Momentum, contrarian, and the January seasonality

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Abstract

This paper reexamines the apparent success of two prominent stock trading strategies: long-term contrarian and intermediate-term momentum. The paper demonstrates that long-term contrarian is entirely attributable to the classic January size effect, rather than to investor overreaction, as argued by De Bondt and Thaler (1985). Further, the paper also resolves the Novy-Marx (forthcoming) concern about whether return autocorrelation "is really momentum" by demonstrating that the superior performance of intermediate-term momentum is due to strong January seasonality in the cross-section of returns. The implications are that long-term contrarian must be considered largely illusory, and intermediate-term momentum must take account of annual seasonalities in returns.

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1. Introduction

The literature dealing with stock trading strategies focuses extensively on the momentum strategy, which involves buying recent winners and selling recent losers (Jegadeesh and Titman, 1993; Grundy and Martin, 2001; Griffin, Ji, and Martin, 2003, 2005; Wang and Wu, 2011).[1] Jegadeesh and Titman (1993) document that buying three-, six-, nine- or 12-month winners and selling losers together generates an average monthly return of roughly 1%. Fama and French (1996), among others, suggest that stocks with the best short-term (2–6 months) and intermediate-term (7–12 months) prior returns substantially outperform those with the worst short-term and intermediate-term returns. Interestingly, Jegadeesh and Titman (1993), Grundy and Martin (2001) and Asness, Moskowitz and Pedersen (2009) note that use of the momentum strategy leads consistently to monetary losses in January. Grundy and Martin (2001) show that the substantial January loss is due to the short sell of losers that tend to be extremely small firms.

This work examines the implications of the behavior of January returns for two important papers on return reversal and continuation. The paper on return reversal by De Bondt and Thaler (1985) argues that winners of the previous two to five years often become losers, and vice versa. De Long, Shleifer, Summers and Waldmann (1990), Barberis, Shleifer and Vishny (1998) and Daniel, Hirshleifer and Subrahmanyam (1998), among others, suggest that this reversal is driven by long-term correction after investor overreaction. The recent paper on return continuation by Novy-Marx (forthcoming) claims that short-term prior returns contribute little to momentum profits, and that intermediate-term prior returns are the

[1] Many papers have attempted to rationalize momentum: Chan, Jegadeesh and Lakonishok (1996) link momentum to the post-earning-announcement drift effect; Grundy and Martin (2001), Sagi and Seasholes (2007) and Li et al. (2008) point out that firm-specific attributes play an important role; Wang and Wu (2011) demonstrate that Fama-French three factors can explain momentum; Chordia and Shivakumar (2002), Griffin, Ji and Martin (2003), Antoniou, Lam and Paudyal (2007) and Kang et al. (2011) test whether macroeconomic variables can capture momentum; Pastor and Stambaugh (2003) show that a liquidity risk factor appears to account for one-half of momentum profit; Grinblatt and Moskowitz (2004) suggest that tax-loss selling contributes to a large proportion of momentum profit.

main driving force. He questions per se the association of observed momentum profits with "return continuation". The analysis in this paper shows that the behavior of January returns plays a vital role in the long-term negative return autocorrelation and intermediate-term positive return autocorrelation, which lead to the different conclusions from the two previous studies.

This paper shows that apparent long-term contrarian can be attributed entirely to the January effect. De Bondt and Thaler (1987) conduct regression tests to address whether the January effect can account for long-term contrarian. Finding that the optimal tax model of Chan (1986) cannot explain long-term negative autocorrelation of January returns, they reject the possibility. Their inferences are problematic. First, any presumption that the January effect is caused by tax-loss selling is controversial (Keim, 1983; Ng and Wang, 2004; Starks, Young and Zheng, 2006; Sun and Tong, 2010). Second, and more importantly, their tests fail to address directly whether long-term contrarian is the result of the January effect.

This paper fills the aforementioned gap by designing three tests to determine directly the impact of the January effect on long-term contrarian. In analyzing return autocorrelation, I find that long-term negative return autocorrelations become unstable and unreliable outside of January, which contrasts sharply with the huge long-term negative return autocorrelations in January. In the decomposition of contrarian trading profits, the long-term contrarian strategy of buying losers of the prior two to five years and selling winners of the same period does not result in statistically or economically significant returns outside of January. In examining the robustness of the findings across four subperiods (1926–1947, 1948–1969, 1970–1989 and 1990–2009), I find that the long-term contrarian strategy is remarkably profitable in January—but not outside of January—for all subperiods. Based on all of the three pieces of direct evidence, I contend that long-term contrarian can be attributed to the January effect, rather than caused by investor overreaction.

This paper also points out the failure of Novy-Marx's study (forthcoming) to recognize that the nature of the roles of short- and intermediate-term prior returns in momentum is different in January. I show that his claim is driven by the January seasonality. The key to my findings is the analysis of the simple trading strategy of annual seasonality, as investigated by Heston and Sadka (2008). This strategy takes a long position in winners of the month exactly 12 months ago and a short position in losers of the same month. I assert that the January seasonality strategy bets on the size effect in January—the strategy buys extremely small firms of the previous January and sells small firms of the same month. Consequently, it results in considerable profitability.

In contrast, the significant loss of the momentum strategy in January is due to going long in small firms and going short in extremely small firms (Grundy and Martin, 2001). My study also finds that the short-term momentum strategy that ranks stocks by the returns of the previous July–November bets against the size effect in January. Given the offsetting effect of the January seasonality, the intermediate-term momentum strategy that sorts stocks by the returns of the preceding January–June bets less severely against the size effect in January; the strategy buys smaller firms and sells larger firms than does its short-term counterpart. It thus creates the illusion of the superior performance of intermediate-term prior returns. In fact, intermediate-term prior returns affect mainly the loss-making January returns of momentum trading.

Given the different nature of portfolio compositions in January, this paper examines the intermediate-term momentum puzzle by separately analyzing January and non-January returns in three tests. The analysis of return autocorrelation documents that the apparently stronger intermediate-term return autocorrelations, rather than the short-term return autocorrelations, are nonexistent—after controlling for the January influences. The decomposition of trading profits demonstrates that the short- and intermediate-term

momentum strategies generate statistically and economically indistinguishable profits outside of January. These two analyses both provide a clear inference that the January seasonality leads to the apparently superior performance of intermediate-term prior returns. Moreover, the subperiod tests point to the marked persistence of the January seasonality in all four subperiods for equal weighting, and in three out of four subperiods for value weighting.

The remainder of this paper is organized as follows. Section 2 describes the data and portfolio formation. Section 3 uses various tests to demonstrate that long-term contrarian is entirely driven by the January effect. Section 4 provides evidence that the superior performance of intermediate-term momentum is due to the January seasonality. Section 5 concludes this study.

2. Data and portfolio construction

The sample includes all of the stocks listed on the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX) in the monthly files of the Center for Research in Security Prices (CRSP). Closed-end funds, real estate investment trusts, American depository receipts, and foreign stocks are excluded. The sample period is from January 1926 to December 2009.

This paper employs marginal strategy to test for the causes of the apparent success of long-term contrarian and intermediate-term momentum. Novy-Marx (forthcoming) defines marginal strategy as buying the top decile of stocks with the best performance in a single month, starting “lag” months prior to portfolio formation and selling the bottom decile of stocks with the worst performance of the same month. The analysis of sections 3 and 4 shows the importance of marginal strategy and how it can be applied in examining long-term

negative return autocorrelations and short- and intermediate-term positive return autocorrelations.

In this study, the marginal strategy ranks stocks on the basis of firm performance in a single month in the past five years. At the beginning of each month *t*, NYSE and AMEX stocks are assigned into ten deciles by single-month returns in month *t* - *x*, where *x* ranges from 1 to 60.[2] Winners are stocks with the highest returns in a given month of the past, whereas losers are stocks with the lowest returns in the same month. The marginal strategy involves buying winners and selling losers. Winner–loser portfolios are reconstructed at the beginning of each month *t* and held for one month. Both equal- and value-weighted marginal strategies are examined, to prevent the findings from being driven by small, illiquid stocks.

This study implements marginal strategy separately in January and outside of January, in order to better understand the striking behavior of January returns that has been documented so extensively. Rozeff and Kinney (1976) and Sun and Tong (2010) highlight that stock markets experience high returns in January relative to the other 11 months. Keim (1983) and Van Dijk(2011) show that the size effect is particularly pronounced in January. In this vein, Jegadeesh (1990) documents that January returns are negatively correlated with non-January returns. Furthermore, Jegadeesh and Titman (1993), Grundy and Martin (2001) and Asness, Moskowitz and Pedersen (2009) point out that momentum strategy consistently lose money in January. Conversely, De Bondt and Thaler (1985) show that contrarian profits are concentrated mainly in January. Considering the profound implications of the behavior of January returns, the analysis in this paper of non-January returns of the marginal strategy can virtually prevent the finding from being contaminated by the January influences.

Apart from examining return autocorrelations, sections 3 and 4 focus on trading profitability in order to investigate long-term contrarian and intermediate-term momentum

[2] In untabulated results, this study also included NASDAQ stocks in the sample, in addition to NYSE and AMEX stocks— as in Novy-Marx (forthcoming)—and obtained basically similar inferences.

strategies from a practical point of view. Due to the distinct behavior of January returns, this study decomposes the overall-year trading profits into two parts, relating to January investing and non-January investing. I evaluate the overall-year returns, the January returns and the non-January returns for each strategy examined in this paper—the long-term contrarian strategy, the short-term momentum strategy, the intermediate-term momentum strategy as well as the annual seasonality strategy—and review their portfolio constructions.

For the **long-term contrarian strategy**, stocks are ranked by compounded returns in months t - 60 to t - 13 to form ten deciles at the beginning of each month t. Winners (P1) are the decile of stocks with the best performance of the preceding two to five years, and losers (P10) are the decile of stocks with the worst performance of the same period. The long-term contrarian strategy goes long in prior losers (P10) and goes short in prior winners (P1). Zero-investment loser–winner portfolios (P10–P1) are reconstructed at the beginning of each month (i.e. month t), and held for that month. Therefore, there is a one-year gap between portfolio formation and portfolio holding, according to construction. The first ranking period of the *overall investing* is January 1926–December 1929, and the corresponding first investment period is January 1931. The first ranking period of the *January investing* is January 1926–December 1929, and the matching first investment period is January 1931. The first ranking period of the *non-January investing* is February 1926–January 1930, and the corresponding first investment period is February 1931.

The **short-term momentum strategy** ranks stocks on the basis of compounded returns in months t - 6 to t - 2, and accordingly assigns the stocks into ten deciles. Stocks with the highest returns in the preceding two to six months are defined as winners (P10), whereas stocks with the lowest returns during this period are defined as losers (P1). The short-term momentum strategy buys prior winners (P10) and sells prior losers (P1). Zero-investment winner–loser portfolios (P10–P1) are reconstructed at the start of each month, and held for

that month. There is a one-month gap between portfolio formation and portfolio investing in order to avoid the mechanical bid-ask bias, as documented by Lehmann (1990) and De Groot, Huij and Zhou (2012), among others.[3] The first ranking period of the *overall investing* is January 1926–May 1926, and the corresponding first investment period is July 1926. The first ranking period of the *January investing* is July 1926–November 1926, and the matching investment period is January 1927. The first ranking period of the *non-January investing* is January 1926–May 1926, and the corresponding investment period is July 1926.

The **intermediate-term momentum strategy** sorts stocks by compounded returns in months t - 12 to t - 7 into ten deciles. The best performers of the preceding seven to 12 months are defined as winners (P10), whereas the worst performers of the same period are defined as losers (P1). Winner–loser portfolios (P10–P1), which go long in the best prior performers and short sell the worst prior performers, are determined at the beginning of each month and are held for one month (that is, month t). There is a seven-month gap between portfolio formation and portfolio investing by portfolio construction. The first ranking period of the *overall investing* is January 1926–June 1926, and the corresponding first investment period is January 1927. The first ranking period of the *January investing* is January 1926–June 1926, and the matching investment period is January 1927. The first ranking period of the *non-January investing* is February 1926–July 1926, and the corresponding investment period is February 1927.

The **seasonality strategy** assigns stocks into ten deciles by the returns in month t - 12. It takes a long position in stocks with the highest 12-month lagged returns (P10) and a short position in stocks with the worst 12-month lagged returns (P1). Just as in the momentum and contrarian strategies, winner–loser portfolios (P10–P1) are reconstructed each month, and positions are held for a single month (that is, month t). By definition, there is a 12-month gap

[3] Strong winners are likely to have close prices at the ask than at the bid, and strong losers are likely to have close prices at the bid than at the ask.

between ranking and investing. The first formation period of the *overall investing* is January 1926, and the corresponding investment period is January 1927. The first formation period of the *January investing* is January 1926, and the corresponding investment period is January 1927. The first formation period of the *non-January investing* is February 1926, and the corresponding investment period is February 1927.

Although equal-weighted momentum and contrarian strategies are often implemented in the literature (see e.g., Jegadeesh and Titman, 1993; De Bondt and Thaler, 1985), both equal- and value-weighted trading strategies are examined in this paper. Fama (1998) suggests that "apparent anomalies in long-term, post-event returns typically shrink a lot and often disappear when event firms are value-weighted rather than equal-weighted," (page 296). Examining equal- and value-weighted returns not only prevents the results from being largely driven by small, illiquid firms but also enables value-weighted returns to precisely reflect the investors' total wealth effect.

3. Long-term contrarian

This section presents evidence that long-term contrarian is due entirely to the January effect. Section 3.1 reports the implications of January returns for long-term negative return autocorrelations. Section 3.2 examines a decomposition of trading profits of the long-term contrarian strategy with and without controlling for the January effect. Section 3.3 demonstrates the robustness of my findings across different subperiods.

3.1. Return autocorrelation

On the basis of single-month returns of the past two to five years, Figure 1 displays the average monthly returns of 48 marginal strategies that buy winners and sell losers. The figure reports both equal-weighted returns and value-weighted returns for winner–loser portfolios. Equal-weighted results are in black, while value-weighted results appear in grey.

INSERT FIGURE 1 HERE

The upper panel of Figure 1 shows the long-term negative autocorrelations at lag 13 until lag 59, excluding multiples of 12 lags. The marginal strategies that sort stocks by single-month returns in month $t - x$ (where x ranges from 13 to 59, apart from the multiples of 12) create reliably negative returns. The results appear to be consistent with the findings of De Bondt and Thaler (1985) that stocks with high long-term prior returns can have lower average returns than stocks with low long-term prior returns. The findings are robust to varying weighting schemes from equal weighting to value weighting, despite the fact that equal weighting exhibits relatively strong long-term reversal patterns. The overall-year returns of the marginal strategies that are implemented by ranking stocks based on the preceding two-to-five year performance substantiate continued detection of the success of long-term contrarian.[4]

The middle panel of Figure 1 suggests that long-term contrarian is overwhelmingly successful in January. The marginal strategies that sort stocks by single-month returns outside of January of the previous two to five years, but invest in January, earn sizable and negative returns. The equal-weighted marginal strategies that rank stocks by the returns of any month outside of January of the preceding two to five years produce January losses from 0.33% to 5.87%, with an average monthly loss of 2.48% each January. Similarly, the value-weighted marginal strategies generate January losses from 0.01% to 3.27%, with an average monthly loss of 1.41% each January. These results confirm not only the findings of De Bondt and

[4] Nonetheless, the upper panel in Figure 1 shows that the seasonality strategy that buys winners of 24, 36, 48 or 60 months ago, and sells losers of the same month, generates reliable and positive returns (both in January and outside of January)—but it is not the main focus of long-term contrarian.

Thaler (1985) that a large proportion of contrarian profits are realized in January, but also the negative relation documented by Jegadeesh (1990) between January returns and those of the remaining 11 months. The study in this paper makes two other interesting observations: First, the negative relations between January returns and non-January returns decrease monotonically: January's returns and those of the previous December have the strongest negative correlations, whereas January's returns and those of the previous February have the weakest negative correlations. Second, the upward-sloping nature of the profitability of the marginal trading strategies in the middle panel of Figure 1 suggests that long-term contrarian in January weakens as the gap between portfolio ranking and investing increases.

The analysis of the January returns of the marginal strategy provides evidence of the predominant role of January in long-term contrarian. This section examines the non-January performance of the marginal trading strategy, which allows for disentangling the January influence from long-term contrarian. More importantly, it can directly address the issue of whether the appearance of long-term contrarian is due entirely to the behavior of January returns. If long-term contrarian success is driven by the January effect, then the two-to-five year prior returns should not have reliably negative autocorrelations with future returns outside of January. In line with the conjectures, the bottom panel of Figure 1 indeed suggests that the non-January returns of the marginal strategies exhibit a trend distinguishably different from the overall-year returns shown in the upper panel of Figure 1.

The bottom panel of Figure 1 shows that long-term reversal disappears after controlling for the January effect. In sharp contrast with the reliably negative overall-year returns, the non-January returns of the marginal strategies become unreliable and non-persistent. The reported average monthly returns of the marginal strategies and the associated *t*-statistics confirm that this finding is particularly pronounced for equal-weighted results. All of these findings show that the apparently strong long-term negative return autocorrelations do not

exist after disentangling the January effect. Accordingly, the long-term contrarian strategy of buying losers of the past two to five years and selling winners of the same period may not be profitable outside of January. In other words, the source of the profitability of the long-term contrarian strategy can be attributed to the January effect. The next section of this paper provides evidence—from a practical point of view—relating to the extent to which the January effect influences the long-term contrarian, in terms of trading profits.

3.2. The decomposition of trading profits

As an extended analysis of the findings in Section 3.1, this section decomposes profits of the contrarian strategy into two components, relating to the January- and non-January investing, in order to untangle the implications of the January effect on long-term contrarian. Intuitively, if long-term contrarian is driven by the January effect rather than by investor overreaction, then the contrarian strategy should be unprofitable outside of January—which stands in stark contrast to the observed overall-year profits. The decomposition results indeed confirm the conjecture and provide further confirmatory evidence with respect to the findings in Section 3.1.

INSERT TABLE 1 HERE

Table 1 indicates that the contrarian strategy generates an equal-weighted profit of 1.35% per month and a value-weighted profit of 0.82% per month, in line with the findings of De Bondt and Thaler (1985). The decomposition analysis reflects the fact that a huge portion of contrarian profits materialize in January, which is consistent with the findings in Figure 1 that long-term contrarian profits are concentrated primarily in January. With respect to equal weighting, the January contrarian return of 10.73% is approximately 22 times as large as the non-January contrarian return of 0.49%. Value weighting generates similar results, in that the

January contrarian return of 7.27% is roughly 32 times as large as the non-January contrarian return of 0.23%. In addition, the January return of 7.27% for value weighting is two-thirds of the January return of 10.73% for equal weighting, which means that the January long-term reversal is relatively strong in—but not limited to—small firms.

Of central importance is the fact that the long-term contrarian strategy implemented outside of January is statistically and economically unprofitable. This finding provides a strong contrast with the long-term contrarian strategy implemented in January proving to be extremely lucrative. Table 1 documents that the value-weighted returns of the long-term contrarian strategy are both statistically and economically insignificant (0.23% with an associated *t*-statistic of 0.90). Equal-weighted returns show a higher average and marginal significance, but no higher than is explainable by the small stock bias in computed returns of Blume and Stambaugh (1983). The analyses of the return autocorrelations in Section 3.1 and the trading profits in this section both suggest that long-term contrarian is purely the result of the January effect.

Previous behavioral studies have attributed long-term contrarian to various judgment biases of investors. De Long, Shleifer, Summers and Waldmann (1990) and Barberis, Shleifer and Vishny (1998) argue that investors make systematic errors about public information due to conservatism and representativeness, and that they eventually correct their mistakes. Daniel, Hirshleifer and Subrahmanyam (1998) claim that investor overconfidence regarding private information causes prices to stray far away from fundamentals, and that public information gradually draws prices back to the correct position. Given these findings in sections 3.1 and 3.2, the question naturally arises how those behavioral stories reconcile with the evidence of the nonexistence of long-term contrarian outside of January. The direct evidence of this study refutes the claim that apparent investor overreaction to information leads to long-term contrarian.

3.3. Subperiod checks

Thus far, I have shown that the apparent success of long-term contrarian strategies is due solely to the January effect in the entire sample period of 1926–2009. This section addresses concerns about the robustness of my finding across different subperiods. The analysis demonstrates that my finding that long-term contrarian is completely driven by the January effect is robust to different subperiods. Specifically, this section implements the long-term contrarian strategy within four subperiods: 1926–1947, 1948–1969, 1970–1989 and 1990–2009. The earliest subsample period of 1926–1947 covers the 1929–1939 Great Depression, and the latest subsample period of 1990–2009 includes two financial crises—the 1997 Asian financial crisis and the 2007 subprime mortgage crisis. The US stock markets were extremely turbulent in 1926–1947 and 1990–2009, relative to the two other subperiods of 1948–1969 and 1970–1989.

INSERT TABLE 2 HERE

Table 2 presents the average monthly returns of the long-term contrarian strategy for both equal weighting and value weighting within four subperiods. The final column of Panel A reports that the equal-weighted version of the long-term contrarian strategy experiences the highest monthly profit of 3.25% in 1926–1947 and the lowest profit of 0.53% in 1948–1969. The equal-weighted contrarian strategy appears to be economically and statistically profitable across all subperiods, except for the 1948–1969 subperiod. Panel B shows that the value-weighted monthly returns of the long-term contrarian strategy vary dramatically, ranging from 0.11% to 2.03% across four subperiods. Note that, from a practical investment perspective, the value-weighted contrarian strategy is economically and statistically unprofitable in the subperiods of 1948–1969 and 1970–1989.

Being ‘value weighted’ means that average returns are mainly determined by large firms rather than by small firms. The weak value-weighted contrarian effect is consistent with Fama and French (1996), who attribute long-term contrarian success to past losers being small, distressed firms. Keim (1983) and Van Dijk (2011) document that the size effect is largely realized in January. My January explanation of long-term contrarian concurs with the ‘small distressed firm’ story.

Table 2 also documents that the profitability of the long-term contrarian strategy in January is overwhelmingly large and persistent across all subperiods. As the first column of Panel A shows, the long-term contrarian strategy generates the equal-weighted monthly returns of 4.84% to 18.20% each January for different subperiods. The first column of Panel B reports the value-weighted results. The value-weighted long-term contrarian strategy produces average monthly returns ranging from 4.63% to 9.48% each January. Interestingly, profits from long-term contrarian strategies implemented in January have not been traded away since the phenomenon was noticed by De Bondt and Thaler in 1985. The equal-weighted long-term contrarian strategy creates the spread between losers and winners of 11.48% (with an associated *t*-statistic of 3.20) each January in 1990–2009. The value-weighted version yields a similar spread between losers and winners of 8.27% (*t*-statistic=2.20) each January in 1990–2009.

More importantly, both equal- and value-weighted results illustrate that long-term contrarian strategies essentially produce either insignificant or negative returns outside of January. The month-by-month analysis of long-term contrarian strategies reflects the fact that none of the months outside of January can generate statistically positive returns—regardless of whether the returns were spread across different subperiods or shifted from equal weighting to value weighting (with the exception of equal weighting in July in 1948–1969 and in March in 1970–1989). Besides detailing the month-by-month results, the columns

preceding the final column of Table 2 also report the non-January returns of the long-term contrarian strategy. The non-January long-term contrarian strategy is shown to be not statistically profitable during any of the subperiods—even for those that have significant overall-year returns. These results reveal the robustness of the findings that long-term contrarian is due entirely to the January effect in different subperiods.

4. Intermediate-term momentum

To shed light on the implications of the behavior of January returns on the intermediate-term momentum puzzle, this section demonstrates that the dominant role of intermediate-term prior returns on momentum is the result of the January seasonality. Section 4.1 explores the impact of the January seasonality on intermediate-term positive return autocorrelation. Section 4.2 observes the influence of the January seasonality on the profitability of the short-term and intermediate-term momentum strategies. In order to isolate the influence of January returns, I make a decomposition of their trading profits separately in January and outside of January. Section 4.3 investigates the robustness of the findings across different subperiods.

4.1. Return autocorrelation

The upper panel of Figure 2 documents short- and intermediate-term positive return autocorrelations (Novy-Marx, forthcoming; Moskowitz, Ooi and Pedersen, forthcoming). Eleven marginal strategies—which go long in winners of month t - x, where x ranges from 2 to 12, and go short in losers of the same month—generate mostly positive returns.[5] This

[5] The upper panel of Figure 2 shows the strong one-month reversal documented by Jegadeesh (1990) and Lehmann (1990), among other studies. In 1926–2009, the winners of month t - 1 underperform the losers of the same month by an

finding confirms that recent winners continue to outperform recent losers (Jegadeesh and Titman, 1993; Grundy and Martin, 2001; Griffin, Ji, and Martin, 2003, 2005; Wang and Wu, 2011). Novy-Marx (forthcoming), however, argues that the seven-to-12 month prior returns contribute more to momentum profits than the two-to-six month prior returns do. Consistent with his finding, the upper panel shows that the seven-to-12 month prior returns show stronger return continuation than the two-to-six month prior returns do. Additionally, the upward-sloping of the overall-year profitability of the marginal strategies up through lag 12 invites the swift conclusion by Novy-Marx (forthcoming) that intermediate-term prior returns act as a main driving force of momentum. The robust statistical tests of the difference in the contributions of the two-to-six month prior returns and the seven-to-12 month prior returns to momentum profits are reported in the next section.

INSERT FIGURE 2 HERE

Given the well-known behavior of January returns, the middle and bottom panels of Figure 2 depict separately the autocorrelations of January- and non-January returns up to lag 12. The middle panel reports the strong and negative return autocorrelations between January returns and their own lagged returns except for lag 12. The marginal strategies, which sort stocks by the returns of any month outside of January in the previous year and hold winner–loser portfolios in the subsequent January, produce large and negative returns. Eleven marginal strategies produce equal-weighted monthly returns ranging from −11.15% to −1.10% and value-weighted monthly returns ranging from −5.11% to −0.53%. This finding confirms that the momentum strategy consistently loses money in January (Jegadeesh and Titman, 1993; Grundy and Martin, 2001). The marked differences between equal- and value-weighted results illustrate that the January momentum loss is particularly pronounced for small firms.

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equal-weighted return of 2.99% and a value-weighted return of 1.06%. This finding is in support of skipping one month between ranking and investing for the momentum strategy to avoid the mechanical bid–ask bias—since strong winners are likely to have close prices at the ask than at the bid—and vice versa.

The bottom panel of Figure 2 shows that non-January returns exhibit stronger return autocorrelations with regard to their own lags than is the case for overall-year returns shown in the upper panel of Figure 2. This finding is consistent with our expectation that the momentum effect should be enhanced after eliminating the influence of January returns. More importantly, the panel suggests that it is the apparently stronger intermediate-term return autocorrelations, rather than the short-term return autocorrelations, that disappear outside of January. In other words, the two-to-six month prior returns and the seven-to-12 month prior returns make roughly equal contributions to non-January momentum. The finding thus refutes the claim by Novy-Marx (forthcoming) that momentum is largely driven by intermediate-term prior returns instead of short-term prior returns. In line with such seminal studies as Jegadeesh and Titman (1993), outside-January momentum is driven by the tendency of rising and falling stocks to continue rising and falling.

The contrasting patterns of the short-term and intermediate-term autocorrelations in the upper and bottom panels of Figure 2 raise the question as to what causes the differences. The key to the answer is to understand the behavior of January returns.[6] The middle panel of Figure 2 documents the January annual seasonality in which stocks with higher returns in the previous January tend to have higher returns in the subsequent January. The equal-weighted version reports that winners of last January outperform losers by 3.88% in each subsequent January, and the value-weighted version generates the similar result, 2.72%. The strong January annual seasonality creates the illusion of the dominant role of intermediate-term prior returns on momentum. The following section provides further analysis of the January annual seasonality as well as its contribution to the illusion.

[6] Interestingly, section 6.2 of the 2009 version of Novy-Marx's paper was moved to the Appendix of the forthcoming version of his paper, which argues that the January difference is insufficient to explain the heavy dependence of momentum on intermediate-term prior returns.

4.2. The decomposition of trading profits

The statistical test in this section confirms the findings in Section 4.1. I decompose trading profits for both the short-term momentum and intermediate-term momentum strategies into two parts relating to the January- and non-January returns. The decomposition analysis allows for evaluating the profitability of the two strategies separately in January and outside of January. In the context of my research setting, if the superior performance of intermediate-term prior returns is caused by the January seasonality, then short-term momentum and intermediate-term momentum strategies should generate economically and statistically indistinguishable returns outside of January. If not, then the intermediate-term momentum strategy still generates higher returns than its short-term counterpart.

INSERT TABLE 3 HERE

Table 3 reports average monthly returns on sets of ten portfolios formed each month on the returns of months t - 12 to t - 7, t - 6 to t - 2 and t - 12. As shown in the first column of Panel A, the short-term momentum strategy, which ranks stocks by the returns in months t - 6 to t - 2, generates an equal-weighted profit of 0.40% per month (although at the marginally significant level). The fourth column of Panel A shows that the intermediate-term momentum strategy, which sorts stocks by the returns in months t - 12 to t - 7, generates an equal-weighted profit of 0.91% per month. Similar to Novy-Marx (forthcoming), the intermediate-term momentum strategy outperforms its short-term counterpart by 0.51%, with an associated t-statistic of 2.23. The value-weighted results in Panel B tell a similar story. The intermediate-term momentum strategy (1.10%) outperforms its short-term counterpart (0.62%) at the ten percent significance level.[7]

[7] I find that, for both short- and intermediate-term momentum strategies, the value-weighted versions generate slightly higher profits than the equal-weighted versions. This finding is due to the fact that the value-weighted momentum strategies create small January losses relative to the corresponding equal-weighted momentum strategies, as shown in Table 3. This

The second column of Table 3 reports that the short-term momentum strategy, which buys winners of the previous July–November and sells losers of the same period, leads to a substantial loss of 6.43% each January. Compare this with the fifth column of Table 3, which shows that the intermediate-term momentum strategy that buys winners of the previous January–June and sells losers of the same period produces a considerably smaller January loss of 2.39%. These findings are consistent with Jegadeesh and Titman (1993) and Grundy and Martin (2001), which assert that the momentum strategy persistently loses money in January. More importantly, note the statistically and economically significant difference of 4.04% (*t*-statistic=2.72) in the January losses between short-term momentum and intermediate-term momentum strategies. The question arises naturally as to whether the superior performance of intermediate-term momentum is driven purely by the behavior of January returns.

To address the concern that the superior performance of intermediate-term prior returns on momentum is due to January behavior, I examine the non-January profitability of the short-term momentum and intermediate-term momentum strategies. The third column shows that short-term prior winners (i.e., the best performers in months t - 6 to t - 2) outperform short-term prior losers (i.e., the worst performers of the same period) by the equal-weighted monthly return of 1.02% and the value-weighted monthly return of 0.90% outside of January. The sixth column suggests that non-January intermediate-term prior winners (i.e., the best performers in months t - 12 to t - 7) outperform intermediate-term prior losers (i.e., the worst performers of the same period) by the equal-weighted monthly return of 1.21% and the value-weighted monthly return of 1.27%. More importantly, there is no economically and statistically significant difference in the non-January returns between the short-term momentum strategy and its intermediate-term counterpart (0.20% with an associated *t*-

result suggests that momentum applies to small and large firms, which is consistent with the findings of Galariotis (2010). It also illustrates that small firms experience marked January losses compared to large firms.

statistic of 0.95 for equal weighting, and 0.39% with an associated *t*-statistic of 1.48 for value weighting). These findings, in addition to the results of return autocorrelations in Section 4.1, serve to refute Novy-Marx (forthcoming)'s claim that non-January momentum is largely driven by intermediate-term prior returns.

Thus far, we have identified the dominant role of intermediate-term prior returns on momentum in January. The question then becomes the following: why does the intermediate-term momentum strategy suffer considerably fewer January losses than the January loss associated with the short-term momentum strategy? The last three columns of Table 3 provide the answer: the January seasonality causes the apparent success of intermediate-term momentum.[8] In particular, the decomposition analysis of the trading profits suggests that the January seasonality strategy generates a disproportionately large magnitude of returns relative to the remaining 11 months. The January seasonality strategy, which sorts stocks by the previous January's returns and holds winner–loser portfolios in the following January, produces the equal-weighted monthly return of 3.88% and the value-weighted monthly return of 2.72%. More importantly, the analysis of the January seasonality contained in the first column of Table 4 highlights the fact that winners tend to be extremely small firms, whereas losers tend to be small firms. The phenomenon of extremely small firms outperforming small firms in January causes the considerable profitability of the January seasonality.

INSERT TABLE 4 HERE

The short-term momentum strategy in January buys winners of the previous July–November and sells losers of the same period. Consistent with Grundy and Martin (2001), the

[8] My analysis shows that the seasonality strategy which ranks stocks by the returns of month *t*-12 (0.84%) creates an almost identical return as the momentum strategy which sorts stocks by the returns of months *t*-12 to *t*-2 (0.88%), which resembles Heston and Sadka's findings (2008). Heston and Sadka claim the apparent importance of 12-month lagged returns by stating that the past one-year performance of winners and losers can be mostly captured by the performance of winners and losers of the month exactly 12 months ago. To ensure that the comparison of seasonality with momentum is not contaminated by the January behavior, I compare their performance outside of January. The analysis shows that the momentum strategy statistically and economically outperforms the seasonality strategy—by 0.83% for equal weighting (*t*-statistic = 3.72) and 0.92% for value weighting (*t*-statistic = 3.64) outside of January. The comparative analysis highlights the fact that the substantial profitability of the January seasonality leads to the illusion that ranking stocks based on the previous year's returns produces similar profits as when ranking stocks based on the single-month returns of exactly 12 months ago.

third column of Table 4 shows that this strategy can be seen as going long in small firms and going short in extremely small firms. The occurrence of small firms underperforming extremely small firms in January eventually leads to substantial losses.

The intermediate-term momentum strategy in January buys the best performers of the prior January–June and sells the worst performers of the same period. As the second-to-last column of Table 4 shows, the January seasonality results in the intermediate-term winners being smaller firms than the short-term winners, while the intermediate-term losers are larger firms than the short-term losers. Despite the intermediate-term winners remaining smaller than the intermediate-term losers, the intermediate-term winners underperform the intermediate-term losers to a lesser extent than the short-term winners underperform the short-term losers. Thus, the intermediate-term momentum strategy experiences less of a loss than the January loss associated with the short-term momentum strategy.

4.3. Subperiod checks

Table 5 presents the returns (January, non-January as well as overall year) of the short-term momentum and intermediate-term momentum strategies, respectively, in the subperiods of 1926–1947, 1948–1969, 1970–1989 and 1990–2009. The equal-weighted results in Panel A of Table 5 show that the short-term momentum strategy experiences considerable and consistent January losses, ranging from the loss of 3.24% to the loss of 8.28% (across four subperiods). By comparison, the intermediate-term momentum strategy suffers significantly smaller losses, from 0.46% to 4.37%. Panel B of Table 5 reports a value-weighted version of the subperiod analysis, which presents broadly similar findings that the intermediate-term momentum strategy generates substantially smaller January losses than the short-term momentum strategy, due to the January seasonality. Table 6 documents that the average

equal-weighted profits of the January seasonality strategy run from 1.87% to 7.20% for four subperiods, and that the value-weighted profits run from 2.07% to 5.61% for the first three subperiods.[9]

INSERT TABLE 5 HERE

INSERT TABLE 6 HERE

The final column of Table 5 reports a statistical test of whether the overall-year return of the intermediate-term momentum strategy is significantly different from that of the short-term momentum strategy. Panel A of Table 5 for equal-weighted results shows that the intermediate-term momentum strategy outperforms its short-term counterpart by 1.91% (*t*-statistic=2.54) in 1926–1947 and by 0.65% (*t*-statistic=2.11) in 1970–1989. Conversely, the intermediate-term momentum strategy underperforms its short-term counterpart by 0.62% (*t*-statistic=2.78) in 1948–1969 (there is no economically and statistically significant difference in 1990–2009). Contrary to the assertion by Novy-Marx (forthcoming) concerning the heavy dependence of momentum on intermediate-term prior returns, these findings point to the instability and unreliability of the superior performance shown by the intermediate-term momentum strategy across different subperiods. Indeed, the bottom row of Table 1 of the Novy-Marx paper presents qualitatively similar results. In fact, his findings in the subperiod analysis do not support his claim. The second-to-last column of Table 5 shows the results of the difference tests on the non-January returns. With the control of the impact of January returns, the superior performance of the intermediate-term momentum vanishes in the 1970–1989 subperiod, as the test reports the difference of 0.23% (*t*-statistic=0.86). The superiority remains evident in the 1926–1947 subperiod, when there was no momentum effect (Jegadeesh and Timan, 1993).

[9] The January seasonality strategy exhibits a marked difference in the 1990–2009 subperiod, the profit of 1.87% for equal weighting and the profit of 0.09% for value weighting. This finding reflects that the January seasonality in the past 20 years is mostly concentrated in small firms.

The final two columns of Panel B of Table 5 show a value-weighted version of the results of the difference tests. Consistent with the findings in Section 4.2, none of subperiods featured the significant differences in the overall-year returns between intermediate-term momentum and short-term momentum strategies at the 5% significant level. Furthermore, outside of January there is no evidence of the intermediate-term momentum strategy outperforming its short-term counterpart within any subperiod.

5. Conclusions

This study investigates the causes behind the seeming success of long-term contrarian and intermediate-term momentum using several tests and a long sample period from 1926–2009. The evidence suggests that long-term contrarian is due entirely to the January size effect. The return autocorrelation analysis suggests that after controlling for the January effect the overwhelming long-term negative return autocorrelations become unreliable and unstable. The decomposition analysis on the profitability of the long-term contrarian strategy further confirms the findings. The January contrarian strategy is extraordinarily profitable, whereas the contrarian strategy outside of January is economically and statistically unprofitable. These findings are robust to different subperiods. This study highlights the fact that long-term contrarian is nonexistent outside of January, and that it is the result of the January effect.

The findings of this work resolve the concern raised by Novy-Marx (forthcoming) about the heavy dependence of momentum on intermediate-term prior returns. My tests show that the superior performance of intermediate-term prior returns in momentum is caused by the remarkable January seasonality profits neutralizing the considerable and well-known January momentum losses. This work documents that the January seasonality strategy, which buys extremely small firms and sells small firms, essentially bets on the size effect in January.

In contrast, the short-term momentum strategy, which buys small firms and sells extremely small firms, bets heavily against the size effect in January and thereby suffers a substantial loss. Due to the offsetting effect of January seasonality, the intermediate-term momentum bets less severely against the size effect and experiences less of a loss. More importantly, once January influences are controlled for, short- and intermediate-term prior returns contribute approximately equally to outside-January momentum.

These results suggest that long-term reversal can be considered as largely illusory, and the superior performance of intermediate-term momentum must take account of annual seasonality. These findings might help to unfold the mysteries of the profitability of long-term contrarian and intermediate-term momentum strategies.

Nonetheless, the main driving forces for outside-January momentum, outside-January seasonality and the January effect remain unclear. It would be useful to investigate for what kinds of risk those abnormal profits compensate. Such issues are beyond the scope of this work and are best left for future research.

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Table 1

Average monthly returns of long-term contrarian portfolios. For each month *t*, NYSE and AMEX stocks in the CRSP monthly file are ranked into ten deciles on the basis of their compounded returns of month *t* - 60 to *t* - 13. For example, the contrarian trading strategy of investing in January 2009 ranks stocks based on the compounded returns of January 2004 to December 2007. P1 is the decile of stocks with the best performance (i.e., winners) in month *t* - 60 to *t* - 13 and P10 is the decile of stocks with the worst performance (i.e., losers) in the respective same period. This table shows the average monthly returns (in percent) of P1, P2, …, P10, and P10–P1 and the corresponding *t*-statistics in parentheses. Both equal- and value-weighted trading strategies are reported. The sample period covers January 1926 to December 2009.

	Panel A: Equal Weighted			Panel B: Value Weighted		
	Overall	January	NonJan	Overall	January	NonJan
P1	0.93	2.29	0.81	0.81	0.86	0.81
P2	1.11	2.71	0.97	0.83	0.70	0.84
P3	1.22	2.95	1.06	1.00	1.54	0.95
P4	1.31	3.24	1.13	1.06	1.74	1.00
P5	1.25	3.65	1.03	1.06	2.18	0.95
P6	1.35	4.07	1.13	1.13	2.26	1.02
P7	1.35	4.49	1.06	1.11	2.79	0.96
P8	1.46	5.40	1.11	1.26	3.15	1.09
P9	1.62	7.43	1.09	1.31	4.65	1.01
P10	2.28	13.02	1.30	1.63	8.13	1.04
P10–P1	1.35	10.73	0.49	0.82	7.27	0.23
t-stat	(4.66)	(6.54)	(1.90)	(3.03)	(5.21)	(0.90)

Table 2

Subperiod checks for long-term contrarian strategy. For each month *t*, NYSE and AMEX stocks in the CRSP monthly file are ranked on the basis of their compounded returns of month *t* - 60 to *t* - 13 and classified into ten deciles. The long-term contrarian trading strategy examined buys the bottom decile of stocks with the lowest returns (i.e., losers) and sells the top decile of stocks with the highest returns (i.e., winners). Loser–winner portfolios are reconstructed every month and invested for one month (i.e., month *t*). This table shows the average monthly returns (in percent), standard deviations (in percent), and *t*-statistics of loser–winner portfolios month by month. The sample period 1926–2009 is split into four subperiods 1927–1947, 1948–1969, 1970–1989 and 1990–2009.

Panel A: Equal Weighted														
26–47	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	NonJan	Overall
Mean	18.20	3.00	2.25	1.31	8.46	-0.22	3.13	5.16	3.00	-0.89	-0.67	-3.75	1.36	3.25
SD (%)	21.86	12.57	5.08	9.22	27.60	7.98	8.84	19.30	20.14	7.30	8.52	5.77	11.94	15.28
t-stat	3.43	0.99	1.83	0.59	1.26	-0.11	1.46	1.10	0.61	-0.50	-0.32	-2.68	1.55	3.04
48–69														
Mean	4.84	0.51	-0.32	0.48	-0.18	-0.63	1.59	0.13	0.77	-0.45	-1.20	0.80	0.14	0.53
SD (%)	4.13	2.64	2.23	2.34	3.43	2.64	3.70	2.73	2.66	2.54	2.35	4.28	2.97	3.34
t-stat	5.49	0.91	-0.67	0.97	-0.25	-1.12	2.02	0.23	1.35	-0.83	-2.39	0.88	0.72	2.58
70–89														
Mean	10.11	1.45	2.72	0.63	-0.23	-0.33	-0.05	-0.73	-0.54	-2.44	-1.64	-1.54	-0.25	0.62
SD (%)	10.20	6.58	4.08	4.15	4.25	4.05	4.37	3.73	3.53	4.56	2.93	5.02	4.51	5.93
t-stat	4.43	0.98	2.97	0.68	-0.24	-0.37	-0.05	-0.87	-0.68	-2.39	-2.51	-1.37	-0.81	1.61
90–09														
Mean	11.48	2.95	1.30	-0.09	1.53	1.42	0.86	2.14	-0.42	-3.31	-0.76	-0.83	0.43	1.36
SD (%)	16.04	7.86	5.61	5.93	5.62	4.05	4.42	9.21	3.75	4.31	5.52	6.82	6.06	7.96
t-stat	3.20	1.68	1.04	-0.06	1.22	1.57	0.87	1.04	-0.50	-3.44	-0.62	-0.54	1.06	2.64
Panel B: Value Weighted														
26–47	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	NonJan	Overall
Mean	9.48	0.37	2.65	1.98	7.09	-0.37	3.21	4.33	-0.28	-1.45	0.64	-3.24	1.89	2.03
SD (%)	13.21	8.51	7.78	8.82	26.80	6.21	9.94	13.26	10.16	9.27	9.75	6.69	13.84	12.23
t-stat	2.96	0.18	1.40	0.93	1.09	-0.25	1.33	1.35	-0.11	-0.65	0.27	-2.00	1.87	2.37
48–69														
Mean	4.63	0.99	-0.96	-0.67	-0.70	-0.92	0.49	-0.12	0.27	-0.87	-1.05	0.28	-0.30	0.11
SD (%)	4.42	2.78	2.78	3.51	3.37	3.23	4.51	3.13	2.75	2.65	3.66	4.35	3.39	3.74

t-stat	4.91	1.67	-1.61	-0.89	-0.97	-1.33	0.51	-0.17	0.46	-1.54	-1.34	0.30	-1.36	0.50
70–89														
Mean	7.28	0.82	2.38	0.76	-1.47	-1.30	-1.02	-0.83	-0.59	-3.11	-0.18	0.00	-0.41	0.23
SD (%)	12.87	6.66	5.46	4.64	4.40	4.48	6.27	4.68	5.54	5.51	3.76	4.66	5.23	6.54
t-stat	2.53	0.55	1.95	0.73	-1.50	-1.29	-0.73	-0.79	-0.48	-2.53	-0.21	0.00	-1.17	0.54
90–09														
Mean	8.27	3.33	2.30	0.61	1.70	-0.63	-1.51	4.20	-0.67	-3.22	-1.55	0.86	0.49	1.14
SD (%)	16.82	10.24	7.45	6.86	5.30	2.77	5.39	15.30	6.17	6.88	6.91	6.78	8.01	9.27
t-stat	2.20	1.46	1.38	0.40	1.43	-1.01	-1.25	1.23	-0.48	-2.09	-1.00	0.57	0.91	1.91

Table 3

Average monthly returns of momentum and seasonality strategy portfolios. For each month *t*, the short-term momentum strategy sorts NYSE and AMEX stocks in the CRSP monthly file by the compounded returns of month *t* - 6 to *t* - 2 to form ten deciles; the intermediate-term momentum strategy ranks stocks by the compounded returns of month *t* - 12 to *t* - 7 to construct ten deciles; the seasonality strategy sorts stocks by the returns of the month exactly 12 months ago, month *t* - 12. P1 is the decile of stocks with the worst performance (i.e., losers) in month *t* - *x* to *t* - *y* and P10 is the decile of stocks with the best performance (i.e., winners) in the respective same period. All three kinds of trading strategies reconstruct winner–loser portfolios at the beginning of month *t* and hold for that month. This table shows the average monthly returns (in percent) of P1, P2, …, P10, and P10–P1 and the associated *t*-statistics in parentheses. Both equal- and value-weighted trading strategies are reported. The sample period covers January 1926 to December 2009.

Panel A: Equal Weighted

	Short-Term Momentum			Intermediate-Term Momentum			Seasonality		
	Overall	January	NonJan	Overall	January	NonJan	Overall	January	NonJan
P1	1.14	10.32	0.31	0.95	8.54	0.26	0.95	5.53	0.54
P2	1.23	7.06	0.71	1.02	5.71	0.59	0.97	4.09	0.69
P3	1.31	5.85	0.90	1.08	4.86	0.74	1.12	4.06	0.86
P4	1.29	5.46	0.92	1.14	4.56	0.83	1.13	3.75	0.89
P5	1.32	4.42	1.04	1.24	4.28	0.96	1.26	4.30	0.99
P6	1.30	4.20	1.03	1.26	4.17	0.99	1.28	4.51	0.98
P7	1.29	3.74	1.06	1.39	4.29	1.13	1.47	4.99	1.15
P8	1.28	3.46	1.09	1.48	4.55	1.21	1.40	5.04	1.07
P9	1.28	3.34	1.09	1.67	4.77	1.39	1.67	6.33	1.25
P10	1.54	3.89	1.33	1.86	6.15	1.47	1.84	9.40	1.15
P10–P1	0.40	-6.43	1.02	0.91	-2.39	1.21	0.88	3.88	0.61
t-stat	(1.63)	(-4.86)	(4.43)	(4.17)	(-2.64)	(5.47)	(5.84)	(4.52)	(4.30)

Panel B: Value Weighted

	Short-Term Momentum			Intermediate-Term Momentum			Seasonality		
	Overall	January	NonJan	Overall	January	NonJan	Overall	January	NonJan
P1	0.61	4.08	0.30	0.47	3.31	0.21	0.59	1.58	0.50
P2	0.90	3.21	0.69	0.46	1.99	0.32	0.66	1.44	0.59
P3	0.97	2.68	0.82	0.76	2.14	0.64	0.75	1.33	0.70
P4	1.00	2.52	0.86	0.78	2.01	0.66	0.77	1.62	0.69
P5	0.98	1.64	0.92	0.92	1.84	0.83	0.92	1.72	0.85

P6	0.98	1.63	0.92	0.92	1.50	0.87	0.89	2.01	0.79
P7	1.04	1.69	0.98	1.10	1.41	1.07	1.04	2.52	0.91
P8	0.99	1.09	0.98	1.13	2.05	1.05	1.15	2.67	1.01
P9	1.01	0.91	1.02	1.40	2.12	1.33	1.28	3.01	1.12
P10	1.23	1.57	1.20	1.57	2.54	1.48	1.40	4.30	1.13
P10–P1	0.62	-2.51	0.90	1.10	-0.77	1.27	0.81	2.72	0.64
t-stat	(2.47)	(-2.42)	(3.55)	(4.51)	(-1.06)	(4.94)	(4.23)	(3.34)	(3.28)

Table 4

Average market capitalization of relative strength portfolios. For each month *t*, the short-term momentum strategy sorts NYSE and AMEX stocks in the CRSP monthly file by the compounded returns of month *t* - 6 to *t* - 2 to form ten deciles; the intermediate-term momentum strategy ranks stocks by the compounded returns of month *t* - 12 to *t* - 7 to construct ten deciles; the seasonality strategy sorts stocks by the returns of the month exactly 12 months ago, month *t* - 12. P1 is the decile of stocks with the lowest returns (i.e., losers) in month *t* - *x* to *t* - *y* and P10 is the decile of stocks with the highest returns (i.e., winners) in the respective same period. All those three kinds of trading strategies reconstruct winner–loser portfolios at the beginning of month *t* and hold for that month. This table shows the average market capitalizations of stocks of P1, P2,…, P10 (in $million). The sample period covers January 1926 to December 2009.

	Seasonality		Short-Term Momentum		Intermediate-Term Momentum	
	January	NonJan	January	NonJan	January	NonJan
P1	659	295	233	311	359	297
P2	1165	713	539	780	833	705
P3	1257	1090	884	1128	1222	1069
P4	1335	1290	965	1345	1454	1262
P5	1356	1480	1288	1451	1550	1438
P6	1317	1552	1534	1494	1557	1501
P7	1369	1596	1457	1527	1403	1534
P8	1199	1592	1632	1445	1272	1530
P9	932	1445	1612	1273	1093	1379
P10	419	850	976	713	608	788

Table 5

Subperiod checks for short- and intermediate-term momentum strategies. For each month *t*, the short-term momentum strategy ranks all NYSE and AMEX stocks in the CRSP monthly file on the basis of the compounded returns of month *t* - 6 to *t* - 2 and stocks are classified into ten deciles. The intermediate-term momentum strategy sorts stocks based on the compounded returns of months *t* - 12 to *t* - 7 and assigns the stocks into ten deciles. The momentum strategies examined buy the best performers (i.e., winners) and sell the worst performers (i.e., losers). Winner–loser portfolios are reconstructed every month and invested for one month (i.e., month *t*). This table shows the average monthly returns (in percent), standard deviations (in percent), and *t*-statistics of winner–loser portfolios month by month. The *t*-statistics and standard deviations (in percent) of the null that the difference in the returns between intermediate-term momentum strategy and short-term momentum strategy is zero are reported. The entire sample period of 1926–2009 is split into four subperiods 1927–1947, 1948–1969, 1970–1989 and 1990–2009.

Panel A: Equal Weighted

	Short-Term Momentum			Intermediate-Term Momentum			Difference Test	
26–47	Jan	NonJan	Overall	Jan	NonJan	Overall	NonJan	Overall
Mean	-8.28	-0.17	-0.84	-0.46	1.13	1.00	1.37	1.91
SD (%)	16.03	10.26	11.03	12.40	10.94	11.05	10.27	11.93
t-stat	-2.37	-0.25	-1.21	-0.17	1.57	1.43	2.03	2.54
48–69								
Mean	-3.24	1.75	1.33	-2.87	1.03	0.71	-0.72	-0.62
SD (%)	5.48	3.38	3.84	3.11	2.81	3.03	3.58	3.67
t-stat	-2.77	8.04	5.63	-4.34	5.70	3.78	3.11	2.78
70–89								
Mean	-7.19	1.66	0.93	-1.89	1.89	1.57	0.23	0.65
SD (%)	9.52	4.46	5.61	6.90	3.79	4.25	3.91	4.76
t-stat	-3.38	5.53	2.55	-1.23	7.40	5.74	0.86	2.11
90–09								
Mean	-7.25	0.86	0.18	-4.37	0.82	0.39	-0.03	0.21
SD (%)	14.74	7.49	8.59	7.98	6.15	6.46	5.81	6.23
t-stat	-2.20	1.69	0.32	-2.45	1.99	0.94	-0.94	0.53

Panel B: Value Weighted

	Short-Term Momentum			Intermediate-Term Momentum			Difference Test	
26–47	Jan	NonJan	Overall	Jan	NonJan	Overall	NonJan	Overall
Mean	-4.67	0.36	-0.06	-0.73	1.12	0.96	0.86	1.12
SD (%)	10.74	10.34	10.44	7.90	10.91	10.69	10.67	11.11
t-stat	-1.99	0.53	-0.08	-0.42	1.56	1.43	1.23	1.60
48–69								
Mean	-1.11	1.63	1.40	-1.82	1.13	0.88	0.50	-0.51
SD (%)	5.22	3.84	4.03	3.96	3.81	3.91	4.58	4.58
t-stat	-0.99	6.59	5.65	-2.15	4.61	3.68	0.09	-1.82
70–89								
Mean	-2.30	1.04	0.77	-1.01	1.71	1.48	0.66	0.71
SD (%)	8.79	5.63	6.00	7.78	5.13	5.43	5.89	6.29
t-stat	-1.17	2.75	1.98	-0.58	4.94	4.22	1.67	1.76
90–09								
Mean	-2.00	0.55	0.33	0.59	1.15	1.10	0.60	0.77
SD (%)	12.16	9.16	9.44	6.44	9.17	8.96	9.34	9.59
t-stat	-0.74	0.89	0.55	0.41	1.85	1.90	0.95	1.24

Table 6

Subperiod checks for seasonality strategy. For each month *t*, NYSE and AMEX stocks in the CRSP files are ranked on the basis of the returns of month *t* - 12, and classified into ten deciles. The seasonality strategy examined buys the top decile of stocks with the highest returns (i.e., winners) and sells the bottom decile of stocks with the lowest returns (i.e., losers). Winner–loser portfolios are reconstructed every month and invested for one month (i.e., month *t*). This table shows the average monthly returns (in percent), standard deviations (in percent), and *t*-statistics of winner–loser portfolios. The entire sample period 1926–2009 is split into four subperiods 1927–1947, 1948–1969, 1970–1989 and 1990–2009.

	Panel A: Equal Weighted			Panel B: Value Weighted		
26–47	Overall	January	NonJan	Overall	January	NonJan
Mean	0.82	7.20	0.24	1.01	5.61	0.59
SD (%)	7.70	11.84	6.97	7.97	6.63	7.96
t-stat	1.69	2.79	0.52	2.01	3.87	1.13
48–69						
Mean	0.75	2.08	0.63	0.84	2.07	0.72
SD (%)	2.13	2.01	2.11	2.80	2.77	2.78
t-stat	5.70	4.84	4.63	4.87	3.50	4.06
70–89						
Mean	1.49	4.37	1.22	1.35	3.05	1.19
SD (%)	3.47	7.58	2.70	5.01	10.34	4.22
t-stat	6.64	2.58	6.71	4.16	1.32	4.18
90–09						
Mean	0.50	1.87	0.38	0.04	0.09	0.03
SD (%)	3.91	5.77	3.69	7.10	7.75	7.05
t-stat	1.98	1.45	1.51	0.08	0.05	0.07

Figure 1

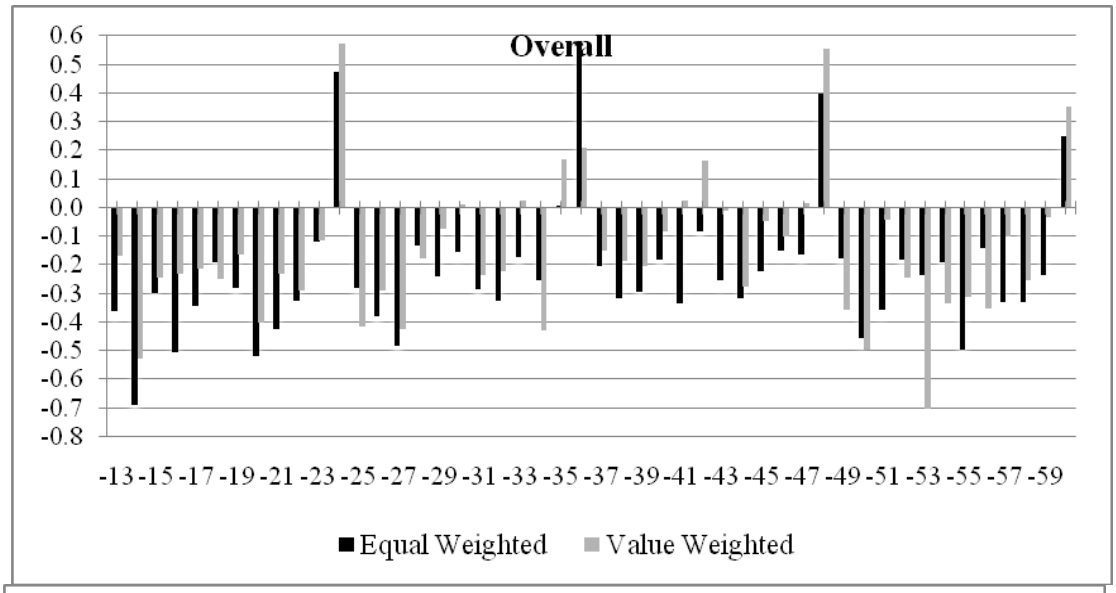
Long-term return autocorrelation. Figure 1 reports the average monthly returns (in percent) of zero-cost winner–loser portfolios, which are formed on the basis of single-month returns in the prior two to five years. The table below shows the average monthly returns (in percent) of winner–loser portfolios and the associated *t*-statistics are in parentheses. Each month *t*, all NYSE and AMEX stocks on the CRSP monthly file are sorted into ten deciles by the returns of month *t* - *x*, where *x* ranges from 13 to 60. Winners and losers are defined as the top- and bottom-decile portfolios in month *t* - *x*. For example, if *x* is equal to 15, winner–loser portfolios are formed according to the returns of month *t* - 15 (i.e., 15-month lagged returns). Winner–loser portfolios are reconstructed at the beginning of every month and the investment period is one month (i.e., month *t*). Equal-weighted results are in black, while value-weighted results are in grey. *Overall* indicates that the investment period covers any calendar month; *January* means that the investment period includes only January; *non-January* suggests that the investment period can be any month outside of January. The sample period covers January 1926 to December 2009.

Panel A: Equal Weighted

Lag	**-13**	**-14**	**-15**	**-16**	**-17**	**-18**	**-19**	**-20**	**-21**	**-22**	**-23**	**-24**
Overall	-0.36	-0.69	-0.30	-0.50	-0.34	-0.19	-0.28	-0.52	-0.42	-0.33	-0.12	0.47
	(-2.18)	(-5.09)	(-2.13)	(-3.28)	(-2.38)	(-1.35)	(-2.34)	(-3.81)	(-3.38)	(-2.44)	(-1.02)	(3.26)
January	-5.87	-5.14	-4.14	-2.77	-3.66	-2.36	-3.53	-3.65	-3.07	-2.36	-2.32	2.32
	(-6.70)	(-6.40)	(-5.91)	(-4.44)	(-4.71)	(-4.77)	(-6.58)	(-5.47)	(-5.04)	(-4.25)	(-4.76)	(4.09)
NonJan	0.13	-0.29	0.05	-0.30	-0.05	0.01	0.01	-0.24	-0.18	-0.14	0.08	0.30
	(0.89)	(-2.40)	(0.37)	(-1.92)	(-0.33)	(0.04)	(0.11)	(-1.80)	(-1.50)	(-1.05)	(0.69)	(2.05)
Lag	**-25**	**-26**	**-27**	**-28**	**-29**	**-30**	**-31**	**-32**	**-33**	**-34**	**-35**	**-36**
Overall	-0.28	-0.38	-0.48	-0.14	-0.24	-0.16	-0.28	-0.32	-0.17	-0.25	0.00	0.58
	(-2.17)	(-2.72)	(-3.56)	(-1.01)	(-1.85)	(-1.25)	(-2.37)	(-2.71)	(-1.49)	(-2.27)	(0.04)	(5.17)
January	-4.00	-3.64	-2.78	-2.21	-2.85	-2.85	-2.46	-2.05	-2.54	-2.03	-0.96	2.22
	(-5.31)	(-4.16)	(-3.89)	(-2.94)	(-5.21)	(-5.10)	(-4.16)	(-3.32)	(-5.28)	(-4.39)	(-1.95)	(4.04)
NonJan	0.05	-0.09	-0.28	0.05	0.00	0.09	-0.09	-0.17	0.04	-0.09	0.09	0.44
	(0.45)	(-0.69)	(-2.11)	(0.41)	(-0.04)	(0.71)	(-0.75)	(-1.44)	(0.35)	(-0.82)	(0.73)	(3.90)
Lag	**-37**	**-38**	**-39**	**-40**	**-41**	**-42**	**-43**	**-44**	**-45**	**-46**	**-47**	**-48**
Overall	-0.20	-0.32	-0.29	-0.18	-0.33	-0.08	-0.25	-0.32	-0.22	-0.15	-0.16	0.40
	(-1.77)	(-2.68)	(-2.32)	(-1.62)	(-2.17)	(-0.64)	(-2.22)	(-2.58)	(-1.93)	(-1.18)	(-1.30)	(3.33)
January	-2.99	-3.07	-2.65	-0.92	-1.78	-1.44	-2.20	-2.11	-1.33	-1.91	-0.33	2.43
	(-4.49)	(-4.56)	(-4.34)	(-1.55)	(-2.62)	(-3.67)	(-4.19)	(-4.27)	(-2.69)	(-3.65)	(-0.69)	(4.64)
NonJan	0.05	-0.07	-0.08	-0.11	-0.20	0.04	-0.08	-0.16	-0.12	0.01	-0.15	0.21
	(0.43)	(-0.64)	(-0.66)	(-1.04)	(-1.30)	(0.29)	(-0.68)	(-1.24)	(-1.04)	(0.07)	(-1.14)	(1.78)

Lag	**-49**	**-50**	**-51**	**-52**	**-53**	**-54**	**-55**	**-56**	**-57**	**-58**	**-59**	**-60**
Overall	-0.18	-0.46	-0.36	-0.18	-0.24	-0.19	-0.50	-0.14	-0.33	-0.33	-0.24	0.25
	(-1.47)	(-3.79)	(-2.95)	(-1.59)	(-2.10)	(-1.59)	(-4.12)	(-1.24)	(-3.08)	(-2.48)	(-2.08)	(2.05)
January	-2.79	-2.94	-2.20	-1.72	-1.80	-1.15	-2.25	-2.08	-1.64	-2.07	-0.33	2.16
	(-4.26)	(-4.81)	(-3.22)	(-2.99)	(-2.79)	(-2.32)	(-2.93)	(-3.64)	(-2.86)	(-4.35)	(-0.64)	(4.62)
NonJan	0.06	-0.23	-0.19	-0.04	-0.10	-0.11	-0.34	0.03	-0.21	-0.17	-0.23	0.07
	(0.49)	(-2.01)	(-1.66)	(-0.39)	(-0.90)	(-0.86)	(-3.07)	(0.29)	(-2.04)	(-1.25)	(-1.98)	(0.60)
Panel B: Value Weighted												
Lag	**-13**	**-14**	**-15**	**-16**	**-17**	**-18**	**-19**	**-20**	**-21**	**-22**	**-23**	**-24**
Overall	-0.17	-0.53	-0.24	-0.23	-0.22	-0.25	-0.16	-0.40	-0.23	-0.29	-0.11	0.57
	(-0.94)	(-2.97)	(-1.22)	(-1.33)	(-1.34)	(-1.42)	(-1.04)	(-2.49)	(-1.21)	(-1.77)	(-0.64)	(3.46)
January	-3.27	-3.18	-2.29	-0.55	-2.04	-1.20	-2.52	-2.17	-2.03	-1.38	-2.01	1.41
	(-5.31)	(-4.14)	(-3.10)	(-0.83)	(-2.85)	(-1.66)	(-3.93)	(-3.18)	(-3.45)	(-2.22)	(-2.50)	(2.01)
NonJan	0.11	-0.29	-0.06	-0.21	-0.05	-0.16	0.05	-0.24	-0.07	-0.19	0.06	0.50
	(0.58)	(-1.61)	(-0.29)	(-1.13)	(-0.32)	(-0.91)	(0.31)	(-1.48)	(-0.34)	(-1.13)	(0.33)	(2.94)
Lag	**-25**	**-26**	**-27**	**-28**	**-29**	**-30**	**-31**	**-32**	**-33**	**-34**	**-35**	**-36**
Overall	-0.42	-0.29	-0.43	-0.18	-0.08	0.01	-0.24	-0.22	0.02	-0.43	0.17	0.21
	(-2.39)	(-1.83)	(-2.37)	(-1.10)	(-0.43)	(0.05)	(-1.49)	(-1.48)	(0.15)	(-2.77)	(1.10)	(1.37)
January	-2.91	-1.60	-1.11	-1.65	-2.21	-2.59	-1.37	-1.56	-0.92	-1.04	-0.75	1.20
	(-2.97)	(-2.30)	(-1.60)	(-2.35)	(-2.91)	(-3.78)	(-1.96)	(-2.39)	(-1.86)	(-1.44)	(-1.23)	(1.71)
NonJan	-0.19	-0.17	-0.36	-0.04	0.12	0.24	-0.13	-0.10	0.11	-0.37	0.25	0.12
	(-1.16)	(-1.07)	(-1.97)	(-0.27)	(0.65)	(1.55)	(-0.83)	(-0.67)	(0.70)	(-2.40)	(1.60)	(0.77)
Lag	**-37**	**-38**	**-39**	**-40**	**-41**	**-42**	**-43**	**-44**	**-45**	**-46**	**-47**	**-48**
Overall	-0.15	-0.19	-0.21	-0.08	0.02	0.16	-0.01	-0.28	-0.05	-0.10	0.02	0.55
	(-1.03)	(-1.27)	(-1.30)	(-0.56)	(0.14)	(1.01)	(-0.08)	(-1.73)	(-0.35)	(-0.59)	(0.09)	(3.29)
January	-1.98	-1.86	-2.28	-1.12	0.05	-0.38	-1.39	-0.89	-0.25	-1.13	1.44	2.84
	(-2.82)	(-2.61)	(-3.53)	(-1.73)	(0.07)	(-0.51)	(-1.90)	(-1.42)	(-0.41)	(-1.84)	(2.32)	(4.53)
NonJan	0.01	-0.04	-0.02	0.01	0.02	0.21	0.11	-0.22	-0.03	-0.01	-0.11	0.35
	(0.08)	(-0.26)	(-0.12)	(0.08)	(0.12)	(1.31)	(0.69)	(-1.35)	(-0.22)	(-0.03)	(-0.66)	(2.00)
Lag	**-49**	**-50**	**-51**	**-52**	**-53**	**-54**	**-55**	**-56**	**-57**	**-58**	**-59**	**-60**
Overall	-0.36	-0.50	-0.04	-0.25	-0.70	-0.33	-0.31	-0.35	-0.10	-0.25	-0.04	0.35
	(-2.37)	(-3.39)	(-0.28)	(-1.58)	(-3.05)	(-1.87)	(-1.91)	(-2.33)	(-0.64)	(-1.33)	(-0.24)	(2.42)

January	-1.73	-1.95	-1.59	-1.00	-1.46	-0.91	-1.36	-1.48	-0.01	-1.04	0.70	2.37
	(-2.39)	(-2.90)	(-2.10)	(-1.61)	(-1.91)	(-1.46)	(-1.78)	(-2.17)	(-0.01)	(-1.80)	(1.39)	(4.13)
NonJan	-0.23	-0.37	0.09	-0.18	-0.64	-0.28	-0.22	-0.25	-0.11	-0.18	-0.10	0.17
	(-1.56)	(-2.48)	(0.60)	(-1.11)	(-2.63)	(-1.52)	(-1.33)	(-1.63)	(-0.69)	(-0.91)	(-0.65)	(1.13)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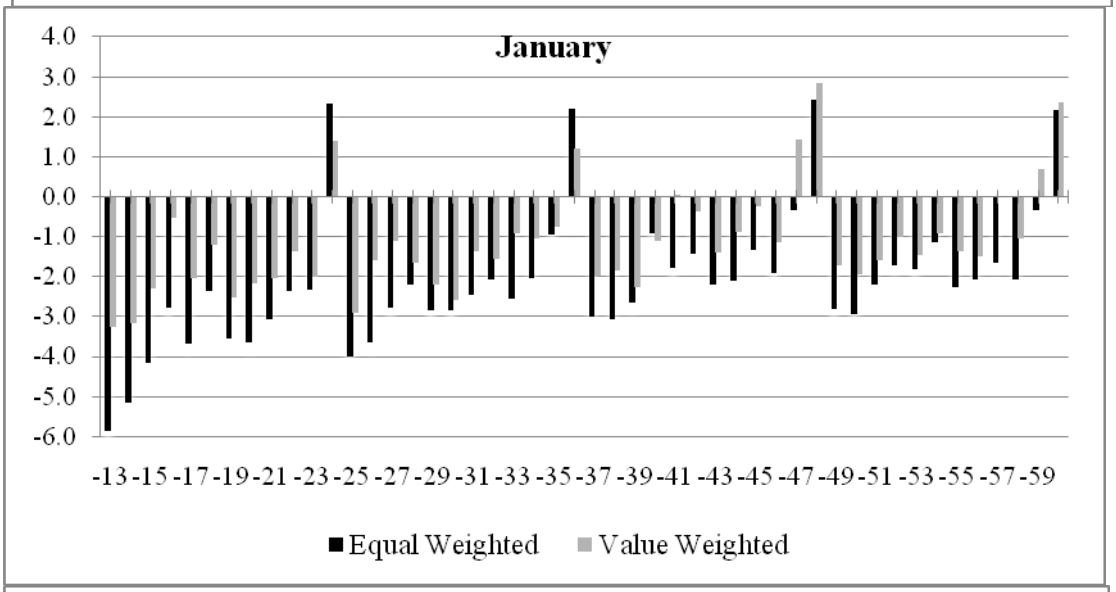
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-13 -15 -17 -19 -21 -23 -25 -27 -29 -31 -33 -35 -37 -39 -41 -43 -45 -47 -49 -51 -53 -55 -57 -59
Equal Weighted
Value Weighted


January
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3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
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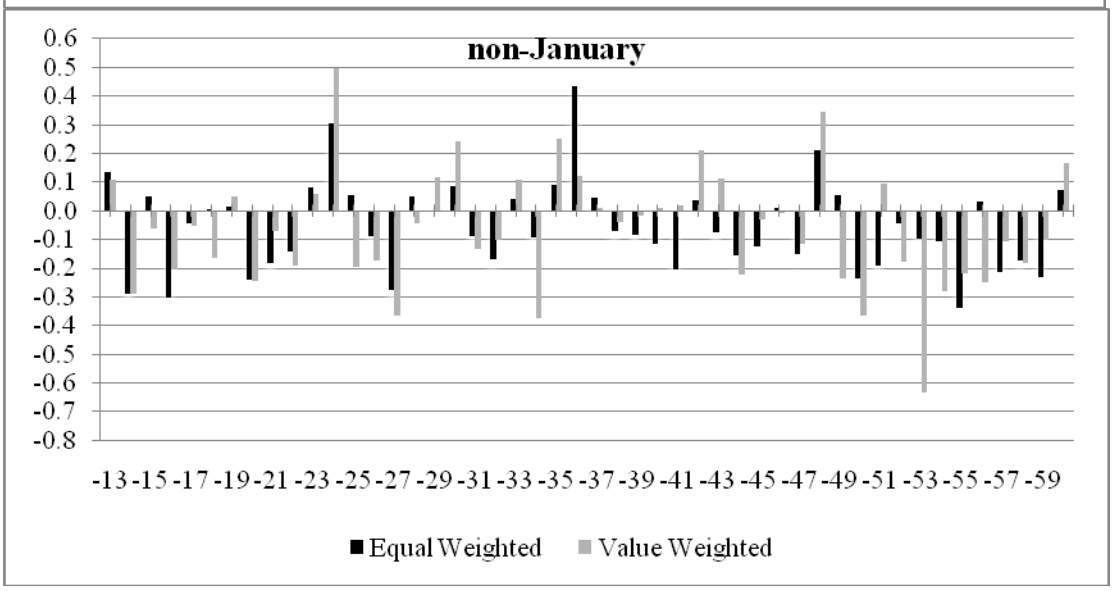
Equal Weighted
Value Weighted


non-January
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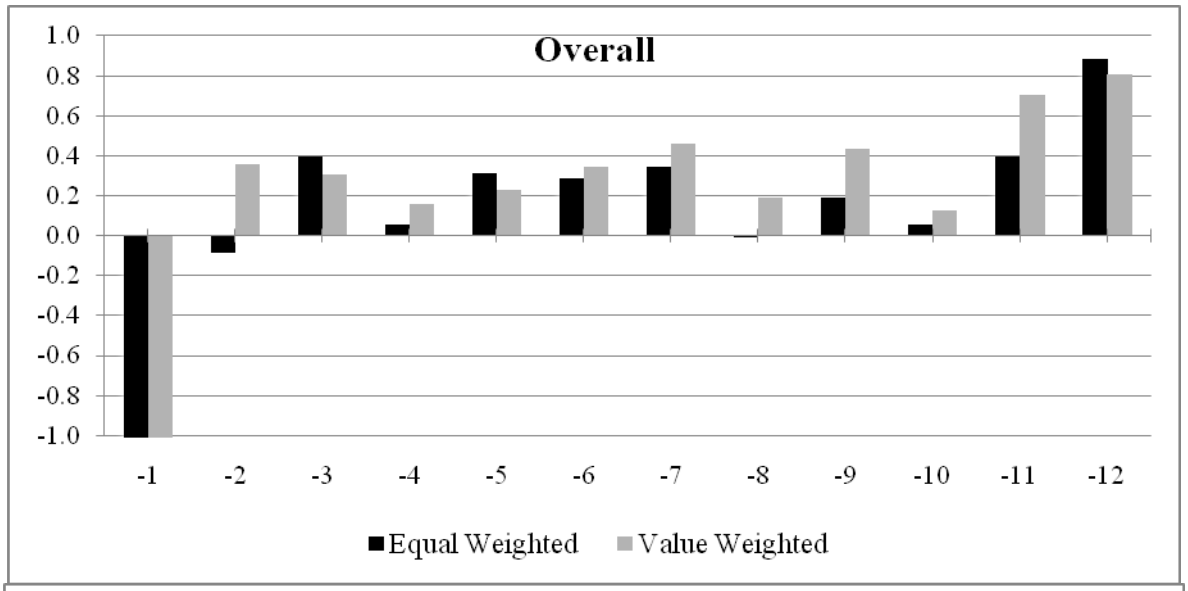
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-13 -15 -17 -19 -21 -23 -25 -27 -29 -31 -33 -35 -37 -39 -41 -43 -45 -47 -49 -51 -53 -55 -57 -59
Equal Weighted
Value Weighted

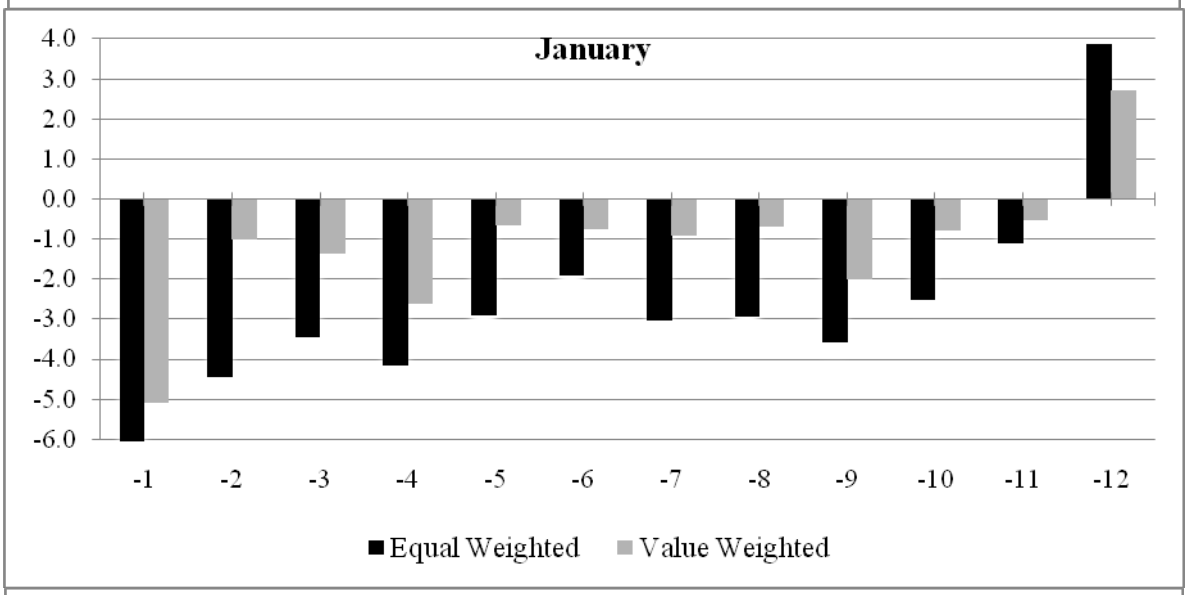
Figure 2

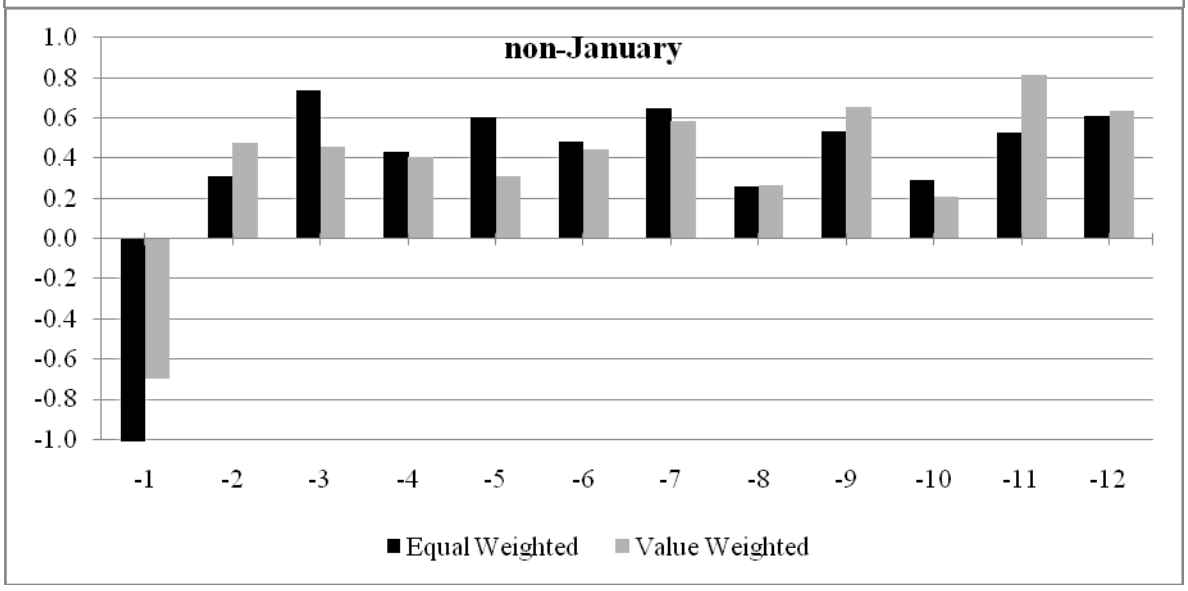
Short- and intermediate-term return autocorrelation. Figure 2 reports the average monthly returns (in percent) of zero-cost winner–loser portfolios. The table below shows the average monthly returns (in percent) of winner–loser portfolios and the associated *t*-statistics are in parentheses. Each month *t*, all NYSE and AMEX stocks on the CRSP's monthly files are ranked into ten deciles on the basis of returns in month *t* - *x*, where *x* ranges from one to 12. Winners and losers are defined as the top- and bottom-decile portfolios in a single month *t* - *x*. For example, if *x* is equal to six, winner–loser portfolios are formed according to the returns in month *t* - 6 (i.e., six-month lagged returns). Winner–loser portfolios are reformed at the beginning of every month and the investment period is one month (i.e., month *t*). Equal-weighted results are in black, while value-weighted results are in grey. *Overall* indicates that the investment period covers any calendar month; *January* means that the investment period includes only January; *non-January* suggests that the investment period can be any month outside of January. The sample period covers January 1926 to December 2009.

Note: in the graph, the one-month reversals of equal-weighted marginal strategies have extraordinarily large magnitudes of negative returns. For that reason, I truncated the returns that are much smaller in absolute magnitude than observed returns. The average monthly returns of the one-month reversals are −2.99%, −11.15% and −2.26% for the *overall*, *January*, and *non-January* investments, respectively.

Panel A: Equal Weighted												
Lag	**-1**	**-2**	**-3**	**-4**	**-5**	**-6**	**-7**	**-8**	**-9**	**-10**	**-11**	**-12**
Overall	-2.99	-0.08	0.39	0.05	0.31	0.28	0.34	0.00	0.19	0.06	0.39	0.88
	(-14.15)	(-0.53)	(2.39)	(0.34)	(2.12)	(1.83)	(2.36)	(-0.02)	(1.28)	(0.41)	(3.08)	(5.84)
January	-11.15	-4.45	-3.46	-4.14	-2.91	-1.92	-3.04	-2.94	-3.58	-2.50	-1.10	3.88
	(-8.43)	(-4.69)	(-4.15)	(-4.28)	(-4.14)	(-3.03)	(-4.19)	(-3.26)	(-5.53)	(-4.50)	(-1.89)	(4.52)
NonJan	-2.26	0.31	0.74	0.43	0.60	0.48	0.65	0.26	0.53	0.29	0.53	0.61
	(-12.61)	(2.20)	(4.66)	(3.13)	(4.18)	(3.07)	(4.64)	(1.69)	(3.64)	(2.02)	(4.12)	(4.30)
Panel B: Value Weighted												
Lag	**-1**	**-2**	**-3**	**-4**	**-5**	**-6**	**-7**	**-8**	**-9**	**-10**	**-11**	**-12**
Overall	-1.06	0.36	0.31	0.16	0.23	0.34	0.46	0.19	0.43	0.12	0.70	0.81
	(-5.26)	(1.88)	(1.61)	(0.83)	(1.17)	(1.72)	(2.52)	(0.98)	(2.36)	(0.69)	(4.09)	(4.23)
January	-5.11	-1.01	-1.37	-2.60	-0.65	-0.77	-0.92	-0.68	-1.99	-0.78	-0.53	2.72
	(-4.56)	(-1.16)	(-1.92)	(-2.86)	(-1.17)	(-1.11)	(-1.33)	(-0.82)	(-3.09)	(-1.29)	(-0.78)	(3.34)
NonJan	-0.70	0.48	0.46	0.41	0.31	0.44	0.58	0.27	0.65	0.21	0.82	0.64
	(-3.64)	(2.51)	(2.32)	(2.15)	(1.48)	(2.14)	(3.10)	(1.37)	(3.43)	(1.08)	(4.60)	(3.28)


Overall
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12
Equal Weighted
Value Weighted


January
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12
Equal Weighted
Value Weighted


non-January
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12
Equal Weighted
Value Weighted