Momentum and Insider Trading*

Qingzhong Ma
Cornell University

First draft: January 15, 2013
This draft: August 02, 2013

* I am grateful to Markus Broman (my EFMA discussant), David Feldman, George Gao, Ming Huang, Andrew Karolyi, Hyunseob Kim, Claire Liang, Edith Liu, Xiaomeng Lu, Pam Moulton, David Ng, Andrey Ukhov, Eric Yeung, Kelvin Chunhui Zhang, Wei Zhang, and participants at the Cornell finance brownbag seminar and the European Financial Management Association (EFMA) 2013 annual meeting at Reading, UK for helpful suggestions, discussions, and/or comments. I thank Ronnie Sadka for generously providing liquidity factor data and Jeffrey Wurgler for generously providing investor sentiment data on their respective webpages. All remaining errors are my own. This paper supersedes an earlier version titled "The coupling of momentum and reversal."
Ma (contact author): 435 B Statler Hall, Cornell University, Ithaca, New York, 14853. Email: qm26@cornell.edu, phone: (607) 255 8140.

Momentum and Insider Trading

Abstract

Both short-term momentum and long-term reversal are attributable to investors underreacting to preceding insider trading information. Past winners (losers) continue to earn significant positive (negative) returns in the short term only if their insider trading activity indicates positive (negative) information. Thus, short-term momentum is attributable to investors underreacting to insider information that confirms past return. In the long term, past winners (losers) earn significant negative (positive) returns only if their insider trading activity indicates negative (positive) information. Thus, long-term reversal is attributable to investors underreacting to insider information that disconfirms past return. After controlling for insider trading information, there is no evidence of overreaction. Further, there is a clear "division of labor" between stocks that contribute to momentum and stocks that contribute to reversal.

Key words:
Momentum, Reversal, Insider trading, Insider silence, Underreaction, Overreaction
JEL classifications: G12, G14, G18

1. Introduction

Jegadeesh and Titman (1993, JT thereafter) document that a strategy of buying past winners and selling past losers generates significant profits in the short term (six to 12 months), which reverse over the long term. After carefully ruling out other potential sources of momentum profits, JT (1993, p.75) conclude that momentum is related to market underreaction to firm-specific information. At the same time, the long-term reversal of momentum profits is also consistent with delayed overreaction, when investors push the price away from the fundamentals, leading to reversal in the longer term. This momentum effect is considered the strongest evidence against the efficient market hypothesis, and for this reason momentum has been the center-stage anomaly of recent years (Fama and French, 2008) and attracted substantial research, both empirical and theoretical (JT, 2011). Yet, as JT (2011) summarize, financial economists are far from reaching a consensus on what drives momentum. In this paper we study whether insider trading information sheds new light on the two behavioral views of momentum: underreaction and overreaction. Specifically, we examine whether the subsequent returns of past winners and losers are systematically related to preceding insider trading information.

We bring in insider trading to the context of momentum as a potential source of private information that helps explain future returns. Corporate insiders are in a unique position between the firm and stock market, because they have favored access to private information of a firm, of which they are allowed to trade shares, to the legally permissible extent (e.g., Cohen, Malloy, and Pomorski, 2012). This special position makes insider trading activity potentially a rich source of private information that predicts future returns. In this paper we test whether momentum, the return continuation of past winners and losers, is attributable to investors underreacting to the information contained in preceding insider trading activity. If investors underreact to insider trading information, the subsequent (short- or long-term, or both) returns of past winners and losers are expected to be systematically related to preceding insider trading information. Conversely, if momentum is due to investor overreaction, the short- and long-term returns are expected to be negatively correlated.

For parsimony we characterize a firm's insider trading information as either positive or negative. Conventional wisdom suggests that insider net buying (selling) would proxy for positive (negative) private information. That is, if insiders possess positive (negative) private information they choose to buy (sell) shares. When the regulatory and litigation risk associated with insider trading is taken into account, however, this view is incomplete. In this paper we consider insiders' decision to keep silent. That is, insiders choose not to trade (neither buy nor sell) when expecting high litigation risk. This concern for litigation risk is asymmetric between buying and selling and is particularly strong for insider sales.[1] Thus, when the private information is negative and insiders anticipate possible large price drop in the future, they do not sell. This is because shareholders and their lawyers launch securities class-action lawsuits following large stock price declines on the basis of Rule 10b-5, mostly alleging that corporate insiders had foreknowledge about the information that led to the price decline but failed to promptly disclose it to the market.[2] In such cases, insiders' selling activity would be taken as evidence that insiders had the foreknowledge about the adverse information.[3] So, *ex ante,* the best course of action for insiders is not to sell, as lack of insider selling undercuts plaintiffs' allegation that insiders knew the information.[4] Neither would they buy, given the negative prospects. As a result, the high litigation risk associated with selling on negative information induces rational insiders not to trade at all. Therefore, insider silence (no insider trading activity) is a proxy for negative private information, and the existence of insider trading (either net buying or net selling) is a proxy for (relatively) positive information.

Our empirical work starts with forming four portfolios by a two-way sort on past insider trading activity (silence or traded) and past returns (winners or losers). Specifically, among past winners or losers we form "traded" and "silence" groups based on whether insider trading activity exists over the past six

[1] See Bettis, Coles, and Lemmon (2000), Ke, Huddart, and Petroni (2003), Cheng and Lo (2006, p. 821), Piotroski and Roulstone (2008), Rogers (2008, p. 1269), Lee, Lemmon, Li, and Sequeira (2012), among others.
[2] See O'Brien and Hodges (1991), Francis, Philbrick, and Schipper (1994), Skinner (1994), among others. For a recent example of securities class-action lawsuits following large stock price declines, see the case involving Yum! Brands: http://securities.stanford.edu/1050/YUM00_01/index.html.
[3] See Grundfest and Perino (1997), Niehaus and Roth (1999), Johnson, Nelson, and Pritchard (2007, p. 642), Rogers (2008), Rogers, Van Burskirk, and Zechman (2011, p.2157), among others.
[4] Niehaus and Roth (1999, p. 68) find that insider selling increases the probability of CEO turnover among firms involved in shareholder class action lawsuits.

months. The "traded" groups consist of stocks (of past winners or losers) that insiders have traded in the past and the "silence" groups consist of stocks that no insider trading activity exists over the past six months.[5] The four portfolios are: traded winners (past winners with positive insider information), silence winners (past winners with negative insider information), traded losers (past losers with positive insider information), and silence losers (past losers with negative insider information).

These four portfolios are used to test underreaction directly.[6] If momentum is due to investors underreacting to insider trading information, the subsequent returns of the portfolios should be systematically related to insider trading information. Specifically, among past winners, firms with negative insider trading information underperform those with positive insider trading information; among past losers, firms with negative insider trading information underperform those with positive insider trading information. That is, the silence-traded spread is negative for both past winners and past losers. On the other hand, if momentum is due to investors overreacting to past information, stronger momentum in the short term should be followed by stronger reversal in the long term. That is, the silence-traded spreads should carry opposite signs between the short and long terms. If the silence-traded spread is negative in the short term, the overreaction view predicts a positive silence-traded spread in the long term.

We form monthly portfolios from January 1989 to December 2007, based on which we examine future returns over the subsequent five years (up to December 2012). We define the short and long terms as the 1st and the subsequent four (2nd to 5th) years, respectively, following portfolio formation.[7] Although the sample is relatively short and recent, we confirm first the basic empirical regularity of significant short–term momentum profits, which are reversed in the long term. The reversal, however, only exists among past losers.

[5] We also examine the difference between cases involving insider net buying and selling. Their differences are, however, economically smaller than those between the silence and traded portfolios. See Table 3 Panels C & D.

[6] Throughout this paper we use the aggregated insider trading activity over a period in the past as a source of private information insiders possess. We do not examine insiders' trading decisions conditional on past returns. Neither do we explore how some insiders are better informed than others (e.g., Cohen, Malloy, and Pomorski, 2012).

[7] In our main analysis the short and long terms are defined as the 1st year and the subsequent four (2nd to 5th) years, respectively. Our conclusions are robust to whether the short term is defined as six or 12 months and to whether the long term goes to two, three, four, or five years.

The main findings are based on the four portfolios, summarized as follows. First, short-term returns are systematically related to insider trading information. Specifically, among past winners (or losers), the silence portfolio significantly underperforms the traded portfolio in the short term. This finding is consistent with underreaction. That is, investors in both past winners and losers have underreacted to insider trading information, which is reflected in future returns.

Second, surprisingly, the silence portfolios continue to underperform the corresponding traded portfolios over the long term, a result that holds in both past winners and losers. This result suggests that the long-term returns are also attributable to investors underreacting to insider trading information. In addition, this result rejects the overreaction view. If momentum is due to investors overreacting to past information, stronger short-term momentum should be followed by stronger long-term reversal. That is, the silence-traded spreads should carry opposite signs between the short and long terms. The finding that they carry the same (negative) signs rejects overreaction.

Third, past winners (losers) continue to earn significant positive (negative) returns in the short term only if their insider trading activity indicates positive (negative) information. Thus, short-term momentum is attributable to investors underreacting to insider trading information that confirms past return.[8] Over the long term, past winners (losers) earn significant negative (positive) returns only if their insider trading activity indicates negative (positive) information. Thus, long-term reversal is attributable to investors underreacting to insider trading information that disconfirms past return.

Fourth, there is a clear "division of labor" between stocks that contribute to short-term momentum and stocks that contribute to long-term reversal. It is well documented that the winner-minus-loser portfolio exhibits strong short-term momentum and long-term reversal, a pattern that holds in our sample as well. This inter-temporal pattern, however, does not emerge in any of the four sub-portfolios conditional on insider trading information. Instead, stocks that exhibit strong short-term momentum do

[8] Insider information is characterized as "confirming" past return if it is of the same direction as that of past return. That is, positive (negative) insider information confirms strong (poor) past return. Insider information is characterized as "disconfirming" past return if it is of the opposite direction as that of past return. That is, positive (negative) insider information disconfirms poor (strong) past return.

not experience long-term reversal, while stocks that experience strong long-term reversal do not exhibit strong short-term momentum. Thus, the well-documented inter-temporal pattern of short-term momentum followed by long-term reversal is a result of aggregating stocks that either exhibit short-term momentum only or experience long-term reversal only, but not both.

The main results survive numerous robustness checks. They are robust to alternative methodologies of measuring abnormal returns (cumulative abnormal returns, buy-and-hold abnormal returns, or average monthly alphas after adjusting for risk factors), and alternative windows to measure past insider trading activity and past return (six or 12 months). They hold whether or not a month is skipped between the periods to measure past and future returns. Further, the findings remain strong after accounting for the impact of market return, investor sentiment, trading volume, nearness to 52-week high, and intermediate horizon returns.

Beyond reporting new results of momentum based on conditional information (e.g., Lee and Swaminathan, 2000; Lewellen, 2002; George and Hwang, 2004; Gutierrez and Prinsky, 2007; Conrad and Yavuz, 2012), this paper contributes to the literature by suggesting a new unified perspective on momentum and reversal. Both momentum and reversal are attributable to investors underreacting to information contained in insider trading activity. Momentum is attributable to investors underreacting to insider trading information that confirms past return, and reversal is attributable to investors underreacting to insider trading information that disconfirms past return. After controlling for insider trading information, there is no evidence of overreaction. Further, there is a clear "division of labor" between stocks that contribute to short-term momentum and stocks that contribute to long-term reversal.

This paper is related to two recent papers that build on the phenomenon of insider silence. Gao and Ma (2012) report that insider silence predicts extreme negative future returns among heavily shorted stocks; Ma and Ukhov (2013) find that the negative returns associated with insider silence partially explain a broad set of return anomalies. It is worth noting that this insider silence phenomenon is not our focus. Rather, we use it as a proxy for insider information to shed light on momentum (and reversal). Thus, a full-fledged examination of insider silence is not pursued here, and we are open to alternative

stories that relate insider silence to future returns. Also, while momentum is one of the anomalies examined in Ma and Ukhov (2013), they are silent on the long-term reversal. Our paper contributes to the literature by providing a unified perspective on both short-term momentum and long-term reversal.

2. Literature and hypotheses

2.1. Momentum

JT (1993) document that a portfolio strategy that buys stocks with high past returns and sells stocks with low past returns earns significant positive returns over the subsequent six to 12 months. This phenomenon appears pervasive and persistent. It is found in international markets (Rouwenhorst, 1998; Griffin, Ji, and Martin, 2003; Chui, Titman, and Wei, 2010), in other asset classes (Bhojraj and Swaminathan, 2006; Asness, Moskowitz, and Pedersen, 2013; Gorton, Hayashi, and Rouwenhorst, 2013; Jostova, Nikolova, Philipov, and Stahel, 2013), and in industries (Moskowitz and Grinblatt, 1999). It survives out-of-sample tests (Carhart, 1997; JT, 2001; Grundy and Martin, 2001; Chabot, Ghysels, and Jagannathan, 2009). Even more puzzling, the positive significant momentum profits in the first six to 12 months tend to reverse in the long term (e.g., JT, 1993; 2001).

It remains unclear why short-term momentum profits exist and why they reverse in the long term (JT, 2011). Rational theories argue that short-term momentum profits are due to cross-sectional variations in expected returns (Lo and MacKinlay, 1990; Conrad and Kaul, 1998), time-variation in expected returns (Berk, Green, and Naik, 1999; Johnson, 2002; Chordia and Shivakumar, 2002; Sagi and Seasholes, 2007), excess covariance (Lewellen, 2002), trading costs (Korajczyk and Sadka, 2004), macroeconomic risk (Liu and Zhang, 2008), or investment (Liu and Zhang, 2011). As JT (2001; 2011) argue, however, rational theories cannot explain long-term reversal, and behavioral models are more promising in explaining both short-term momentum and long-term reversal. Two possible behavioral biases can lead to price momentum: underreaction and overreaction. JT (1993), Chan, Jegadeesh, and Lakonishok (1996), Barberis, Shleifer, and Vishny (1998), Hong and Stein (1999), and Vayanos and Woolley (2013) characterize momentum as an underreaction. Grinblatt and Han (2005) use the disposition effect to

explain momentum. Conversely, De Long, Shleifer, Summers, and Waldman (1990) and Daniel, Hirshleifer, and Subrahmanyam (1998) attribute return continuation to investor overreaction.

2.2. Insider trading and insider silence

It is long been documented in the literature that insiders possess private information that is not incorporated in stock prices and the information is reflected in insiders' trading activity (e.g., Seyhun, 1990; Rozeff and Zaman, 1998; Lakonishok and Lee, 2001; Jenter, 2005; Piotroski and Roulstone, 2005; Sias and Whidbee, 2010; Cohen, Malloy, and Pomorski, 2012).

What we bring in that is new to the literature is the possibility of insider silence. That is, insiders choose not to trade. We argue that insider silence is informative based on the fact that insider trading is regulated and subject to shareholder litigation (at least in the United States). Due to the risk of regulatory action and shareholder litigation associated with insider trading, insiders choose not to trade (neither buy nor sell) when the expected litigation risk is high. This concern for litigation risk is asymmetric between buying and selling and is particularly strong for insider sales.[9] Thus, when the private information insiders possess is negative and insiders anticipate possible large price drop in the future, they do not sell. This is because shareholders and their lawyers launch securities class-action lawsuits following large stock price declines on the basis of Rule 10b-5, mostly alleging that corporate insiders had foreknowledge about the information that led to the price decline but failed to promptly disclose it to the market.[10] In such cases, insiders' selling activity would be taken as evidence that insiders had the foreknowledge about the adverse information.[11] So, *ex ante*, the best course of action for insiders is not to sell, as lack of insider selling undercuts plaintiffs' allegation that insiders knew the information.[12] Neither would they buy, given the negative prospects. As a result, the high litigation risk associated with selling on negative information induces rational insiders not to trade at all. Therefore, insider silence (no insider trading activity) is a

[9] See Bettis, Coles, and Lemmon (2000), Ke, Huddart, and Petroni (2003), Cheng and Lo (2006, p. 821), Piotroski and Roulstone (2008), Rogers (2008, p. 1269), Lee, Lemmon, Li, and Sequeira (2012), among others.
[10] See O'Brien and Hodges (1991), Francis, Philbrick, and Schipper (1994), Skinner (1994), among others.
[11] See Grundfest and Perino (1997), Niehaus and Roth (1999), Johnson, Nelson, and Pritchard (2007, p. 642), Rogers (2008), Rogers, Van Burskirk, and Zechman (2011, p.2157), among others.
[12] Niehaus and Roth (1999, p. 68) argue that insider selling increases the probability of CEO turnover whose firm is involved in shareholder class action lawsuits.

proxy for negative private information, and the existence of insider trading (either net buying or net selling) is a proxy for (relatively) positive information.

Several recent working papers find that insider silence is related to negative future returns. Gao and Ma (2012) find that insider silence predicts extreme negative future returns among heavily shorted stocks; Ma and Ukhov (2013) report that the negative returns associated with insider silence explain a significant portion of the negative returns in the short legs of a broad set of return anomalies.[13]

2.3. Momentum and insider trading information

In this paper we bring in insider trading, including the choice of not trading, as a source of private information to shed light on the underreaction and overreaction views of momentum. We test whether momentum, the return continuation of past winners and losers, is attributable to investors underreacting to the information contained in preceding insider trading activity. If investors underreact to insider trading information, the subsequent (short- or long-term, or both) returns of past winners and losers are expected to be systematically related to preceding insider trading information. Conversely, if momentum is due to investor overreaction, the short- and long-term returns are expected to be negatively correlated.

3. Sample and data

The sample is based on all NYSE/Amex/NASDAQ common stocks (share code 10 or 11) covered in CRSP/Compustat merged database from January 1989 to December 2007, a total of 228 year/month cross-sections. The sample starts from 1989 when insider trading data is available and ends in 2007 so that we examine subsequent five-year event returns up to 2012.

To ensure that our results are compatible with JT (2001), we choose to apply the same filters as in JT (2001). Specifically, we exclude stocks whose prior month-end price is lower than $5 and stocks that would be classified into the lowest NYSE market capitalization decile.[14] We also exclude firms with

[13] For parsimony, our main analyses focus on insiders' decision to trade or not. As shown in Table 3 Panels C and D, distinguishing between net buying and net selling does not reveal additional significant insights.

[14] These two restrictions eliminate low-price and small stocks, which are likely to have low past returns. As a result, the average trailing six-month return of the remaining stocks is 12.7% (see Table 1). Without these restrictions the average would be 7.6%. Further, since insiders' buying and selling activities are more informative among small firms (e.g., Lakonishok and Lee, 2001; Sias and Whidbee, 2010), excluding these firms reduces the return

missing or non-positive book value of equity. We obtain stock return data from the Center for Research in Security Prices (CRSP) at the University of Chicago and accounting data from Compustat. We follow Fama and French (1992) to construct firm size and B/M ratio, and JT (2001) to estimate past returns and form portfolios. Past return of month *j* is estimated as the buy-and-hold returns over the past six months (from month *j*-6 to *j*-1). We require that stock returns exist in each month over the past six months.

We obtain insider trading data from Thomson Reuters Insider Filing Data Feed. The Securities and Exchange Commission (SEC) mandates that officers and directors, large shareholders (those who own 10% or more of the outstanding shares), and affiliated shareholders report their transactions to the SEC by the 10th of the month following the transactions (prior to August 2002) or within two days (since August 2002). The database cleaning process largely follows recent studies (e.g., Rozeff and Zaman, 1998; Lakonishok and Lee, 2001; Piotroski and Roulstone, 2005; Sias and Whidbee, 2010).[15] Defined in equation (1), the net insider demand (NID) for month *j* is the total number of shares insiders buy minus the total number of shares insiders sell over the past six months, normalized by the total number of shares outstanding at the end of month *j*-1. Our main results are robust to an alternative window of 12 months.

$$\mathrm{NID_j} = \frac{\#\ \text{shares insiders buy}_{\mathrm{j-6,j-1}} - \#\ \text{shares insiders sell}_{\mathrm{j-6,j-1}}}{\#\ \text{shares outstanding}_{\mathrm{j-1}}} \quad (1)$$

We then use past returns and past insider trading information to form portfolios. Following the literature, we assign stocks with past six-month returns ranked in the top and bottom deciles to the "winner" and "loser" portfolios, respectively. Stocks with no insider trading activity *reported*[16] over the past six months form the "silence" portfolio, and stocks with any past insider trading activity form the "traded" portfolio. For completeness we also define "buy" and "sell" portfolios, which consist of stocks

predictability following insiders' buying and selling activities (see Table 3 panels C and D). Our main findings are robust when these restrictions are relaxed. See the robustness section and Table 11 for details.

[15] We follow the literature (e.g., Lakonishok and Lee, 2001; Sias and Whidbee, 2010) to "clean" the insider trading data. Specifically, we use the following filters. We delete duplicate and amended records and records with cleanse code of "S" or "A" are deleted. Transaction price must be available, and we delete records if the number of shares in a transaction is below 100. The transaction code is either "P" or "S" for stock transactions and "M" for options exercised. We delete transactions that involve more than 20% of total shares outstanding, and delete records if the transaction price is outside the 80%–120% range of the CRSP end-of-day stock price.

[16] We use *report* date to ensure that the information extracted from insider trading activity is public information by the time of portfolio formation. Results are robust if we use transaction date instead.

with positive and non-positive NID, respectively. The intersection between past returns and past insider trading information then forms four portfolios: silence winners, traded winners, silence losers, and traded losers. Future returns start from month *j*. All variables are defined in the Appendix. It is worth noting that past return and past insider trading activity are *public* information by the time of portfolio formation.

Figure 1 presents, month by month from January 1989 to December 2007, the proportion of firms with insider net selling, net buying, and insider silence over the trailing six-month period. The proportion of insider silence is over 40% in the early time and generally declines over time. The sample average proportion of insider silence is 27.3%. Insider net selling is more frequent than net buying.

[Insert Figure 1 about here]

Table 1 shows summary statistics of the sample and the sub-portfolios sorted on past returns and past insider trading information. The group of past winners (losers) consists of stocks with trailing six-month return in the highest (lowest) decile. The group "middle groups" include all stocks in the 2nd to 9th deciles. For all stocks, the average return over the trailing six months is 12.7%. This average return is higher than one would expect, mainly because the sampling procedure (following JT, 2001) eliminates low-price and small stocks, which are likely to have low past returns. Section 6 (Table 11) shows that our main results hold when this restriction is relaxed. The sample average NID over the trailing six months is -0.337%, consistent with insiders on average being net sellers. The average six-month NID is also comparable to the literature. For example, Sias and Whidbee (2010, p.1551) estimate an average quarterly NID of -0.145%, approximately half of our six-month measure. NID is more negative for past winners (-0.663%) than past losers (-0.308%), consistent with the literature that the contemporaneous correlation between net insider demand and stock returns is negative (e.g., Sias and Whidbee, 2010). Both past winner and loser stocks are relatively small and have lower book-to-market values (JT, 2001). Conditional on past returns, the "silence" groups have smaller sizes but higher B/M ratios than their corresponding "traded" groups. In addition, the "buy" groups are smaller firms with higher B/M ratios, consistent with the notion that insiders of larger firms tend to sell and insiders are contrarian (Seyhun,

1986; Rozeff and Zaman, 1998; Piotroski and Roulstone, 2005). The evidence on firm characteristics also suggests that we control for size and B/M when examining future returns.

[Insert Table 1 about here]

4. Results

We examine event returns of past losers and winners. We follow the literature (e.g., JT, 2001) and define the first year as the short term and the subsequent four (2^{nd} to 5^{th}) years as the long term. Our conclusions are robust to whether the short term is defined six or 12 months and to whether the long term is defined up to two, three, four, or five years.

4.1. Returns of past winners and losers

For stocks in the extreme and middle deciles formed on past return, Panel A of Table 2 presents their time-series averages of equal-weight cross-sectional average returns for the first to fifth 12-month periods following portfolio formation.[17] The t-statistics in square brackets are based on Newey-West standard errors. Loser stocks earn 6.10% in the first year following portfolio formation and a cumulative 68.77% over the subsequent four years; winner stocks earn 16.36% over the first year and 57.12% over the subsequent four years; and the winner-minus-loser portfolio earns 10.26% in the first year. Over the subsequent four years the returns are -5.65%, -8.01%, 2.75%, and -0.74%, respectively, resulting in a cumulative return of -11.65%. Although the cumulative returns over the 2^{nd} to 5^{th} years are only marginally significant (t= -1.73, with Newey-West adjustment of 47 lags), the negative returns over the long term do reverse the short-term returns in the first year. This pattern is largely consistent with the prior literature (e.g., JT, 1993; 2001; Lee and Swaminathan, 2000, p. 2025).[18]

As shown in Table 1, past winners and losers have different characteristics such as size and B/M ratio. We examine returns of these portfolios after adjusting for size and B/M. The procedure is described

[17] Our sample also generates results very close to JT (2001, Table 5). For confirmation purpose only, these results are not reported but available upon request.

[18] Following the same approach we further confirm that the winner-minus-loser portfolio return for the 1965-1981 sample period is 11.81% (t= 4.22) in year one, followed by -12.30% (t= -2.39) over the subsequent four years; for the 1982-1998 sample period the short- and long-term returns are 12.23% (t= 5.60) and -1.22% (t= -0.21), respectively; for 1965-1998 sample period the short- and long-term returns are 12.02% (t= 6.77) and -6.76% (t= -1.57), respectively. These results are largely consistent with the prior literature (e.g., JT, 2001).

in the Appendix. Panel B of Table 2 shows the results. For past loser stocks, their short-term abnormal returns are -4.43% (t= -3.83), followed by cumulative long-term abnormal returns of 10.98% (t= 2.97) over the subsequent four years, suggesting that there is short-term momentum and long-term reversal for past loser stocks. For past winners, the first-year abnormal returns are 3.85% (t= 2.08), consistent with the general pattern that past winners continue to perform well in the short term. There is, however, no reversal in the long term. Instead, the long-term return is a positive 6.45% (t= 1.61). The winner-minus-loser portfolio exhibits the well-documented pattern of short-term momentum (8.28% with t= 3.29) and long-term reversal (-4.54% with t= -1.28). Figure 2 plots the cumulative returns to the winner-minus-loser portfolio over the subsequent five years following portfolio formation, which shows a familiar pattern of strong momentum in the short term followed by reversal in the long term.

[Insert Table 2 & Figure 2 about here]

4.2. Portfolios formed on past return and past insider trading information

We now break down stocks of past winners and past losers by their insider trading information over the trailing six months and examine their future returns. Specifically, among past winners or losers, the "silence" portfolio consists of stocks that insiders do not trade over the past six months; the "traded" portfolio consists of stocks that insiders trade over the past six months. We call these portfolios silence winners, traded winners, and so on. With these portfolios we test the implications of the underreaction and overreaction views. The underreaction view predicts that the silence-traded spread is negative; the overreaction view predicts that the silence-traded spread over the long term has an opposite sign to that of the spread over the short term. Thus, if the silence-traded spread is negative over the short term, the overreaction view predicts that it is positive over the long term. Results are shown in Table 3.

Panel A of Table 3 presents, for the portfolios among past winners, their time-series averages of equal-weight mean abnormal returns over the short term (1st year), long term (2nd to 5th years), and each of the four years during the long-term period. For the purpose of comparing between the subsamples and the whole sample of past winners, we also present results for all past winners, in the row "All." Average number of stocks in each portfolio is shown in parentheses. The last two rows in Panel A present the

silence-traded spreads with t-stats in brackets. All tests are based on Newey-West standard errors. Column "Yr 1" shows that silence winners earn 0.61% (not statistically significant) over the short term while traded winners earn 5.48% (significant at the 1% level), resulting in a significant silence-traded spread of -4.87% (t=-3.66). The significant negative silence-traded spread in the short term suggests that investors underreacted to insider trading information and the underreaction is being corrected over the short term. The second column in Panel A shows the long-term returns of the portfolios. Over the long term, silence winners earn a significant -8.13% and traded winners earn a significant 11.11%, resulting in a significant silence-traded spread of -19.24% (t=-4.28). This result has two implications. First, the correction of underreaction to insider trading information continues into the long term. Thus, the long-term return also reflects the market's correction of underreaction to insider trading information. Second, it rejects the overreaction view. The overreaction view predicts that the silence-traded spreads carry opposite signs between the short and long terms. Thus, given a negative silence-traded spread over the short term, the long-term spread should be positive. The spread is not positive, but negative and significant, rejecting the overreaction view.

Panel B of Table 3 is similarly structured as Panel A but focuses on past losers. The first column shows that silence losers earn a significant -9.97% while the traded losers earn a small, marginally significant -1.93% in the short term, resulting in a significant silence-traded spread of -8.04% (t= -6.93). This result is consistent with the view that investors of past losers underreact to insider trading information. The second column in Panel B shows the long-term returns. Over the long term, silence losers earn a small, marginally significant -3.12% while traded losers earn a significant positive 16.86%, resulting in a significant silence-traded spread of -19.99% (t= -6.00). The significant negative silence-traded spread over the long term suggests that the long-term returns of past losers are also attributable to investor underreaction to insider trading information. Further, this result rejects the overreaction view, as the overreaction view would predict a positive silence-traded spread over the long term.[19]

[19] For completeness we also run the same analysis as in Panels A and B of Table 3 for all the middle deciles (from decile 2 to 9) and find that the silence-traded spreads are negative and significant in both the short term (-3.61% with

Since no theory specifies at which time point reversal starts or ends, it is important to check whether our results hold for alternative definitions of the short and long terms. The last four columns of Panels A and B present, year by year, the abnormal returns over the subsequent four years. The silence-traded spreads over each of the four years, for both past winners and losers, are negative and significant, suggesting that underreaction is supported and overreaction is rejected regardless of whether the long term is defined as short as one year (the 2nd year) or as long as four years (2nd to 5th years).[20]

[Insert Table 3 about here]

For completeness, Panels C and D of Table 3 show results for the "buy" and "sell" portfolios and the spreads between the two. The "buy" and "sell" portfolios consist of stocks that insiders net buy and sell over the past six months, respectively. In Panel C, both "buy" and "sell" winners earn significant short- and long-term returns, similar to the combined "traded" portfolio. The "buy" and "sell" portfolios of past losers also exhibit similar patterns as the "traded" losers. Furthermore, the buy-sell spreads are in general statistically less significant and economically smaller than the corresponding silence-traded spreads. For instance, the silence-traded spread for past losers over the long term (2nd to 5th years) is -19.99% (t=-6.00) while the corresponding buy-sell spread is only -5.97% (t=-1.74).[21] Overall, the evidence in Panels C and D indicates that more of the information in insider trading activity resides in the silence-traded spread, not the buy-sell spread. Further, in an unreported analysis we split the "sell" and

t=-6.09) and the long term (-12.31% with t=-4.18). Unreported for brevity, this result is consistent with our prior that insider silence is a proxy for negative insider information and the existence of insider trading activity is a proxy for relatively positive insider information. We also checked the results by forming quintiles instead of deciles based on past returns. The results are similar in that the silence-traded spreads are negative and significant over the short and long terms for both past winners (top quintile) and past losers (bottom quintile).

[20] Splitting the first year into two six-month periods does not alter the conclusion. Specifically, silence winners earn 1.91% and -1.30% during the two six-month periods, respectively; traded winners earn 4.16% and 1.32% during the two six-month periods, respectively. The silence-traded spreads are -2.25% and -2.62% (both significant at the 1% level) during the two six-month periods, respectively. Similarly, the silence-traded spreads among past losers are -3.36% and -4.68% (both significant at the 1% level) during the two six-month periods, respectively. Unreported for brevity, the evidence on the two six-month periods suggests that underreaction is supported and overreaction is rejected whether the short term is defined as six or 12 months.

[21] A negative buy-sell spread might seem surprising. It is mainly due to the sampling procedure, which follows JT (2001). In the sampling, we eliminate the low-priced and small-cap stocks, among which insiders' buying and selling activities have stronger predictive power for future returns. Indeed, as shown in the robustness section, when we relax the sampling restriction and include the small-cap firms, the first-year buy-sell spreads are 4.24% (t= 3.35) for past winners and 0.92% (t=0.93) for past losers, which are more consistent with the prior literature (e.g., Lakonishok and Lee, 2001; Sias and Whidbee, 2010). See Table 11 for more details.

"buy" portfolios each into two equal-size portfolios. In general, the spreads between the finer portfolios are relatively small compared to the silence-traded spreads. As such, for parsimony our subsequent discussions mainly focus on the silence and traded portfolios.

4.3. Earnings announcement returns

To further investigate whether investors underreact to information contained in insider trading and whether they are systematically surprised when the relevant information is subsequently disclosed to the market, we extract quarterly earnings announcement dates from Compustat and calculate three-day announcement period abnormal returns adjusted by CRSP equal-weight daily market returns (i.e., an event window [-1, +1] covering one trading day before and one day after the earnings announcement date). For each of the portfolios, we then calculate the average three-day abnormal returns of its earnings-announcement firms during each of the subsequent five 12-month periods. If investors underreact to insider trading information, we expect that the silence-traded spread in earnings announcement returns is negative. If, however, investors overreact in the short term, we expect that the silence-traded spread carries opposite signs between the short and long terms.

Table 4 presents the time-series averages of the cross-sectional mean earnings announcement period abnormal returns. Panel A shows a significant earnings announcement return of -0.22% for silence winners, while for the traded winners the average announcement return is only 0.04%, which is not statistically significant, resulting in a significant negative silence-traded spread of -0.26% (t=-2.77). Note that the negative return of -0.22% for silence winners is economically significant, as compared to the annual cumulative abnormal return of 0.61%. The result suggests that by the time of portfolio formation, investors of past winners have underreacted to the negative information contained in insider silence. When the negative information is subsequently released to the market in earnings announcements, investors are surprised, resulting in significant negative market reactions.

Evidence of underreaction continues over the subsequent four years, as shown in the second column of Table 4. Panel A shows that the silence winners continue to surprise investors with a significant average abnormal return of -0.21% around earnings announcements. The silence-traded spread

over the long term is a significant -0.28% (t=-7.48), suggesting that the correction of underreaction continues over the long term. This result is inconsistent with the overreaction view, which predicts that the silence-traded spread is positive over the long term, reversing a negative spread in the short-term.

Panel B shows a similar pattern among past losers. The silence losers are associated with significant negative earnings announcement returns over the short and long terms; the traded losers are associated with small negative surprises over the short term but significant positive surprises over the long term. The silence-traded spreads are negative and significant in both the short and long terms, a result consistent with investors underreacting to insider trading information. Conditional on insider trading information, there is no evidence of overreaction.

[Insert Table 4 about here]

5. Discussion

The results in Tables 3 and 4 suggest a new perspective that both momentum and reversal are attributable to investors underreacting to information contained in preceding insider trading activity. In this section we discuss how the new perspective reconciles with prior findings. We first discuss the nature of insider trading information by its relation with past returns. We then describe how preceding insider trading information is related to both short- and long-term returns, why momentum occurs in the short term and reversal arises in the long term, and why the winner-minus-loser portfolio exhibits both short-term momentum and long-term reversal.

5.1. The nature of insider trading information

Theory that explains momentum naturally interprets strong past return as investors reacting to a positive signal about firm fundamental and poor past return a negative signal. Studies that characterize momentum as underreaction argue that past winners (losers) continue to earn significant positive (negative) returns because investors underreacted to the positive (negative) signal. To fit insider trading information in the context of momentum and reversal, we characterize insider trading information by its relation with past return. That is, insider trading information either confirms or disconfirms past return.

Specifically, we characterize insider trading information as *confirming* past return if the insider trading information points to the same direction as that in past return. That is, insider silence (negative insider information) confirms poor past return (past losers), and the existence of insider trading activity (positive insider information) confirms strong past return (past winners). Conversely, insider trading information is viewed as *disconfirming* past return if the insider trading information is in the opposite direction to that in past return. That is, insider silence (negative insider information) disconfirms strong past return (past winners), and the existence of insider trading activity (positive insider information) disconfirms poor past return (past losers). The chart below illustrates the two-by-two characterization.

Insider activity \ past return	Past winners	Past losers
Insiders traded (positive information)	Confirming	Disconfirming
Insiders kept silent (negative information)	Disconfirming	Confirming

This characterization of insider trading information helps relate the nature of insider trading information (confirming or disconfirming past return) to subsequent return pattern (momentum or reversal), which we describe next.

5.2. How is insider trading information related to momentum and reversal?

With insider trading information characterized as either confirming or disconfirming past return, the relation between preceding insider trading information and subsequent return pattern is straightforward. That is, momentum is attributable to investors underreacting to insider trading information that confirms past return; and reversal is attributable to investors underreacting to insider trading information that disconfirms past return.

To see this point, we refer back to Table 3 Panels A and B. Note, as discussed in the introduction, insider silence indicates negative private information and the existence of insider trading activity (buying, selling, or both) is a proxy for relatively positive insider information. Shown in Panel A, past winners continue to earn significant positive returns in the short term only if the insider information is positive (insiders have traded in the past). That is, only when the insider information, which is positive, confirms the positive signal contained in strong past return, momentum arises subsequently among past winners. In

Panel B, significant negative returns over the short term are predominantly concentrated in past losers whose insiders have not traded in the past, indicating that insiders might have known some significant negative information, which prevented them from selling the shares due to fear of litigation risk. Thus, losers continue to earn significant negative returns in the short term only when the insider information, which is negative, confirms negative past return. Combining what drives return continuation among past winners and past losers, it is clear that momentum, or return continuation, arises because investors have underreacted to insider trading information that confirms past return.

Panel A of Table 3 also shows that a subset of past winners exhibit strong reversal (negative returns) in the long term. These stocks are those that insiders have kept silent with. That is, insiders knew some significant negative information, which prevented them from selling shares. Neither would they buy shares, given the negative prospects. Insider silence thus disconfirms the positive signal contained in strong past return, for which these stocks are classified as past winners. The result is consistent with the view that investors have underreacted to the disconfirming insider trading information, which is eventually reflected in future returns. Similarly, Panel B shows that a subset of past losers exhibit strong reversal (positive returns) in the long term. These stocks are those that insiders have traded in the past. That is, insider information is positive. The existence of insider trading activity thus disconfirms the negative signal contained in poor past return, for which these stocks are classified as past losers. The result is consistent with the view that investors have underreacted to the disconfirming insider trading information, which is eventually reflected in future returns. Combining what drives return reversal in the long term among past winners and past losers, it is clear that long term reversal arises because investors have underreacted to insider trading information that disconfirms past return.

In addition, when portfolios are conditional on insider trading information, or after insider trading information is controlled for, there is no evidence of overreaction.

5.3. Why does momentum arise in the short term and reversal in the long term?

It is worth noting the different timing in incorporating confirming and disconfirming information. It appears that it takes longer for the market to subsequently incorporate disconfirming information into

stock prices than confirming information. Confirming information is reflected, at least partially, in the short term: traded winners earn a significant 5.48% and silence losers earn a significant -9.97% in year one (see Panels A and B of Table 3).

It takes longer for disconfirming information to show up in future returns. Panel A of Table3 shows that, silence winners, whose insider information (negative) disconfirms past return (strong positive), exhibit strong reversal only in the long term (-8.13%). There is no significant negative return in the short term, even though investors are experiencing negative earnings shocks (-0.22% for silence winners in Panel A of Table 4) during this period. The small insignificant abnormal return over the entire first year for the silence winners can be viewed as an outcome of investors incorporating the disconfirming information: the negative shocks from the earnings announcements, which insiders might have foreknowledge about, and the positive information contained in strong past return, for which the stocks are classified as winners. Similarly, Panel B of Table 3 shows that the traded losers, whose insider information (positive) disconfirms past return (strong negative), do not experience reversal until the second year following portfolio formation. Their first year return is even negative (-1.93%).

In sum, the differential timing between momentum and reversal seems to suggest that it takes longer for the market to incorporate disconfirming than confirming information.

5.4. A "division of labor" between short-term momentum and long-term reversal

A well-documented, puzzling aspect of the momentum phenomenon is its long-term reversal, which we replicate in our relatively short and recent sample (see Figure 2). Surprisingly, such a pattern emerges in none of the four sub-portfolios formed on both past return and past insider trading information. To see this, we plot in Figure 3 the cumulative abnormal returns for the four portfolios as well as the all-winner and all-loser portfolios.

Figure 3 shows, for both past winners and losers, a "division of labor" between two mutually exclusive groups of stocks: one group of stocks generates momentum in the short term and the other group of stocks generates reversal in the long term. In this case, the familiar pattern of short-term momentum followed by long-term reversal results from aggregating sub-portfolios, which exhibit either

short-term momentum only (traded winners and silence losers) or long-term reversal only (silence winners and traded losers), but not both.

This point is best illustrated in the relation between the all-loser portfolio and its two sub-portfolios: silence losers and traded losers. Among past loser stocks, the group of traded losers experiences significant positive returns in the long term (strong reversal) but exhibits no significant negative short-term returns (no momentum), and the group of silence losers exhibits significant negative short-term returns (strong momentum) but experiences no positive long-term returns (no reversal). Thus, there is a clear "division of labor" among past losers: short-term momentum is driven solely by the silence losers, and long-term reversal is driven solely by the traded losers. The all-loser portfolio, which is aggregated from combining silence losers and traded losers, exhibits both significant momentum (-4.43%) and significant reversal (10.98%).

A similar "division of labor" exists among past winners as well. The group of traded winners exhibits significant positive short-term returns (strong momentum) but experiences no negative long-term returns (no reversal), and the group of silence winners experiences significant negative long-term returns (strong reversal) but exhibits no significant short-term returns (no momentum). Thus, short-term momentum is driven solely by the traded winners and long-term reversal is driven solely by the silence winners. The all-winner portfolio, which is aggregated from combining silence winners and traded winners, exhibits strong short-term momentum (3.85%). There is, however, no strong long-term reversal. The lack of strong long-term reversal is due to traded winners' continued positive returns in the long term (11.11%) outweighing silence winners' reversing negative returns (-8.13%).

[Insert Figure 3 about here]

5.5. Implication for theory

Numerous studies provide explanations for both momentum and reversal. Here we discuss four that explicitly unify the two phenomena and the implications our results have for future theory.

Barberis, Shleifer, and Vishny (1998) build their model on two psychological biases: conservatism and representativeness heuristics. Due to conservatism, investors underreact to news. Thus

conservatism contributes to momentum. Due to representativeness heuristics, after observing a long sequence of good news, investors expect that the next period is also good news. As such, the price becomes too high, which leads to negative returns in the future. Thus, long-term reversal is attributable to representativeness heuristics. Daniel, Hirshleifer, and Subrahmanyam (1998) propose that overconfidence and self-attribution contribute to short-term momentum and long-term reversal. In their model, the overconfident-informed investor over-weights her private signal, causing the price to overreact. The investor's confidence rises when she receives confirming public information. But disconfirming information causes confidence to fall only modestly. Thus public information on average triggers continued overreaction, which causes momentum in stock prices. Such momentum is reversed in the long term as further public signals gradually pulls the price back toward fundamentals. Hong and Stein (1999) assume two groups of bounded-rational agents: newswatchers and momentum traders, and private information flowing slowly. The newswatchers make forecasts based on private signals they observe about fundamentals but they do not condition on current or past prices. Momentum traders condition on past price changes but their forecasts are univariate functions of the price history. When only newswatchers are active, prices adjust slowly to new information, leading to underreaction. Momentum traders' arbitrage activity accelerates the price reaction, which eventually causes overreaction. Thus, underreaction attracts momentum traders to enter the market, whose trade causes overreaction. Vayanos and Woolley (2013) argue that, due to investor inertia or institutional constraints, fund outflows are gradual. Momentum arises if fund outflows are gradual and if the outflows trigger a gradual price decline and a drop in expected returns; reversal arises if fund outflows push prices below fundamental value.

All the theories explain the unconditional phenomenon of short-term momentum followed by long-term reversal. While no theory explicitly account for insider trading information, some elements of each model can also explain certain aspects of our findings, which are conditional on insider trading information. For example, the finding that traded winners and silence losers exhibit return continuation is consistent with investor underreaction. That is, return continuation results from investors underreacting to past information, and the underreaction could be due to conservatism (Barberis, Shleifer, and Vishny,

1998), slow flowing of private information (Hong and Stein, 1999), or gradual fund outflows (Vayanos and Woolley, 2013). Conversely, for silence winners, the negative information is reflected in subsequent returns only in the long term, in spite of the negative shocks being released in earnings. This result is consistent with self-attributed investors ignoring the disconfirming earnings information, as modeled in Daniel, Hirshleifer, and Subrahmanyam (1998, p.1842).

None of the theories, however, explains the entirety of the results reported in this paper, especially the inter-temporal pattern of short-term momentum followed by long-term reversal. All four theories predict that short-term momentum is followed by long-term reversal. Results reported in this paper suggest a "division of labor" in generating the two phenomena. That is, stocks that exhibit strong short-term momentum do not experience significant long-term reversal, and stocks that experience strong long-term reversal do not exhibit significant short-term momentum. This "division of labor" is made possible by forming portfolios on the preceding insider trading information. In this sense, our results suggest that further theoretical work take into account insider information.

6. Robustness checks

We conduct numerous robustness checks, including alternative methodologies, alternative window to measure past return and/or past insider trading activity, alternative samples and subsamples, and an alternative momentum strategy. The main results hold in all cases. Details are discussed below.

6.1. Alternative methodology

In our main analysis we use cumulative abnormal returns. Because estimating long-term abnormal returns has long been cautioned (e.g., Barber and Lyon, 1997; Fama, 1998; Lyon, Barber, and Tsai, 1999), we check whether our results hold for alternative method of measuring abnormal returns. To do so, we estimate average monthly alphas from the Fama and French (1993) three-factor model. Results are virtually identical when we include the liquidity factors developed by Pastor and Stambaugh (2003) and Sadka (2006). Specifically, following the formation of each portfolio, we form calendar time equal- and value-weight portfolios of the stock returns over each of the 12-month periods and regress the excess

returns on the Fama and French (1993) three factors. The alphas are the average abnormal monthly returns for each of the 12-month periods. Results are shown in Table 5.

The two panels of Table 5 are similarly structured as Panels A and B of Table 3. Since both value-weight and equal-weight results reach the same conclusions, for simplicity our discussion focuses on Panel A (equal-weight) only. The results in general confirm those presented in Table 3, with minor exceptions discussed below. First, results on the average monthly alphas show significant positive short-term returns for past winners and significant negative short-term returns for past losers. The portfolio of all winners does not experience long-term reversal, while the portfolio of all losers does. These results show a similar picture as in Table 3. Second, the silence-traded spreads for both past winners and losers are negative and significant over the short term, supporting underreaction; the significant negative signs of the silence-traded spreads for both past winners and losers over the long term reject the overreaction view. Instead, the result suggests that the long-term returns are also attributable to investors' underreaction to insider trading information.

[Insert Table 5 about here]

We conduct additional robustness checks by using buy-and-hold abnormal returns over the 12-month periods and find very similar results, which support underreaction but not overreaction. Unreported for brevity, these results are available upon request.

6.2. Alternative window to measure insider trading information and/or past returns

In the main analysis we measure past returns and past insider trading information over a six-month window and find evidence that supports underreaction. In this section we examine whether our main findings hold when we choose a 12-month window to measure insider trading activity and past returns, when we skip a month between the periods to measure past and future returns, and when we use the intermediate horizon past returns (Novy-Marx, 2012). Our main findings are remarkably robust.

6.2.1. Insider trading activity and past returns over a 12-month window

In the main tests we use a window of six months to measure past insider trading activity and past returns. To alleviating concern of data mining, we check robustness by using a window of 12 months to

measure both insider trading information and past returns. Accordingly, we reconstruct the portfolios and examine their future returns. Results are shown in Table 6.

With a longer window to measure insider trading activity, the probability of insider silence is lower. So are the average numbers of stocks in the "silence" portfolios, which are reduced from 72 and 77 to 42 and 47 for past winners and losers, respectively. The smaller portfolio size could reduce statistical power. Nevertheless, we find as strong evidence of underreaction. That is, the silence-traded spreads over the short term are negative and significant for both past winner and loser groups. At the same time, the silence-traded spreads over the longer term are also negative and significant for both past winner and loser groups, suggesting that long-term returns are also attributable to underreaction to insider trading information and that the overreaction view is rejected. In addition, a clear "division of labor" exists between stocks that contribute to short-term momentum and stocks that contribute to long-term reversal.

Along this line of thought, we also examine the other combinations (insider trading information over the past six months but past returns over the past 12 months; insider trading information over the past 12 months but past returns over the past six months) and find that our main findings are robust. Unreported for brevity, these results are available upon request.

[Insert Table 6 about here]

6.2.2. Skipping a month between past and future returns

In the main analysis we do not skip a month between the time periods to measure past and future returns. The momentum literature also adopts a method that skips a month between the portfolio formation and holding periods to deal with the short-term reversal at the monthly level (Jegadeesh, 1990; Lehmann, 1990). For robustness we rerun our test as in Table 3 after redefining past returns over the past six months ending one month before the first month for future returns. Table 7 presents the results, which clearly show that the silence-traded spreads are negative and significant in the short term, consistent with investors underreacting to insider trading information. The silence-traded spreads continue to be negative and significant over the longer term, rejecting overreaction. Further, a clear "division of labor" exists between stocks that contribute to momentum and stocks that contribute to reversal.

[Insert Table 7 about here]

6.2.3. Novy-Marx (2012) intermediate horizon past returns

Novy-Marx (2012) finds that momentum is driven more strongly by intermediate horizon past returns (over the period 12 to seven months prior to portfolio formation) than the immediate past returns.

In the context of Novy-Marx (2012), we address the following potential issues. First, do the portfolios formed on insider trading activity (silence vs. traded) among past winners and past losers have different intermediate horizon past returns? Unreported analysis shows that they do. Among past winners, the average intermediate horizon past returns are 17% for the silence portfolio and 22% for the traded portfolio, resulting in a significant difference of 5%. Similarly, among past losers, the average intermediate horizon past returns are 15% for the silence and 18% for the traded portfolio, with a significant 3% difference. Thus, it is possible that the silence-traded spreads over the subsequent years are driven by the intermediate horizon past returns. That is, maybe the silence portfolios are associated with lower future returns because they have experienced lower intermediate horizon past returns in the past.

To examine whether the intermediate horizon past returns drive our main results, we run the following test. We replace the silence/traded portfolios with portfolios formed on intermediate horizon past returns. That is, we first form past winners (top decile) and past losers (bottom decile) based on returns over the past six months. Within past winners and past losers, we sort stocks into two equal groups based on their intermediate horizon past returns. We find that the two portfolios have similar performance over the short term in the future (1^{st} year), and this conclusion holds in both past winners and past losers. Thus, it is unlikely that our results based on the silence/traded portfolios are driven by intermediate horizon past returns.

Finally, we use the intermediate horizon past returns to form the past winner (top decile) and loser (bottom decile) portfolios and examine whether our main results on silence and traded portfolios remain. Specifically, among these new past loser and winner stocks, we form the silence and traded portfolios based on the insider trading activity over the past six months. We then estimate their short- (1^{st} year) and long-term (2^{nd} to 5^{th} years) returns following portfolio formation. Table 8 reports the results.

Panel A in Table 8 shows that the silence and traded portfolios among past winner stocks exhibit the same pattern as shown in Panel A of Table 3. That is, the silence-traded spread is negative and significant over both the short and long terms. This similar pattern emerges among past loser stock as well, shown in Panel B of Table 8. Overall, results in Table 8 suggest that our main findings hold among past winners and losers formed on intermediate horizon past returns.

[Insert Table 8 about here]

6.3. Subsamples and alternative samples

In this section we examine whether our main findings hold in subsamples formed on cross-sectional characteristics, in subsamples formed on time-series characteristics, and in a less restrictive sample with low-priced and small stocks included. As shown below, our main findings are remarkably robust, which support underreaction but not overreaction.

6.3.1. Subsamples formed on cross-sectional characteristics

An extensive line of research explores the cross-sectional variation of momentum profits. An inevitably incomplete list of the relevant characteristics includes book-to-market ratio (Daniel and Titman, 1999; Asness, 1997), firm size and number of analysts following (Hong, Lim, and Stein, 2000), trading volume (Lee and Swaminathan, 2000), information uncertainty (Zhang 2006), firm performance (Sagi and Seasholes, 2007), credit risk (Avramov, Chordia, Jostova, and Philipov, 2007), and heterogeneous beliefs (Verardo, 2009), among others. Chui, Titman, and Wei (2010) study the role of cultural difference in momentum profits. Conrad and Yavuz (2012) form momentum portfolios based on both size and book-to-market.

We choose size, B/M ratio, and number of analysts to examine the robustness of our main findings in cross-sectional subsamples. The choice of these three variables is mainly based on data availability. If there is no analyst forecast reported over the past six months, the stock is assigned zero analysts following. The analyst data is from I/B/E/S. To control the impact of firm size on number of analysts, we regress the natural logarithm of one plus the number of analysts on the natural logarithm of firm size and keep the residual as the size-adjusted residual analyst following.

Every month we first sort stocks into deciles based on returns over the past six months. We independently sort stocks into two groups based on one of the three variables (size, B/M, and the residual analyst following). The cut-off point is the NYSE median for size, and cross-sectional median for B/M and residual analyst following. This way, for each of the three cross-sectional variables, we obtain four portfolios, within which we form silence and traded portfolios. We then examine their short and long-term returns. Results are reported in Panels A, B, and C of Table 9.

For brevity we only present the 1st year (short term) and subsequent four-year (long-term) abnormal returns of the portfolios. Panel A of Table 9, for example, shows that short-term momentum exists among both small and large firms (e.g., Hong, Lim, and Stein, 2000; Fama and French, 2008). Within each of the four past winner and loser groups, the silence-traded spreads are negative and significant in both short and long terms. The significant negative silence-traded spreads over the short term strongly support underreaction, while the similarly significant negative silence-traded spreads over the long term reject overreaction. In addition, the familiar pattern of strong short-term momentum followed by strong long-term reversal does not exist in any of the sub-portfolios. This pattern of negative silence-traded spreads over both short and long terms holds also in Panels B (sort on B/M) and C (sort on residual analyst following). Overall, our main findings hold in subsamples formed on these cross-sectional characteristics.

We also examine subsamples formed on trading volume. Lee and Swaminathan (2000, p.2049) find that trading volume is a proxy for relative under- or over-valuation, which might be correlated with insider information. It is then important to check whether our results based on insider trading information remain after accounting for trading volume. Following Lee and Swaminathan (2000), we focus on NYSE/AMEX stocks only. As a result, sample size drops substantially. We first independently sort on past return (deciles) and trading volume (two groups). We then construct portfolios based on insider trading information and examine their short- and long-term returns. Results are presented in Panel D of Table 9. With a smaller sample size weaker statistical power is expected. Nevertheless, our main results remain. Notably, the silence-traded spreads are negative in all subsamples over both short and long terms,

and significant in six out of eight cases. This analysis suggests that trading volume does not explain our results based on insider trading information.

[Insert Table 9 about here]

6.3.2. Subsamples formed on time-series characteristics

Returns based on momentum strategies also vary in the time series. For example, JT (2001) find that long-term reversal exists in their earlier sample period (1965-1981) but not the more recent period (1982-1997). Momentum profits are related to macroeconomic variables in the U.S. market (Chordia and Shivakumar, 2002), although not in international markets (Griffin, Ji, and Martin, 2003). Momentum profits are stronger following positive market return (Cooper, Gutierrez, and Hameed, 2004), continued market condition (Asem and Tian, 2009), lower return dispersion (Stivers and Sun, 2010), or lower market volatility (Wang and Xu, 2010). Recently, Antoniou, Doukas, and Subrahmanyam (2011) and Stambaugh, Yu, and Yuan (2012) find greater momentum profits following higher investor sentiment.

Due to data availability on insider trading activity, our sample covers a relatively short time period (1989 to 2007). Thus, the capacity to explore the time-series variability in momentum is somewhat limited. Nevertheless, we check the robustness of our main results in two chronological sub periods (1989-1997 and 1998-2007), two equal sub periods formed on investor sentiment, and two equal sub periods formed on past market return. Following the literature, the investor sentiment index is from Baker and Wurgler (2006, 2007). The time-series averages of cross-sectional mean abnormal returns of the silence and traded portfolios are presented in Panels A (early and later sub periods), B (low and high level of investor sentiment), and C (low and high past market return) of Table 10.

Across all three panels, the silence-traded spreads are all negative and significant (most at the 1% level, all at least 5% level) over both the short and long terms for both past winners and past losers. For example, the silence-traded spreads for past winners following high investor sentiment level (Panel B) is -5.79% (t=-2.81) in the short term and -23.07 (t=-3.90) in the long term. Again, the significant negative silence-traded spreads over the short term strongly support underreaction, while the similarly significant

negative silence-traded spreads over the long term reject the overreaction view. Further, a clear "division of labor" exists between stocks that contribute to momentum and stocks that contribute to reversal.

[Insert Table 10 about here]

6.3.3. A sample that includes small and low-priced stocks

In the main analysis we eliminate low-priced and small stocks by requiring minimum stock price of $5 and market cap above the first NYSE size decile. Since momentum is stronger among smaller firms (Hong, Lim, and Stein, 2000), it is likely that we are missing an important portion of the firms by excluding the lower-priced and smaller firms. To see whether our findings survive, we reconstruct a sample in which we only require that the prior month end stock price is at least $1 and we do not impose any filter on market cap. Based on this less restrictive sample we repeat the analysis in Table 3.

The results shown in Table 11 are qualitatively similar to those in Table 3, even though the sample in Table 11 is almost double that in Table 3. For example, past winners experience a significant 3.51% short-term momentum and an insignificant 2.44% over the subsequent four years; past losers experience a significant short-term momentum of -4.89% and a significant long-term reversal of 13.38%. These patterns are similar to those in Table 3. The main results are remarkably similar to those in Table 3. For example, the silence-traded spreads for past winners are -4.41% (t=-4.83) over the short term and -16.21% (t=-3.32) over the long term. Once again, the significant negative silence-traded spreads over the short term strongly support underreaction, while the similarly significant negative silence-traded spreads over the long term reject overreaction. Further, a clear "division of labor" exists between stocks that contribute to momentum and stocks that contribute to reversal.

Panels C and D show returns of the buy and sell portfolios, in which insiders net buy and set sell, respectively. Between the buy and sell portfolios, the buy portfolios outperform the corresponding sell portfolios over the short term, and significantly so among past winners. This result is expected since this less restricted sample includes many smaller firms, among which insiders' buying and selling activities are more informative of future returns (e.g., Lakonishok and Lee, 2001; Sias and Whidbee, 2010).

[Insert Table 11 about here]

6.4. Alternative momentum strategy

George and Hwang (2004) propose an alternative momentum strategy based on nearness to 52-week high. They find that this strategy of buying stocks with prices closest to their 52-week high and selling stocks with prices furthest away from their 52-week high earn significant momentum profits even after controlling for past returns as in JT (1993) and industry returns as in Moskowitz and Grinblatt (1999). Further, they find that the momentum profits based on 52-week high do not reverse in the long term. In this section we examine whether insider trading information still makes a difference in the extreme portfolios formed on the nearness to 52-week high. To do so, we form new past winners and losers based on stocks' nearness to 52-week high as defined in George and Hwang (2004, p. 2149), which is the ratio of prior month end price to the highest stock price over the past 12-month period that ends on the last day of the prior month. Within these new winner and loser groups we further form portfolios based on insider trading information and examine their short- and long-term returns.

Results are presented in Table 12. Since the nearness variable is between zero and one, we assign all stocks with nearness equal to one to the top decile. For some months the top decile exceeds 10% of the stocks when more than 10% of the stocks have their nearness variable equal to one. Thus, the average portfolio size for the winner group (261) is greater than 10% of the population, while the loser group has an average decile size of 255. The first rows of Panels A and B confirm their result that the strategy is profitable in the short term, as past winners earn 2.10% and past losers earn -2.79%, resulting in a short-term momentum of 4.89%. Because our sample period (1989-2007) is much shorter and more recent than theirs (1963-2001), our sample does not perfectly replicate the long-term results in George and Hwang (2004). In our sample, there is long-term reversal of -10.88% (=0.63% – 11.51%), driven by past losers.

Among past winners and losers formed on nearness to 52-week high, insider trading information remains important. Specifically, the silence-traded spreads in Table 12 are negative and significant over the short term in both past winners and losers, the same pattern as in our main analysis (see Table 3). These results support the notion that short-term momentum is due to investors underreacting to insider trading information. After controlling for insider trading information, there is no evidence of overreaction.

Instead, the relation between long-term returns and insider trading information also indicates that investors have underreacted to insider trading information. Further, a clear "division of labor" exists between stocks that contribute to momentum and stocks that contribute to reversal.

[Insert Table 12 about here]

7. Conclusion

This paper provides empirical evidence that preceding insider trading information is important for understanding momentum. We report the following results. Past winners (losers) continue to earn significant positive (negative) returns over the short term only if their insider trading activity indicates positive (negative) insider information. Thus, short-term momentum is attributable to investors underreacting to insider trading information that confirms past return. Over the long term, past winners (losers) earn significant negative (positive) returns only if their insider trading activity indicates negative (positive) information. Thus long-term reversal is attributable to investors underreacting to insider trading information that disconfirms past return. After controlling for insider trading information, there is no evidence of overreaction.

The results show a clear "division of labor" between stocks that contribute to short-term momentum and stocks that contribute to long-term reversal. It is well documented that the winner-minus-loser portfolio exhibits strong short-term momentum and long-term reversal, a pattern replicated in our sample. This inter-temporal return pattern, however, does not emerge in any of the sub-portfolios formed on both past return and past insider trading information. Instead, stocks that exhibit strong short-term momentum do not experience long-term reversal while stocks that experience strong long-term reversal do not exhibit strong short-term momentum. In this sense, the well-documented inter-temporal return pattern of short-term momentum followed by long-term reversal results from aggregating stocks that either exhibit short-term momentum only or experience long-term reversal only, but not both.

References:

Antoniou, C., J. A. Doukas, A. Subrahmanyam, 2011. Sentiment and Momentum. Working paper.

Asem, Ebenezer, and Gloria Tian, 2010. Market dynamics and momentum profits. Journal of Financial and Quantitative Analysis 45, 1549-1562.

Asness, Clifford S., 1997, The interaction of value and momentum strategies, Financial Analysts Journal March–April, 29–36.

Asness, C., T. Moskowitz, and L. Pedersen. 2013. Value and momentum everywhere. Journal of Finance Advance Access published January 30, 2013, 10.1111/jofi.12021.

Avramov, Doron, Tarun Chordia, Gergana Jostova, and Alexander Philipov, 2007, Momentum and credit rating, Journal of Finance 62, 2503-2520.

Baker, M., Wurgler, J., 2006. Investor sentiment and the cross–section of stock returns. Journal of Finance 61, 1645–80.

Baker, M., Wurgler, J., 2007. Investor sentiment in the stock market. Journal of Economic Perspectives 21, 129–152.

Barber, B., Lyon, J. 1997. Detecting Long-Run Abnormal Stock Returns: The Empirical Power and Specification of Test Statistics. Journal of Financial Economics 43, 341-372.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny, 1998, "A model of investor sentiment," Journal of Financial Economics 49, 307–343.

Berk, JB, RC Green, and V Naik, 1999, Optimal investment, growth options, and security returns, Journal of Finance 54, 1553-1607.

Bettis, J.C., Coles, J.L., Lemmon, M.L., 2000. Corporate policies restricting trading by insiders. Journal of Financial Economics 57, 191–220.

Bhojraj, Sanjeev and Bhaskaran Swaminathan, 2006. Macromomentum: Returns Predictability in International Equity Indices. Journal of Business 79, 429-451.

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

Chabot, B.R., E. Ghysels, and R. Jagannathan, 2009, Momentum cycles and limits to arbitrage: evidence from Victorian England and post-depression US stock markets, NBER working paper No. 15591.

Chan, Louis K. C., Narasimhan Jegadeesh, and Josef Lakonishok, 1996, "Momentum strategies," Journal of Finance 51, 1681–1713.

Cheng, Q., Lo, K., 2006. Insider trading and voluntary disclosures. Journal of Accounting Research 44, 815-848.

Chordia, T., Shivakumar, L., 2002, Momentum, business cycle, and time-varying expected returns," Journal of Finance, 57, 985-1019.

Chui, A, Titman, S., Wei., J., 2010, Individualism and momentum around the world, Journal of Finance, 65, 361-392.

Cohen, L, Malloy, C., Pomorski, L., 2012. Decoding inside information. Journal of Finance 67, 1009–1043.

Conrad, J., Kaul, G., 1998, An anatomy of trading strategies, Review of Financial Studies, 11, 489-519.

Conrad, Jennifer, and M. Deniz Yavuz. 2012. Momentum and reversal: Does what goes up always come down? Working paper, available at: http://ssrn.com/abstract=2011148

Cooper, M., Gutierrez, C. Jr., Hameed, A., 2004, Market states and momentum, Journal of Finance, 49, 1345-1365.

Daniel, Kent, and Sheridan Titman, 1999, "Market Efficiency in an Irrational World," Financial Analyst Journal 55, 28-40.
Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998, "Investor Psychology and Security Market Under-and Overreactions," Journal of Finance 53, 1839-1886.
DeLong, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann, 1990, "Positive feedback investment strategies and destabilizing rational speculation," Journal of Finance 45, 379–395.
Fama, E. F., 1998, Market efficiency, long-term returns and behavioral finance, Journal of Financial Economics 49, 283–306.
Fama, E. F., and K. R. French. 1992, The cross-section of expected stock returns, Journal of Finance 47, 427–465.
Fama, E., French, K., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3–56.
Fama, E. F., and K. R. French. 2008. Dissecting Anomalies. Journal of Finance 63:1653–78.
Francis, J., Philbrick, D., Schipper, K., 1994. Shareholder litigation and corporate disclosures. Journal of Accounting Research 32, 137–164.
Gao, George and Ma, Qingzhong, The sound of silence: What do we know when insiders do not trade? (October 28, 2012). Available at SSRN: http://ssrn.com/abstract=2167998.
George, Thomas, and Chuan-Yang Hwang, 2004, The 52-week high and momentum investing, Journal of Finance 59, 2145-2176.
George, Thomas, and Chuan-Yang Hwang, 2007. Long-term return reversals: overreaction or taxes? Journal of Finance 62, 2865-2896.
Gorton, G., F. Hayashi, and G. Rouwenhorst. 2013. The fundamentals of commodity futures returns. Review of Finance 17:35–105.
Griffin, John M., Xiuqing Ji, and J. Spencer Martin, 2003, Momentum investing and business cycle risk: Evidence from pole to pole, Journal of Finance 58, 2515-2547.
Grinblatt, Mark, and Bing Han, 2005, Prospect theory, mental accounting and momentum, Journal of Financial Economics 78, 311-339.
Grundfest, J., Perino, M., Ten Things We Know and Ten Things We Don't Know About the Private Securities Litigation Reform Act of 1995. Joint written testimony before the Subcommittee on Securities of the Committee on Banking, Housing, and Urban Affairs, United States Senate, July 24, 1997.
Grundy, Bruce D. and Spencer J. Martin, 2001, Understanding the Nature of Risks and the Sources of Rewards to Momentum Investing, Review of Financial Studies 14, 29-78.
Gutierrez, Roberto C., and Christo Prinsky, 2007. Momentum, reversal, and the trading behaviors of institutions. Journal of Financial Markets 10, 48-75.
Hong, H., and J. Stein, 1999, "A Unified Theory of Underreaction, Momentum Trading and Overreaction in Asset Markets," Journal of Finance 54, 2143-2184.
Hong, Harrison, Terence Lim and Jeremy C. Stein, 2000, Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies, Journal of Finance 55, 265-295.
Jegadeesh, Narasimhan, 1990, Evidence of Predictable Behavior of Security Returns, Journal of Finance 45, 881-898.
Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, Journal of Finance 48, 65–91.
Jegadeesh, Narasimhan, and Sheridan Titman, 2001, Profitability of momentum strategies: An evaluation of alternative explanations, Journal of Finance 56, 699-720.

Jegadeesh, Narasimhan, and Sheridan Titman, 2011, Momentum. Working paper, January 2011. Available at: http://ssrn.com/abstract=1919226.
Johnson, TC, 2002, Rational momentum effects, Journal of Finance 57, 585-608.
Johnson, M., Nelson, K., Pritchard, A., Do the Merits Matter More? The Impact of the Private Securities Litigation Reform Act. Journal of Law, Economics, and Organization 23 (2007): 627–52.
Jostova, Gergana, Nikolova Stanislava, Alexander Philipov, Christof Stahel. 2013. Momentum in corporate bond returns. Review of Financial Studies 26, 1649-1693.
Ke, B., Huddart, S., Petroni, K., 2003. What insiders know about future earnings and how they use it: Evidence from insider trades. Journal of Accounting and Economics 35, 315–46.
Korajczyk, R.A., Sadka, R., 2004. Are momentum profits robust to trading costs? Journal of Finance 59, 1039–1082.
Lakonishok, J., Lee, I., 2001. Are insider trades informative? Review of Financial Studies 14, 79–111.
Lee, Charles and Bhaskaran Swaminathan, 2000, Price Momentum and Trading Volume, Journal of Finance 55, 1217-1269
Lee, I., Lemmon, M., Li, Y., Sequeira, J., 2012. Do voluntary corporate restrictions on insider trading eliminate informed insider trading? Working paper June 2012.
Lehmann, Bruce, 1990, ``Fads, Martingales and Market Efficiency," Quarterly Journal of Economics 105, 1-28.
Lewellen, Jonathan. 2002.Momentum and autocorrelation in stock returns. Review of Financial Studies 15, 533-563.
Liu, Laura Xiaolei, and Zhang, Lu, 2008. Momentum profits, factor pricing, and macroeconomic risk, Review of Financial Studies.
Liu, Laura Xiaolei, and Zhang, Lu. 2011. A model of momentum. Working paper.
Lo, AW, and AC MacKinlay, 1990, When are contrarian profits due to stock-market overreaction, Review of Financial Studies 3, 175-205.
Lyon, J., Barber, B., Tsai, C. 1999. Improved Methods for Tests of Long-Run Abnormal Stock Returns. Journal of Finance 54, 165-201.
Ma, Qingzhong and Ukhov, Andrey, What is Common among Return Anomalies? Evidence from Insider Trading Decisions (May 7, 2013). Available at SSRN: http://ssrn.com/abstract=2188653.
Moskowitz, Tobias J. and Grinblatt, Mark, 1999, “Does Industry Explain Momentum?” Journal of Finance 54, 1249-1290.
Newey, W.K., West, K.D., 1987. A simple positive semi–definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 55, 703–708.
Niehaus, G., and G. Roth. “Insider Trading, Equity Issues, and CEO Turnover in Firms Subject to Securities Class Action.” Financial Management 28 (1999): 52–72.
Novy-Marx, R., 2012, Is momentum really momentum? Journal of Financial Economics 103, 429-453.
O'Brien, V.E., Hodges, R.W., "A Study of Class Action Securities Fraud Cases." Work-ing paper, Law and Economics Consulting Group, Berkeley, Calif., 1991.
Pastor, L., and R. F. Stambaugh, 2003, Liquidity risk and stock returns. Journal of Political Economy 111, 642-685.

Piotroski, J.D., Roulstone, D.T., 2005. Do insider trades reflect both contrarian beliefs and superior knowledge about future cash flow realizations? Journal of Accounting and Economics 39, 55–81.

Piotroski, J.D., Roulstone, D.T., 2008. Evidence on the Non-linear Relation between Insider Trading Decisions and Future Earnings Information. Journal of Law, Economics, and Policy 4, 409-448.

Rogers, Jonathan. 2008. Disclosure quality and management trading incentives. Journal of Accounting Research 46, 1265-1296.

Rogers, J.L., Van Burskirk, Andrew, and Sarah Zechman. 2011. Disclosure tone and shareholder litigation. The Accounting Review 86, 2155-2183.

Rouwenhorst, K. Geert, 1998, "International momentum strategies," Journal of Finance 53, 267–284

Rozeff, M.S., Zaman, M.A., 1998. Overreaction and insider trading: Evidence from growth and value portfolios. Journal of Finance 53, 701–16.

Sadka, R., 2006. Momentum and post-earnings-announcement drift anomalies: The role of liquidity risk. Journal of Financial Economics 80, 309-349.

Sagi, Jacob S., and Mark S. Seasholes, 2007, Firm-specific attributes and the cross-section of momentum, Journal of Financial Economics 84, 389–434.

Seyhun, H.N., 1986. Insiders' profits, costs of trading, and market efficiency. Journal of Financial Economics 16, 189–212.

Sias, R., Whidbee, D., 2010. Insider trades and demand by institutional and individual investors. Review of Financial Studies 23, 1544–1595.

Skinner, D. "Why Firms Voluntarily Disclose Bad News." Journal of Accounting Research 32 (1994): 38–60.

Stambaugh, R., J. Yu, and Y. Yuan (2012). The short of it: investor sentiment and anomalies. Journal of Financial Economics 104, 288-302.

Stivers, Chris, and Licheng Sun, 2010, Cross-sectional return dispersion and time variation in value and momentum premia, Journal of Financial and Quantitative Analysis 45, 987-1014.

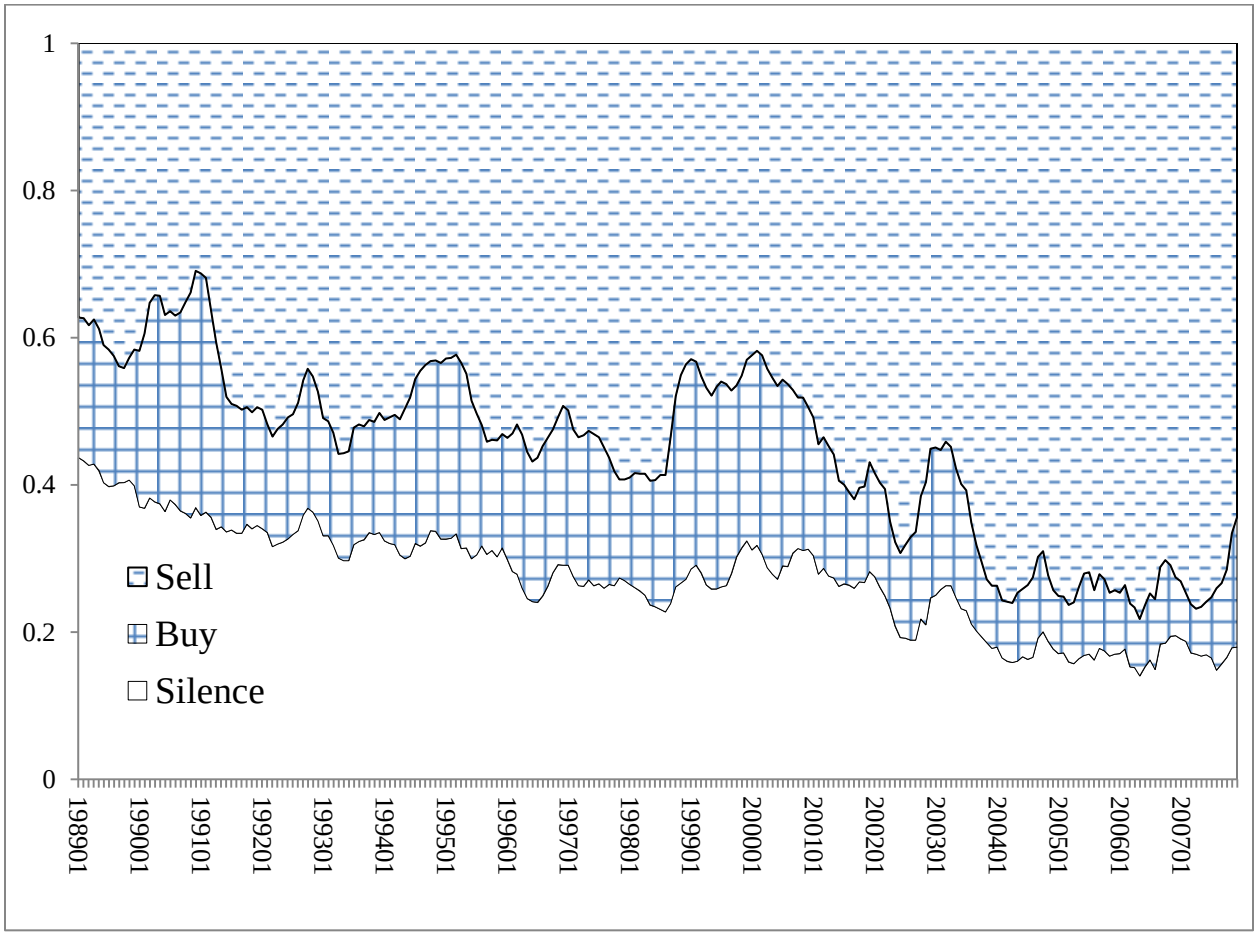
Vayanos, Dimitri, and Paul Woolley. 2013. An institutional theory of momentum and reversal. Review of Financial Studies 26, 1087-1145.

Verardo, Michela, 2009, Heterogeneous beliefs and momentum profits, Journal of Financial and Quantitative Analysis, 44, 795-822.

Wang, Kevin Q. and Jianguo Xu, 2010, Time-Varying Momentum Profitability, working paper.

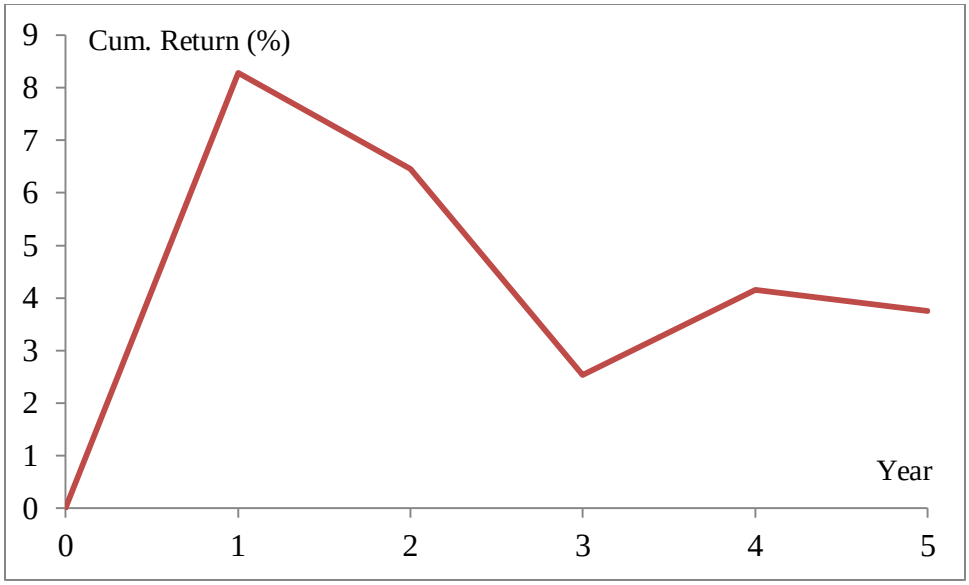
Zhang, X. Frank, 2006, Information uncertainty and stock returns, Journal of Finance 61, 105-137.

Figure 1: The proportion of firms with insider silence, net buying, and net selling



Every month from January 1989 to December 2007, we calculate the cross-sectional proportion of firms with no insider trading (silence), net insider buying (buy), and net insider selling (sell). Stocks with no insider trading activity over the prior six-month period form the "silence" group; stocks with positive and non-positive net insider demand (NID) form the "buy" and "sell" groups, respectively. NID is defined in the Appendix.

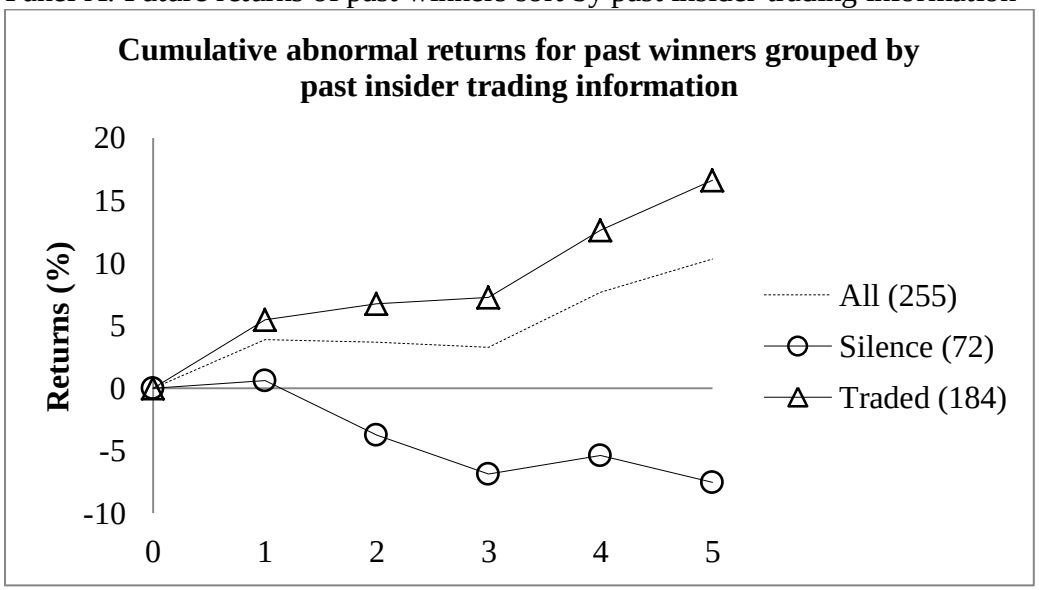
Figure 2: Momentum returns (in %, 1989 – 2007)



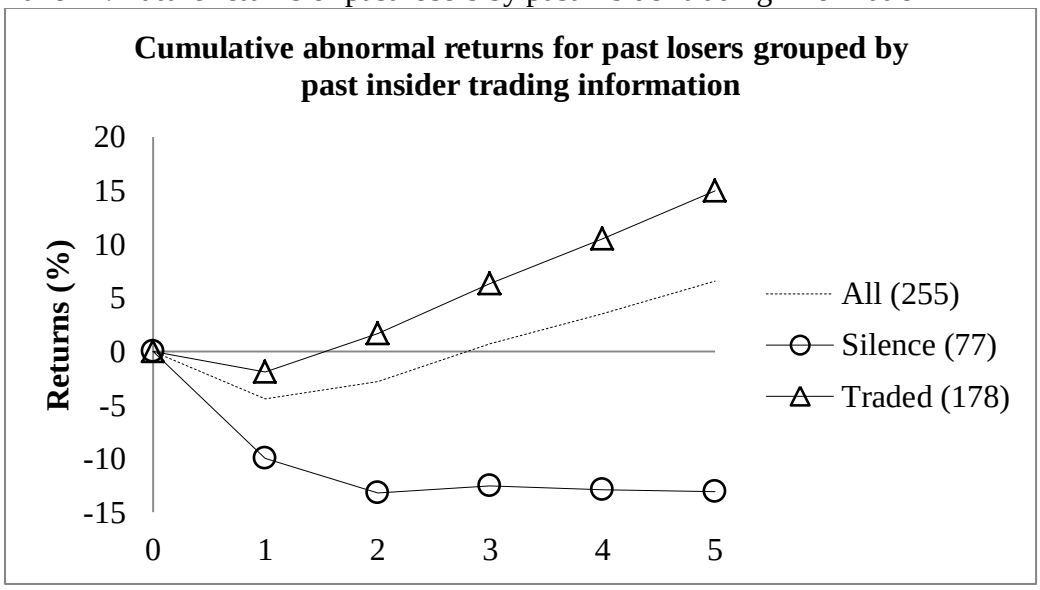
The sample covers 1989 to 2007. This figure plots the cumulative momentum returns (winners minus losers) over the five 12-month periods following portfolio formation. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. The returns are adjusted for size and book-to-market, as defined in the Appendix.

Figure 3: Future returns by past insider trading information

Panel A: Future returns of past winners sort by past insider trading information



Panel B: Future returns of past losers by past insider trading information



Panels A and B show the cumulative abnormal returns over the subsequent five years for portfolios formed on past insider trading information among past winners (A) and losers (B), respectively. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. The dashed lines represent all past winners or losers. Average portfolio size is shown in parentheses within the legend.

Table 1: Summary statistics

Past returns patterns	Past NID patterns	N	Past return	NID (%)	Size	B/M
All stocks		2558	0.127	-0.337	6.510	-0.769
Past winners	All	255	0.900	-0.663	5.726	-0.794
	Silence	72	0.948		5.439	-0.670
	Traded	184	0.877	-0.663	5.842	-0.842
	Buy	35	0.924	0.156	5.409	-0.558
	Sell	149	0.867	-0.847	5.946	-0.916
Middle groups	All	2047	0.088	-0.300	6.623	-0.728
	Silence	552	0.083		6.319	-0.581
	Traded	1495	0.090		6.735	-0.780
	Buy	365	0.068	0.084	6.366	-0.562
	Sell	1130	0.098	-0.420	6.853	-0.860
Past losers	All	255	-0.327	-0.308	6.383	-1.070
	Silence	77	-0.330		6.204	-0.941
	Traded	178	-0.326	-0.308	6.459	-1.124
	Buy	53	-0.327	0.110	6.330	-0.944
	Sell	126	-0.326	-0.482	6.506	-1.208

This table presents the time-series averages of cross-sectional equal-weight mean values of past return, NID, size, and B/M. Both size and B/M are taken natural logarithms. Monthly portfolios from January 1989 to December 2007 are formed on past returns and past insider trading information. Past winners (past losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Middle groups include all remaining stocks. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio; stocks with positive and non-positive net insider demand (NID) form the "buy" and "sell" portfolios, respectively. Column "N" lists the average number of stocks in the portfolio. All variables are defined in the Appendix.

Table 2: Returns (in %) of past winner and loser stocks

Portfolios	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 2 - 5
Panel A: Raw returns						
Loser	6.10	15.65	20.15	16.96	16.01	68.77
	[1.51]	[3.15]	[3.64]	[3.41]	[3.78]	[9.04]
5	12.76	12.53	14.58	13.40	12.81	53.32
	[5.18]	[4.15]	[4.58]	[4.32]	[3.85]	[6.74]
Winner	16.36	10.00	12.14	19.71	15.26	57.12
	[3.73]	[2.40]	[2.73]	[3.68]	[3.03]	[7.03]
Winner - Loser	10.26	-5.65	-8.01	2.75	-0.74	-11.65
	[3.12]	[-1.75]	[-2.74]	[1.09]	[-0.22]	[-1.73]
Panel B: Size and B/M adjusted returns						
Loser	-4.43	1.62	3.54	2.79	3.03	10.98
	[-3.83]	[0.94]	[2.21]	[1.62]	[2.89]	[2.97]
5	-0.30	-0.26	0.57	-0.02	-0.09	0.20
	[-0.29]	[-0.27]	[0.63]	[-0.02]	[-0.11]	[0.13]
Winner	3.85	-0.20	-0.38	4.40	2.62	6.45
	[2.08]	[-0.21]	[-0.35]	[3.43]	[1.32]	[1.61]
Winner - Loser	8.28	-1.82	-3.92	1.62	-0.41	-4.54
	[3.29]	[-0.84]	[-2.22]	[1.01]	[-0.17]	[-1.28]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns. Panel A (B) presents the time-series average of the cross-sectional equal-weight average raw (adjusted) returns for the portfolios. The winner, 5, and loser portfolios include stocks with returns over the past six months ranked in the top, 5th, and bottom deciles, respectively. Columns "Yr 1" to "Yr 5" are the cumulative returns over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four years from the 2nd to the 5th years following portfolio formation. The row "winner – loser" represents return spreads between the winner and loser deciles. The t-statistics in square brackets are based on Newey-West standard errors with 11 lags for the 12-month returns and 47 lags for the four-year returns. Returns adjusted by size and B/M are defined in the Appendix.

Table 3: Returns (%) of portfolios formed on past return and insider trading information

Portfolios (N)	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Past winners, silence vs. traded						
All (255)	3.85b	6.45	-0.20	-0.38	4.40a	2.62
Silence (72)	0.61	-8.13b	-4.37a	-3.10b	1.46	-2.12
Traded (184)	5.48a	11.11b	1.24	0.55	5.34a	3.98c
Silence-Traded	-4.87a	-19.24a	-5.60a	-3.65a	-3.88a	-6.10a
	[-3.66]	[-4.28]	[-4.65]	[-2.70]	[-3.14]	[-4.61]
Panel B: Past losers, silence vs. traded						
All (255)	-4.43a	10.98a	1.62	3.54b	2.79	3.03a
Silence (77)	-9.97a	-3.12c	-3.24b	0.65	-0.35	-0.19
Traded (178)	-1.93c	16.86a	3.61c	4.64a	4.18b	4.43a
Silence-Traded	-8.04a	-19.99a	-6.85a	-3.99a	-4.53a	-4.61a
	[-6.93]	[-6.00]	[-5.29]	[-4.08]	[-3.64]	[-3.93]
Panel C: Past winners, buy vs. sell						
Buy (35)	7.75a	5.05b	-1.53	-0.34	4.35a	2.57
Sell (149)	5.14b	12.22b	1.81c	0.72	5.58a	4.10c
Buy-Sell	2.61c	-7.17b	-3.34a	-1.06	-1.23	-1.53
	[1.89]	[-2.01]	[-3.03]	[-0.75]	[-0.75]	[-0.86]
Panel D: Past losers, buy vs. sell						
Buy (53)	-3.47a	12.74a	2.91c	1.83	3.36b	4.64a
Sell (126)	-1.31	18.71a	3.84c	5.78a	4.75b	4.34a
Buy-Sell	-2.16b	-5.97c	-0.92	-3.96a	-1.39	0.30
	[-2.17]	[-1.74]	[-0.90]	[-2.78]	[-0.96]	[0.24]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio; stocks with positive and non-positive NIDs form the "buy" and "sell" portfolios, respectively. The average portfolio size is in parentheses. The rows "silence-traded" and "buy-sell" represent return spreads between the corresponding portfolios. Columns "Yr 1" through "Yr 5" are the cumulative abnormal returns (in %, adjusted by size and B/M) over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. NID, and abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 4: Subsequent earnings announcement returns (in %)

Portfolios	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
			Panel A: Past winners			
All	-0.02	0.01	-0.09	-0.03	0.10c	0.04
Silence	-0.22b	-0.21a	-0.35a	-0.09	-0.19a	-0.20
Traded	0.04	0.07	-0.01	-0.01	0.20a	0.12
Silence-Traded	-0.26a	-0.28a	-0.33a	-0.08	-0.39a	-0.32a
	[-2.77]	[-7.48]	[-4.37]	[-0.70]	[-5.56]	[-2.92]
			Panel B: Past losers			
All	-0.21a	0.10	0.05	0.13c	0.13	0.10c
Silence	-0.41a	-0.19b	-0.10	-0.17c	-0.23	-0.26a
Traded	-0.13c	0.21a	0.11	0.25a	0.26a	0.23a
Silence-Traded	-0.28a	-0.40a	-0.21b	-0.42a	-0.49a	-0.49a
	[-3.76]	[-5.33]	[-2.51]	[-4.14]	[-3.07]	[-5.45]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. The row "silence-traded" represents return spreads between the two portfolios. Every column presents the time-series averages of cross-sectional mean abnormal returns (in %) over the three-day window earnings announcement period. The abnormal returns are adjusted by CRSP equal-weight daily market returns. Columns "Yr 1" through "Yr 5" refer to the 1st to 5th years, respectively, and "Yr 2 – 5" refers to the four-year period from 2nd to 5th year. The t-statistics in square brackets are based on Newey-West standard errors with 11 lags for 12-month periods and 47 lags for the four-year period. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Monthly Fama-French three-factor alphas (in %)

Portfolios	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Equal-weight portfolio						
Panel A1: Past winners						
All	0.31a	0.02	-0.13	-0.17	0.34b	0.14
Silence	0.04	-0.30b	-0.53b	-0.41b	0.06	-0.28c
Traded	0.44a	0.13	0.00	-0.09	0.41a	0.27b
Silence - Traded	-0.40a	-0.43a	-0.53a	-0.32a	-0.35a	-0.55a
	[-3.10]	[-5.55]	[-4.17]	[-2.81]	[-2.97]	[-4.80]
Panel A2: Past losers						
All	-0.73a	0.12	0.02	0.20	0.05	0.20
Silence	-1.16a	-0.23	-0.43c	-0.14	-0.31c	-0.14
Traded	-0.53b	0.27b	0.20	0.32b	0.20	0.34b
Silence - Traded	-0.63a	-0.51a	-0.64a	-0.47a	-0.51a	-0.48a
	[-6.16]	[-5.89]	[-5.58]	[-3.70]	[-4.02]	[-4.40]
Panel B: Value-weight portfolio						
Panel B1: Past winners						
All	0.43b	0.18c	0.13	-0.04	0.46a	0.22
Silence	-0.00	-0.18b	-0.33c	-0.28c	0.15	-0.30b
Traded	0.54a	0.23c	0.20	0.01	0.49a	0.29c
Silence - Traded	-0.54a	-0.40a	-0.53a	-0.29	-0.34c	-0.59a
	[-2.71]	[-3.08]	[-2.62]	[-1.38]	[-1.84]	[-3.12]
Panel B2: Past losers						
All	-0.73a	0.14	0.14	0.35b	0.01	0.16
Silence	-0.97a	-0.27a	-0.42b	-0.13	-0.26c	-0.23
Traded	-0.63a	0.24a	0.31c	0.46a	0.08	0.22c
Silence - Traded	-0.34b	-0.51a	-0.73a	-0.59a	-0.35b	-0.44a
	[-2.19]	[-5.63]	[-4.84]	[-3.85]	[-2.32]	[-2.91]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. The row "silence-traded" represents the return spreads between the two portfolios. Column "Yr 2 – 5" refers to the four-year period from 2nd to 5th year; and "Yr 1" through "Yr 5" refer to the 1st to 5th years, respectively. Panel A (B) presents the average monthly alphas (in %) for the portfolios by regressing the calendar-time equal-weight (value-weight) monthly excess returns on Fama and French (1993) three factors. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Robustness by insider trading activity and past returns over 12 months

Portfolios (N)	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Past winners, silence vs. traded						
All (255)	1.03	5.19	-0.93	0.19	4.53b	1.39
Silence (42)	-4.04c	-22.94a	-7.44a	-6.28a	-1.83	-7.39a
Traded (214)	2.23	9.37c	0.31	1.10	5.36a	2.61
Silence-Traded	-6.27a	-32.31a	-7.75a	-7.38a	-7.19a	-9.99a
	[-3.79]	[-4.39]	[-3.67]	[-3.79]	[-3.70]	[-3.80]
Panel B: Past losers, silence vs. traded						
All (255)	-2.47c	11.68a	1.56	3.70b	2.58c	3.85a
Silence (47)	-12.33a	-17.54a	-7.49a	-2.26	-4.69b	-3.10a
Traded (208)	-0.18	17.69a	3.36c	4.83a	4.24a	5.27a
Silence-Traded	-12.15a	-35.24a	-10.85a	-7.09a	-8.93a	-8.37a
	[-7.62]	[-9.80]	[-5.87]	[-5.04]	[-5.65]	[-6.38]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past 12 months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior 12-month period form the "silence" portfolio; stocks with insider trading activity over the prior 12-month period form the "traded" portfolio. The average portfolio size is in parentheses. The row "silence-traded" represents return spreads between the corresponding portfolios. Columns "Yr 1" through "Yr 5" are the cumulative abnormal returns (in %, adjusted by size and B/M) over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 7: Robustness by skipping a month

Portfolios (N)	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Past winners, silence vs. traded						
All (255)	3.14c	6.83c	-0.33	-0.09	4.81a	2.44
Silence (69)	-0.28	-8.27b	-4.61a	-3.30b	1.86	-2.23
Traded (187)	4.71b	11.44b	1.15	0.92	5.66a	3.70c
Silence-Traded	-4.99a	-19.71a	-5.75a	-4.22a	-3.80a	-5.93a
	[-3.55]	[-4.06]	[-4.43]	[-3.07]	[-2.84]	[-4.94]
Panel B: Past losers, silence vs. traded						
All (255)	-4.27a	11.06a	1.74	3.53b	2.63	3.16a
Silence (80)	-9.18a	-2.06	-2.74c	0.76	-0.46	0.38
Traded (175)	-1.90c	16.86a	3.70b	4.61a	4.08b	4.47a
Silence-Traded	-7.27a	-18.92a	-6.44a	-3.85a	-4.54a	-4.08a
	[-7.23]	[-5.82]	[-5.33]	[-3.88]	[-4.01]	[-3.94]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. One month is skipped between past return portfolio formation and future return prediction. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. The average portfolio size is in parentheses. The row "silence-traded" represents the return spreads between the corresponding portfolios. Columns "Yr 1" through "Yr 5" are the cumulative abnormal returns (in %, adjusted by size and B/M) over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 8: Sort on intermediate horizon past returns (Novy-Marx, 2012)

Portfolios (N)	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Past winners, silence vs. traded						
All (255)	-1.37	6.55	-0.83	1.71	4.30b	1.37
Silence (64)	-5.25a	-12.11a	-5.52a	-2.41c	0.08	-4.27a
Traded (191)	0.21	11.72b	0.71	2.86b	5.37a	2.78c
Silence-Traded	-5.46a	-23.83a	-6.23a	-5.27a	-5.29a	-7.05a
	[-4.54]	[-4.88]	[-5.74]	[-4.28]	[-3.71]	[-4.54]
Panel B: Past losers, silence vs. traded						
All (255)	0.34	10.84a	1.60	3.08c	3.10a	3.05a
Silence (88)	-3.10b	-1.57	-2.97b	0.58	0.78	0.03
Traded (168)	2.27	17.03a	3.95a	4.26a	4.32a	4.50a
Silence-Traded	-5.36a	-18.60a	-6.93a	-3.67a	-3.54a	-4.46a
	[-5.56]	[-6.16]	[-5.88]	[-3.48]	[-3.67]	[-4.88]

Monthly portfolios are formed from January 1989 to December 2007, based on intermediate horizon past returns and past insider trading information. Intermediate horizon past returns are the buy-and-hold returns from the 12^{th} to 7^{th} months prior to portfolio formation. Past winners (losers) are stocks with intermediate horizon returns ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. The average portfolio size is in parentheses. The row "silence-traded" represents the return spreads between the corresponding portfolios. Columns "Yr 1" through "Yr 5" are the cumulative abnormal returns (in %, adjusted by size and B/M) over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 9: Evidence based on cross-sectional subsamples

Portfolios	Avg. N	Yr 1	Yr 2 - 5	Avg. N	Yr 1	Yr 2 - 5
Panel A: By market cap						
	Small			Large		
Panel A-1: Past winners						
All	185	3.68c	5.44	71	4.69b	9.29b
Silence	58	0.77	-8.44b	14	0.13	-7.42
Traded	127	5.53b	10.60b	57	6.11a	12.75b
Silence-Traded		-4.76a	-19.04a		-5.97a	-20.17b
		[-3.16]	[-5.89]		[-3.68]	[-2.00]
Panel A-2: Past losers						
All	198	-4.80a	9.93a	58	-3.20c	14.74a
Silence	64	-10.78a	-4.29b	13	-6.00b	1.73
Traded	134	-1.75c	16.38a	45	-2.30	18.55a
Silence-Traded		-9.03a	-20.67a		-3.70b	-16.83a
		[-6.83]	[-6.06]		[-1.99]	[-4.36]
Panel B: By B/M						
	Growth			Value		
Panel B-1: Past winners						
All	134	4.77b	7.72	121	3.07c	4.31
Silence	33	-0.25	-13.56a	38	1.54	-4.54
Traded	101	6.76a	13.19b	83	4.20b	8.14a
Silence-Traded		-7.01a	-26.75a		-2.66c	-12.68a
		[-4.77]	[-5.43]		[-1.82]	[-3.00]
Panel B-2: Past losers						
All	168	-2.62b	15.57a	87	-7.81a	1.30
Silence	46	-8.97a	1.71	31	-11.80a	-10.89a
Traded	123	-0.24	20.24a	56	-5.15a	8.14a
Silence-Traded		-8.74a	-18.53a		-6.66a	-19.03a
		[-5.87]	[-4.18]		[-3.76]	[-8.63]
Panel C: By residual analyst following						
	Few analysts			Many analysts		
Panel C-1: Past winners						
All	122	2.30	2.80	133	5.42b	9.63b
Silence	42	-0.02	-10.21a	30	1.51	-4.30
Traded	81	3.92b	7.78c	103	6.80a	13.50a
Silence-Traded		-3.94a	-17.99a		-5.29a	-17.80a
		[-3.28]	[-3.32]		[-2.89]	[-4.17]
Panel C-2: Past losers						
All	104	-6.08a	8.50b	152	-3.21b	12.69a
Silence	37	-11.22a	-4.72b	40	-8.77a	-1.18
Traded	67	-3.26a	15.17a	112	-1.02	17.86a
Silence-Traded		-7.96a	-19.88a		-7.75a	-19.04a
		[-5.88]	[-5.78]		[-5.43]	[-5.22]

Panel D: By trading volume (NYSE/AMEX stocks only)						
	Low volume			High volume		
Panel D-1: Past winners						
All	25	1.71	1.72	67	3.30a	-0.02
Silence	9	0.59	0.53	18	-0.59	-11.77a
Traded	16	3.80b	3.64	50	5.12a	3.06c
Silence-Traded		-3.54	-3.11		-5.71a	-14.83a
		[-1.46]	[-0.70]		[-2.80]	[-2.89]
Panel D-2: Past losers						
All	32	-7.65a	-1.94	81	-6.60a	1.95
Silence	13	-10.67a	-9.88	24	-12.07a	-19.52a
Traded	19	-3.54b	2.30	57	-4.39b	9.79a
Silence-Traded		-5.76c	-11.83a		-7.68a	-29.32a
		[-1.71]	[-2.87]		[-4.16]	[-4.64]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks are independently sorted into two groups based on size, B/M, the residual analyst following, and trading volume in Panels A, B, C, and D, respectively. The cut-off point is the NYSE median for size and the cross-sectional medians for B/M, residual analyst following, and trading volume. Residual analyst following is the regression residual of the natural logarithm of one plus the number of analysts on the natural logarithm of firm size. Trading volume is the average turnover over the prior six months. Panels A, B, and C include all stocks, and Panel D includes NYSE/AMEX stocks only. Within each subsample of past winners or losers, portfolios are formed on insider trading information over the past six months. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. Column "N" lists the average portfolio size; "Yr 1" presents the cumulative abnormal returns (in %, adjusted by size and B/M) over the first 12-month period following portfolio formation; and "Yr 2 – 5" presents the cumulative abnormal returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 10: Evidence based on time-series subsamples

Portfolios	Avg. N	Yr 1	Yr 2 - 5	Avg. N	Yr 1	Yr 2 - 5
Panel A: By sub periods						
	Early (1989 - 1997)			Later (1998 - 2007)		
Panel A-1: Past winners						
All	254	3.40a	10.86	256	4.25	2.47
Silence	82	-0.29	-3.27	63	1.42	-12.50b
Traded	173	5.33a	16.18b	193	5.61	6.55b
Silence-Traded		-5.62a	-19.45a		-4.19b	-19.05a
		[-3.49]	[-3.90]		[-2.07]	[-3.45]
Panel A-2: Past losers						
All	254	-5.65a	10.88c	256	-3.34c	11.07a
Silence	88	-11.10a	-2.68	67	-8.94a	-3.51b
Traded	166	-2.79b	17.77b	189	-1.15	16.05a
Silence-Traded		-8.32a	-20.46a		-7.79a	-19.56a
		[-7.78]	[-4.78]		[-3.92]	[-5.51]
Panel B: By sentiment						
	Low sentiment			High sentiment		
Panel B-1: Past winners						
All	240	1.71	6.78c	271	5.99b	6.11
Silence	70	-0.90	-4.74c	74	2.11	-11.52a
Traded	170	3.05c	10.68a	197	7.91a	11.54b
Silence-Traded		-3.95b	-15.41a		-5.79a	-23.07a
		[-2.21]	[-9.48]		[-2.81]	[-3.90]
Panel B-2: Past losers						
All	240	-4.37a	4.83a	271	-4.49a	17.13a
Silence	78	-8.78a	-8.48a	76	-11.16a	2.24
Traded	162	-2.16	11.00a	195	-1.70	22.73a
Silence-Traded		-6.62a	-19.47a		-9.46a	-20.50a
		[-6.23]	[-6.27]		[-5.08]	[-4.13]
Panel C: By past market return						
	Low market return			High market return		
Panel C-1: Past winners						
All	241	1.49	5.19a	270	6.21b	7.70b
Silence	66	-0.69	-6.44a	77	1.91	-9.82c
Traded	175	2.73	8.62a	192	8.22b	13.60a
Silence-Traded		-3.42b	-15.06a		-6.32a	-23.42a
		[-2.33]	[-7.14]		[-3.18]	[-3.41]
Panel C-2: Past losers						
All	241	-4.00b	5.89a	270	-4.86a	16.07a
Silence	73	-8.89a	-4.96b	81	-11.04a	-1.28
Traded	168	-1.68	10.61a	189	-2.17	23.12a
Silence-Traded		-7.21a	-15.57a		-8.87a	-24.40a
		[-4.67]	[-11.07]		[-7.12]	[-6.65]

Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. Column "N" lists the average portfolio size; "Yr 1" presents the cumulative abnormal returns (in %, adjusted by size and B/M) over the first 12-month period following portfolio formation; and "Yr 2 – 5" presents the cumulative abnormal returns over the four (2^{nd} to 5^{th}) years following portfolio formation. Panels A, B, and C separate the time-series into two by chronological order, investor sentiment, and past market return, respectively. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 11: Robustness based on a less restrictive sample

Portfolios (N)	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Past winners, silence vs. traded						
All (484)	3.51b	2.44	-1.25	-1.47c	3.34a	1.82
Silence (198)	1.04	-7.71b	-4.06a	-4.18a	1.39	-0.86
Traded (286)	5.45a	8.50b	0.61	0.33	4.36a	3.19
Silence-Traded	-4.41a	-16.21a	-4.68a	-4.51a	-2.97b	-4.05a
	[-4.83]	[-3.32]	[-4.46]	[-3.52]	[-2.57]	[-3.73]
Panel B: Past losers, silence vs. traded						
All (484)	-4.89a	13.38a	3.77	4.35b	2.07	3.19a
Silence (236)	-7.91a	4.31b	1.36	2.32	-0.40	1.04
Traded (248)	-2.25	20.90a	6.00b	5.90a	4.02b	4.97a
Silence-Traded	-5.65a	-16.59a	-4.64a	-3.59a	-4.42a	-3.94a
	[-5.04]	[-3.84]	[-3.90]	[-3.32]	[-4.42]	[-2.91]
Panel C: Past winners, buy vs. sell						
Buy (85)	8.48a	3.13c	-0.70	-1.03	2.11b	2.76c
Sell (201)	4.23b	10.51b	1.07	0.85	5.25a	3.34
Buy-Sell	4.24a	-7.39c	-1.77c	-1.88	-3.15b	-0.59
	[3.35]	[-1.83]	[-1.78]	[-1.31]	[-2.05]	[-0.39]
Panel D: Past losers, buy vs. sell						
Buy (104)	-1.69	18.53a	5.81b	4.76b	2.89b	5.07a
Sell (144)	-2.61c	23.01a	6.18b	6.82a	5.16b	4.85a
Buy-Sell	0.92	-4.48c	-0.37	-2.05	-2.27	0.21
	[0.93]	[-1.96]	[-0.28]	[-1.47]	[-1.29]	[0.18]

The sample includes all common stocks with prior month end price of at least $1. Monthly portfolios are formed from January 1989 to December 2007, based on past returns and insider trading information. Past winners (losers) are stocks with returns over the past six months ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio; stocks with positive and non-positive net insider demand (NID) form the "buy" and "sell" portfolios, respectively. The average portfolio size is in parentheses. The rows "silence-traded" and "buy-sell" represent the return spreads between the corresponding portfolios. Columns "Yr 1" through "Yr 5" are the cumulative abnormal returns (in %, adjusted by size and B/M) over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Table 12: Sort on nearness to 52-week high

Portfolios (N)	Yr 1	Yr 2 - 5	Yr 2	Yr 3	Yr 4	Yr 5
Panel A: Past winners, silence vs. traded						
All (261)	2.10c	0.63	0.23	-0.63	0.90	0.12
Silence (74)	0.41	-6.11a	-1.75	-2.11b	-0.11	-2.13a
Traded (187)	2.85b	2.80	0.90	-0.12	1.28	0.75
Silence-Traded	-2.44a	-8.91a	-2.65a	-1.99b	-1.39	-2.88a
	[-4.32]	[-2.73]	[-4.15]	[-2.07]	[-1.49]	[-2.72]
Panel B: Past losers, silence vs. traded						
All (255)	-2.79b	11.51a	1.35	3.33b	3.22b	3.61a
Silence (74)	-8.51a	-2.66	-3.86b	-0.04	0.08	1.15
Traded (181)	-0.36	17.13a	3.53b	4.48a	4.41b	4.71a
Silence-Traded	-8.16a	-19.79a	-7.39a	-4.51a	-4.34a	-3.55b
	[-6.90]	[-7.23]	[-5.94]	[-3.70]	[-2.90]	[-2.47]

Monthly portfolios are formed from January 1989 to December 2007, based on nearness to 52-week high and insider trading information. Nearness to 52-week high is defined as the ratio of the stock price at the end of past month to the highest stock price over the past 12-month period that ends the last day of the past month (see George and Hwang, 2004). Past winners (losers) are stocks with nearness value ranked in the top (bottom) decile. Stocks with no insider trading activity over the prior six-month period form the "silence" portfolio; stocks with insider trading activity over the prior six-month period form the "traded" portfolio. The average portfolio size is in parentheses. The row "silence-traded" represents the return spreads between the corresponding portfolios. Columns "Yr 1" through "Yr 5" are the cumulative abnormal returns (in %, adjusted by size and B/M) over each of the five 12-month periods following portfolio formation; column "Yr 2 – 5" refers to the cumulative returns over the four (2^{nd} to 5^{th}) years following portfolio formation. The t-statistics in square brackets are based on Newey-West standard errors with 11 and 47 lags for the annual and four-year returns, respectively. Superscripts [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively. Abnormal returns adjusted by size and B/M are defined in the Appendix.

Appendix

The data sources are the Center for Research in security Prices (CRSP), Compustat, Thomson Reuters Insider Filing Data Feed. Time t in Compustat refers to fiscal year end in calendar year t. The main variables are defined below.

Firm characteristics

MC: Market capitalization, the natural log of price times number of shares outstanding at the end of June of year t, from CRSP.

B/M: Book to market ratio, the natural log of the ratio of the book value of equity to the market value of equity. Book value B is total assets (Compustat item AT) for year t-1, minus liabilities (LT), plus balance sheet deferred taxes and investment tax credit (TXDIC) if available, minus preferred stock liquidating value (PSTKL) if available, or redemption value (PSTKRV) if available, or carrying value (PSTK). Market value M is price times share outstanding at the end of December of t-1, from CRSP.

Past return: The buy-and-hold return from month j-6 to j-1, where j-1 is the month of portfolio formation and j is the first month of forecasted future returns.

Insider trading information

Silence: Equal to one if there is no insider trading activity during the past six-month period, and zero otherwise.

Traded: Equal to one if there is insider trading (buying, selling, or both) activity during the past six-month period, and zero otherwise.

NID: Net insider demand, NID of month j is defined as the number of shares that insiders buy minus the number of shares that insiders sell over the past six months, normalized by the total number of shares outstanding at the end of month j-1.

Future return variable

Future return: We construct abnormal returns adjusted by size and B/M. Specifically, at the end of June of year t, we independently form NYSE size and book–to–market (B/M) quintiles to extract the breakpoint values, and assign AMEX and NASDAQ stocks to the 5 x 5 portfolios according to their size and B/M values. The equal–weight portfolio return serves as the benchmark return for the stock in the same size and B/M portfolio for the months starting from July of year t to June of year t+1. Portfolio assignment is rebalanced every year. The monthly abnormal return for a stock is its raw return minus the benchmark portfolio return. The monthly abnormal returns are then accumulated by 12-month periods. If a stock is delisted before the holding period, the delisting return is used for the delisting month, and returns of the months after delisting are replaced with the benchmark portfolio returns.