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# THE DISPOSITION EFFECT AND UNDER-REACTION TO NEWS

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# The Disposition Effect and Under-reaction to News

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**ABSTRACT**

This paper tests whether the tendency of investors to lock in gains and ride losses, known as the disposition effect, induces under-reaction to corporate news, leading to price predictability. The disposition effect implies that stock prices under-react to bad news when more current holders are facing a capital loss, and under-react to good news when more current holders are facing a capital gain. I use a database of mutual funds holdings to construct a measure of reference prices for individual stocks. Using this novel measure of reference price, I show that post-event predictability is most severe where the disposition effect predicts the biggest under-reaction. Exposure to a disposition proxy generates large differences in post-event returns: post-event drift is larger when the news and the capital gains overhang have the same sign and the magnitude of the drift is directly related to the amount of unrealized capital gains (losses) experienced by the stock holders prior to the event date. An event-driven equity strategy based on this effect yields monthly alphas of over 200 basis points.

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In recent years, mounting evidence has challenged the traditional view that securities are rationally priced to reflect publicly available information. An extensive body of empirical literature reports that, with surprising regularity, investors appear to under-react to corporate news announcements. Stock prices tend to drift after important news: positive news is generally met with price appreciation, but prices subsequent to the announcement show positive abnormal drift. Similarly, negative news generates negative market reaction around the event date, but tends to be followed by a negative drift. As a result, event-driven equity strategies based on market impact can earn risk-adjusted returns in the subsequent months[1].

In a recent paper Grinblatt and Han (2004) consider a model of equilibrium prices where a combination of prospect theory[2] and mental accounting[3] generates a disposition effect, a tendency to hold on to losing positions. Trading frictions from disposition-prone investors generate price under-reaction to information, and create a spread between a stock fundamental value and its equilibrium price. Spread convergence, arising from the evolution of fundamental values and updating of reference prices through trading, generates momentum in stock returns. This result paves the way to a line of empirical research where the key variable forecasting the cross section of stock returns is the difference between the current price and the market cost basis (reference price) for individual stocks.

I propose a novel method to compute the aggregate basis for individual stocks which relies on holdings data. I use a database of mutual funds holdings to construct a time series of reference prices for individual stocks. I then employ this measure to construct a test of stock price under-reaction to corporate news, generated by trading frictions from disposition-prone managers.

This paper makes several contributions to the existing literature on the behavior of mutual fund managers, event-driven return predictability, and the cross section of stock returns.

First, I outline a method to compute reference prices for individual stocks which does not rely on trading volumes and that has the advantage of using information regarding the

[1]Events of this type include earnings announcements (Mendenhall (1991), Abarbanell and Bernard (1992)), stock splits (Grinblatt, Masulis, and Sheridan (1984), Desai and Prem (1997) and David Ikemberry and Stice (1996)), tender offer and open market repurchases (Lakonishok and Vermaelen (1990) , Ikenberry, Lakonoshok, and Varmaelen (1995)), analysts' recommendations revisions (Groth, Lewellen, Scharbaum, and Lease (1979), Bjerring, Lkonishok, and Vermaelen (1983), Elton, Grueber, and Gultekin (1984), Womack (1996)), SEOs (Lougran and Ritter (1995), Teoh, Welch, and Wong (1998)), public announcements of insider trades (Seyhun (1986), Seyhun (1988)), venture capital share distributions (Gomper and Lerner (Forthcoming)), headline news (Chan (2003)) and R&D expenses increases (Eberhart, Maxwell, and Siddique (2004)).

[2]Kahneman and Tversky (1979).

[3]Thaler (1985).

cross sectional distribution of unrealized gains among shareholders. This measure can be constructed whenever holdings data are available for individual stocks.

Previous empirical work has focused on a measure of reference prices based on trading volume[4]. The major problem with using turnover to estimate reference prices is that the resulting measure can be a biased estimator of the stock cost basis. Using volume implicitly assumes that all shares are equally likely to be exchanged on a particular date. This approach neglects information regarding shareholders heterogeneity and the cross sectional distribution of their reference prices.

For example, assume that a stock has a large ownership of "natural" holders reluctant to sell and the cost basis for these investors is 10$ while the current price is 20$. There are also two shareholders, which own just one stock but continuously trade with each other for liquidity reason. If their turnover is high enough, using volume to infer the reference price would give an estimate close to current price of 20$. For example, if turnover in past month was 50%, then you would conclude that half of the outstanding shares traded at prices between the previous month low and high. Nevertheless, on an aggregate basis, the reference point is still around 10$ and the stock is trading at a large capital gain. In this case using volume gives an upper biased measure of the aggregate cost basis, the higher the turnover the larger the bias.

Second, I document the extent of the disposition effect among US mutual fund managers and show that this adversely affects returns. Losers funds tend to be as disposition-prone as retail investors. The results confirm the intuition in Wermers (2003): managers of under-performing funds appear reluctant to close their losing positions. Conversely, successful managers realize losses at higher rates than gains.

Third, I use the gain/loss measure to explore the role of unrealized capital gains in generating stock price under-reaction to public news. I test the specific hypothesis that trading frictions by disposition-prone investors hamper the transmission of information when tangible (firm-specific) information is released, such as on earnings announcements, inducing a predictable price drift. The drift depends upon the news content (positive or negative) and the difference between the current and the reference price.

In order to test for event-driven return predictability, I sort stocks into different classes for which capital gains are more likely to induce a sluggish response to corporate news

[4]Grinblatt and Han (2004) estimate reference prices from turnover. Ferris, Haugen, and Makhija (1988) use a similar measure by computing the total volume occurring at different price levels.

and construct a long/short equity strategy. The central prediction is that exposure to a disposition proxy should forecast cross-sectional differences in subsequent returns of the test portfolios.

To understand why investors who tend to ride losses and lock in paper gains may generate under-reaction to news, consider the following example. Stock XYZ is trading at $13 and its aggregate cost basis is equal to $16; that is, most of the current holders acquired their shares at a price around $16 and the stock is currently trading at a capital loss. At date t bad news is released revealing a fundamental value of only $11.

In absence of frictions the stock price should promptly adjust to $11. Nevertheless, if holders are reluctant to realize the paper loss they will tend to ration the available supply. If demand functions are not perfectly elastic, the stock price will only fall between $13 and $11 as holders unwilling to trade restrict the available supply, hampering price impact.

After the initial price drop investors who did trade will update their reference point by setting it to the trading price. This will bring the aggregate cost basis closer to the current price. As references points are updated via trading, the stock price approaches the fundamental value generating a negative post-event drift.

Now consider the same initial scenario, but let the initial aggregate cost basis be equal to $5, in this case the stock is initially trading at a large capital gain. When the bad news is revealed there is no friction rationing the supply of the stock, since most of the current holders are engaged in active selling to lock in their paper gains. In this alternative scenario the active selling will indeed help the market to promptly incorporate the bad news and the stock price should speedily drop to the new fundamental value. Post-event abnormal returns should be on average zero.

The reluctance to unload asset trading at a loss generates a "hampered" price discovery whenever negative news hits securities trading at a capital loss, creating post-event drift. As disposition-prone investors ration the supply, bad news travels slowly across asset trading at large capital losses, generating post-event (negative) return predictability.

Since disposition-prone investors are more likely to realize gains than losses, a similar argument can be made for good news socks. When most of the current holders are trading at large paper gains, their active selling tends to create excess supply, leading to a lower price impact, thus generating under-reaction to good news. Good news travels slowly across asset trading at large capital gains, generating post-event (positive) return predictability. This hypothetical example is illustrated in figures (1) and (2) which report the impact of

positive and negative news on stocks with unrealized gains and losses.

The novel result is that once event stocks are sorted using the new measure of capital gains, post-event predictability is indeed most severe where the disposition effect predicts the biggest under-reaction. Post-event drift is larger when news and capital gains have the same sign and its magnitude is directly related to the amount of unrealized gains (losses) experienced by the stock holders on the event date.

Last, I present cross sectional evidence that the new gain/loss variable is a strong univariate predictor of short term returns and appears to drive both price and earnings momentum. The inclusion of the holdings-based gains drives out both past returns and an alternative regressor constructed from turnover as a predictor of subsequent returns. This result provides stronger evidence that both price and earnings momentum are driven by disposition type effects, and that past returns are indeed a noisy proxy for unrealized capital gains experienced by the stock holders. The fact that using holdings allows to compute a variable that drives out alternative regressors is consistent with more precise estimates of the stock's cost basis to the current shareholders being better predictors of stock returns.

The rest of the article is organized as follows. Section I gives a brief introduction to the disposition effect. Section II defines the central variable: the capital gains overhang. I also document the extent of the disposition effect among fund managers. In section III, I describe the hypothesis and report abnormal returns for the main test assets. Section IV reports returns net of trading costs. Section V revisits the results in a regression context and analyzes the relationship between capital gains and the cross section of stock returns. Section VI concludes.

# I. The disposition effect

The disposition effect was introduced into the finance literature by Shefrin and Statman (1985) and refers to the tendency of investors to ride losses and realize gains. This runs counter to sound tax planning. The availability of account-level transaction data has made the disposition effect a widely documented empirical regularity: subsequent to the seminal paper by Odean (1998), several studies find investors reluctant to unload assets at a loss relative to the price at which they were purchased.

The available evidence[5] shows that although greater investor sophistication is associated

[5]See Odean (1999), Barber and Odean (2000, 2001, 2002) , Grinblatt and Keloharju (2000), Brown,

with less susceptibility to the disposition effect, professional traders are far from immune to it. Locke and Mann (2000) analyze the trading behavior of professional futures traders and find that while all traders hold losers longer than winners, the least successful traders hold losers the longest, while the most successful traders hold losers for the shortest time. Coval and Shumway (2000) report evidence of behavioral biases among professional market makers at the Chicago Board of Trade with the most compelling evidence concentrating in morning-loser traders. Shapira and Venezia (2001) find evidence of the disposition effect among professional investors in Israel while results in Wermers (2003) show that managers of losing funds appear reluctant to sell their losing stocks, which is consistent with their being disposition-prone.

# II. The capital gains overhang

Grinblatt and Han (2004) develop a model of equilibrium prices where trading frictions from disposition-prone investors generate price under-reaction to information and create a spread between a stock fundamental value and its equilibrium price. As investors trade and update their reference price, the spread between the reference price and the fundamental value mean-reverts to zero, generating momentum in stock returns.

Their model generates two main testable predictions that have spurred a new line of empirical research. First, the capital gains overhang, defined as the difference between the stock cost basis (reference price) and the current price, should be a univariate predictor of stock returns. Stocks with large capital gains have subsequent high returns, conversely, stocks with large capital losses have subsequent low return. Second, capital gains are a sufficient statistics for the cross section of returns, that is, they should drive out competing forecasting variables.

Grinblatt and Han estimate reference prices from trading volume and show that capital gains generate the profitability of price momentum strategies. Furthermore, once this variable is controlled for, past returns have no predictability for the cross-section of returns. Grinblatt and Moskowitz (2004) and George and Hwang (2004) report further evidence on momentum consistent with this model. Goetzmann and Massa (2003) find that a behavioral factor capturing the stochastic change in the percentage of disposition investors impact daily returns. Their results suggest that exposure to this disposition factor seems to be priced.

Chappel, da Silva Rosa, and Walter (2002), Dhar and Zhou (2002)

The previous research has focused exclusively on price momentum and on a measure of the cost basis based on trading volume. I want to devise a measure based portfolio holdings and analyze the transmission of information when tangible firm-specific information is released in the form of public news.

I compute the reference price as

$$RP_t = \phi^{-1} \sum_{t=1}^{n} V_{t,t-n} P_{t-n} \tag{1}$$

where $V_{t,t-n}$ is the number of shares purchased at date t-n that are still held by the original purchasers at date t, $\phi$ is a normalizing constant $\phi = \sum_{t=1}^{n} V_{t,t-n}$ and $P_t$ is the stock price at the end of month t.

Whenever a stock is purchased several times, then partially sold at different dates, investors are assumed to use the purchase price as the base to compute gains and losses and (when trading) to employ an historical cost-based mental accounting (FIFO, first-in-first-out) to associate a quantity of shares in their portfolio to the corresponding reference price[6].

For example, assume that an investor purchases 100 shares at date 0 at $P_0 = \$20$, an additional 100 shares at date 1 at $P_1 = 23.3$ and subsequently sells 120 shares at date 2 for $P_2 = 22$. Out of the 120 shares sold, 100 units are assumed to be drawn from the shares acquired at date 0, realizing a sell at a gain while the remaining 20 shares will be sold at loss. The total mental gain/loss will be $(22 - 20) * 100 + (22 - 23.3) * 20$ while at the end of period 2 the "mental book" will be given by $V_{2,0} = 0$ and $V_{2,1} = 80$.

The capital gains overhang is defined as the percentage deviation of the aggregate cost basis from the current price

$$g_t = \frac{P_t - RP_t}{P_t} \tag{2}$$

Capital gains are meant to be the best estimate of the stock's cost basis to the representative investor. The advantage of using holdings relies on the possibility of unambiguously identifying the fraction of shares purchased at a previous date which is still held by the original purchasers at the current date, thus taking into account shareholders heterogeneity in the anchor points.

In the empirical analysis, I use mutual funds common stock holdings to compute capital

[6] Using reference prices constructed employing a LIFO criterion (last-in-first-out), the last trading price, the last buying price or averages of past buying and selling prices, does not alter any of the main results

gains and losses for individual stocks. This assumes that mutual fund managers are a representative sample of the cross section of shareholders but the approach is general and can be applied whenever holdings data are available for individual stocks[7]. Using holdings of fund managers, investment professionals who, ex ante, are expected to be less exposed (if not immune) to behavioral biases, seems a conservative choice when testing for under-reaction to news induced by the disposition effect, since it would tend to bias the results against the null hypothesis.

## A. Data Description

The data come from three primary sources. Stock returns and accounting data between January 1980 and December 2002 are obtained from the CRSP/COMPUSTAT merged database. Quotes and trades are obtained from the New York Stock Exchange Trades and Quotations (TAQ) database, the TAQ data covers the period 1993-2002.

Mutual fund holdings from January 1980 to December 2002 are obtained from the Thomson Financial CDA/Spectrum Mutual Funds database which includes all registered mutual funds filing with the SEC plus 3,000 global funds. The data show holdings of individual funds collected via fund prospectuses and SEC N30D filings. The statutory requirements for reporting holdings are semi-annual. The data include the date holdings are recorded (report date) and the date reports are filed with SEC (file date). Holdings are adjusted for stock splits and are assumed to be public information with a 30 days lag from the file date[8]. Holdings are merged with CRSP data and filtered to eliminate potential anomalies probably due to misreporting or errors in data collecting. Holdings are set to missing whenever:

1. The number of shares in a fund portfolio exceeds the total amount of shares outstanding at a particular date
2. The value of the fund's holding of a particular stock on a particular date is larger than the total asset value of the fund reported by CDA

[7] Clearly we would like to use holdings of all the shareholders at a particular date, including retail investors. I repeated the analysis combining the mutual fund data (1980-2002) with individual investors holdings from a nationwide discount brokerage house (1991-1996). The results are unchanged as the size of mutual funds common stocks holdings tends to swamp the fraction of shares outstanding owned by retail investors. Since I only have access to retail investors' holdings for a limited period of 5 years and they do not generate noticeable difference in the analysis I present results generated using mutual funds holdings only.

[8] This choice is reasonable since the N30D filings can be accessed on the SEC EDGAR system immediately after being received

3. The asset has zero shares outstanding

4. The total asset value of the fund reported by CRSP differs from the implied CRSP value by more than 100%

After these filters are applied the data contains end of quarter stock holdings for 29,812 US domestic mutual funds between January 1980 and December 2002. The stock price at the report date is used as a proxy for the buying or selling price[9]. Clearly this will be a noise measure since the actual transaction price will be different from the price at the report date. Nevertheless, to the extent that stock prices are equally likely to increase or decrease after being purchased or sold by a mutual fund, there is no reason to expect this measure to bias the results one way or the other.

## B. Cross sectional determinants of the capital gains overhang

Table I provides summary statistics of the capital gains overhang. In terms of market capitalization, on average 84.4% of CRSP stocks have a valid capital gains over the period 1980-2002 . The gap is filled by very small stocks due to the fact that mutual funds tend to avoid micro cap illiquid securities.

Table II reports coefficients from Fama MacBeth (1973) regressions of unrealized gains by regressing them, cross sectionally, on the stock's past short and long term returns, size, turnover and some fund-related variables.

Model 1 shows the likelihood of winning (losing) stocks to exhibit large unrealized capital gains (losses) with most of the effect coming from recent price movements. The size coefficient is also positive, perhaps reflecting the fact that large stocks have a different ownership structure with investors tilted towards riding gains rather than realizing them or reflecting liquidity issues.

In model 2, I add the firm turnover in the past year (TURN) and an interaction term between turnover and returns as a control[10]. The results show that controlling for past returns, low volume winners tend to have larger capital gains while high volume losers tend to experience smaller capital losses.

[9] The report date (RDATE) is the calendar day when the snapshot of the portfolio is recorded; it usually coincides with the file date (FDATE) but in some cases dates back as much as 6 months prior to the file date.

[10] The coefficients are allowed to be different for NASDAQ stocks since turnover numbers do not have the same interpretation in a dealer market.

In model 3, I add to the regressors the percentage of shares owned by the mutual funds (MF_HOLD) as well the average return in the previous year of all the funds holding the stocks (HOLD_RET). If losing funds are reluctant to realize losses, we would expect stocks with a low HOLD_RET to be trading at a loss. The results show that stocks mostly held by losing (winning) funds display larger losses (gains). High fund ownership stocks tend to trade at a gain, probably reflecting the fact that the average manager is less disposition-prone when compared to retail investors.

Finally, I regress the absolute value of capital gains on the absolute value of the full set of regressors. Stocks mostly held by mutual funds and by funds with large returns in the previous year tend to have reference prices closer to the current stock price. Large stocks also trade closer to reference prices. High turnover accompanied by large return realizations of either sign keeps the overhang closer to zero, although the coefficient on raw turnover is positive, probably reflecting some non linearities not captured by the linear specification. High momentum stocks tend to have large capital gains of either sign.

## C. The disposition effect in mutual fund managers

Table III compares the aggregate Proportion of Gains Realized (PGR) to the aggregate Proportion of Losses Realized (PLR) for all the 29,812 mutual funds in the database. Each quarter a sale takes place between two report dates in a mutual fund portfolio, the current stock price is compared to the purchase price to determine whether the stock is trading at a gain or at a loss. If the current price is above the original purchase price, then the stock is counted as trading at a gain, if below the historical price, then the stock is trading at a loss. Managers are assumed to use the FIFO criterion in updating the reference price.

PGR is the number of realized gains divided by the sum of realized gains and the number of paper (unrealized) gains, and PLR is the number of realized losses divided by the number of realized losses plus the number of paper (unrealized) losses. At the beginning of each quarter mutual funds are ranked by their previous year return; PGR and PLR are reported for the full sample and across the performance-based quintiles. The t statistics test the null hypothesis that the difference in proportions is equal to zero.

What emerges from table III is a statistically strong (t-statistics = 44) tendency for mutual fund managers to sell a higher proportion of their winners than their losers. The magnitude of the aggregate difference (PGR - PLR) is around 3%, which is smaller than

the average 5% reported by Odean (1998) for retail investors, but still the same order of magnitude.

What is striking is the amount of variation that can be observed across the performance-based quintiles. Loser funds show signs of a disposition effect with magnitudes comparable to retail investors: they are 1.7 times more likely to realized a paper gain than a paper loss, an 8% (t-statistics = 25.5) difference between PGR and PLR. This result confirms the evidence in Wermers (2003): managers of losing funds appear reluctant to sell their losing stocks.

# III. Under-reaction to corporate news

I describe the main under-reaction hypothesis and design a related investment rule to construct the test assets. The conjecture is that in the presence of disposition-prone investors, stock prices will under-react to a specific set of news generating post-event drift.

**Hypothesis UR (Under-Reaction):** *When most of the current holders are facing a capital loss, stock prices under-react to negative news generating a negative post announcement price drift. When most of the current holders are facing a capital gain, stock prices under-react to positive news generating a positive post announcement price drift. Moreover, holding the news constant, the capital gains overhang forecasts post-event returns*

An interaction between the news content and capital gains generates return predictability[11]. The example in the introduction reveals the intuition behind the hypothesis: trading (or reluctance to trade) by disposition-prone investors tends to hamper price discovery. Positive (negative) news travels slowly in stocks with large capital gains (losses) as disposition prone traders tend to dampen the transmission of information, thus generating return continuation.

The hypothesis UR implies that a long/short position where good news stocks are held with positive weights, offset by a short position in negative news stocks, should yield higher returns the higher the spread in the capital gains overhang between the long and the short side. Since stocks with large gains under-react more to good news and stock with large losses under-react more to bad news, the difference in capital gains between the long and the short

[11] A previous version of this paper contained a simple model can be used to generate this proposition.

side will forecast returns of a long/short news strategy.

I refer to the maximum-profits strategy as the *overhang spread*, that is, a portfolio that is long good news stocks with the largest paper gains and short bad news stocks with the largest paper losses. Such a portfolio has the largest capital gains spread between the long and short side.

I call the opposite extreme portfolio the *negative overhang spread*, that is a portfolio that is long good news stocks with the largest capital losses and short bad news stocks with the largest capital gains. Such a strategy has the minimum (negative) gains spread between the long and short side.

I use an investment rule which exploits the post earning announcement drift. Labeled by Fama (1998) as "above suspicion," the inability of stock prices to speedily impound earnings information is among the most compelling evidence of under-reaction in equity markets: an extensive literature, dating back to Ball and Brown (1968), indicates that investors under-react to the information content of earnings, generating return continuation, otherwise known as the post earnings announcement drift anomaly [12] (hereafter PEAD). The profitability of rolling investment strategies based on the PEAD is extensively analyzed in Jegadeesh, Chan, and Lakonishok (1996).

I use a rolling portfolio approach following Jegadeesh and Titman (1993) and Fama (1998). The resulting overlapping returns can be interpreted as the returns of a trading strategy that in any given month t holds a series of portfolios selected in the current month as well as in the previous k months, where k is the holding period. At the beginning of each month, an independent sort is used to rank stocks on the basis of their most recent earnings surprises and the capital gains overhang at the end of the previous month. The ranked stocks are assigned to one of 25 quintile portfolios. All stocks are equally weighted within a given portfolio and the overlapping portfolios are rebalanced every calendar month to maintain equal weights[13].

Earnings surprises are measured using the market model cumulative abnormal returns around the most recent earnings announcement date[14]. This is a fairly clean measure of

[12] See Joy, Litzenberger, and McEnally (1977), Rendleman, Jones, and Latane (1982), Olsen and Shevlin (1984), Bernard and Thomas (1989, 1990), Affleck-Graves and Mendenhall (1992), Ball and Bartov (1996) and more recently Collins and Hribar (2000), Tarun and Shivakumar (2002).

[13] I use equal weights for comparison to the existing literature one earnings and price momentum. Value weighting delivers identical results.

[14] The daily abnormal returns are cumulated from the two days preceding the event date to one day after, in order to account for the possibility of early or delayed reaction to the announcement caused by information

news since it does not rely on assumptions regarding the market expectation for earnings. A return-driven news sort also appears appropriate since it closely mimics the under-reaction hypothesis at hand.

A caveat that arises when sorting stocks using capital gains is that it is likely for winning (losing) stocks to exhibit large gains (losses). Ideally, we would like the sub-samples to contain stocks with similar characteristics but a wide spread in capital gains. Therefore, I sort stocks using both the *capital gains overhang* and a *residual overhang*. The residuals are constructed from cross-sectional regressions of gains on past returns, size and volume [15].

The time series of returns of the rolling portfolios tracks the calendar month performance of a post-event strategy which is entirely based on observables. Such an investment rule should earn zero abnormal returns in an efficient market. I compute abnormal returns from a time series regression of the portfolio excess returns on contemporaneous Fama and French (1993) factors in calendar time[16].

Positive abnormal returns following positive news will indicate the presence of post-event drift consistent with under-reaction. The opposite will be true for negative news. Under the hypothesis UR, the overhang spread consistently earns higher returns than the negative overhang spread. Ceteris paribus, the wider the spread in capital gains between the long and the short side, the larger the subsequent alpha.

There is a distinctive prediction of the hypothesis at hand that should be emphasized: the disposition effect makes a specific prediction about the sign of the under-reaction pattern in different scenarios. The under-reaction is more severe whenever capital gains and the event have the same sign. Stocks where most current holders are experiencing large paper losses severely under-react to negative news, as opposed to stocks with similar news but trading at large gains. The opposite is true for positive news stocks.

# IV. Results

The focus of the analysis is on short term under-reaction. Since earnings news is released quarterly, I use a three-month strategy as the benchmark portfolio when presenting the results.

leaking, pre-announcements or a delayed response for less frequently traded stocks.

[15] Specifically, the residuals are obtained using model 2 in table II.

[16] The monthly factors and the risk free rate are from Ken French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french

I begin by reporting returns of standard PEAD strategy. The last column in table IV confirms that there is significant PEAD in the full sample. The baseline rolling strategy that is long the top 20% positive earnings news stocks and short the bottom 20% generates risk adjusted returns of 1.242 percent a month (t-statistics = 10.78). Negative (positive) earnings momentum stocks display negative (positive) return continuation and the effect is monotonic with average returns increasing as we move from the bottom to the top quintile. Such values are comparable to the ones reported in previous studies of the PEAD.

Tables VI reports monthly alphas for the main test assets. Separating stocks according to their unrealized gains induces dramatic differences in subsequent returns. The overhang spread, a strategy which holds a portfolio of top 20% positive news stocks with large paper gains (top 20% capital gains) for three months and offset this position by shorting the bottom 20% bad news stocks with large paper losses (bottom 20 % capital gains), delivers abnormal returns of 2.433 percent per month (t-statistics = 6.60).

The results support the hypothesis UR: bad (good) news travels slowly among stocks with large unrealized capital losses (gains) generating large subsequent returns for the overhang spread portfolio. Post-event returns of the negative overhang spread are not significantly different from zero. When negative news hits securities trading at large paper losses, it generates a severe post-event drift. Similarly, subsequent returns are large for positive news stocks trading at large gains. Conversely prices quickly adjust when good (bad) news hits securities trading at large paper losses (gains) and post-event abnormal returns are on average zero.

Using residual rather than raw overhang delivers similar results. The alpha of the overhang spread is 2.201% (t-statistics = 6.56), but it is not significantly different from zero for the negative overhang spread portfolio. The results show that even after controlling for past returns, high overhang stocks under-react to earnings news generating subsequent abnormal returns.

Table VI better illustrates the result by reporting returns for different overhang quintiles. In the table, portfolio $j$ is defined as a zero cost portfolio which holds the top 20% good news stocks in the $j$ overhang quintile and sells short the bottom 20 % bad news stocks in the $(6-j)th$ overhang quintile. Hence portfolio #5 corresponds to the *overhang spread* which is the strategy with the largest (positive) difference in the overhang between the long and short side. Portfolio #1 corresponds to the *negative overhang spread* which is the strategy with the minimum (negative) difference in the overhang between the long and short side.

Indeed, the spread in capital gains between the long and the sort side forecasts future returns. The alpha declines monotonically across the quintiles portfolios as the spread in capital gains goes from maximum (positive) in portfolio #5 to minimum (negative) in portfolio #1. The returns generated by the overhang spread are statistically different from the negative overhang spread (t-statistics 3.64). The induced difference is remarkable, being over 200 basis points per month.

These results are consistent with the hypothesis HR: the post-event drift anomaly is related to investors' initial under-reaction to news, generated or amplified by the rate at which they tend to realize gains and losses. The findings are consistent with an incomplete price discovery on the event date.

There is also an intrinsic asymmetry in the mechanism generating the price drift, depending upon the news content. In the case of good news, fund managers with positive overhang may be willing to sell and settle for a price lower than the fundamental value in order to lock in the profit. This active selling leads to a relatively low price and the consequent price drift. In contrast, when bad news is revealed and the manager is trading at a loss, he decides not to sell the stock, which affects the price in a more indirect and passive manner[17]. Thus, it is likely that the first case has a stronger effect on price under-reaction than the second. Table VI seems to support this conjecture as returns on the long side of the overhang spread portfolio tend to be larger than those on the short side.

To the extent that an argument can be made that these returns reflect loadings on some traded factor, note that the cross sectional variation in returns is large enough to make "within news" strategies profitable. For example, holding the bottom 20% *bad news* stocks with large paper gains for three months and shorting the bottom 20% *bad news* with large paper losses generates an alpha of 88 basis points a month. Since this portfolio includes only bad news stocks it will load negatively on a momentum factor. Similar spreads can be constructed across different overhang quintiles and news stocks.

The results show that the bulk of the profitability of the PEAD is concentrated in high overhang stocks . Consistent with the hypotheses UR, stocks with large unrealized capital gains tend to under-react to, and only to, positive earnings surprises while negative overhang stocks under-react to, and only to, negative earnings news. This induces dramatic differences between returns of the overhang spread and negative overhang spread portfolio.

Table VII reports factors loadings for the three-month rolling strategy. The portfolios

[17]I'd like to thank an anonymous referee for pointing this out

have similar market and size exposure. High capital gains stocks of either news sign are slightly more concentrated on glamor stocks. The intercept of the overhang spread are particularly eye catching (-1.129 % and 1.304%). These dramatic alphas stem from the fact that the bad news portfolio has persistently low returns even though it is tilted toward small stocks which would tend to raise expected returns. The second portfolio has higher returns but a negative loading on $HML$ which, ceteris paribus, should decrease expected returns. None of the factor loadings is significant for the long/short overhang spread, which is consistent with returns being driven by under-reaction to the initial news content rather than reflecting systematic risk. Separating high overhang stocks has the effect of exacerbating the PEAD anomaly since it allows to substantially increase returns with respect to a standard PEAD long/short strategy while maintaining a market neutral risk profile.

# V. Liquidity, size and trading costs

Post-event price drift is consistent with a world where firm-specific information diffuses only gradually across the investing public and market participants only partially extrapolate information from prices. A priori, we would expect the drift to be most severe in stocks where price discovery is likely to be sluggish, such as small stocks[18].

In a recent paper, Lesmonda, Schill, and Zhouc (2004) argue that momentum strategies require frequent trading in disproportionately high cost securities such that trading costs prevent profitable strategy execution[19]. Trading frictions associated with small or illiquid stocks may explain why the drift appears to persist but they cannot explain why it arises in the first place. To realize the overhang spread returns, the relevant investor must fully open and close both the long and the short position. The execution requires paying the full spread, incurring the commissions fees and costs associated with price impact on four trades.

Since trading costs vary according to firm size, I break the sample into size quintiles[20] and compare the returns of the overhang strategy to the trading costs associated with executing these positions. Since portfolios are equally weighted, round trip trading costs are also

[18] Hong, Lim, and Stein (2000) show that momentum profits are larger for stocks with low analysts' coverage and for smaller stocks once stocks in the lowest NYSE size quintile are excluded from the sample. This result is consistent with under-reaction caused by slow diffusion of information as proxy by firm size or analysts' coverage.

[19] Their analysis focuses on price, not earnings momentum.

[20] I use NYSE breakpoints

equally weighted.

Trading costs estimates as follows: for each stock in the TAQ database I obtain trades and quotes for a randomly selected day in each calendar month and compute the average direct effective spread and commission on that trading day. Monthly firm estimates are then computed using 12 monthly estimates obtained prior to the inclusion in the portfolio. I use the standard approach to compute the effective spread as twice the absolute trading price deviation from the bid-ask midpoint. I use a combination of price and tick test to infer trade direction[21]. The trade is classified as buyer-initiated or seller-initiated respectively if the trade price is above or below the quote midpoint. If the trade occurred at the midpoint, then the effective spread is zero.

To compute commissions for each trade I use a discount brokerage schedule from CIGNA financial services[22]. Since TAQ data are available only between 1993 and 2002, I assume that the average effective spread plus commissions in the later part of the sample period is a reasonable estimate for the period 1980-1992[23].

I set a minimum liquidity threshold by not allowing trading in stocks with a closing price at the end of the previous month below \$3. This ensures that both returns and the trading costs estimates are not contaminated by micro cap illiquid securities.

Table VIII reports results for the overhang spread portfolios across size quintiles. For each portfolio I report the Fama-French alpha, the average turnover, the average trading cost and the maximum trading cost. The latter is defined as the round trip trading cost necessary to eliminate the abnormal return, given the portfolio turnover. The t-statistics

[21] Lee and Ready (1991).

[22] This is the same schedule used by Lesmonda, Schill, and Zhouc (2004). The commission schedule is subject to a \$38 overriding minimum. Commissions are then as follows:

| Dollar volume (V) | | | commissions |
|---|---|---|---|
| \$0 | - | 2,500 | \$29+1.70% V |
| 2,500.01 | - | 6.250 | 55+0.66% V |
| 6,250.01 | - | 20,000 | 75+0.34% V |
| 20,000.01 | - | 50,000 | 99+0.22% V |
| 50,000.01 | - | 500,000 | 154+0.11% V |
| 500,000 | + | | 254+0.09% V |

Since NASDAQ securities are reported in the TAQ database on a net basis with commissions embedded into the reported trade price, the use of the commission schedule may overstates the true commission costs for those securities. The commissions are also high with respect to the rates available in the latest part of the sample period.

[23] Lesmonda, Schill, and Zhouc (2004) provide evidence that this assumption is a fairly reasonable one.

test the hypothesis that average trading costs exceed the maximum threshold. Last, I report the alpha net of trading costs and the average net semiannual buy-and-hold return. I use the actual monthly turnover to compute net returns.

The results strongly confirm the previous findings: stock prices under-react to bad news when more current holders are facing a capital loss, and under-react to good news when more current holders are facing a capital gain. Abnormal returns of the overhang spread portfolios are statistically significant and economically large across all the size sub-samples. As conjectured, they tend to be larger for small stocks where information asymmetries are more likely to be pronounced.

Dropping low-priced stocks increases the magnitude of the drift, due to the fact that micro cap stocks tend to exhibit reversals induced by supply shocks. None of the alphas of the negative overhang spread portfolios (not reported) is significantly different from zero.

Furthermore, the trading costs associated with these positions do not prevent profitable strategy execution. The baseline overhang spread portfolio delivers net monthly alphas of 0.885% and 1.062% depending upon the holding period of the underline rolling strategy. On a net basis, returns are higher for the six-month strategy [24] as the lower turnover more than compensate the reduction in returns with respect to the three-month strategy. The six- month overhang strategy delivers semiannual buy-and-hold returns between 1.7% and 6% which is a significant achievement considering that those are zero beta returns.

An extensive battery of additional robustness tests is reported in the appendix. All the results tell a consistent story: signed overhang predicts future returns. The post-event drift is larger when the news and the capital gains overhang have the same sign: bad (good) news travels slowly among negative (positive) overhang stocks, generating post-event return predictability.

# VI. Cross sectional regressions

I this section I take a somewhat different approach to measure the same basic phenomenon and I use it to show some related results. As explained in the introduction, we would expect holdings to deliver a more accurate estimate of reference prices than trading volume. Finally, I present a rigorous test of this conjecture.

I use Fama and MacBeth (1973) regressions to disentangle the predictive power of the

[24] This implies fully opening and closing both the long and the short position every two quarters.

capital gains overhang and other variables that influence the cross section of returns. Every month I run a cross sectional regression of individual stock returns on the previous year return[25], the most recent earnings surprise and various measures of capital gains. I first confirm that capital gains predict the cross section of returns. I then run a horse race and show that this novel variable does indeed have an edge in terms of forecasting power over past returns and a competitor variable constructed from turnover.

The turnover-based overhang follows Grinblatt and Han (2004). The number of shares purchased at date t-n that are still held by the original purchasers at date t is computed as

$$V_{t,t-n} = TO_{t-n} \left( \prod_{\tau=1}^{n-1} (1 - TO_{t-n+\tau}) \right) \tag{3}$$

where $TO_t$ is turnover in month t. The reference price is estimated using 1.

This measure treats all shares as symmetric: turnover ratios correspond to trading probabilities and the probability $V_{t,t-n}$ is equal to the probability that a share traded at date t-n and never traded again up to date t. Hence it is equal to the probability that the reference price is equal to the t-n price. Averaging over all possible reference prices gives the estimated cost basis for the market.

All the regressions include firm size and book-to-market as controls. In order to account for possible nonlinearities, I express each explanatory variable in terms of its ordinal ranking and then I scale it to lie between zero and one. This has the advantage of expressing all the variables on a common scale, so that the estimated coefficients can be directly compared. The dependent variable is either the buy-and-hold return over the subsequent three or six months. Table IX reports the time series averages of the estimated coefficients.

In model 1 to 3 I replicate the well know results by Jegadeesh, Chan, and Lakonishok (1996): prior returns and earnings surprises predict subsequent returns. Models 4 and 5 revisit the main results from Grinblatt and Han (2004): the capital gains overhang is a univariate predictor of future returns. More importantly, past returns have no predictability for the cross section of returns once this variable is controlled for. When earnings surprises and past returns are added to the regressors, the average slope coefficient of past returns is not statistically different from zero.

In model 6 to 9 I run a horse race between past returns and the two measures of capital

[25] The last month is skipped to control for short term reversals, see Jegadeesh (1990).

gains. If using holdings gives a more precise measure of the cost basis to the marginal investor, we would expect such a variable to drive out the predictability of the competing variables.

The results confirm that the holdings measure predicts subsequent returns. The average slope coefficient is 4.9 percent (t-statistics = 7.65). When all the regressors are considered simultaneously, the holdings-overhang drives out both past returns and the alternative regressor as a predictor of subsequent returns. The average slope coefficient of both past returns and the turnover measure are not reliably different from zero.

The fact that using holdings allows to compute a variable that drives out both past returns and an alternative gains variable is consistent with more precise estimates of the stock's cost basis to the current shareholders being better predictors of stock returns. Using holdings allows to identify the fraction of shares purchased at a previous date that are still held by the original purchasers at the current date, thus giving a more precise measure of the reference price.

Finally, in model 10, I revisit the results from table VI in a regression context: controlling for earnings surprises, the capital gains overhang predicts subsequent returns. Model 10 also shows that the capital gains overhang cuts in half the predictability of returns using past earnings surprises. Comparing model 1 and 9 reveals that the inclusion of capitals gains knocks the estimated coefficient on past earnings surprises from to 4.1 to 2.1. This result shows that the predictability of returns using capital gains and the one generated by reaction to earnings news are not separate phenomenons. In other words, although both variables forecast returns, there is a detectable interaction between aggregate gains and returns on earnings surprises. This provides further evidence suggesting that the stock's cost basis to the marginal investor influences the markets reaction to earnings news. Earnings news travels slowly in stocks with large unrealized capital gains/losses generating return continuation.

The results for six-month returns are reported in Panel B and they are quantitatively similar to those reported in Panel A.

The findings reported in table IX provide strong evidence that both price and earnings momentum are driven by disposition type effects and that past returns are indeed only a noisy proxy for unrealized capital gains experienced by the stock holders.

# VII. Conclusion

This paper suggests that the disposition effect can induce under-reaction to news, leading to return predictability and a post-announcement price drift. The price pattern depends upon the information content of the news, and on the reference price of the investor relative to the current price: bad news travels slowly among stocks trading at large capital losses, leading to a negative price drift. Similarly, good news travels slowly among stocks trading at large capital gains leading to a positive price drift. This paper provides a test of this hypothesis.

I propose a new method to compute a measure of the aggregate basis for individual stocks which relies on holdings data. I use a database of mutual funds holdings to construct a measure of reference prices for individual stocks. I then use the gain/loss to construct a test of stock price under-reaction to news.

The calendar-time rolling method used in the portfolio approach allows for a straightforward test and controls for cross correlation among event stocks, which tends to invalidate inference in event studies performed in event-time. The focus is on short term under-reaction, hence the asset pricing model misspecification problem, typical of long term event studies, is less likely to be an issue. The methodology also allows an interpretation of the testing procedure as an executable investment strategy whose risk profile and performance can be assessed using simple time series regressions.

The results show that stocks with large unrealized capital gains have higher subsequent returns as investors initially under-react to news announcements generating a predictable price drift. The post-event predictability is most severe where the disposition effect predicts the biggest under-reaction. Post-event drift is larger when the news and the overhang have the same sign and the magnitude of the post earnings announcement drift is directly related to the amount of unrealized capital gains (losses) experienced by the stock holders at the event date.

Stocks with large unrealized capital gains under-react to, and only to, positive news while stocks with large unrealized capital losses under-react to, and only to, negative news. These findings are consistent with a world where trading frictions, captured by the capital gains overhang, impede a speedy transmission of information to stock prices via price impact.

Cross sectional results reveal that the capital gains overhang is a univariate predictor of returns and appears to drive both price and earnings momentum. Moreover, the holdings-based overhang drives out past returns and an alternative capital gains regressor constructed

from past turnover as a predictor of subsequent returns. This is consistent with more precise estimates of the stock's cost basis to the current shareholders being better predictors of stock returns.

Capital gains will predict returns under alternative hypotheses which do not rely on the disposition effect. Suppose that the overhang is simply a measure of the holding period of the stock holders: some stocks have "loyal" holders who sell very rarely. Since, on average, stock prices increase over time, stocks with loyal holders will have large unrealized gains. Since loyal holders are reluctant to trade, it may take a while for the market to incorporate good news thus generating the post-event drift.

Another alternative hypothesis is the following: some stocks have low turnover and are generally illiquid therefore they have "loyal" holders. Since lower-than-average turnover and positive historical returns means high overhang stocks, overhang will be negatively correlated with turnover and positive correlated with size. This is consistent with the empirical findings reported in section B. Small and illiquid stocks react less to good news since they react less to any news due since they do not trade as often. In this world residual overhang will be a better predictor of returns than raw overhang.

Last, since reference prices are share weighted, is the possibility that capital gains capture disagreement about a stock. In presence of short sale constraints stocks with the higher disagreement have lower expected returns[26].

Although it is possible that the capital gains overhang captures liquidity-related factors, none of the hypotheses above can explain the asymmetry in the price response to news: under-reaction is most severe when capital gains and the event have the same sign. Stocks with large unrealized gains under-react to good news, and to good news only. Stocks with large unrealized losses only under-react to negative news. Overhang is not just a proxy for liquidity since the response goes to one direction for positive news, and a different direction for negative news.

This asymmetric pattern is consistent with the disposition effect because the latter predicts signed orders flows as a function of the difference between the current and the reference price. When facing a capital loss, disposition-prone investors are reluctant to realize it thus generating under-reaction to negative news. Similarly, their active selling prevents the price from rising immediately to the new level on positive news announcements. As a result, post-event risk adjusted returns can be systematically achieved by a using sort on the capital

[26] Miller (1977).

gains overhang, suggesting that such a variable predicts the gradual market response to new information.

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# A. Appendix

## A.1. Sub-samples based on mutual fund ownership

Capital gains are meant to be the best estimate of the stock's cost basis to the representative investor. Since reference prices are constructed using mutual fund holdings, it is plausible for this measure to be more relevant for stocks mostly held by mutual funds, and less relevant for stocks mostly held by retail investors. I address this issue by splitting the sample into stocks with high and low mutual fund ownership. Ownership is defined as the percentage of shares held by mutual funds sector. I use the median ownership at the end of the previous month as the breakpoint. The results in table X shows that separating stocks by mutual fund ownership has little effect on the magnitude of the overhang spread. The difference in returns between the overhang and the negative overhang spreads is large and significant for both groups of stocks.

## A.2. Out of sample evidence

Using holdings limits the analysis to the period 1980-2002 where mutual fund data is available and relies on the assumption that mutual fund managers are a random sample of the population of shareholders. I repeat the analysis by splitting the sample into the two sub-periods 1962-1979 and 1980-2002 and I use the turnover-based measure of overhang proposed by Grinblatt and Han (2004). Results in table X are consistent with the previous findings: stocks with large unrealized gains (losses) severely under-react to positive (negative) news. The fact that in the overlapping period 1980-2002 abnormal returns are lower and more volatile (lower t-statistics) with respect to the holdings measure, is consistent with the evidence in table IX: holdings deliver a more accurate measure of unrealized gains than turnover.

## A.3. Characteristics-adjusted returns

Daniel and Titman (1998a, 1998b) suggest that characteristics can be better predictors of future returns than factor loadings. I follow Barber and Lyon (1997) and measure abnormal return comparing the return of event stocks to that of a single control stock. First, using conditional sorts and NYSE breakpoints, all stocks in the sample are assigned to one of 125 ($5 \times 5 \times 5$) characteristics portfolios based on size, book-to-market (B/M) and return in previous 12 months. To find a match for a given sample stock, all the non-event stocks in the

same characteristics portfolio are ranked based on the difference between the sample stock and the matching stock on each characteristics. Ranks are summed across the different characteristics, and the lowest rank is selected as the matching stock. The match is maintained until the next event or the delisting date. If a match becomes unavailable at a given point, either because of delisting or because it has an earnings announcement, then from that point forward it is replaced by the second lowest rank stock. This procedure ensures that there is no look-ahead bias. I subtract the size, B/M and momentum matched returns from stock returns and then calculate calendar time rolling returns as before. Results in table X confirm that even after controlling for past returns, security prices tend to under-react to public news and that the magnitude of such post-event drift is indeed predictable by the signed overhang. The overhang spread portfolio consistently earn higher risk adjusted returns than the negative overhang spread portfolio.

### A.4. Standardized unexpected earnings

Using returns around the most recent event-day gives a clean and easy to implement measure of earnings surprises, since it does not require a model for expected earnings. Nevertheless, it may also have some drawbacks. Event-day returns only capture changes over a window of a few days of the market's view about earnings. An accounting-based measure of earnings news incorporates information up to the last quarter. Hence it should reflect earnings surprises over a longer period. Jegadeesh, Chan, and Lakonishok (1996) show that different measures of earnings surprises may have low correlation, suggesting that different surprise definitions may capture different aspects of market expectation of earnings releases. I use standardized unexpected earnings defined as $sue_t = (e_t - e_{t-4})$ where $e_t$ is the most recent quarterly earnings per share as of month t, $e_{t-4}$ is the earnings per share four quarters before month t and $\sigma$ is the standard deviation of unexpected earnings $(e_t - e_{t-4})$ over the preceding eight quarters. The results table X are strikingly similar to the previous findings: bad (good) news travels slowly among negative (positive) overhang stocks, generating post-event return predictability. The lower magnitude of the drift may be due to the fact strategies based on accounting surprises and market impact exploit market under-reaction to separate pieces of information, embedded in different news proxies.

### A.5. Analysts' stock recommendation revisions

The under-reaction hypothesis is not specific to earnings announcements but can be applied to any situation where firm-specific information is released. I use an additional long/short strategy which mimics most recent changes in analysts' stock recommendations. Analysts' recommendation revisions have been found to have predictive power for future stock returns[27]. In particular, upgraded stocks outperform downgraded stocks, implying that stock prices do not adjust immediately to a recommendation revision. Brokers' and analysts' recommendations are from the I/B/E/S database. The Recommendations Detail file contains analysts' ratings for a particular company: each recommendation received from the contributors is assigned a numeric value, and mapped to one of the I/B/E/S standard ratings from 1 (strong buy ) to 5 (sell). I use the I/B/E/S rating code to compute changes in recommendations for each analyst following a particular stock, since the most recent recorded value. Analysts' revisions' event days are defined as the trading days when at least one revision occurs. The data run from January 1993 to December 2002. The news proxy is the market model cumulative abnormal returns around the most recent revision date. Results in table X (panel G) confirm the previous findings: the overhang spread portfolio displays price drift following analysts' recommendation changes.

[27]See Womack (1996) and more recently Jegadeesh, Kim, Krische, and Lee (2004)

**Table I**
**The capital gains overhang, summary statistics**

This table reports summary statistics for the capital gains overhang. The capital gains overhang is defined as the percentage deviation of the aggregate reference price from the current price $g_t = (P_t - RP_t)/P_t$. The reference price is defined as $RP_t = \phi^{-1} \sum_{t=1}^{n} V_{t,t-n} P_{t-n}$ where $V_{t,t-n}$ is the number of shares that at date t are still held by the original purchasers at t-n, $\phi$ is a normalizing constant and $P_t$ is the stock price at the end of month t. Investors are assumed to use a FIFO criterion (first-in-first-out) to associate shares in their portfolio to the corresponding reference price. The table reports mean, standard deviation, skewness, the first and the fifth quintile for selected years. %STOCKS is the percentage of stocks in the CRSP database with a valid capital gains overhang, % MV is the percentage of total market value of stocks with a valid capital gains overhang.

| Year | Mean | Median | Stdev | Skew | P20 | P80 | %STOCKS | %MV |
|---|---|---|---|---|---|---|---|---|
| 1985 | -0.08 | 0.01 | 0.42 | -2.55 | -0.26 | 0.18 | 64.5 | 95.9 |
| 1990 | -0.27 | -0.11 | 0.55 | -1.99 | -0.54 | 0.10 | 62.2 | 96.9 |
| 1995 | -0.07 | 0.03 | 0.44 | -2.61 | -0.24 | 0.20 | 83.6 | 82.0 |
| 2000 | -0.33 | -0.14 | 0.67 | -1.54 | -0.72 | 0.16 | 88.6 | 73.8 |
| 1980-2002 | -0.15 | -0.01 | 0.52 | -2.30 | -0.36 | 0.18 | 72.7 | 84.4 |

**Table II**
**The capital gains overhang, Fama MacBeth regressions 1980 - 2002**

This table reports coefficients from Fama MacBeth regressions of the capital gains overhang on a set of firm and fund-specific regressors. $R_{-12,1}$ is the prior year stock return, $R_{-36,-13}$ is the previous two-year return, $\log(mv_{-1})$ is the log of market capitalization at the end of the previous month, TURN is the average turnover in the previous 12 months, MF_OWN is the percentage of shares outstanding owned by mutual funds and HOLD_RET is the average return in the previous twelve months of all funds holding the stocks. Prior funds returns are weighted by the percentage of ownership in the stock. NASD is a NASDAQ dummy. Cross sectional regressions are run every month and standard errors are adjusted for heteroskedasticity and autocorrelation using a Bartlett kernel. In model 4 the absolute value of the overhang variable is regressed on the absolute value of the full set of regressors. t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters. The $\overline{R}^2$ is the average $R^2$ from the cross sectional regressions.

| Model No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Dependent variable | capital gains | capital gains | capital gains | abs(capital gains) |
| $R_{-12,-1}$ | **0.396** | **0.553** | **0.557** | **0.273** |
| | (10.87) | (15.29) | (15.25) | ( 5.71) |
| $R_{-36,-13}$ | **0.044** | **0.068** | **0.073** | **0.012** |
| | (4.27) | (6.81) | (7.90) | ( 2.89) |
| $\log(mv_{-1})$ | **0.064** | **0.071** | **0.069** | **-0.072** |
| | (13.91) | (13.44) | (17.07) | ( -14.96) |
| TURN | | **-0.110** | **-0.127** | **0.106** |
| | | (-15.80) | (-12.68) | ( 8.86) |
| NASD*TURN | | **0.086** | **0.073** | **-0.062** |
| | | (3.87) | (7.58) | ( -7.22) |
| $R_{-12,1}$*TURN | | **-0.124** | **-0.134** | **-0.099** |
| | | (-11.40) | (-10.82) | ( -5.35) |
| MF_OWN | | | **0.452** | **-0.290** |
| | | | (10.67) | ( -8.87) |
| HOLD_RET | | | **0.424** | **-0.474** |
| | | | (8.14) | ( -7.88) |
| $\overline{R}^2$ | 0.25 | 0.28 | 0.30 | 0.15 |

**Table III**
**Proportion of Gains Realized to the aggregate Proportion of Losses Realized, Mutual funds (1980-2002)**

This table compares the aggregate Proportion of Gains Realized (PGR) to the aggregate Proportion of Losses Realized (PLR), where PGR is the number of realized gains divided by the number of realized gains plus the number of paper (unrealized) gains. PLR is the number of realized losses divided by the number of realized losses plus the number of paper (unrealized) losses. Realized gains, paper gains, losses and paper losses are aggregate across funds from 1980 to 2002. PGR and PLR are reported for the full sample and across mutual funds ranked by the previous year return. The t-statistics test the null hypothesis that the difference in proportions is equal to zero and 5% statistical significance is indicated with bold characters.

| | Fund return in the previous year (quintiles) | | | | | |
|---|---|---|---|---|---|---|
| | 1 (low) | 2 | 3 | 4 | 5 (high) | all |
| PLR | 0.112 | 0.122 | 0.137 | 0.158 | 0.169 | 0.145 |
| PGR | 0.193 | 0.182 | 0.188 | 0.179 | 0.198 | 0.176 |
| PGR - PLR | **0.081** | **0.060** | **0.051** | **0.021** | **0.029** | **0.031** |
| t - stat | (24.0) | (25.5) | (23.0) | (17.0) | (10.0) | (43.6) |

**Table IV**
**Post earnings announcement drift, monthly alphas 1980 - 2002**

At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns on the most recent earnings announcement date. The daily abnormal returns are cumulated from the two days preceding the event date to one day after. Stocks are assigned to one of five equally weighted quintile portfolios. This table include all available stocks and reports Fama and French (1993) three factors alphas. The dependent variable is the monthly excess return of the treasury bill rate from rolling strategy, the explanatory variables are the monthly returns from Fama and French (1993) mimicking portfolios. L/S is the alpha of a zero cost portfolio that holds the top 20% good news stocks and sells short the bottom 20% bad news stocks. Alphas are in monthly percent, $t-$statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters. "Rolling period" is the holding period of the rolling strategy, in months.

| | Earnings news quintile | | | | | |
|---|---|---|---|---|---|---|
| Rolling period | 1 (bad) | 2 | 3 | 4 | 5 (good) | L/S |
| +1 | **-0.558** | -0.253 | 0.014 | 0.232 | **0.595** | **1.152** |
| | ( -2.69) | ( -1.84) | ( 0.11) | ( 1.82) | ( 3.20) | ( 8.17) |
| +2 | **-0.512** | 0.044 | 0.137 | 0.215 | **0.657** | **1.169** |
| | ( -2.07) | ( 0.32) | ( 1.04) | ( 1.75) | ( 3.91) | ( 7.11) |
| +3 | **-0.624** | -0.070 | 0.080 | **0.221** | **0.618** | **1.242** |
| | ( -3.22) | ( -0.68) | ( 0.80) | ( 2.29) | ( 4.45) | ( 10.78) |

**Table V**
**Overhang spread and negative overhang spread alphas**

This table reports Fama and French (1993) three-factor alphas for the overhang spread and the negative overhang spread. At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns around the most recent earnings announcement date and the most recent capital gains overhang. The overhang spread is defined as a zero cost portfolio that holds the top 20% good news stocks in the top (positive) overhang quintile, and sells short the bottom 20% bad news stocks in the bottom (negative) overhang quintile. The negative overhang spread is defined as a zero cost portfolio that holds the top 20% good news stocks in the bottom (negative) overhang quintile, and sells short bottom 20% bad news stocks in the top (positive) overhang quintile. The residual overhang is obtained by regressing (cross sectionally) the raw overhang on previous 12 and 36-month return, the previous 12-month average turnover and the log of market capitalization at end of the previous month. Alphas are in monthly percent, t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters. "Rolling period" is the holding period of the rolling strategy, in months.

| Rolling period | overhang spread | | | negative overhang spread | | | residual overhang spread | | | negative residual overhang spread | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | bad news | good news | L/S | bad news | good news | L/S | bad news | good news | L/S | bad news | good news | L/S |
| +1 | **-0.980** | **1.110** | **2.077** | -0.453 | 0.347 | 0.798 | **-1.010** | **1.144** | **2.153** | -0.595 | 0.074 | 0.670 |
| | ( -3.04) | ( 5.86) | ( 5.45) | ( 0.96) | ( -1.60) | ( 1.84) | ( -3.09) | ( 5.20) | ( 5.10) | ( 0.23) | ( -1.13) | ( 1.58) |
| +2 | **-1.072** | **1.429** | **2.486** | -0.003 | -0.129 | -0.123 | **-0.929** | **1.337** | **2.266** | -0.028 | -0.157 | -0.129 |
| | ( -2.82) | ( 7.39) | ( 5.54) | ( -0.38) | ( -0.01) | ( -0.27) | ( -2.87) | ( 6.15) | ( 5.57) | ( -0.47) | ( -0.09) | ( -0.28) |
| +3 | **-1.129** | **1.304** | **2.433** | -0.245 | -0.152 | 0.092 | **-1.137** | **1.063** | **2.201** | -0.024 | -0.184 | -0.160 |
| | ( -3.51) | ( 9.56) | ( 6.60) | ( -0.57) | ( -1.61) | ( 0.28) | ( -3.99) | ( 7.02) | ( 6.56) | ( -0.74) | ( -0.14) | ( -0.54) |
| +6 | **-0.777** | **0.954** | **1.731** | -0.025 | -0.234 | -0.209 | **-0.712** | **0.841** | **1.552** | 0.070 | -0.238 | -0.307 |
| | ( -2.62) | ( 9.47) | ( 5.38) | ( -0.99) | ( -0.21) | ( -0.84) | ( -2.81) | ( 7.51) | ( 5.54) | ( -1.10) | ( 0.57) | ( -1.32) |
| +12 | **-0.439** | **0.548** | **0.986** | -0.032 | -0.108 | -0.076 | **-0.416** | **0.501** | **0.917** | -0.031 | -0.133 | -0.102 |
| | ( -2.63) | ( 5.46) | ( 3.79) | ( -0.49) | ( -0.28) | ( -0.38) | ( -2.84) | ( 4.89) | ( 4.05) | ( -0.69) | ( -0.27) | ( -0.56) |

**Table VI**
**Monthly alphas by overhang quintiles**

This table reports Fama and French (1993) three-factor alphas for a long/short news strategy in different overhang quintiles. At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns around the most recent earnings announcement date and the most recent capital gains overhang. For $j \in 1, ..., 5$ portfolio $j$ is defined as a zero cost portfolio that holds the top 20% good news stocks in the $j$ overhang quintile, and sells short the bottom 20 % bad news stocks in the $(6-j)th$ overhang quintile. The last column reports the difference between the overhang spread and the negative overhang spread. The residual overhang is obtained by regressing (cross sectionally) the raw overhang on previous 12 and 36-month returns, the previous 12-month average turnover and the log of market capitalization at end of the previous month. Alphas are in monthly percent, t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters. "Rolling period" is the holding period of the rolling strategy, in months.

| | Panel A: overhang quintiles | | | | | | Panel B: residual overhang quintiles | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling period | 5 (overhang spread) | 4 | 3 | 2 | 1 (negative overhang spread) | 5 - 1 | 5 (overhang spread) | 4 | 2 | 3 | 1 (negative overhang spread) | 5 - 1 |
| +1 | **2.077** | **1.878** | **0.914** | **1.309** | 0.798 | 1.279 | **2.153** | **1.577** | **1.572** | **1.572** | 0.670 | **1.484** |
| | ( 5.45) | ( 6.08) | ( 3.29) | ( 3.48) | ( 1.84) | ( 1.85) | ( 5.10) | ( 4.99) | ( 5.35) | ( 4.03) | ( 1.58) | ( 2.07) |
| +2 | **2.486** | **1.119** | **1.251** | **0.819** | -0.123 | **2.609** | **2.266** | **1.315** | **0.988** | **0.780** | -0.129 | **2.395** |
| | ( 5.54) | ( 3.40) | ( 3.95) | ( 2.44) | ( -0.27) | ( 3.36) | ( 5.57) | ( 3.72) | ( 3.01) | ( 2.50) | ( -0.28) | ( 3.37) |
| +3 | **2.433** | **1.615** | **0.973** | **0.613** | 0.092 | **2.341** | **2.201** | **1.522** | **1.243** | **0.863** | -0.160 | **2.361** |
| | ( 6.60) | ( 6.43) | ( 4.87) | ( 2.78) | ( 0.28) | ( 3.64) | ( 6.56) | ( 6.25) | ( 6.82) | ( 4.92) | ( -0.54) | ( 4.16) |

**Table VII**
**Three factors time series regressions: alphas and factor loadings**

This table reports Fama and French (1993) three-factor loadings and alphas for the overhang spread and the negative overhang spread strategy. The dependent variable is the monthly excess return of the treasury bill rate from the rolling strategy, the explanatory variables are the monthly returns from Fama and French (1993) mimicking portfolios. The holding period for the rolling strategy is three months. Alphas are in monthly percent, t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters.

| | overhang spread | | | negative overhang spread | | |
|---|---|---|---|---|---|---|
| | bad news | good news | L/S | bad news | good news | L/S |
| $\alpha(\%)$ | **-1.129** | **1.304** | **2.433** | -0.245 | -0.152 | 0.092 |
| | ( -3.51) | ( 9.56) | ( 6.60) | ( -1.61) | ( -0.57) | ( 0.28) |
| $MKT$ | **1.216** | **1.064** | -0.152 | **1.038** | **1.164** | 0.126 |
| | ( 14.76) | ( 30.47) | ( -1.61) | ( 26.75) | ( 16.91) | ( 1.49) |
| $SMB$ | **1.002** | **0.833** | -0.169 | **0.772** | **1.000** | **0.228** |
| | ( 9.78) | ( 19.18) | ( -1.44) | ( 16.01) | ( 11.69) | ( 2.17) |
| $HML$ | -0.011 | **-0.115** | -0.104 | -0.107 | 0.150 | **0.257** |
| | ( -0.09) | ( -2.25) | ( -0.75) | ( -1.87) | ( 1.49) | ( 2.07) |
| $R^2$ | 0.656 | 0.895 | 0.018 | 0.864 | 0.699 | 0.026 |

**Table VIII**
**Overhang spread portfolio: net profits by size**

This table reports returns of the overhang spread portfolio. Stocks are assigned to size quintiles according to market capitalization at the end of the month prior to inclusion in the portfolio using NYSE breakpoints. The effective spread is defined as twice the absolute trading price deviation from the bid-ask midpoint. Commissions are compute using a discount brokerage schedule. The maximum trading cost is defined as the round trip trading cost necessary to eliminate the abnormal return, given the portfolio turnover. The t-statistics test the hypothesis that average trading costs exceed the maximum threshold. The portfolios are constructed using only stocks with split adjusted prices above 3$. Alphas, returns, and trading costs are in monthly percent, t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters. "Rolling period" is the holding period of the rolling strategy, in months.

| NYSE quintile | all | | 1 (small) | | 2 | | 3 | | 4 | | 5 (large) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rolling period | 3 | 6 | 3 | 6 | 3 | 6 | 3 | 6 | 3 | 6 | 3 | 6 |
| Fama-French alpha | **2.447** | **1.922** | **2.777** | **2.052** | **2.480** | **1.970** | **2.554** | **2.017** | **1.466** | **1.464** | **1.308** | **1.165** |
| | ( 7.88) | ( 6.65) | ( 8.02) | ( 6.71) | ( 6.45) | ( 6.09) | ( 5.84) | ( 5.20) | ( 3.26) | ( 3.89) | ( 3.20) | ( 3.60) |
| Average turnover | 34.3 | 18.7 | 36.1 | 20.0 | 36.0 | 19.8 | 36.1 | 19.7 | 35.5 | 19.1 | 34.3 | 18.4 |
| Max trading cost | 7.12 | 10.23 | 7.67 | 10.23 | 6.87 | 9.90 | 7.06 | 10.23 | 4.12 | 7.64 | 3.81 | 6.32 |
| effective spread | **4.55** | **4.58** | 7.67 | **7.66** | **4.02** | **4.08** | **2.87** | **2.95** | **2.08** | **2.06** | **1.44** | **1.42** |
| plus commissions | ( 39.8) | ( 102.7) | ( -0.2) | ( 28.2) | ( 48.7) | ( 104.7) | ( 83.4) | ( 140.8) | ( 12.7) | ( 61.6) | ( 58.3) | ( 142.3) |
| Net alpha | **0.885** | **1.062** | -0.002 | **0.521** | **1.028** | **1.158** | **1.511** | **1.435** | 0.726 | **1.071** | **0.816** | **0.904** |
| after trading costs | ( 2.76) | ( 3.62) | ( -0.01) | ( 2.36) | ( 2.63) | ( 3.54) | ( 3.43) | ( 3.67) | ( 1.60) | ( 2.84) | ( 1.98) | ( 2.79) |
| Semi-annual return | **3.870** | **4.915** | -1.559 | **1.741** | **4.960** | **5.455** | **6.805** | **6.017** | 2.230 | **3.938** | 3.298 | **3.865** |
| after trading cost | ( 3.39) | ( 4.84) | ( -1.12) | ( 2.50) | ( 2.60) | ( 3.84) | ( 4.20) | ( 4.65) | ( 1.30) | ( 2.30) | ( 1.82) | ( 2.58) |

**Table IX**

**Fama-MacBeth Regressions of returns on prior returns, earnings surprises and the capital gains overhang, 1980-2002**

This table reports Fama-MacBeth regressions of individual stocks returns on the previous 12-month return, skipping the last month, (R12), the abnormal return around the most recent earnings announcement date (CAR), and the capital gains overhang constructed using mutual fund holdings or turnover. The dependent variable is the stock's buy-and-hold return either over the subsequent three (Panel A) or six months (Panel B). Each explanatory variable is expressed in term of its percentile rank and scaled to fall between 0 and 1. Cross sectional regressions are run every calendar month and standard errors are adjusted for heteroskedasticity and autocorrelation using a Bartlett kernel. The capital gains overhang is defined as the percentage deviation of the aggregate reference price from the current price $g_t = (P_t - RP_t)/P_t$. The reference price is defined as $RP_t = \phi^{-1} \sum_{t=1}^{n} V_{t,t-n} P_{t-n}$ where $V_{t,t-n}$ is the number of shares at date t still held by the original purchasers at t-n, $\phi$ is a normalizing constant and $P_t$ is the stock price at the end of month t. Holdings are used to calculate $V_{t,t-n}$. To compute the turnover-based overhang, $V_{t,t-n}$ is estimated as $V_{t,t-n} = TO_{t-n} \cdot \pi_{t=1}^{n-1}(1 - TO_{t-n+\tau})$ where $TO_t$ is turnover in month t.

| Model No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| RHS variable | Panel A: Dependent variable: three-month return | | | | | | | | |
| Event-date return (CAR) | **0.041** (10.43) | | **0.039** (10.46) | | **0.034** (9.32) | | **0.020** (7.95) | **0.029** (8.05) | **0.021** (8.71) |
| Previous year return (R12) | | **0.049** (6.98) | **0.037** (4.78) | | 0.019 ( 1.71) | | | 0.013 (1.48) | |
| Turnover-based gains | | | | **0.033** (5.24) | **0.035** (3.46) | | 0.006 ( 0.93) | 0.003 (0.40) | |
| Holdings-based gains | | | | | | **0.049** (7.65) | **0.040** (5.20) | **0.034** (4.52) | **0.045** (5.73) |
| | Panel B: Dependent variable: six-month return | | | | | | | | |
| Event-date return (CAR) | **0.062** ( 11.31) | | **0.058** ( 10.52) | | **0.046** ( 8.32) | | **0.044** ( 6.99) | **0.042** ( 6.98) | **0.038** ( 8.05) |
| Previous year return (R12) | | **0.102** ( 8.87) | **0.085** ( 6.99) | | 0.017 ( 1.60) | | | 0.034 ( 1.86) | |
| Turnover-based gains | | | | **0.081** ( 10.16) | **0.039** ( 4.94) | | 0.021 ( 1.37) | 0.013 ( 1.17) | |
| Holdings-based gains | | | | | | **0.099** ( 10.38) | **0.079** ( 6.53) | **0.063** ( 5.05) | **0.090** ( 8.49) |

**Table X**
**Robustness checks**

This table reports Fama and French (1993) three-factor alphas for the three-month overhang spread and the negative overhang spread. Panel A and B report results for sub-samples based on mutual funds ownership. The breakpoint is the median ownership at the end of the previous month. Panel C and D report results for a turnover-based overhang. The fraction number of shares purchased at date t-n still held by the original purchasers at date t is computed as $V_{t,t-n} = TO_{t-n} \cdot \pi_{t=1}^{n-1}(1 - TO_{t-n+\tau})$ where $TO_t$ is turnover in month t. Panel E reports characteristics-adjusted returns using a single control firm matched on size, book-to-market and price momentum. Panel F reports results for portfolios constructed using standardized unexpected earnings (SUE) as measure of earnings news. $SUE = (e - e_{-4})/\sigma$ where $e$ is the most recent quarterly earnings per share as of month t, $e_{t-4}$ is the earnings per share 4 quarters before month t and $\sigma$ is the standard deviation of unexpected earnings $e_t - e_{t-4}$ over the preceding 8 quarters. Panel G reports results for strategies constructed using analysts' recommendations revisions. The news variable is the event-day return around the most recent date when a change in analysts' recommendations occurred. Alphas are in monthly percent, t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated with bold characters.

| | | overhang spread | | | negative overhang spread | | |
|---|---|---|---|---|---|---|---|
| | | bad news | good news | L/S | bad news | good news | L/S |
| A | Low mutual | **-1.098** | **1.337** | **2.435** | -0.284 | 0.010 | 0.275 |
| | fund ownership | ( -2.95) | ( 8.16) | ( 6.28) | ( 0.03) | ( -1.59) | ( 0.85) |
| B | High mutual | **-1.083** | **1.202** | **2.284** | -0.083 | -0.222 | -0.140 |
| | fund ownership | ( -3.88) | ( 8.33) | ( 6.49) | ( -0.87) | ( -0.55) | ( -0.42) |
| C | Turnover-based | **-1.014** | **1.533** | **2.547** | 0.202 | 0.213 | 0.012 |
| | gains, 1963-1979 | ( -2.61) | ( 5.48) | ( 5.01) | ( 0.58) | ( 0.69) | ( 0.03) |
| D | Turnover-based | **-0.559** | **1.361** | **1.920** | -0.141 | 0.299 | 0.440 |
| | gains, 1990-2002 | ( -2.36) | ( 7.40) | ( 4.79) | ( 0.93) | ( -0.75) | ( 1.67) |
| E | Characteristics | **-0.920** | **0.931** | **1.851** | 0.011 | -0.014 | -0.025 |
| | matched returns | (-4.30) | (3.32) | ( 5.60) | (0.90) | ( -0.04) | ( -0.04) |
| F | Standardized | **-0.672** | **1.066** | **1.738** | -0.049 | 0.278 | 0.339 |
| | unexpected earnings | ( -2.52) | ( 8.28) | ( 5.26) | ( 0.99) | ( -0.27) | ( 0.97) |
| G | analysts' | **-1.568** | **1.193** | **2.761** | 0.159 | -0.652 | -0.811 |
| | revisions | ( -2.07) | ( 3.43) | ( 2.84) | ( -0.95) | ( 0.53) | ( -1.01) |

**Figure 1. An example of stock price response to negative news.** This figure shows an example of a stock price response to negative news. The initial stocks price is 13$. At date 0 public news reveals a fundamental value of 11$

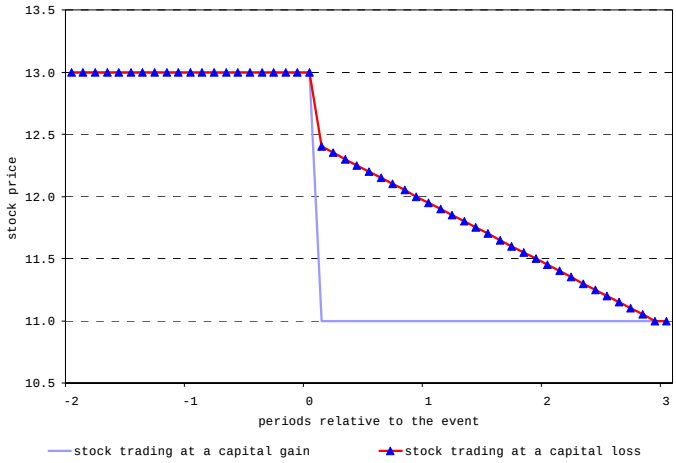


**Figure 2. An example of stock price response to positive news.** This figure shows an example of a stock price response to positive news. The initial stocks price is 11$. At date 0 public news reveals a fundamental value of 13$