0.27)	(0.39)	(0.74)	(-2.00)	(2.33)	(2.80)	(3.66)	(1.68)	(3.12)
Asset Growth	Low	-0.33***	0.21**	0.54***	-0.93***	0.50***	1.43***	0.60***	0.29*	0.89***
		(-2.87)	(2.35)	(4.50)	(-5.31)	(3.24)	(5.39)	(6.64)	(1.89)	(4.46)
	High	-0.63***	0.02	0.65***	-1.10***	0.17	1.26***	0.47***	0.15	0.62**
		(-3.40)	(0.13)	(4.52)	(-4.02)	(1.37)	(3.70)	(4.28)	(0.75)	(2.17)

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		Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement		
Anomaly	Investor Sentiment	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low
Investment Growth	Low	-0.17*	0.12	0.29***	-0.67***	0.46***	1.13***	0.50***	0.35**	0.84***
		(-1.85)	(1.61)	(3.08)	(-4.25)	(3.06)	(4.94)	(5.04)	(2.36)	(4.32)
	High	-0.27*	0.11	0.38***	-0.73***	0.25**	0.98***	0.46***	0.15	0.60**
		(-1.84)	(0.80)	(3.70)	(-3.07)	(2.34)	(3.37)	(4.17)	(0.82)	(2.28)
Net Stock Issue	Low	-0.34***	0.28***	0.62***	-0.62***	0.32***	0.94***	0.27***	0.04	0.32*
		(-3.14)	(3.39)	(5.57)	(-3.73)	(3.10)	(4.07)	(2.95)	(0.36)	(1.77)
	High	-0.49***	0.21*	0.70***	-0.83***	0.33***	1.16***	0.34***	0.12	0.46***
		(-2.91)	(1.88)	(5.58)	(-3.06)	(3.68)	(4.37)	(2.79)	(1.49)	(2.55)
Accrual	Low	-0.33***	0.20**	0.53***	-0.78***	0.47***	1.25***	0.45***	0.27*	0.72***
		(-2.48)	(2.03)	(4.61)	(-4.23)	(3.11)	(4.63)	(5.48)	(1.86)	(3.78)
	High	-0.49***	-0.05	0.44***	-0.95***	0.27***	1.22***	0.46***	0.32*	0.78***
		(-2.70)	(-0.30)	(4.11)	(-3.69)	(2.49)	(4.32)	(4.38)	(1.75)	(2.91)
Net Operating Asset	Low	-0.37***	0.11	0.48***	-0.84***	0.31**	1.15***	0.47***	0.20	0.67***
		(-2.53)	(0.98)	(2.81)	(-4.40)	(1.98)	(3.88)	(5.27)	(1.34)	(3.44)
	High	-0.77***	0.39***	1.16***	-1.22***	0.67***	1.88***	0.45***	0.27	0.72***
		(-4.44)	(2.91)	(5.61)	(-5.03)	(3.78)	(4.93)	(4.31)	(1.54)	(2.85)

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Table 11: Excluding Microcap Stocks

This table reports the improvement in Fama-French five-factor alpha based on the trend-managed trading strategy excluding Microcap stocks, which are stocks falling in the bottom 20 percentile of NYSE size breakpoints. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. We also report the percentage increase in the alpha (%Inc) in Panel C. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**			
Anomaly	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low	%Inc
Book-To-Market	0.10	-0.05	-0.16**	-0.24*	0.02	0.26	0.34***	0.07	0.41***	256.2
	(1.34)	(-1.14)	(-2.10)	(-1.89)	(0.17)	(1.57)	(4.36)	(0.76)	(3.07)	
Gross Profit	0.01	0.17**	0.16	-0.22	0.29***	0.50***	0.23*	0.11	0.34*	212.5
	(0.14)	(2.40)	(1.43)	(-1.58)	(2.75)	(2.67)	(1.70)	(1.20)	(1.69)	
Operating Profit	0.06	0.01	-0.06	-0.22*	0.16*	0.38**	0.28***	0.15	0.43***	716.7
	(1.02)	(0.09)	(-0.62)	(-1.72)	(1.64)	(2.12)	(2.48)	(1.57)	(2.46)	
Asset Growth	-0.30***	0.04	0.34***	-0.72***	0.19*	0.90***	0.42***	0.15	0.57***	167.6
	(-2.99)	(0.76)	(3.26)	(-4.55)	(1.77)	(3.87)	(4.97)	(1.50)	(3.46)	
Investment Growth	-0.08	0.07	0.16**	-0.52***	0.25***	0.76***	0.43***	0.17*	0.61***	381.2
	(-1.16)	(1.34)	(2.21)	(-3.71)	(2.52)	(3.88)	(4.45)	(1.84)	(3.63)	
Net Stock Issue	-0.31***	0.08	0.39***	-0.50***	0.08	0.58***	0.19**	0.00	0.19	48.7
	(-3.55)	(1.45)	(4.49)	(-3.23)	(1.20)	(3.23)	(2.09)	(0.04)	(1.47)	
Accrual	-0.31***	0.04	0.35***	-0.74***	0.14	0.88***	0.43***	0.10	0.52***	148.6
	(-3.69)	(0.62)	(4.46)	(-4.72)	(1.39)	(4.17)	(4.37)	(0.90)	(2.95)	
Net Operating Asset	-0.46***	0.31***	0.77***	-0.81***	0.46***	1.27***	0.35***	0.15	0.50***	64.9
	(-4.10)	(3.58)	(4.99)	(-5.08)	(3.03)	(4.55)	(4.50)	(1.27)	(2.94)	

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Table 12: Carhart Four-Factor Alpha

This table reports the improvement in Carhart four-factor alpha with the trend-managed trading. Panel A, B, and C report the alphas of the original anomalies, trend-enhanced anomalies, and the difference between the trend-enhanced and original anomalies, respectively. We also report the percentage increase in the alpha (%Inc) in Panel C. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**			
Anomaly	Low	High	High-Low	Low	High	High-Low	Low	High	High-Low	%Inc
Book-To-Market	-0.21**	0.29***	0.50***	-0.54***	0.32***	0.86***	0.33***	0.03	0.36***	72.0
	(-1.96)	(4.24)	(4.32)	(-4.23)	(2.89)	(6.15)	(5.23)	(0.23)	(2.99)	
Gross Profit	-0.15	0.38***	0.53***	-0.36***	0.37***	0.73***	0.22***	-0.01	0.20**	37.7
	(-1.48)	(4.83)	(4.62)	(-2.64)	(4.28)	(4.96)	(2.72)	(-0.17)	(2.00)	
Operating Profit	-0.18*	0.24***	0.42***	-0.35***	0.27***	0.62***	0.16**	0.03	0.20**	47.6
	(-1.65)	(2.99)	(3.12)	(-2.50)	(3.12)	(3.77)	(2.41)	(0.42)	(2.20)	
Asset Growth	-0.38***	0.16*	0.53***	-0.79***	0.14	0.93***	0.41***	-0.02	0.40***	75.5
	(-4.43)	(1.83)	(5.53)	(-7.20)	(1.60)	(7.34)	(7.16)	(-0.19)	(3.91)	
Investment Growth	-0.16**	0.16**	0.32***	-0.52***	0.24***	0.76***	0.36***	0.08	0.44***	137.5
	(-2.11)	(2.28)	(5.03)	(-4.90)	(2.64)	(6.39)	(6.21)	(0.87)	(4.01)	
Net Stock Issue	-0.35***	0.41***	0.77***	-0.54***	0.35***	0.88***	0.18***	-0.07	0.12	15.6
	(-4.27)	(5.58)	(7.11)	(-4.68)	(4.95)	(7.03)	(2.99)	(-1.05)	(1.58)	
Accrual	-0.24***	0.14*	0.38***	-0.60***	0.21***	0.81***	0.37***	0.07	0.44***	115.8
	(-2.55)	(1.62)	(4.75)	(-5.54)	(2.44)	(6.56)	(7.17)	(0.84)	(4.31)	
Net Operating Asset	-0.40***	0.26***	0.66***	-0.74***	0.25***	0.99***	0.34***	-0.01	0.33***	50.0
	(-4.32)	(3.05)	(5.34)	(-7.29)	(2.57)	(6.47)	(6.41)	(-0.10)	(3.75)	

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Table 13: Trend Enhanced Anomalies

This table reports the performance enhancement on 73 anomalies using the trend-managed trading strategy. Panel A, B, and C report the performance of the original anomalies, trend-enhanced anomalies, and the difference between the two, respectively. For each panel, we report the average returns (Avg Ret) and standard deviations (Std Dev) in percentage, and Sharpe ratios for the spread portfolio (High-Low). We also report the percentage increase in the average returns (%Inc) in Panel C. Significance at the 1%, 5%, and 10% levels is given by an ***, and **, and an *, respectively. The sample period is from July 1963 to December 2016.

	Panel A: Original			**Panel B: Trend Enhanced**			**Panel C: Improvement**			
Anomaly	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
absacc	0.00	4.70	0.00	0.25	4.63	0.05	0.24	4.38	0.06	
	(0.02)			(1.13)			(1.17)			
acc	0.70***	3.06	0.23	1.06***	4.12	0.26	0.36*	4.26	0.08	51.4
	(4.82)			(5.41)			(1.78)			
bm_ia	0.44***	3.67	0.12	0.67***	4.64	0.15	0.24	3.53	0.07	54.5
	(2.51)			(3.06)			(1.40)			
cashdebt	0.08	5.99	0.01	0.06	7.63	0.01	-0.02	3.30	-0.01	-25.0
	(0.27)			(0.15)			(-0.14)			
cashpr	0.81***	3.30	0.25	1.08***	4.70	0.23	0.27*	3.08	0.09	33.3
	(5.18)			(4.82)			(1.82)			
cfp	0.41*	5.11	0.08	0.49	7.10	0.07	0.08	3.94	0.02	19.5
	(1.67)			(1.45)			(0.45)			
cfp_ia	0.31**	3.02	0.10	0.53***	4.30	0.12	0.22	3.76	0.06	71.0
	(2.17)			(2.59)			(1.22)			
chatoia	0.31***	1.66	0.19	0.61***	3.87	0.16	0.30*	3.61	0.08	96.8
	(3.96)			(3.32)			(1.75)			
chcsho	0.94***	2.93	0.32	1.26***	4.89	0.26	0.32**	3.05	0.10	34.0
	(6.76)			(5.42)			(2.20)			
chempia	0.81***	2.34	0.34	1.44***	4.43	0.33	0.64***	3.94	0.16	79.0
	(7.24)			(6.87)			(3.41)			
chfeps	0.86***	2.73	0.31	1.22***	5.02	0.24	0.36**	3.37	0.11	41.9
	(5.75)			(4.45)			(1.97)			
chinv	0.98***	2.38	0.41	1.30***	3.81	0.34	0.32*	3.50	0.09	32.7
	(8.71)			(7.19)			(1.90)			

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	Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement			
Anomaly	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
chnanalyst	0.13	2.30	0.06	0.50**	4.60	0.11	0.36	4.32	0.08	276.9
	(1.07)			(2.00)			(1.50)			
chpmia	0.00	2.65	0.00	0.19	4.06	0.05	0.19	4.02	0.05	
	(0.04)			(0.99)			(0.97)			
currat	0.01	3.32	0.00	0.14	4.93	0.03	0.14	4.42	0.03	1400.0
	(0.04)			(0.62)			(0.66)			
depr	0.53**	4.93	0.11	0.71***	4.69	0.15	0.18	4.54	0.04	34.0
	(2.27)			(3.18)			(0.82)			
disp	0.89***	4.76	0.19	1.24***	6.15	0.20	0.35**	2.74	0.13	39.3
	(3.42)			(3.70)			(2.37)			
dy	0.02	3.70	0.01	0.31	5.13	0.06	0.29**	3.08	0.09	1450.0
	(0.13)			(1.27)			(1.97)			
egr	0.87***	3.68	0.24	1.14***	4.81	0.24	0.27	4.28	0.06	31.0
	(4.99)			(5.00)			(1.33)			
ep	0.08	6.28	0.01	0.41	5.43	0.08	0.32	4.35	0.07	400.0
	(0.28)			(1.58)			(1.57)			
fgr5yr	0.24	7.41	0.03	0.78*	8.23	0.10	0.55***	3.25	0.17	229.2
	(0.59)			(1.74)			(3.08)			
gma	0.14	4.02	0.03	0.42	5.99	0.07	0.28	4.20	0.07	200.0
	(0.73)			(1.47)			(1.41)			
grCAPX	0.80***	2.66	0.30	1.13***	4.75	0.24	0.33**	3.58	0.09	41.2
	(6.35)			(5.01)			(1.93)			
grltnoa	1.16***	3.01	0.39	1.57***	4.87	0.32	0.41**	3.81	0.11	35.3
	(8.13)			(6.79)			(2.25)			
herf	0.40**	3.84	0.10	0.59**	5.90	0.10	0.20	3.21	0.06	50.0
	(2.19)			(2.13)			(1.29)			
hire	1.15***	3.28	0.35	1.52***	4.80	0.32	0.37**	3.83	0.10	32.2
	(7.41)			(6.66)			(2.02)			
invest	1.37***	3.12	0.44	1.79***	4.89	0.37	0.41**	3.81	0.11	29.9
	(9.26)			(7.71)			(2.30)			
lev	0.82***	6.16	0.13	1.08***	6.74	0.16	0.26*	3.02	0.09	31.7
	(2.81)			(3.39)			(1.83)			

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	Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement			
Anomaly	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
lgr	0.99***	2.29	0.43	1.31***	4.60	0.29	0.32*	4.04	0.08	32.3
	(9.13)			(6.01)			(1.67)			
ms	0.06	3.42	0.02	0.38	5.39	0.07	0.32**	3.31	0.10	533.3
	(0.37)			(1.48)			(2.03)			
mve_ia	0.30	4.18	0.07	0.60***	4.89	0.12	0.30*	3.58	0.09	100.0
	(1.49)			(2.59)			(1.79)			
nanalyst	0.49**	4.52	0.11	0.90***	5.26	0.17	0.41**	3.80	0.11	83.7
	(1.99)			(3.14)			(1.98)			
operprof	0.25	4.21	0.06	0.52*	6.22	0.08	0.27	3.91	0.07	108.0
	(1.26)			(1.76)			(1.44)			
orgcap	0.68***	5.54	0.12	1.10***	5.27	0.21	0.42**	3.97	0.11	61.8
	(2.58)			(4.41)			(2.26)			
pchcapx_ia	0.30**	3.13	0.10	0.80***	5.25	0.15	0.50***	3.93	0.13	166.7
	(2.00)			(3.21)			(2.69)			
pchcurrat	0.12	2.25	0.05	0.57***	4.53	0.12	0.44**	4.22	0.10	366.7
	(1.16)			(2.63)			(2.21)			
pchdepr	0.21**	2.05	0.10	0.51***	4.31	0.12	0.30	4.55	0.07	142.9
	(2.21)			(2.51)			(1.39)			
pchgm_sa	0.34***	2.00	0.17	0.80***	5.21	0.15	0.47**	4.15	0.11	138.2
	(3.53)			(3.24)			(2.36)			
pchquick	0.10	2.24	0.04	0.50**	4.49	0.11	0.40**	4.19	0.10	400.0
	(0.95)			(2.34)			(2.01)			
pchsa_inv	0.36***	1.95	0.18	0.89***	4.54	0.20	0.53***	4.14	0.13	147.2
	(3.89)			(4.12)			(2.68)			
pchsa_rt	0.19**	1.72	0.11	0.67***	4.21	0.16	0.48**	4.29	0.11	252.6
	(2.38)			(3.35)			(2.33)			
pchsa_xa	0.21**	1.99	0.10	0.73***	4.97	0.15	0.52**	4.68	0.11	247.6
	(2.20)			(3.10)			(2.36)			
pchsaleinv	0.41***	1.94	0.21	0.78***	4.75	0.16	0.37*	4.07	0.09	90.2
	(4.46)			(3.45)			(1.90)			
pctacc	0.61***	1.99	0.31	1.09***	3.79	0.29	0.48***	3.14	0.15	78.7
	(6.49)			(6.05)			(3.19)			

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	Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement			
Anomaly	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
pricedelay	0.11	2.06	0.06	0.46***	3.91	0.12	0.34**	3.27	0.10	309.1
	(1.17)			(2.45)			(2.20)			
ps	0.43**	3.84	0.11	0.69***	5.86	0.12	0.26	3.38	0.08	60.5
	(2.38)			(2.48)			(1.61)			
quick	0.00	3.68	0.00	0.10	5.10	0.02	0.09	3.78	0.03	
	(0.01)			(0.40)			(0.53)			
rd	0.17	1.95	0.09	0.37	2.85	0.13	0.20	1.96	0.10	117.6
	(0.48)			(0.72)			(0.57)			
rd_mve	1.20***	6.28	0.19	1.31***	6.58	0.20	0.11	3.92	0.03	9.17
	(4.02)			(4.20)			(0.61)			
rd_sale	0.01	7.55	0.00	-0.02	8.13	-0.00	-0.03	4.53	-0.01	-300.0
	(0.02)			(-0.05)			(-0.13)			
realestate	0.14	3.86	0.04	0.51*	5.82	0.09	0.38*	4.14	0.09	271.4
	(0.69)			(1.72)			(1.78)			
roic	0.20	6.09	0.03	0.15	7.69	0.02	-0.04	3.37	-0.01	-20.0
	(0.68)			(0.42)			(-0.26)			
salecash	0.28	4.86	0.06	0.42	6.27	0.07	0.14	3.65	0.04	50.0
	(1.20)			(1.40)			(0.81)			
saleinv	0.44***	2.90	0.15	0.71***	5.40	0.13	0.27*	3.49	0.08	61.4
	(3.22)			(2.79)			(1.64)			
salerec	0.15	3.60	0.04	0.35*	4.22	0.08	0.20	3.25	0.06	133.3
	(0.87)			(1.76)			(1.32)			
sfe	0.08	7.03	0.01	1.09***	6.78	0.16	1.01***	6.24	0.16	1262.5
	(0.20)			(2.94)			(2.97)			
sgr	0.96***	2.92	0.33	1.16***	4.82	0.24	0.20	4.04	0.05	20.8
	(6.93)			(5.06)			(1.03)			
sp	1.31***	5.60	0.23	1.32***	6.44	0.21	0.02	3.57	0.00	1.53
	(4.91)			(4.32)			(0.09)			
tang	0.24	4.55	0.05	0.64**	5.66	0.11	0.39**	4.17	0.09	162.5
	(1.13)			(2.38)			(1.99)			
tb	0.11	2.79	0.04	0.39	5.01	0.08	0.28*	3.23	0.09	254.5
	(0.83)			(1.62)			(1.80)			

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	Panel A: Original			Panel B: Trend Enhanced			Panel C: Improvement			
Anomaly	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	Avg Ret	Std Dev	Sharpe	%Inc
aeavol	0.21**	2.12	0.10	0.79***	3.69	0.21	0.58***	3.22	0.18	276.2
	(2.11)			(4.51)			(3.77)			
cash	0.26	5.33	0.05	0.63**	5.85	0.11	0.38**	3.76	0.10	146.2
	(1.01)			(2.28)			(2.12)			
chtx	0.60***	2.29	0.26	1.01***	4.22	0.24	0.41***	3.03	0.14	68.3
	(5.52)			(5.04)			(2.85)			
cinvest	0.16*	1.84	0.09	0.67***	4.98	0.13	0.51**	4.60	0.11	318.8
	(1.82)			(2.83)			(2.34)			
ear	0.64***	2.30	0.28	1.04***	4.72	0.22	0.40***	3.12	0.13	62.5
	(5.87)			(4.65)			(2.69)			
nincr	0.42***	2.36	0.18	0.89***	4.22	0.21	0.47***	3.15	0.15	111.9
	(3.76)			(4.45)			(3.15)			
roaq	0.52*	6.45	0.08	0.74**	7.97	0.09	0.22	2.95	0.07	42.3
	(1.69)			(1.95)			(1.56)			
roavol	0.09	7.63	0.01	0.10	8.74	0.01	0.01	2.67	0.01	11.1
	(0.24)			(0.24)			(0.11)			
roeq	0.61**	5.62	0.11	0.92***	7.41	0.12	0.31**	3.12	0.10	50.8
	(2.29)			(2.61)			(2.09)			
rsup	0.02	2.98	0.01	0.71***	3.84	0.18	0.69***	4.05	0.17	3450.0
	(0.13)			(3.88)			(3.58)			
stdacc	0.47	6.07	0.08	0.51	7.15	0.07	0.04	2.99	0.01	8.51
	(1.61)			(1.50)			(0.31)			
stdcf	0.46	6.25	0.07	0.47	7.36	0.06	0.00	3.09	0.00	0.00
	(1.57)			(1.34)			(0.02)			
sue	1.09***	2.31	0.47	1.52***	4.74	0.32	0.43***	3.23	0.13	39.4
	(9.95)			(6.73)			(2.78)			

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