The Disposition Effect and Under-reaction to News

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ABSTRACT

This paper develops a test of under-reaction to news induced by the presence of investors who display the tendency to realize gains and ride losses, known as the disposition effect. The disposition effect, a widely documented fact in investor behavior, implies that stock prices under-react more to bad news when more current holders are facing a capital loss, and under-react more 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 when the disposition effect predicts the biggest under-reaction. I show that exposure to a disposition variable spreads the cross-sectional differences in post-event returns: post-event drift is bigger when the news and the capital gains overhang have the same sign and the magnitude of the post-event drift is directly related to the amount of unrealized capital gains (losses) experienced by the stock holders prior to the event date.

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In recent years a mounting body of evidence has challenged the traditional view that securities are rationally priced to reflect publicly available information. Among the various stock price patterns documented in the literature, a persistent anomaly has been promoted, by out-of-sample tests, either over time or across firm classes, to the full status of empirical regularity: short term event-driven return predictability.

An extensive body of empirical literature examines a wide range of corporate news events and reports that with surprising regularity investors appear initially to under-react to news releases. Event-date average abnormal returns tend to have the same sign as average subsequent stock price performance over varying horizons. Stock prices appear to drift after important news, both regularly scheduled, such as earnings announcements or unexpected, such as a stock split: positive news is generally met with price appreciation and in these cases returns subsequent to the announcement show positive abnormal drift. Similarly, negative news events generate negative market reaction around the event date but tend to be followed by a negative drift.

As a result long/short strategies based on the event-date market impact earn risk-adjusted returns in the subsequent months. Events for which such a phenomenon has been detected include, but are not limited to: earnings announcements[1], stock splits[2], tender offer and open market repurchases[3], analysts' recommendations revisions[4], SEOs[5], public announcements of insider trades[6], venture capital share distributions[7] and more recently headline news[8] and R&D expensed increases[9].

In a recent paper Grinblatt and Han (2002) show how the disposition effect cause demand perturbations induced by disposition-prone investors and generate under-reaction to public news. When some investors' demands are affected by a reference price and demand functions are not perfectly elastic then future returns, conditional on a current event, will depend upon unrealized capital gains or losses experienced by the stock holders. This result paves the way to a line of empirical research exploring the relation between investor heterogeneity, unrealized capital gains or losses (hereafter capital gains overhang) and the cross section of stock returns.

The goal of this paper is to empirically explore the role of unrealized capital gains/losses and the proportion of disposition-prone investors holding a particular stock, in causing stock price under-reaction to public news and event-driven return predictability. The hypothesis tested is that in the presence of disposition-prone investors a wedge between the current and a reference price will hamper the transmission of information, thus generating the post-event drift.

In order to test the hypothesis that stocks with large unrealized capital gains have higher drift I construct a capital gain regressor using common stock holdings for mutual funds. Stocks are then sorted into different classes for which the capital gains overhang is more likely to induce a sluggish response to current earnings news.

The central prediction is that exposure to a disposition factor should spread the cross-sectional differences in post-event returns: stocks with large unrealized capital gain-losses should exhibit a more pronounced post-event drift so that momentum or event driven strategies should work best once stocks are sorted using their capital gains overhang at the event date. The main result is that when event stocks are sorted using this novel measure of reference price constructed using mutual fund common stock holdings, post-event predictability is most severe when the disposition effect predicts the biggest under-reaction. Post-event drift is bigger 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.

The rest of the article is organized as follows. Section 2 gives a brief introduction to the disposition effect. Section 3 examines the hypothesis under scrutiny and the methodology used. Section 4 analyzes the extent of the disposition effect among mutual fund managers and motivates the empirical specification used. It also examines the cross sectional determinants of the capital gains overhang. Section 5 reports the main results on the overhang spread strategies. Section 6 checks that the results are robust by replicating them for various sub-samples and different definitions or earnings news. It also expands the dataset and reports out of sample tests using a different definition of the capital gains overhang. Section 7 contains an extension by reporting results for price momentum strategies and strategies based on stock analysts' recommendation revisions. Section 8 presents evidence from price impact, volume and order imbalances around event dates which are estimated using daily and transaction level flow data. Section 9 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 individual investors to ride losses and realized gains. This runs counter to sound tax planning. The availability of account-level transaction data has made the disposition effect a widely documented behavioral regularity: subsequent to the seminal paper by Odean (1998), several studies find that investors are reluctant to sell assets at a loss relative to the price at which they were purchased. Furthermore, the average performance of stocks disposition-prone investors sell is better than that of the stocks they hold on to.

The available evidence[10] shows that although greater investor sophistication is associated 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 (2000) find evidence of the disposition effect among professional investors in Israel.

While the evidence that large numbers of investors are prone to behavioral biases such as the disposition effect is quite compelling, the empirical analysis of their asset pricing implications has been quite limited. Behavioral biases among investors are irrelevant from an asset pricing or investment management perspective unless biased agents can be shown to be the marginal investor in economically meaningful settings. Among the few exceptions, Grinblatt and Han (2002) use a capital gain regressor variable constructed from weekly volume data and show that such a variable drives out prior returns in explaining intermediate-horizon return autocorrelation. Goetzmann and Massa (2003) estimate the behavioral component of the Grinblatt and Han model and show that statistical exposure to a disposition factor help explain cross-sectional differences in daily returns.

To summarize, the research evidence to date shows that the disposition effect is substantial yet subject to variation across investors. Nobody has yet carefully documented or rejected the presence of the disposition effect among mutual fund managers in the US equity markets; nevertheless, 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. Furthermore, Wermers reports evidence of mutual fund flow-related buying impact on stock prices. To the extent that fund managers exhibit some degree of heterogeneity with respect to their propensity to realize paper gains or losses and to the extent that mutual funds can be thought as a proxy for the marginal investor in the market[11], their common stock holdings can be used to construct a test of stock price under-reaction to corporate news induced by the presence of holders reluctant to unload stocks around negative news releases or eager to realize gains following positive news.

II. The disposition effect and under-reaction to news

A. The hypothesis

The central hypothesis is that in the presence of disposition-prone investors, stock prices will under-react to news generating post-event drift. Let news be released at date t, then:

Proposition 1 *Public event date abnormal returns tend to have the same sign as average subsequent abnormal performance, moreover expected returns will be increasing in the signed unrealized capital gains overhang at the event date*

Formally:

$$E\left(r_{t+k} \middle| \quad Positive\ News, \overline{g}\right) > E\left(r_{t+k} \middle| \quad Positive\ News, \underline{g}\right) \geq 0 \tag{1}$$

$$E\left(r_{t+k} \middle| \quad Negative\ News, \underline{g}\right) < E\left(r_{t+k} \middle| \quad Negative\ News, \overline{g}\right) \leq 0 \tag{2}$$

where $\overline{g} > 0 > \underline{g}$ and $k > 1$.

Proposition 2 *The capital gains overhang tend to mean reverts to zero and the minimum (maximum) post-event abnormal returns occurs approximately when the overhang has closed half of the initial gap*

A formal derivation of the two propositions is contained in the appendix. The capital gains overhang is defined as the percentage deviation of the aggregate average cost basis reference price from the current price

$$g_t = \frac{P_t - RP_t}{P_t} \tag{3}$$

where P_t is the stock price at the end of month t and RP_t is an aggregate reference price to be defined below.

Equations (1) and (2) imply that *signed* capital gains overhang predicts future post-event returns. At the time of bad news releases, stocks with large negative overhang are expected to exhibit a more severe negative drift compared with stocks having the same news but trading close or above to their reference price.

A simple example will reveal the intuition behind (1)-(2): consider a stock trading at \$13, with a reference point at \$16 when bad news is released, revealing a fundamental value of only \$11. In the presence of investors reluctant to realize a paper loss and if the demand functions are not perfectly elastic, then the price will fall to somewhere between \$13 and \$11 at the announcement date. Subsequently, as trading occurs and the reference point gets updated, the price will eventually drift down to \$11. Ceteris paribus the initial price impact will be lower than \$2 for such a stock hence the subsequent higher post-event drift.

This scenario is illustrated in figure (**??**) which reports an example of price impact on negative earnings news for stocks with high and low overhang as well as the stock price pattern according to the efficient market hypothesis (EMH). The price impact is attenuated for stocks with large unrealized losses which implies a subsequent pronounced drift.

To the extent that stock prices under-react to earning news, both stocks with large unrealized capital gains or losses will initially experience negative abnormal returns. Nevertheless, stocks with negative overhang will display a more persistent downward drift due to the reluctance of disposition traders to unload the stock, which prevented the bad news from being immediately compounded into the stock price. Only as trading occurs and the reference price is updated will the price eventually drift to the fundamental value, hence the predictability in post-event returns.

Since disposition-prone investors are more likely to realize paper gains than paper losses a similar argument can be made for good news releases: specifically, positive news will be "hampered" on the event day as holders with high unrealized capital gains tend to generate excess selling pressure, leading to a more pronounced positive drift in the subsequent months.

Proposition (2) states that the exact time profile of the post-event drift depends upon the degree of mean reversion of the capital gains overhang. Aggregate reference prices constructed using moving averages of past prices are always closing the gap with respect to the latest market price: as trading occurs, reference prices are updated with some weighting of the last market price. When a sufficiently large shock to the fundamental value occurs with the same sign as the difference between the latest and the reference price, then initially the price impact increase the overhang in absolute value. Subsequently the trading-induced update of the reference price cause the capital gains overhang to mean revert toward zero and post-event abnormal returns are generated as the stock price slowly drifts towards the new fundamental value. As a result, the horizon at which the overhang-based under-reaction will generate abnormal returns will depend on the degree of mean reversion of the capital gains overhang which can easily be estimated. The implicit assumption behind (2) is that investors are initially slow to update their reference price following a large returns realization but as trading occurs they tend to pay less attention to their original anchor point and put more emphasis on the current observed trading price. This cause the reference price to approach both the current price and the fundamental value at variable speed. Returns will peak (or reach a bottom) at some date following the event, approximately corresponding to the period when the overhang closes half of the initial gap.

To summarize, proposition (1) 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 profits the higher the difference in the capital gains overhang between the long and the short side. I will refer to this maximum-profits strategy as the *overhang spread*, that is, a portfolio that is long good news stocks with the highest overhang (biggest paper gains) and short bad news stocks with the lowest overhang (lowest paper losses). The name *no-overhang spread* will be reserved for a strategy that is long good news stocks with the lowest overhang and short bad news stocks with the highest overhang and therefore has the lowest (negative) difference in the capital gains overhang between the long and the short side. Furthermore, proposition (2) implies that the holding period should be calibrate to approximately match the half -life of the capital gains overhangs.

There are two distinctive predictions of the hypothesis at hand that should be emphasized: first the disposition effect makes a specific prediction about the sign of the under-reaction pattern in different situations. Stocks experiencing large unrealized capital gains under-react to good news and to good news only while stocks with large negative overhang are predicted to under-react to, and only to, negative news. Signed overhang predicts future returns: equations (1) and (2) imply more under-reaction if and only if the overhang and the event have the same sign. I will return to the issue of asymmetry of the price response when considering alternative hypotheses to the empirical findings.

Second, the time profile of the post-event is directly related to the speed of mean reversion of the overhang: returns of an investment rule which exploit this pattern of under-reaction should be maximized when the holding period of the portfolios is chosen to match the half-life of the capital gains overhang.

In order to test the hypotheses (1) and (2) I use investment strategies which exploit the post earning announcement drift. Labeled by Fama (1998) as "above suspicion," the inability of stock prices to speedily impound earnings information is probably one of the most compelling evidence of under-reaction in equity markets: an extensive empirical 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).

The practical implication of the under-reaction pattern induced by the presence of disposition investors in the market, is that when constructing strategies based on PEAD, overhang spread strategies are to be preferred to no-overhang spreads. That is, one would want to short bad news stocks with large unrealized negative overhang and offset this by a long position in good news stocks with large unrealized positive overhang. Ceteris paribus, the wider the spread in the capital gains overhang between the long and the short side the larger subsequent alpha. Furthermore, zero beta returns can be achieved by a "within" overhang spread that has the advantage of being earning momentum neutral, that is a long/short strategy within the same news class, e.g., short *bad news* stocks with unrealized losses and long *bad news* stocks with unrealized gains.

B. Methodology

If stocks with large unrealized capital gains exhibit consistent under-reaction to information and subsequent larger drift patterns then alpha-profitable strategies based on past observables will exist. In order to increase the power of the tests I follow Jegadeesh and Titman (1993)and Fama (1998) and I use a rolling portfolio approach. 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 calendar month from January 1980 to December 2002 stocks are ranked on the basis of a measure of earnings news. An independent sort is then used to classify stocks according to their capital gains overhang. The ranked stocks are then 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. Good/bad news zero cost portfolio returns are also calculated for each capital gains overhang quintile.

The ranking variable for earning news strategies is the market model cumulative abnormal returns around the most recent earnings announcement date:

$$car_{it} = \sum_{h=-2}^{+1} (r_{i,h} - \overline{r}_{i,h}) \tag{4}$$

where r_h is the stock return on day h, with the event date being at $h = 0$, and $\overline{r}_{i,h}$ is the CRSP equally weighted NYSE/AMEX/NASDAQ index[13].

This returns-based measure is a fairly clean measure of news since it does not rely on any assumption regarding the market expectation for earnings. For example, no matter what the actual quarterly earnings number is, an event-day abnormal return in the top quintile is classified as strong positive news. A return-driven news sort also appears more appropriate than an accounting definition based on a model for expected earnings since it mimics closely the under-reaction hypothesis under study.

The time series of monthly return of the rolling portfolios tracks the calendar month performance of a post-event strategy which is entirely based on past observables. Such an investment rule should earn zero abnormal returns in an efficient market

For example, assume we are interested in evaluating the PEAD drift for the bottom 20% negative capital gains stocks over a period of 6 months: at the end of each month I would calculate the average abnormal return for stocks which had at least one earning announcement during the last 6 months and fell into the bottom 20% overhang quintile. The cross sectional abnormal return of such stocks would give the calendar month return of a rolling portfolio with a holding horizon of 6 months and monthly rebalancing. Repeating this procedure every month yields a time series of returns. The test statistics are then simply time series averages of calendar month abnormal returns.

The test statistics have an intuitive interpretation in terms of the legs of a trading strategy. In fact, they are equal to the average monthly return of a funds-of-funds holding an equally weighted portfolio of managers with a very simple strategy: buy stocks that just had an event, hold them for 6 months (and do nothing in between), then sell them. The only difference across the single managers is that they started operation in a different calendar month.

Standardized average abnormal returns should be distributed unit normal if there is no systematic post-event drift. Positive abnormal returns following positive news will indicate the presence of post-event drift consistent with under-reaction while negative abnormal returns will be evidence consistent with reversals. The opposite will be true for negative news.

III. The capital gains overhang

Any test of the presence of risk-adjusted returns induced by the disposition effect is undoubtedly a joint test both of an asset pricing model of expected returns and a mental accounting model used by market participants to update their reference price. I follow Grinblatt and Han (2002) and estimate the reference price as:

$$RP_t = \phi^{-1} \sum_{t=1}^{n} V_{t,t-n} P_{t-n} \tag{5}$$

where $V_{t,t-n}$ is the number of shares that at date t that are still held by the original purchasers at $t-n$, ϕ 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.

Investors are assumed to use an historical cost-based mental accounting (FIFO, first-in-first-out) to associate a specific quantity of shares in their portfolio to the corresponding reference price[14].

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 reference price (5) can be thought of as a moving average of past prices with time varying coefficients tilted towards the most recent date. As trading occurs the reference price gets updated with some weight on the latest market price.

An important caveat in using such an overhang variable is that in some cases it will mechanically display some correlation with previous stock returns it is likely for winning (losing) stocks to exhibit large unrealized capital gains (losses). To the extent that the capital gains overhang is in fact the driving force behind price momentum, as in Grinblatt and Han (2002), past returns will only be a noisy proxy for large unrealized capital gains. Nevertheless, any test which tries to discriminate between the two effects is likely to have poor power properties since the portfolio constituents will tend to be skewed while ideally the sub-samples should contain stocks with similar past performance but a wide spread in capital gains overhang.

In order to increase signal-to-noise ratios and ensure that the results are not a simple manifestation of the interaction between price and earnings momentum documented in Jegadeesh, Chan, and Lakonishok (1996), I sort stocks using both the *capital gains overhang* and a *residual overhang* where the residuals are constructed from monthly cross-sectional regressions of unrealized capital gains on past cumulative returns, size and volume. I will also report results for characteristics matched returns which explicitly control for price momentum.

A. Data Description

The data come from two primary sources. Stock returns and accounting data between January 1980 and December 2002 are obtained from the CRSP/COMPUSTAT merged database. The stock file contains monthly and daily prices, shares outstanding, split factors, volume and returns for NYSE, AMEX, and NASDAQ stocks. The COMPUSTAT contains quarterly and annual relevant accounting information for most publicly traded US stocks.

Mutual fund holdings from January 1980 to December 2002 are obtained from the Thomson Financial CDA/Spectrum Mutual Funds database which include all registered mutual funds filing with the SEC plus 3,000 global funds. The CDA/Spectrum S12 mutual fund data shows the holdings of individual funds. The data is collected via fund prospectuses and SEC N30D filings. The statutory requirements for reporting mutual fund holdings are semi-annual.

The data include a Report Date (RDATE) which is the date for the "holdings" while the File Date is the date the report is filed with SEC. Holdings are adjusted for stock splits through the quarter end date or File date and are assumed to be public information with a 30 days lag from the file date[15]. Prices and shares outstanding are from the CRSP monthly stock file. Common stocks holdings are merged with CRSP data on shares outstanding, price and adjustment factors and then filtered to eliminate potential anomalies probably due to misreporting or errors in data collecting. Holdings for a particular fund 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
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.

Results are reported for reference prices computed from mutual fund holdings and using stocks prices at the report date (rdate) as a proxy for the buying or selling price[16]. Clearly this will be a noise measure of the reference price 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, a priori there is no reason to expect this measure to bias the results one way or the other.

B. The disposition effect in mutual fund managers

Table I 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 any sale takes place between two report dates in a mutual fund portfolio, the current stock price is compared to the price at 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. Fund managers are assumed to use a FIFO criterion to associate a specific quantity of shares in their portfolio to the corresponding 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. Realized gains, paper gains, losses and paper losses are aggregate across funds. At the beginning of each quarter mutual funds are ranked by their previous twelve months compounded 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 I is that there is a statistically strong (t-stat = 44) tendency for mutual fund managers to sell a higher proportion of their winners than their losers. The magnitude of the aggregate difference (PRG - PLR) is around 3%, which is smaller than the average 5% reported by Odean (1998) for individual investors but still the same order of magnitude.

What is striking is that amount of variation that can be observed across the performance-based quintiles. Extreme loser funds and managers up to the third performance quintile do indeed show signs of a disposition effect with magnitudes comparable to the ones observed in individual investors. Loser funds appear no different than individual investors; they are 1.7 times more likely to realized paper gain than a paper loss, an 8% (t-statistics = 25.5) difference between PGR and PLR while funds in the second and third quintile show differences of 6% and 5% (t-statistics = 25.5 and 23). This result confirms the evidence in Wermers (2003): managers of losing funds appear reluctant to sell their losing stocks.

In order to better assess the extent of the cross sectional variation of PGR - PLR I calculate PGR and PLR in each year from 1980 to 2002 for each fund in the database. Figure (**??**) reports the cross sectional distribution of fund-by-fund time series averages. The estimated distribution shows that there is a great deal of cross sectional variation across fund managers with respect to the proportion of winners and losers sold in a given year, which motivates the use of mutual fund holdings in a test of under-reaction due to the presence of disposition-prone investors in the market.

Clearly the fact that in a given year some funds tend to realize gains at a higher rate than losses is not per se definitive evidence of a disposition bias by mutual fund managers especially given the fact that I am unable to observe actual transaction prices. On the other hand whether or not managers tend to ride losses and realize gains for rebalancing purposes or alternative motivations other than loss aversion is irrelevant in a test of (1) and (2): as long as managers are unwilling to unload stocks on bad news releases or tend to realize gains experienced on good announcement days then stock prices will under-react to current news and the capital gains overhang will predict future returns. I will return to this point when considering alternative explanations for the results.

Furthermore, using holdings of mutual fund managers, investment professionals who are a priori expected to be the investor class less exposed (if not immune) to behavioral biases, seems a conservative choice in a test of under-reaction to news induced by the disposition effect since it would tend to bias the results against the null hypothesis.

C. Cross sectional determinants of the capital gains overhang

Table II provides summary statistics of the capital gains overhang in the full sample. These include time series means, medians, skewness and standard deviation for selected years, along with the 20th and 80th percentiles.

Over the period 1980 - 2002 on average 72.7 % of the CRSP stocks have a valid capital gain regressor, 84.4% in terms of total market capitalization. The gap is filled mostly by the smallest stocks since the size distribution of the sample (not shown) mimics the CRSP universe with the exception of the lowest decile where the CRSP stocks display more negative skewness. This feature of the data is driven by the fact that the reference price is estimated using mutual fund holdings and it is well know that mutual funds tend to avoid micro cap illiquid stocks; it ensures that the results are not contaminated by small stocks where supply shocks-induced reversals are more likely to swamp any post-event autocorrelation in returns. I will return further to this point when examining the robustness of the results in various size sub-samples.

The distribution of the capital gains overhang is plotted in figure (**??**). The capital gains overhang tends to be highly negatively skewed: the long left tail and the asymmetry of the distribution is consistent with the presence of fund managers who tend to realize losses and ride gains, especially for extreme price movements. If current holders are reluctant to sell assets trading at a loss relative to the price at which they were purchased then, as stocks prices fall sharply, the reference price tends to lag behind the current falling price, generating overhangs as low as the one observed in the left tail of the distribution. Conversely if managers immediately tend to realize large paper gains then the reference price will be updated which will bring the capital gains overhang closer to zero.

I obtain further insight into the cross sectional determinants of the capital gains overhang regressor by regressing it, cross sectionally, on the stock's past short and long term cumulative returns, size, turnover and some fund-related variables.

Table III reports coefficients from Fama MacBeth regressions. Cross sectional regressions are run every calendar month and standard errors are adjusted for heteroskedasticity and autocorrelation.

In Model 1, the capital gains overhang is regressed on the prior year return ($R_{-12,1}$), the previous two years return ($R_{-36,-13}$) and the log of market capitalization at the end of the previous calendar month . As expected, the results show 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 average turnover in the last month ($TURN$) and an interaction term between turnover and past returns as a control; the coefficients are allowed to be different for NASDAQ stocks since turnover numbers do not have the same interpretation in a dealer market,

At first glance it would be reasonable to expect that high past turnover would translate into reference prices being close to trading prices since trading induces agents to update their reference points. On the other hand the reference price is always trying to catch up with the current price and will deviate from this for large returns realization. Since the typical stock tends to rise on high volume and fall on low volume this would cause high volume stocks to trade at a paper gain and low volume stocks to have unrealized capital losses. The two effects have opposite implications and the net result will probably depend upon the specific trading patterns among investors, which is unlikely to be fully captured by a simple linear specification.

The results in Model 3 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.

Model 4 checks whether fund-related variables may be driving the cross section of capital gains overhang by adding to the regressors the percentage of shares owned by the mutual funds (MF_HOLD) as well the average return in the previous twelve months of all the funds holding the stocks ($HOLD\_RET$). Prior returns are weighted by the percentage of ownership in the stocks. Since losing funds are the ones displaying reluctance to realize losses we would expect stocks with a low $HOLD\_RET$ to be trading at a loss. Results in column 3 show that after controlling for mutual fund ownership, past returns and volume, stocks mostly held by losing (winning) funds display larger unrealized losses (gains) while funds with a higher share of mutual fund ownership tend to trade at a gain, probably reflecting the fact that the average mutual fund manager displays a much lower degree of disposition effect when compared with individual investors.

Finally in Model 4 I regress the absolute value of the capital gains overhang on the absolute value of the full set of regressors. The results show that 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 tend to keep the overhang closer to zero although the coefficient of the raw turnover is positive probably reflecting some non linearities not captured by the linear specification. Finally high momentum stocks tend to have large capital gains overhang of either sign.

The adjusted R^2 are moderate, averaging about 28% , which suggests that although past returns, size and turnover are certainly among the determinants of capital gains overhang, there is enough unexplained cross sectional variation to allow for an analysis of the interaction between post-event drift and *residual capital gains overhang* by filtering out the predictable component in order to control for the correlation of capital gains overhang and past returns. In the construction of the rolling portfolios I use the cross sectional residuals generated by Model 2 as a capital gains overhang adjusted for price momentum, size and turnover.

IV. Results

As explained in section 1, the time pattern of the abnormal returns generated by the under-reaction to news depends upon the speed of mean reversion of the capital gains overhang since as the gap narrows over time stock prices drift slowly to the new fundamental value. The average $AR(1)$ coefficient of g is around 0.55 in quarterly data which implies a half-life between 3 and 4 months. Hence I use a holding period of 3 months as the relevant horizon for the rolling portfolios: short term under-reaction will be more severe for stock where news and the capital gains overhang have the same sign, so that once the holding period of the underlying rolling strategy is set to three months, overhang spreads should display risk adjusted alphas and dominate no-overhang spreads. I first report results for simple excess returns, then Fama and French (1993) three factors regression alphas and finally for size, book-to-market and price momentum adjusted returns. Last, results are shown for various sub-samples and adjusted datasets.

A. Univariate sort: the reference benchmark

I begin the analysis of post earning announcement strategies by presenting results from a univariate sort on event date cumulative abnormal returns as a reference benchmark for the results that follow.

Table IV show average excess monthly returns over the CRSP NYSE/AMEX/NASDAQ equally weighted index, of rolling portfolios with holding periods between one and three months. The last column in table IV confirms that there is significant PEAD in the full sample. Over the first three months the baseline rolling strategy that is long the top 20% positive earnings news stocks and short the bottom 20% generates a solid 1.235 percent a month in excess of the equally weighted market return ($t-$statistics = 12.35). 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.

B. Bivariate sort: excess returns

Tables V and VI show monthly average excess returns for the PEAD strategy cut by raw and residual capital gains overhang. For every calendar month stocks are assigned to one of 25 quintile portfolios using independent sorts on the last available event-date *car* and the raw or residual capital gains overhang at the end of the previous month. The residuals are calculated from monthly cross sectional regressions of unrealized capital gains on the past cumulative returns, size and volume.

When profits are calculated across overhang quintiles, portfolio j is defined as a zero cost portfolio which hold the top 20% good news stocks in the j overhang quintile and sell short the bottom 20 % bad news stocks in the $(6-j)th$ overhang quintile. Hence portfolio #5 correspond to the *overhang spread* which is the strategy with the largest (positive) difference in overhang between the long and short side while portfolio #1 correspond to the *no-overhang* spread which is the strategy with the minimum (negative) difference in overhang between the long and short side.

Separating stocks according to their unrealized capital gains/losses at the event date induces dramatic differences in subsequent returns. A strategy which holds a portfolio of top 20% winners with high capital gains overhang (top 20% capital gain) and offset this position by shorting the bottom 20% bad news stocks trading well below their reference price (bottom 20 % capital gains), delivers an average 2.332 percent a month in excess of the market for the first 3 months ($t-$statistics = 6.33). The no overhang spread is essentially zero beyond the one month horizon.

The results support hypotheses (1) - (2): bad news stocks with the lowest capital gain losses exhibit a severe and significant negative post-event drift which is not matched by similar bad news stocks with high unrealized capital gains. Consistent with the estimated speed of mean reversion of the capital gains overhang, overhang spread profits peak three months after portfolio formation.

Subsequently, they decline but still deliver an attractive 0.8 percent after 12 months. There is little sign of reversal consistent with under-reaction to the initial news content. The post-event drift is not significantly different from zero in no-overhang stocks.

Using residual rather than raw overhang delivers similar results. The average post-event abnormal return for the overhang spread is 2.15 % ($t-$statistics 6.35) while it is not significantly different from zero in no-overhang stocks. The results show that even after taking into account the recent movements in stock price in the sorting period, stocks with large capital gains overhang under-react to earnings news generating significant abnormal returns thus suggesting that price momentum is unlikely to be driving the findings.

Table VI better illustrates the results by reporting returns for different overhang quintiles. Average post-event excess returns decline monotonically across the quintiles portfolios and the average excess return generated by the overhang spread is statistically different from the no-overhang spread profits ($t-$statistics 3.58). The induced difference is remarkable, being slightly more than 200 basis points a month.

These results are consistent with the hypothesis that 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 their gains/losses, as measured by the stock's capital gains overhang. The potential profits are generated by an incomplete price discovery at the event date and peak around one quarter from portfolio formation as the spread between the current and the reference price mean reverts to zero.

To the extent that an argument can be made that such returns are in fact reward for loading on a risk factor proxy by some traded price or earnings momentum factor, note that the cross sectional variation in abnormal returns induced by the capital overhang sort is large enough to make an earnings momentum neutral loser - loser (or a winner - winner) spread profitable. For example, holding the bottom 20% *bad news* stocks with large unrealized capital losses and shorting the bottom 20% *bad news* with large unrealized gains earns 77 basis points a month for the first 3 months and presumably this portfolio would have no loading on such an earnings momentum factor. Similar spreads can be constructed across different overhang quintiles and news stocks.

The results above show that not only the bulk of the profitability of the PEAD is concentrated in high overhang stocks but, consistent with (1) and (2), signed overhang, conditional on extreme returns on earnings releases predicts future returns. Stock priced with large unrealized capital gains tend to under-react to, and only to, positive earnings surprise while negative overhang stocks under-react more to, and only to, negative earnings news thus inducing dramatic differences between the abnormal returns of the overhang and no overhang spread.

High overhang stocks, if they are riskier than low overhang stocks, should deliver worse (better) returns in bad (good) states of the world, regardless of the identity of the underlying risk factors. If bad and good states of the world correspond to low and high market returns (as in the CAPM) then high overhang stocks should perform better (worse) in up (down) markets. Nevertheless, exactly the *opposite* is true: there is no evidence that high overhang spreads are exposed to larger downside risk. If anything they perform best in down markets when the $S\&P$ 500 falls below the treasury bill rate. The 3 months rolling overhang spread has a S&P 500 beta of -0.017 and deliver an annualized 26% gross return. Hence, separating high overhang stocks has the effect of exacerbating the PEAD anomaly since it allows almost double the average monthly returns with respect to a standard univariate long/short strategies while maintaining a market neutral risk profile.

C. Bivariate sort: three factors alphas

Clearly a possible explanation for the pattern of post-event returns outlined above is that event driven strategies based on capital gain spreads simply select riskier stocks thus reflecting non-diversifiable risk rather than drift driven by under-reaction. Nevertheless, the observed time profile of monthly profits suggests that risk is unlikely to be the main driving factor behind the results.

Abnormal returns tend to peak one quarter after portfolio formation and later decline monotonically with the holding period, disappearing after 12 - 15 months. This pattern is consistent with a sluggish price discovery at the event date: as time goes and the stocks approaches its fundamental value, event driven profits will be declining. A risk-based explanation for such a pattern requires overhang strategies to consistently pick stocks with a monotonically declining risk profile, which is of course possible but unlikely.

If anything, when evaluating price or earnings momentum strategies using risk adjusted returns, the spread in abnormal returns tends to be amplified, not reduced. Past winners tend in fact to be growth stocks. Hong, Lim, and Stein (2000) point out that the relation between momentum returns and size is non linear with the smallest stock exhibiting reversals. As a result estimated factor loadings can display the wrong sign causing the spread in alpha across quintiles to be larger than the one in expected returns as in Fama and French (1996).

For each news and overhang quintiles the rolling procedure described above is used to obtain a monthly time series of returns. The holding period of the rolling strategy is set to three months. Factor loadings are then estimated from a time series regression of portfolio excess returns on contemporaneous Fama and French (1993) factors in calendar time[17]:

$$r - rf = \widehat{\alpha} + \widehat{\beta}_1 MKT + \widehat{\beta}_2 HML + \widehat{\beta}_2 SMB + \widehat{\varepsilon} \quad (6)$$

Table VII reports factors loadings and alphas for the overhang and the no-overhang strategies.

The portfolios of positive and negative earnings news have similar market and size exposure. High capital gains portfolios of both earnings news signs appear slightly more concentrated on glamour stocks hence the negative loading of the book to market factor (HML). The intercept for the negative news portfolios with large unrealized losses and the positive news portfolio with large unrealized gains are particularly eye catching (-1.121 % and 1.348% a month). Such portfolios are the constituent of the overhang spread. These dramatic abnormal returns stem from the fact that bad news portfolio with negative overhang has persistently low returns even though is tilted toward small stocks which would tend to raise expected returns. Good news portfolios with overhang tend to have higher returns but have a negative loading on HML which, ceteris paribus, should decrease expected returns.

As expected the spread in abnormal returns is larger then the difference in average excess returns: the capital gains spread earns significant higher risk-adjusted alphas than the no-overhang spread. Furthermore, results for the intermediate overhang quintiles and holding period up to 12 months (not reported) confirm that abnormal returns decline monotonically across the different overhang quintiles and peak for a holding period of three months.

The main conclusion from tables VI is that adjusting for size and book to market does not change the observed patterns of returns. Separating stocks according to the unrealized capital gains generates dramatic differences in PEAD strategies: a difference in monthly alphas of 2.365 % ($t-$statistics = 3.57).

V. Robustness checks

The patter of under-reaction unveiled in the previous sections is consistent with a world in which firm specific information diffuses only gradually across the investing public and market participants only partially extrapolate this information from prices. Trading by disposition investors is an example of a factor which can induce a sluggish price discovery but it is clearly not the only one. Hong, Lim, and Stein (2000) show that momentum profits are higher for stock with low analysts' coverage and for smaller stocks once stocks in the lowest NYSE size quintile are excluded from the sample. These results are consistent with under-reaction caused by slow diffusion of information as proxy by firm size or analysts' coverage. To the extent that the results above does not simply reflect a size effect or are not limited to illiquid or low priced stocks we would expect the differential between overhang and no-overhang strategies to hold across size sub-samples and for an adjusted dataset which excludes illiquid stocks. Moreover the results should be stronger for smaller stocks or more in general for stocks where price discovery is more likely to be slower, such as stocks with low or no analysts' coverage.

A. Size, book to market and momentum adjusted returns

In this section I consider an alternative method of constructing abnormal returns.

Daniel and Titman (1998a, 1998b) suggest that size and book to market (B/M) 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 the market capitalization at the end of the month prior to the earnings announcement, stocks are assigned to one of five market cap quintiles. Each market cap quintile is further divided into five more quintiles based on the ratio of book equity to market equity. Book value is computed using the standard method outlined by Fama and French (1992). Finally, within each size - B/M group, stocks are further classified using quintiles based on their compounded return in the last 12 months, skipping the last month. The previous month return is skipped to control for short term reversals[18]. Once those NYSE cutoffs are defined for a given month all stocks in the sample are assigned to one of these 125 ($5 \times 5 \times 5$) characteristics portfolios.

In order to find a match for a given sample stock, all the non-event stocks in the same characteristics portfolio are ranked based on the distance between the sample stock and the matching stock on each characteristics. Ranks are then summed across the different characteristics and the lowest rank is selected as the matching stock. The match is then 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.

The momentum adjustment is worth some clarification: from an asset pricing perspective it is not at all clear that returns should be adjusted for momentum in a study of under-reaction; if anything the empirical evidence to date is consistent with momentum reflecting nothing more than under-reaction to news and some extra noise[19]. On the other hand the high correlation between the capital gains overhang and prior stock returns can raise the suspicion that the under-reaction pattern uncovered is a simple manifestation of price momentum which is not appropriately controlled for by the cross sectional regression filters. Once returns are adjusted for price momentum the evidence of short term under-reaction can be interpreted as net of a "normal" drift which we would expect to see in high momentum stocks.

For each month I subtract the size, B/M and momentum matched returns from stock returns and then calculate calendar time rolling returns as before.

Results in panel A of table VIII show that even after controlling for price momentum, security prices tend to under-react to public news and that, as conjectured in (1) and (2), the magnitude of such post-event drift conditional on the initial price reaction (or price path) is indeed predictable by the signed unrealized capital gain at the event date. As a results the overhang spread consistently earn higher risk adjusted returns than the no-overhang spread.

Since the capital gains overhang tends to be correlated with past returns it is not surprising that adjusting returns for momentum reduces average abnormal returns for both strategies. Nevertheless, the main result is unchanged: high overhang stocks are characterized by a more severe post earnings announcement drift. A quarter from portfolio formation, abnormal returns for the overhang spread are 1.851%(raw overhang, $t-$statistics = 5.6) and 2.083& a month (residual overhang, $t-$statistics = 5.12) and I cannot reject the hypothesis that abnormal returns for the no-overhang spreads are statistically different from zero.

B. Liquidity: the effect of low priced stocks

Commissions, high direct transactions costs, larger price impact associated with bigger trades and short sale constraints can all preclude the possibility of taking advantage of the under-reaction patterns uncovered. Trading frictions associated with small or illiquid stocks can explain why the drift appears to persist although it cannot explain why it arises in the first place. A simple way control for liquidity is to exclude stocks with high transactions cost or price impact. I repeat the analysis in section B but eliminate stocks with a split adjusted stock price equal to or below $5. Dropping low priced stocks reduces the CRSP sample for this period by 30% (stocks in all months).

The abnormal returns for the reduced dataset reported in panel B of table VII are similar to those of table VI. The capital gains overhang spread reaches 2.485% a month in three months after the announcement ($t-$statistics = 6.75) while the no-overhang spread is not significantly different from zero.

C. Results for sub-samples based on size

This section reports results based on size sub-samples[20]. In order to disentangle variation across overhang strategies unrelated to size the sample is broken into size quintiles. I use market capitalization six months prior to the start of the sorting period as a measure of size. Breakpoints are computed using NYSE stocks only.

Results reported in panel C table VIII show that the difference between the overhang and the no-overhang drift is statistically significant and economically large across all the size sub-samples and, as conjectured, it tends to be higher for smaller stocks where information asymmetries are likely to be more pronounced.

The results tell a consistent story: separating stocks using unrealized gains yields dramatic differences across all size quintiles: the overhang spread consistently earns higher returns than the no-overhang strategy. These results clearly show that even across size sub-samples stocks with large unrealized capital gain / losses display under-reaction to public news generating predictability of future returns using event date overhang.

Clearly the implementation shortfall of the overhang spread, the difference between gross and net returns, will display variation across the size quintiles. 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[21]. A complete back test of the profitability of the overhang spreads, using estimated price impact, bid-ask spread based on trades size and stock characteristics, is beyond the scope of this paper; it is true that returns are highest for smaller stocks and that the strategies considered have a high turnover yet a back of the envelope calculation based on table VII can give an idea of how profitable overhang spreads can be even for large cap stocks.

Madhavan and Keim (1998) report commissions of about 0.18% for institutional traders on NYSE and average one way cost (not including commissions) of 0.31% for large institutional traders, thus implying an annual round trip trading cost of about 1%. The overhang spread in PEAD for the biggest quintile stocks is on average 1.268% a month for the three month rolling strategy. Using monthly rebalancing the average turnover of such a strategy is 50% a month.

These values imply an average *net* annual return of 14.7% which is a non-trivial achievement especially considering that this is a zero beta strategy. It is difficult to argue that such a strategy would not be feasible or profitable: price impacts are unlikely to be an issue since executing this particular spread implies trading the largest and most liquid stocks on the US stock markets. Short sale constraints will not be an issue either since many of those stocks are listed on some major stock market index[22] and have exchange traded option written on them.

D. Results for sub-samples based on mutual fund ownership

Since reference prices are constructed using mutual fund holdings, it is plausible for the measure of overhang to be more relevant for stocks which are mostly held by mutual funds and less relevant for stocks which are mostly held by individual investors. The variable of interest is really the cost-based reference price to the representative investor and mutual fund holdings will be a noisy measure for the portfolio of the marginal investor in the market.

I address this issue by splitting the sample into stocks with high mutual fund ownership and stocks with low mutual fund ownership. Ownership is defined as the percentage of share outstanding held by mutual funds and I use the median mutual fund percentage ownership at the end of the previous calendar month as the breakpoint. The results in panel A of table IX confirm the intuition above: separating stocks by mutual fund ownership has little effect on the magnitude of the overhang spread which still delivers around 200 basis point a month in excess of the market. The difference in average excess returns between the overhang and the no-overhang spreads is larger for high mutual fund ownership stocks than for low mutual fund ownership stocks. High mutual fund ownership stocks with large negative (positive) overhang do not under-react to bad (positive) news so the no-overhang drift is essentially zero while some post-event drift is detectable for low overhang stocks with low mutual fund ownership.

E. A different definition of earning news

In the results above, earnings news is classified using the cumulative abnormal return around the most recent event day. While this return-based measure is a fairly clean and easy-to-implement measure of earnings surprises, since it does not require an explicit model for expected earnings, 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[23] suggesting that different earnings surprise definitions may capture different aspects of market expectation of earnings releases.

In order to check the robustness of the results for an alternative definition of earnings surprises, earning news is sorted using standardized unexpected earnings (SUE), defined as

$$SUE_t = (e_t - e_{t-4})/\sigma \tag{7}$$

where e_t is the most recent quarterly earning per share as of month t , e_{t-4} is the earnings per share four quarters before month t and σ is the standard deviation of unexpected earnings $e_t - e_{t-4}$ over the preceding eight quarters.

Panel C in table VII documents the performance of PEAD portfolios sorted on SUE and the capital gains overhang. The results are strikingly similar to the previous findings: high overhang stocks tend to have higher expected returns generating large differences in post-event returns.

F. A different capital gains overhang: out of sample evidence

The capital gains overhang constructed using mutual fund holdings is meant to be the best estimate of the stock's cost basis to the representative investor. The advantage of using portfolio 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. Nevertheless it limits the scope of the analysis to the period 1980 - 2002 where mutual fund data is available and he relies on the assumption that mutual fund managers are a valid proxy for the marginal investors. Out of sample tests require estimation of the capital gains overhang by specifying a model of trading behavior and using price and volume data to infer the aggregate cost basis for the market in a particular stock.

In this section I borrow the Grinblatt and Han (2002) specification of the capital gains overhang and model the fraction of share purchased at month $t-n$ and held by the month $t-n$ purchaser through month t as:

$$V_{t,t-n} = TO_{t-n}\left[\prod_{\tau=1}^{n-1}(1 - TO_{t-n+\tau})\right] \tag{8}$$

where TO_t is turnover in month t defined as total volume standardized by shares outstanding. Turnover ratios exceeding one are set to one and the reference price is then estimated as above:

$$RP_t = \phi^{-1}\sum_{t=1}^{n} V_{t,t-n}P_{t-n} \tag{9}$$

This model treats all shares as symmetric by assuming that each share outstanding is equally likely to be sold at any date. The intuition behind (8) is straightforward: 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 price at date $t-n$. Summing over the possible reference prices gives the estimated cost basis for the market.

Using this new estimate of the capital gains overhang I analyze under-reaction to earnings news for the period 1962 - 1979 not covered by the mutual fund database.[24] The caveat of employing a symmetric model of trading behavior is that it will not capture non linearities between turnover and reference prices: for example assume that a stock has a large ownership of "natural" holders who are reluctant to sell no matter what news is released but that 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 then the reference price (9) will be closer to the current price. Still the stock price should under-react to news since the float is essentially zero and the current holders are reluctant to trade.

In panel B of table IX I split the sample into the two sub-periods 1962 - 1979 and 1980 - 2002 and compute Fama French (1993) alphas for the overhang and the no-overhang spreads using the new estimated capital gains variable. Results are consistent with the previous findings: when using an alternative capital regressor estimated from past volume data, high overhang stocks under-react most to earnings news while no-overhang stocks do not display significant post-event drift.

VI. Extension: price momentum and analysts' stock recommendation revisions

The under-reaction hypothesis (1) - (2) is clearly not specific to earnings announcements but can be applied to any situation where firm-specific information is released and investors initially under-react to it. In this section I consider an extension of the tests above by concentrating on two different investment strategies: price momentum and a 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[25]. In particular, upgraded stocks outperform downgraded stocks, implying that stock prices do not adjust immediately to a recommendation revision. It is also well know that stocks with higher (lower) price momentum earn higher (lower) returns over the next 12 months[26].

Jegadeesh, Chan, and Lakonishok (1996) analyze price and earning momentum strategies and show that some of the profitability of price momentum strategies is related to earning news and more importantly that combined abnormal returns over the two earnings announcements subsequent to portfolio formation can account for over 40% of momentum profits. More recently Chan (2003) show that there is substantial overlap between a long/short strategy based on public news releases, identified from headlines and extreme concurrent monthly returns, and a pure price momentum strategy. These findings are consistent with momentum reflecting nothing more than under-reaction to news and some extra noise. As such momentum can be cast into the empirical framework suggested by (1) and (2) by interpreting extreme past price performance as news released at the sorting date and by using a sort on past returns to map news into an observable variable.

Brokers' and analysts' recommendations are from the I/B/E/S database. The Institutional Brokers Estimate System provides consensus, detailed recommendations and forecasts from security analysts. 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 then defined as the trading days when at least one revision occurs. The data run from January 1993 to December 2002.

Like the PEAD strategies analyzed above, the ranking variable for the strategy based on analysts recommendation revisions is the market model cumulative abnormal returns around the most recent revision date. The ranking variable used for the price momentum strategy is the stock's compounded return in the last 12 months, skipping the last month. The data for the momentum strategy run from January 1980 to December 2002. As above, independent sorts are used to construct long/short overhang and no-overhang spreads. Fama and French (1993) three factors alphas are reported in table X[27].

Consistent with the previous findings stocks with large unrealized capital gains display a severe drift following analysts' recommendation changes accompanied by extreme price movement, consistent with an initial under-reaction to the news content of such revisions predictable by the signed residual overhang at the event date. Low overhang stocks exhibit reversals of almost the same magnitude generating a significant 3% difference in alphas in the first quarter following a revision. This pattern of returns and the role of the capital gains overhang in propagating news content of analysts' recommendation revisions awaits further research. Momentum strategies also work best once past winners and losers are sorted using their residual unrealized gains or losses, generating a difference in post-event alphas at the three month horizon of 200 basis points per month.

VII. Price impact, volume and the capital gains overhang

The results above show that exposure to a disposition factor as measured by the capital gains overhang predicts cross-sectional differences in post-event monthly returns, even after controlling for size or liquidity. This evidence is consistent with the hypothesis that trading between disposition-prone investors and their counter-parts impact relative prices at the announcement date thus generating post-event drift. In this section I use daily volume and returns around earnings announcement days to analyze the role on unrealized gains in propagating news around event dates.

To the extent that post-event abnormal returns observed above are generated by a sluggish price discovery as a results of exposure to a disposition factor, we would expect event-day return and volume reaction to news to be weaker the higher the spread between the current and the reference price.

Trading volume should be lower for negative earnings news stocks with large unrealized losses, as disposition-prone investors are reluctant to unload stocks at a loss. Conversely, volume should be higher for positive earnings news stocks with large unrealized gains as disposition-prone investors rush to realize their paper gains.

Since I want to analyze the impact of capital gains overhang on event day returns I use SUE as measure of earnings surprises.

From January 1980 to December 2002 I compute the abnormal turnover around earnings announcement dates for each stock in the database. Turnover τ is defined as log trading volume normalized by the number of shares outstanding

$$\tau_t = \log\left(\frac{V_t}{S_t}\right) \tag{10}$$

Abnormal turnover AT is calculated as

$$AT = \tau - \overline{\tau} \tag{11}$$

$$\overline{\tau_t} = \sum_{t=-40}^{-11} \tau_t. \tag{12}$$

where the subscript t indicates trading days.

On announcement dates event stocks are sorted on the basis of their standardized unexpected earnings and the most recent available capital gains overhang.

Tables XI shows average abnormal turnover across capital overhang percentiles (from the bottom 10% $= 1$ to the top 10% $= 10$) for the top and bottom earnings surprise quintile (SUE1 and SUE5) tracked in event time.

As expected for both negative and positive earnings news, turnover tends to be higher the higher the capital gains overhang at the event date.

For negative earnings surprise (bottom 20% SUE) abnormal volume is only 0.32, 44% below average in the bottom overhang percentiles ($t-$statistics $= 31.57$) while it reaches 1.34, 185% above average for stocks with large unrealized gains ($t-$statistics 48.09). Similarly after positive earnings news (top 20% SUE) turnover for stocks with the largest overhang is almost doubled with respect to stocks in the bottom overhang quintile (2.15 and 1.18, $t-$statistics 29,85 and 18.01)

These results are consistent with the hypothesis that price discovery is hampered by the capital gains overhang and that unrealized gains or losses at the time news is released may affect asset price dynamics.

In order to test the hypothesis that under-reaction to public news is related to the presence of disposition-induced trading I run a series of event time, cross sectional and Fama MacBeth regressions of cumulative abnormal returns around event dates on a measure of earnings news (SUE), firm size (defined as log of market capitalization at the end of the previous month) and the capital gains overhang g:

$$car = \alpha + \gamma_1 SUE + \gamma_2 g + \gamma_3 SIZE + \varepsilon \tag{13}$$

To the extent that the capital gains overhang tend to hamper the price response to earnings news we should expect to see a negative coefficient.

Results reported in table XII confirm that unrealized capital gains tend to dampen event day price response: the coefficient γ_1 is uniformly negative across all the news quintiles as well for the whole sample.

VIII. Conclusion

This paper develops a test of under-reaction to news induced by the presence of investors who display the tendency to realize gains and ride losses, otherwise known as the disposition effect. In the presence of disposition-prone investors, stock prices under-react to news, generating post-event drift. Exposure to a disposition factor as measured by the capital gains overhang, spreads the cross-sectional differences in post-event returns: stocks with large unrealized capital gain-losses should exhibit a severe post-event drift so that momentum or event-driven strategies work best once stocks are sorted using their capital gains overhang at the event date.

The calendar time rolling method used 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 chosen 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 in calendar time.

The results show that stocks with large unrealized capital gains have higher expected returns as investors initially under-react to news releases generating a predictable price drift. The post-event predictability is most severe when the disposition effect predicts the biggest under-reaction. Post-event drift is bigger when the news and the capital 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. Furthermore post-event returns are maximized when the holding period is selected to match the half life of the capital gains overhang. Size, book to market, price momentum, trading cost, the choice of earnings news variable or mutual fund ownership in the test stocks cannot explain the drift.

The findings are consistent with a world in which trading friction captured by the capital gains overhang impede a speedy transmission of information to stock prices via price impact.

Investors may be reluctant to unload stocks which have experienced a string of negative (positive) returns thus having unrealized losses (gains), culminating in an extreme event day drop (jump), if they forecast reversal following extremes returns. Nevertheless, such beliefs will be consistently violated ex post since post-event returns show little sign of reversals.

Capital gains overhang will predict future 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 tend to increase over time, stocks with loyal holders will tend to have large unrealized gains. Since the 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 associated with 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 C. Small and illiquid stocks react less to good news since they react less to any news due to their illiquidity and in this world residual overhang will be a better predictor of future returns than raw overhang.

Last is the possibility that the capital gains overhang is just a proxy for investor disagreement about a stock: in the presence of short sale constraints stocks with the higher disagreement may have lower expected returns as in Miller (1977).

Although it is possible that the capital gains overhang is capturing some liquidity-related factor, none of the hypotheses above can explain the asymmetry in the stock price response to news: under-reaction is most severe when the capital gains overhang and the event have the same sign. Stocks with large unrealized capital gains under-react to good news and to good news only while stocks with negative overhang 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 of price response and drift is consistent with the disposition effect because the latter predicts signed trading imbalances as a function of the distance 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 while their excess selling pressure prevents the price from raising immediately to the new level on positive news releases. As a result post-event risk adjusted returns can be systematically achieved by a using sort on the capital gains overhang suggesting that such a variable predicts the gradual market response to new information.

References

Abarbanell, Jeffery S., and Victor Bernard, 1992, Analysts' Overreaction / Underreaction to Earnings Information as an Explanation for Anomalous Stock Price Behavior, *Journal of Finance* 47, 1181–1207.

Ball, Ray, and Eli Bartov, 1996, How Naive is the Stock MarketŠs Use of Earning Information, *Journal of Accounting and Economics* 21, 319–337.

Ball, Ray, and Philip Brown, 1968, An Empirical Evaluation of Accounting Income Numbers, *Journal of Accounting Research* 6, 159–178.

Barber, Brad M., and John D. Lyon, 1997, Detecting Abnormal Operating Performance: The Empirical Power and Specification of Test Statistics, *Journal of Financial Economics* 41, 341–372.

Barber, Brad M., and Terrance Odean, 2000, Trading Is Hazardous To Your Wealth: The Common Stock Investment Performance of Individual Investors, *Journal of Finance* 55, 773–806.

Barber, Brad M., and Terrance Odean, 2001, Boys Will Be Boys: Gender Overconfidence and Common Stock Investment, *Quarterly Journal of Economics* 116, 261–292.

Barber, Brad M., and Terrance Odean, 2002, Online Investors: Do the Slow Die First?, *Review Of Financial Studies* 15, 455–487.

Bernard, V., and J. Thomas, 1989, Post-Earnings Announcement Drift and: Delayed Price Response or Risk Premium?, *Journal of Accounting Research* 27, 1–36.

Bernard, V., and J. Thomas, 1990, Evidence That Stock Prices Do Not Fully Reflect the Implications of Current Earnigns for Future Earnings, *Journal of Accounting and Economics* 13, 305–340.

Bjerring, James H., Josef Lkonishok, and Theo Vermaelen, 1983, Stock Prices and Financial Analysts' Recommendations, *Journal of Finance* 38, 187–204.

Brown, Philip R., Nick Chappel, Raymond da Silva Rosa, and Terry Stirling Walter, 2002, The Reach of the Disposition Effect: Large Sample Evidence Across Investor Classes, *Working Paper, Lancaster University.*

Chan, Wesley, 2003, Stock Price Reaction to News and No-News: Drift and Reversal After Headlines, *Journal of Financial Economics* 70, 223–260.

Collins, Daniel W., and Paul Hribar, 2000, Earnings Based and Accrual Based Market Anomalies: One Effect or Two?, *Journal of Accounting and Economics* 29, 101–123.

Coval, J., and T. Shumway, 2000, Do Behavioral Biases Affect Prices?, *Working Paper, University of Michigan.*

Daniel, Kent D., and Sheridan Titman, 1998a, Characteristics or Covariances?, *Journal of Portfolio Management* 24(4), 24–33.

Daniel, Kent D., and Sheridan Titman, 1998b, Evidence on the Characteristics of Cross-Sectional Variation in Common Stock Returns, *Journal of Finance* 52, 1–33.

David Ikemberry, Rankine Gaeme, and Earl K. Stice, 1996, What Do Stock Splits Really Signal?, *Journal of Financial and Quantitative Analysis* 31, 357–375.

Desai, Hemang, and Jain C. Prem, 1997, Long-Run Common Stock Returns Following Stock Splits and Reverse Splits Dividends, *Journal of Business* 70, 409–434.

Dhar, Ravi, and Z. Ning Zhou, 2002, Up Close and Personal: An Individual Level Analysis of teh Disposition Effect, *Yale ICF Working Paper.*

Eberhart, Allan C., William F. Maxwell, and Akhtar R. Siddique, 2004, Returns and Operating Performance Following R&D Increases, *Journal of Finance* 59, 623–650.

Elton, Edwin J., Martin J. Grueber, and Mustafa N. Gultekin, 1984, Professional Expectations: Accuracy and Diagnosis of Errors, *Journal of Financial and Quantitative Analysis* 19, 351–363.

Fama, Eugene, and Kenneth French, 1996, Multifactor Explanations of Asset Pricing Anomalies, *Journal of Finance* 51, 55–84.

Fama, Eugene F., 1998, Market Efficiency, Long Term Returns and Behavioral Finance, *Journal of Financial Economics* 49(3), 283–306.

Goetzmann, William N., and Massimo Massa, 2003, Disposition Matters: Volume, Volatility and Price Impact of a Behavioral Bias, *Yale ICF Working Paper No. 03-01*.

Gomper, Paul, and Josh Lerner, Forthcoming, Venture Capital Distribution: Short Run and Long Run Reactions, *Journal of Finance*.

Grinblatt, Mark, and Bin Han, 2002, The Disposition Effect and Momentum, *NBER Working Paper No. W8734*.

Grinblatt, Mark, and Matti Keloharju, 2000, What Makes Investors Trade?, *Yale ICF Working Paper No. 00-02*.

Grinblatt, Mark, Ronald W. Masulis, and Titman Sheridan, 1984, The Valuation Effects of Stocks Splits and Stock Dividends, *Journal of Financial Economics* 13, 97–112.

Groth, John C., Wilbur G. Lewellen, Gary C. Scharbaum, and Ronald C. Lease, 1979, An Analysis of Brokerage House Securities Recommendations, *Financial Analysts Journal* 35, 32–40.

Hong, Harrison, Terrence Lim, and Jeremy C. Stein, 2000, Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies, *Journal of Finance* 55.

Ikenberry, David, Josef Lakonoshok, and Theo Varmaelen, 1995, Market Underreaction to Open Market Repurchases, *Journal of Financial Economics* 39, 181–208.

Jegadeesh, N., 1990, Evidence of Predictable Behavior of Security Returns, *Journal of Finance* 45, 881–898.

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

Jegadeesh, Narasimhan, J. Kim, S. D. Krische, and C. M. C. Lee, 2004, Analyzing the Analysts: When Do Recommendations Add Value?, *Journal of Finance* 59(3), 1083 – 1124.

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, 2002, Momentum, *University Of Illinois Working Paper.*

Joy, O. Maurice, Robert H. Litzenberger, and Richard W. McEnally, 1977, The Adjustment of Stock Prices to Announcements of Unanticipated Changes in Quarterly Earnings, *Journal of Accounting Research* 15(2), 207–225.

Lakonishok, Josef, and Theo Vermaelen, 1990, Anomalous Price Behavior Around Repurchase Tender Offers, *Journal of Finance* 1990, 455–477.

Lesmonda, David A., Michael J. Schill, and Chunsheng Zhouc, 2004, The Illusory Nature of Momentum profits, *Journal of Financial Economics* 71, 349–380.

Locke, P., and S. Mann, 2000, Do Professional Traders Exhibit Loss Realization Aversion?, *Working Paper, The George Washington University and Texas Christian University.*

Lougran, Tim, and Jay Ritter, 1995, The New Issues Puzzle, *Journal of Finance* 50, 23–52.

Madhavan, Ananth N., and Don Keim, 1998, The Empirical Evidence on the Cost of Equity Trades: An Overview, *Financial Analysts Journal* 30, 199–221.

Mendenhall, Richard, 1991, Evidence of Possible Underweighting of Earnings-Related Information, *Journal of Accounting Research* 29, 170–140.

Miller, E., 1977, Risk, Uncertainty and Divergence of Opinion, *Journal of Finance* 32, 1151 – 1168.

Odean, Terrance, 1998, Are Investors Reluctant to Realize their Losses?, *Journal of Finance* 53, 1775–1798.

Odean, Terrance, 1999, Do Investors Trade Too Much?, *American Economic Review* 89, 1279–1298.

Olsen, G. C., and T. Shevlin, 1984, Earnings Releases, Anomalies, and the Behavior of Security Returns, *The Accounting Review* 59, 574–603.

Rendleman, R., C. Jones, and H. Latane, 1982, Empirical Anomalies Based on Unexpected Earnings and the Importance of Risk Adjustments, *Journal of Financial Economics* 10, 269–287.

Seyhun, H. Nejat, 1986, Insiders' Profits, Cost of Trading and the Market Efficiency, *Journal of Financial Economics* 61, 189–212.

Seyhun, H. Nejat, 1988, The Information Content of Aggregate Insider Trading, *Journal of Business* 61, 1–24.

Shapira, Z., and I. Venezia, 2000, Patterns of Behaviour of Professionally Managed and Independent Investors, *WP, Stern School of Business and Hebrew University.*

Shefrin, H., and M. Statman, 1985, The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence, *Journal of Finance* 40(3), 777–791.

Tarun, Chordia, and Lakshmanan Shivakumar, 2002, Earnings, Business Cycle and Stock Returns, *WorkingPaper.*

Teoh, Siew Hong, Ivo Welch, and T. J. Wong, 1998, Earnings Management and the under-Performance of Seasoned Equity Offering, *Journal of Financial Economics* 50.

Wermers, Russell R., 2003, Is Money Really "Smart"? New Evidence on the Relation Between Mutual Fund Flows, Manager Behavior, and Performance Persistence, *Working Paper, University of Maryland.*

Womack, Kent L., 1996, Do Brokerage Analysts' Recommendations Have Investment Value?, *Journal of Finance* 51, 137–168.

Notes

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[11]At least for stocks mostly held by mutual funds

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

[13]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 leaking, pre-announcements or a delayed response for less frequently traded stocks

[14]Using reference prices constructed employing a LIFO criterion (last-in-first-out), the last trad-

ing, buying price or averages of past buying and selling prices, does not alter any of the main results

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

[16]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.

[17]The monthly factors are from Ken French's website:

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[18]See Jegadeesh (1990)

[19]See Grinblatt and Han (2002), Jegadeesh, Chan, and Lakonishok (1996) and Chan (2003)

[20]Since sorting stocks according to their raw or residual capital gain overhang produces almost identical results, for brevity I will only report returns for raw overhang cuts

[21]Their analysis is focused on price, not earnings momentum

[22]Hence they are relatively easier to short since index funds are "natural lenders"

[23]Although they all generate PEAD

[24]CRSP coverage of the trading volume starts in 1962

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

[26]For a review of the available evidence on momentum see Jegadeesh and Titman (2002)

[27]Since I am analyzing price momentum strategies I report results for residual overhang cuts.

A. Appendix

In section I motivate the empirical predictions using a particular continuous time version of the Grinblatt and Han model. Assume a risky stock in fixed unit supply. Public news reveals the fundamental value F at date 0, just prior to trading, there is no uncertainty subsequent to date 0.Date t demand function for the representative investor are given by

$$d(t) = 1 + b(t)[(F - P(t)) + \lambda(RP(t) - P(t))] \tag{14}$$

For $\lambda > 0$, the representative investor is relatively more adverse to realizing losses with respect to the rational (downward sloping) component of the demand function given by $b(t)$. Setting $d(t) = 1$ the equilibrium price will be given by

$$P(t) = wF + (1 - w)RP(t) \tag{15}$$

where $w = 1/(1 + \lambda)$. Assume that the reference price is updated following

$$\frac{dRP}{dt} = v(t)\,[P(t) - RP(t)] \tag{16}$$

where $\dot{x}$ indicates time derivatives. The reference price is then a weighted average of past prices with time varying coefficients

$$RP(t) = \int_0^t v(u)P(u)du \tag{17}$$

In order to close the model we need to specify how the agent set the weight in updating his reference price. Let

$$v(t) = 1 - \alpha^t \tag{18}$$

where $\alpha \in (0, 1)$.Equation (18) implies that investors are initially slow to update the reference price but as trading occurs they pay less attention to their initial anchor point and more emphasis on the current observed trading price.

Equations (15), (16) and (18) admit a closed form solution for the dynamic evolution the stock price, the reference price and post event returns.

Combining (15), (16) and (18) yields the ordinary differential equation:

$$\frac{dP}{dt} = (1-w)\left(1-\alpha^{t}\right)\left[P(t)-RP(t)\right] \quad (19)$$

$$= w\left(1-\alpha^{t}\right)\left[F-P(t)\right] \quad (20)$$

with the initial condition

$$P(0) = wF + (1-w)RP(0)$$

The solution to (19) is given by:

$$P(t) = F - k_1(t)\left[P(0)-RP(0)\right] \quad (21)$$

where

$$k_1(t) = \frac{1-w}{w}e^{w\frac{\alpha^{t}-t\log\alpha-1}{\log\alpha}} > 0$$

Equation (21) implies that negative (positive) overhang stock will initially under-react to bad (good) news while eventually the stock price will drfit towards the new fundamental value since

$$\lim_{t\to\infty} P(t) = F \quad (22)$$

The path of post-event returns is given by:

$$ret(t) = \frac{dP}{dt}$$

$$= k_2(t)\left[P(0)-RP(0)\right] \quad (23)$$

where

$$k_2(t) = (1-w)(1-\alpha^t)e^{\frac{w(-1+\alpha^t - t\log\alpha)}{\log\alpha}} > 0$$

Equations (21) and (23) allow to prove the two main propositions regarding the price dynamics after the initial announcement.

Proposition 3 *Signed capital gains overhang at date 0 predicts future returns. Returns following bad (good) news have a unique min (max) at a date $\tau^* > 0$.*

Proof. Since $k_2(t) > 0$ then $sign\,[ret(t)] = sign\,[P(0) - RP(0)]$. From 23 we have:

$$\frac{dret}{dt} = \frac{dk_2}{dt}\,[P(0) - RP(0)] \tag{24}$$

$$= \frac{w}{1-w}\frac{dk_2}{dt}\,[F - P(0)] \tag{25}$$

and the unique positive root $\frac{dk_2(\tau^*)}{dt} = 0$ is given by

$$\tau^* = \frac{\log\left[\left(2w - \log\alpha + \sqrt{\log\alpha(-4w + \log\alpha)}\right)/2w\right]}{\log\alpha}$$

Since $ret(t)$ is a continuous function and

$$\lim_{x\to\infty} ret(t) = 0 \tag{26}$$

$$\lim_{x\to 0} ret(t) = 0 \tag{27}$$

then post event returns will have a unique min or max at τ^*, depending on sign $sign\,[P(0) - RP(0)]$. QED ■

Proposition 4 *The capital gains overhang monotonically mean reverts to zero subsequent to date 0 and the minimum (maximum) returns occurs approximately when the overhang has closed half of the initial gap.*

Proof. Combining (21) and (15) yields:

$$P(t) - RP(t) = -k_3(t)\left[P(0) - RP(0)\right] \tag{28}$$

where

$$k_3(t) = e^{w\frac{\alpha^t - 1 - t\log\alpha}{\log\alpha}} > 0$$

Since we have

$$\lim_{t\to\infty} k_3(t) = 0 \tag{29}$$

$$\frac{dk_3}{dt} = -w(1-\alpha^t)e^{w\frac{\alpha^t - t\log\alpha - 1}{\log\alpha}} < 0 \tag{30}$$

then the capital gain overhang will monotonically mean revert to zero from the initial deviation.

In order to show that max (min) post event returns are achieved approximately at the half life of the capital gains overhang define the function $q(\alpha, w)$ such that :

$$P(\tau^*) - RP(\tau^*) - q\left[P(0) - RP(0)\right] = 0 \tag{31}$$

where τ^* is the date where returns achieved the max or min. To prove that τ^* correspond to the half life of the overhang is then is sufficient to show that $q(\alpha, w) \approx \frac{1}{2}$ for $(\alpha, w) \in (0, 1)$.The function $q(\alpha, w)$ is plotted in figure (5) while the values are tabulated in table XIII. For the relevant parameter range we have $q \in (0.41, 0.57)$ that is returns peak (or reach the bottom) approximately when the capital gain overhang has covered between 40% and 60% of the initial deviation, depending on parameter values. QED. ■

The return pattern following negative $(F < P_0)$ and positive news $(F > P_0)$ is plotted in figure (6) and (7).

Notes

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Table I: Mutual funds Proportion of Gains Realized to the aggregate Proportion of Losses Realized, 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 twelve months compounded return. The $t-$statistics test the null hypothesis that the difference in proportions is equal to zero.

	Fund returns 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 II: Summary statistics for the capital gains overhang

This table report summary statistics for the capital gains overhang. The capital gains overhang is defined as the percentage deviation of the aggregate average cost basis reference price from the current price $g_t = \frac{P_t - RP_t}{P_t}$. 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 in the portfolio at date t that are still held by the original purchasers at $t-n$, ϕ 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. Investors are assumed to a FIFO criterion (first-in-first-out) to associate a specific quantity of shares in their portfolio to the corresponding reference price. The table reports mean, standard deviation, skewness, the first and the fifth quintile for selected year. %STOCKS 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
1980	0.13	0.13	0.16	-0.60	0.02	0.25	52.9	81.2
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	52.0
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 III: Determinants of capital gains overhang, Fama MacBeth regressions 1980 - 2002

This table reports coefficients from Fama MacBeth regressions of the capital gains overhang (g) 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 years 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 month, 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 calendar 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. The $\overline{R}^2$ is the average R^2 from the cross sectional regressions.

Model No.	1	2	3	4
Dependent variable	g	g	g	$abs(g)$
$R_{-12,-1}$	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 IV: Post Earnings Announcement Drift profits, monthly excess returns 1980 - 2002

At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns at 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 then assigned to one of five equally weighted quintile portfolios. L/S is a zero cost portfolio which holds the top 20% good news stocks and sells short the bottom 20% bad news stocks. This table include all available stocks and reports the time series averages of monthly returns, in excess of the CRSP NYSE/AMEX/NASDAQ market index, obtained using calendar-time rolling portfolios. Returns are in monthly percent, $t-$statistics are shown below the coefficient estimates. "Months" is the holding period of the rolling strategy.

	Earnings news quintile					
Months	1 (bad)	2	3	4	5 (good)	L/S
+1	-0.415	-0.058	0.192	0.400	0.784	1.199
	(-2.46)	(-0.62)	(1.80)	(4.39)	(5.25)	(8.45)
+2	-0.323	0.116	0.280	0.407	0.863	1.186
	(-1.79)	(1.42)	(3.21)	(5.01)	(6.85)	(9.25)
+3	-0.440	0.057	0.226	0.383	0.795	1.235
	(-3.00)	(0.79)	(2.72)	(5.04)	(7.16)	(12.35)

Table V: PEAD profits: Capital gains overhang and no-overhang spread returns

This table reports the time series averages of monthly returns in excess of the CRSP NYSE/AMEX/NASDAQ market index obtained using calendar-time rolling portfolios for the overhang spread and the no-overhang spread. At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns at the most recent earnings announcement date and the most recent capital gains overhang. The overhang spread is defined as a zero cost portfolio which holds the top 20% good earnings news stocks in the top 20% overhang quintile and sells short the bottom 20% bad earnings news stocks in the bottom overhang quintile. The no-overhang spread is defined as a zero cost portfolio which holds the top 20% good news stocks in the bottom overhang quintile and sells short bottom 20% bad news stocks in the top overhang quintile. The residual overhang is obtained by regressing (cross sectionally) the raw overhang on previous 12 and 36 months returns, the previous 12 months average turnover and the log of market capitalization at end of the previous calendar month. Returns are in monthly percent, $t-$statistics are shown below the coefficient estimates. "Months" is the holding period of the rolling strategy.

	overhang spread			no overhang spread			residual overhang spread			no residual overhang spread		
Months	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	-0.766	1.208	1.974	-0.434	0.682	1.116	-0.802	1.254	2.056	-0.388	0.306	0.694
	(-2.70)	(5.27)	5.16	(-1.44)	(1.88)	(2.39)	(-2.83)	(4.73)	(4.88)	(-1.29)	(1.02)	(1.64)
+2	-0.893	1.441	2.334	0.018	0.277	0.260	-0.743	1.420	2.163	0.114	0.267	0.153
	(-2.63)	(5.86)	(5.20)	(0.06)	0.80	(0.52)	(-2.48)	(5.75)	(5.26)	(0.38)	(0.90)	(0.33)
+3	-0.971	1.361	2.332	-0.209	0.034	0.243	-0.947	1.198	2.145	0.142	0.165	0.023
	(-3.48)	(6.76)	(6.33)	(-1.01)	(0.16)	(0.75)	(-3.90)	(6.11)	(6.35)	(0.71)	(0.82)	(0.08)
+6	-0.623	0.990	1.613	-0.034	-0.013	0.020	-0.490	0.966	0.220	0.110	1.456	-0.110
	(-2.52)	(5.41)	(4.98)	(-0.20)	(-0.07)	(0.08)	(-2.35)	(5.54)	(1.33)	(0.65)	(5.07)	(-0.46)
+12	-0.225	0.564	0.788	-0.029	0.138	0.167	-0.118	0.595	0.070	0.206	0.713	0.136
	(-1.03)	(3.45)	(2.93)	(-0.19)	(0.78)	(0.81)	(-0.65)	(3.97)	(0.49)	(1.38)	(2.92)	(0.70)

Table VI: PEAD: monthly profits by overhang quintiles

This table reports the time series averages of monthly returns for post earnings announcement strategies in excess of the CRSP NYSE/AMEX/NASDAQ market index obtained using calendar-time rolling portfolios for different overhang quintiles. At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns at 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 which hold the top 20% good earnings news stocks in the j overhang quintile and sell short the bottom 20 % bad earnings news stocks in the $(6-j)th$ overhang quintile. The last column report the difference between the overhang spread and the no-overhang spread. The residual overhang is obtained by regressing (cross sectionally) the raw overhang on previous 12 and 36 months compounded returns, the previous 12 months average turnover and the log of market capitalization at end of the previous calendar month. Returns are in monthly percent, $t-$statistics are shown below the coefficient estimates. "Months" is the holding period of the rolling strategy.

	Panel A: overhang quintiles						**Panel B: residual overhang quintiles**					
Months	5 (overhang spread)	4	3	2	1 (no-overhang spread)	5 - 1	5 (overhang spread)	4	2	3	1 (no-overhang spread)	5 - 1
+1	1.974	1.828	1.073	1.305	1.116	0.858	2.056	1.746	1.675	1.573	0.694	2.362
	(5.16)	(6.04)	(3.83)	(3.55)	(2.39)	(1.20)	(4.88)	(5.54)	(5.73)	(4.11)	(1.64)	(1.90)
+2	2.334	1.093	1.362	0.918	0.260	2.074	2.163	1.225	1.031	0.840	0.153	2.010
	(5.20)	(3.38)	(4.36)	(2.75)	(0.52)	(3.58)	(5.26)	(3.47)	(3.17)	(2.73)	(0.33)	(3.81)
+3	2.332	1.554	0.976	0.786	0.243	2.089	2.145	1.438	1.245	0.921	0.023	2.122
	(6.33)	(6.29)	(4.92)	(3.60)	(0.75)	(3.27)	(6.35)	(5.97)	(6.93)	(5.34)	(0.08)	(3.72)

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

This table reports Fama-French three factors loadings and alphas for the overhang spread and the no-overhang spread strategy. The dependent variable is the monthly excess return of the treasury bill rate from rolling strategy based upon sorting stocks according to their cumulative abnormal return around the most recent earnings announcement date and the most recent capital gains overhang. The explanatory variables are the monthly returns from Fama and French (1993) mimicking portfolios. The holding period for the rolling strategy is three months. $t-$statistics are shown below the coefficient estimates.

	overhang spread			no-overhang spread		
	bad news	good news	L/S	bad news	good news	L/S
$\alpha(\%)$	-1.121	1.348	2.469	-0.204	-0.100	0.104
	(-3.37)	(9.75)	(6.50)	(-1.31)	(-0.36)	(0.30)
MKT	1.261	1.082	-0.179	1.057	1.211	0.154
	(14.80)	(30.59)	(-1.84)	(26.51)	(16.80)	(1.76)
SMB	1.042	0.838	-0.204	0.785	1.036	0.250
	(9.84)	(19.06)	(-1.69)	(15.85)	(11.56)	(2.30)
HML	-0.011	-0.120	-0.110	-0.118	0.157	0.275
	(-0.08)	(-2.32)	(-0.77)	(-2.02)	(1.49)	(2.14)
R^2	0.658	0.896	0.025	0.863	0.696	0.029

Table VIII: Robustness checks

This table reports the time series averages of monthly returns in excess of the CRSP NYSE/AMEX/NASDAQ market index obtained using calendar-time rolling portfolios for the overhang spread and the no-overhang spread. The holding period for the rolling strategy is three months. "Raw" refers to a sort based on the raw capital gains overhang, "residual" indicates a sort based on the residual overhang. Panel A reports characteristics-adjusted returns using a single control firm matched on size, book-to-market and price momentum. Panel B reports results for portfolios constructed using only stocks with split adjusted prices above 5$. Panel C reports results for portfolios constructed using an alternative measure of earnings news. Earnings news are sorted into quintiles using standardized unexpected earnings, defined as $sue = (e - e_{-4})/\sigma$ where e is the most recent quarterly earning per share as of month t , e_{t-4} is the earnings per share 4 quarters before month t and σ is the standard deviation of unexpected earnings $e_t - e_{t-4}$ over the preceding 8 quarters. Panel D shows results for portfolio constructed in sub-samples based on firm size. Stocks are assigned to size quintiles according to market capitalization six months prior to the start of the sorting period and excess returns are computed using the corresponding CRSP size-based market index. Returns are in monthly percent, $t-$statistics are shown below the coefficient estimates.

	Panel A: matched returns			**Panel B: liquidity adjusted returns**			**Panel C: SUE sort**		
	overhang	no-overhang	difference	overhang	no-overhang	difference	overhang	no-overhang	difference
Raw	1.851	-0.025		1.787	-1.214	3.001	1.680	0.287	
	(5.60)	(-0.04)		(2.27)	(-1.87)	(2.99)	(5.64)	(0.95)	
Residual	2.083	0.576		1.787	-1.214	3.001	1.632	0.359	
	(5.21)	(1.85)		(2.27)	(-1.87)	(2.99)	(5.24)	(1.08)	

Panel D: results based on size

	overhang spread					no-overhang spread				
Size quintiles	1 (small)	2	3	4	5 (large)	1 (small)	2	3	4	5 (large)
Raw	2.539	2.535	2.484	1.444	1.268	0.886	-0.232	-0.407	-0.096	0.541
	(6.09)	(7.21)	(6.26)	(3.54)	(3.28)	(1.82)	(-0.66)	(-1.01)	(-0.24)	(1.46)

Table IX: Mutual fund ownership and turnover-based definition of the capital gains overhang

This table reports the time series averages of monthly returns in excess of the CRSP NYSE/AMEX/NASDAQ market index obtained using calendar-time rolling portfolios for the overhang spread and the no-overhang spread. Panel A shows portfolios constructed for sub-samples based on mutual funds ownership. The breakpoint is the median mutual fund percentage ownership at the end of the previous calendar month. Panel B reports results based on capital gains overhang estimated using a model of trading behavior. The fraction of shares purchased at month t-n and held by the month t-n purchasers through month t is computed as $V_{t,t-n} = TO_{t-n} \cdot \prod_{\tau=1}^{n-1} (1 - TO_{t-n+\tau})$ where TO_t is turnover in month t . The reference price is estimated as $RP_t = \phi^{-1} \sum_{t=1}^{n} V_{t,t-n} P_{t-n}$. The holding period for the rolling strategy is three months. Returns are in monthly percent, $t-$statistics are shown below the coefficient estimates.

Panel A: sub-samples based on mutual fund ownership

low mutual fund ownership			high mutual fund ownership		
overhang	no-overhang	difference	overhang	no-overhang	difference
2.054	1.050	1.004	2.118	-0.265	1.853
(5.22)	(3.23)	(2.76)	(6.14)	(-0.86)	(3.89)

Panel B: turnover-based definition of the capital gains overhang

1963 - 1979			1980 - 2002		
overhang	no-overhang	difference	overhang	no-overhang	difference
2.017	-0.519	2.536	1.400	-0.080	1.480
(3.99)	(-1.21)	(3.17)	(3.50)	(-0.30)	(2.53)

Table X: Momentum and analysts' revisions: overhang and no-overhang alphas

This table reports three factors Fama and French alphas for momentum and post analysts' revision drift strategies for the overhang and the no-overhang spread. The overhang spread is defined as a zero cost portfolio which holds the best performing 20% in the top overhang quintile and sells short bottom 20% worst performing stocks in the bottom overhang quintile. The no-overhang spread is defined as a zero cost portfolio which holds the top 20% best performing stocks in the bottom overhang quintile and sells short the worst performing bottom 20 % in the top overhang quintile. The residual overhang is obtained by regressing (cross sectionally) the raw overhang on previous 12 and 36 months returns, the previous 12 months average turnover and the log of market capitalization at end of the previous calendar month. The ranking variable for the momentum portfolios is the compounded return in the last 12 months, skipping the last month while the sorting variable for the analysts revision strategy is the event-day cumulative abnormal 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. "Months" is the holding period of the rolling strategy.

	Panel A: Momentum $\alpha(\%)$			**Panel B: analysts's recommendations revisions $\alpha(\%)$**		
Months	residual overhang	no residual overhang	difference	residual overhang	no residual overhang	difference
+1	1.627	1.208	0.623	1.822	-2.013	3.835
	(4.49)	(1.03)	(0.55)	(2.10)	(-2.70)	(3.64)
+2	1.272	-0.458	1.973	1.848	-1.225	3.073
	(3.51)	(-0.30)	(2.78)	(2.12)	(-1.71)	(2.41)
+3	0.996	-0.852	2.020	1.787	-1.214	3.001
	(3.04)	(-0.58)	(2.80)	(2.27)	(-1.87)	(2.99)

Table XI: Daily abnormal turnover around earnings announcement dates

Turnover τ is defined as log trading volume normalized by the number of shares outstanding $\tau = \log(V/S)$. Abnormal turnover AT is calculated as $AT = \tau - \overline{\tau}$ where $\overline{\tau_t} = \sum_{t=-40}^{-11} \tau_t$. The subscript t indicates trading days. On announcement dates event stocks are sorted on the basis of their standardized unexpected earnings and the most recent available capital gains overhang. The table shows average abnormal turnover across capital overhang percentiles (from the bottom 10% $= 1$ to the top 10% $= 10$) for the top and bottom earnings surprise quintiles. "Days" indicates trading days relative to the event date.

Panel A: daily abnormal turnover, bottom 20% SUE

days	Overhang percentiles									
	1	2	3	4	5	6	7	8	9	10
-5	-0.16	-0.18	-0.40	0.01	-0.16	-0.10	0.21	0.08	0.17	0.38
-2	-0.16	-0.31	-0.50	0.00	-0.16	-0.11	0.24	0.12	0.20	0.50
-1	-0.04	-0.15	-0.31	0.20	0.03	0.11	0.51	0.33	0.43	0.75
0	0.32	0.30	0.19	0.75	0.56	0.72	1.11	0.91	1.02	1.34
1	0.74	0.78	0.75	1.33	1.16	1.35	1.73	1.53	1.65	1.96
2	0.97	1.02	1.04	1.67	1.51	1.73	2.11	1.91	2.03	2.27
5	1.20	1.36	1.51	2.26	2.01	2.29	2.72	2.46	2.57	2.66
	t statistics									
-5	-0.95	1.35	1.38	0.50	0.90	2.93	2.15	1.48	2.21	2.31
-2	4.66	7.75	7.21	7.65	7.15	9.33	6.92	6.84	6.39	7.55
-1	15.83	18.91	18.53	19.01	19.24	20.58	20.00	21.51	20.91	24.26
0	31.57	37.17	39.26	41.46	41.04	39.55	41.47	44.69	42.63	48.09
1	35.06	36.97	41.63	43.43	40.43	39.88	41.15	41.75	44.33	43.52
2	19.20	21.75	23.18	23.47	24.05	22.84	23.81	25.48	28.48	26.95
5	5.85	7.74	9.63	10.68	10.48	10.27	11.70	13.01	12.96	12.17

Panel B: daily abnormal turnover, top 20% SUE

days	Overhang percentiles									
	1	2	3	4	5	6	7	8	9	10
-5	-0.05	0.01	0.03	-0.04	-0.18	0.27	0.29	0.10	-0.06	0.50
-2	0.09	0.20	0.27	0.18	0.01	0.49	0.56	0.30	0.07	0.76
-1	0.45	0.58	0.64	0.55	0.39	0.91	0.97	0.73	0.47	1.24
0	1.18	1.33	1.40	1.34	1.21	1.71	1.79	1.57	1.27	2.15
1	1.96	2.07	2.20	2.17	2.01	2.49	2.61	2.38	2.08	2.98
2	2.39	2.48	2.65	2.60	2.47	2.94	3.07	2.86	2.59	3.48
5	3.04	3.06	3.33	3.31	3.26	3.70	3.88	3.73	3.47	4.35
	t statistics									
-5	-1.17	-2.63	-1.04	-2.15	0.27	-0.42	1.40	1.03	2.27	2.59
-2	-0.41	-1.96	-1.11	0.92	-0.22	0.67	1.30	2.13	3.15	2.81
-1	6.20	9.21	10.24	10.10	9.95	11.08	13.02	10.69	12.38	12.09
0	18.00	24.59	27.43	28.70	26.34	30.85	29.52	28.60	31.10	29.85
1	21.06	25.66	29.37	29.17	29.44	30.40	29.43	29.07	33.30	30.50
2	11.29	12.69	16.26	18.89	17.60	19.90	19.19	18.83	20.81	16.15
5	2.78	5.48	6.71	7.80	6.17	7.87	9.45	7.98	7.45	3.61

Table XII: Fama MacBeth regressions: cumulative abnormal returns around earnings announcement dates and overhang

This table show results from Fama MacBeth regressions of cumulative abnormal returns around earnings announcement dates $CAR = \sum_{h=-1}^{2}(r_h - \overline{r})$ on event-day standardized unexpected earnings (SUE) and the most recent capital gains overhang (g):

$$CAR = \alpha + \gamma_1 SUE + \gamma_2 g + \gamma_3 SIZE + \varepsilon$$

Standardized unexpected earnings are defined as $SUE = \frac{e - e_{-4}}{\sigma}$ 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 σ is the standard deviation of unexpected earnings $e_t - e_{t-4}$ over the preceding 8 quarters. $SIZE$ is the log of market capitalization at the end of the previous month. g is the capital gains overhang. The table reports results from Fama MacBeth regression for event date SUE quintiles and for the whole sample. Standard errors are adjusted for heteroskedasticity and autocorrelation, $t-$statistics are reported below the coefficient estimates.

	SUE quintiles					
coefficient	1 (low)	2	3	4	5 (high)	all
SUE	0.210	0.086	0.679	0.636	0.362	0.392
	(4.30)	(1.13)	(7.13)	(7.11)	(6.65)	(31.38)
g	-0.193	-0.226	-0.414	-0.548	-0.366	-0.291
	(-7.12)	(-7.97)	(-14.57)	(-17.01)	(-9.81)	(-8.65)

Table XIII: Function $q(\alpha, w)$

This table tabulates the function $q(\alpha, w)$ derived in the appendix for the parameter values $(\alpha, w) \in (.1, .9)$.

	α								
w	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.1	0.41	0.42	0.42	0.43	0.44	0.45	0.47	0.49	0.52
0.2	0.43	0.44	0.45	0.46	0.47	0.48	0.50	0.52	0.54
0.3	0.44	0.45	0.46	0.48	0.49	0.50	0.51	0.53	0.55
0.4	0.45	0.46	0.48	0.49	0.50	0.51	0.52	0.54	0.56
0.5	0.46	0.47	0.49	0.50	0.51	0.52	0.53	0.54	0.56
0.6	0.47	0.48	0.49	0.50	0.51	0.52	0.54	0.55	0.57
0.7	0.47	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.57
0.8	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.56	0.57
0.9	0.48	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57

Figure 1. An example of stock price response to negative news releases. This figure shows an example of a stock price response to a negative earnings announcement. EMH is the stock price response according to the efficient market hypothesis, low-overhang and high-overhang are the price repose for stocks with high and low capital gains overhang. The capital gains overhang is defined as the percentage deviation of the aggregate average cost basis reference price from the current price $g_t = \frac{P_t - RP_t}{P_t}$. 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 in the portfolio at date t that are still held by the original purchasers at $t-n$, ϕ 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. Investors are assumed to a FIFO criterion (first-in-first-out) to associate a specific quantity of shares in their portfolio to the corresponding reference price.

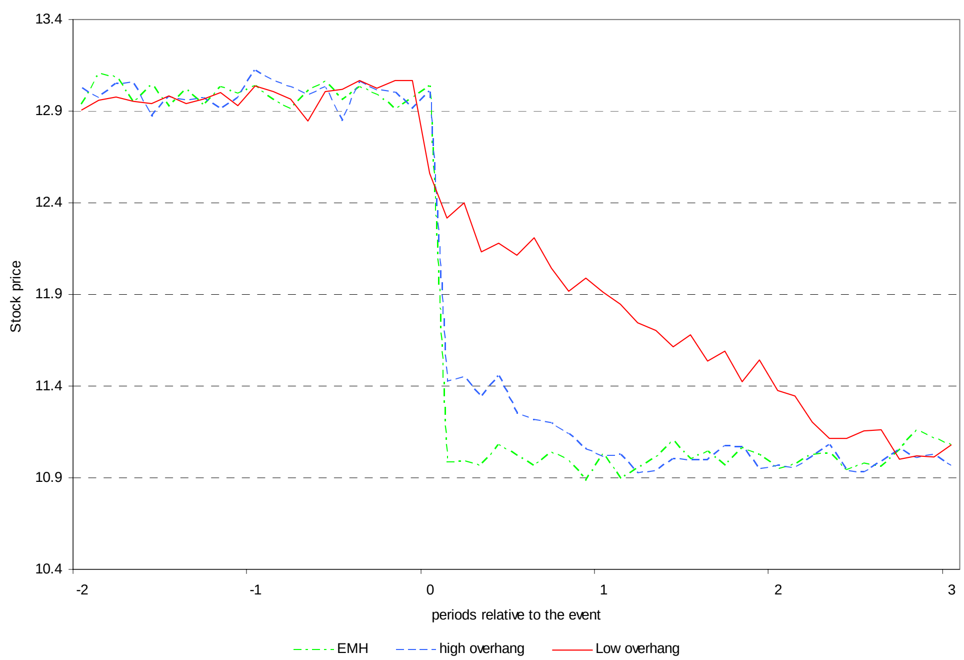

Figure 2.

Figure 3. Distribution of PGR - PLR for mutual fund managers. This figure plots the distribution of the aggregate Proportion of Gains Realized (PGR) minus 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, and 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 aggregated across time for each mutual fund in the database.

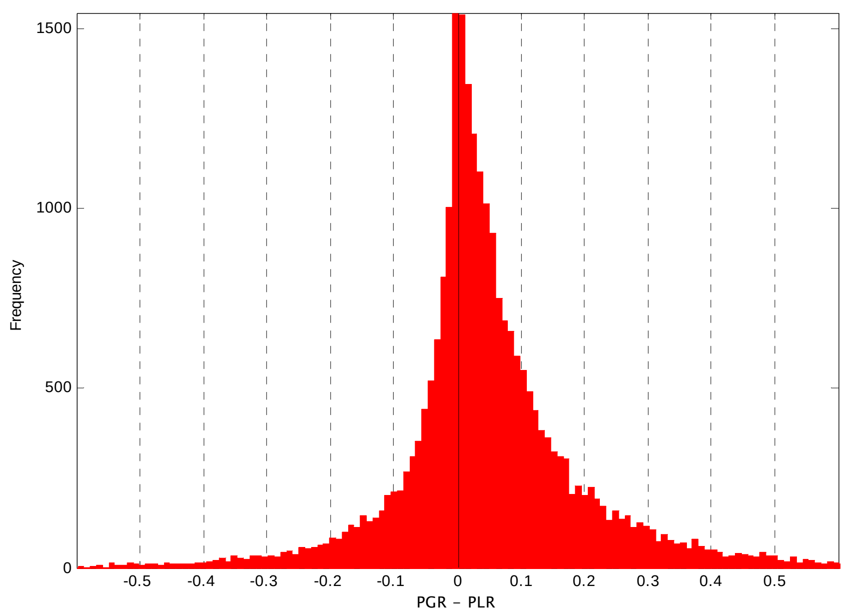

Figure 4. Distribution of the capital gains overhnag, all stocks 1980 - 2002. The capital gains overhang is defined as the percentage deviation of the aggregate average cost basis reference price from the current price $g_t = \frac{P_t - RP_t}{P_t}$. The reference price is defined as $RP_t = \phi^{-1} \sum_{t=1}^{n} V_{t,t-n} P_{t-n}$ where $V_{t,t-n}$ is the number of shares in the portfolio at date t that are still held by the original purchasers at $t - n$, ϕ 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. Investors are assumed to a FIFO criterion (first-in-first-out) to associate a specific quantity of shares in their portfolio to the corresponding reference price.

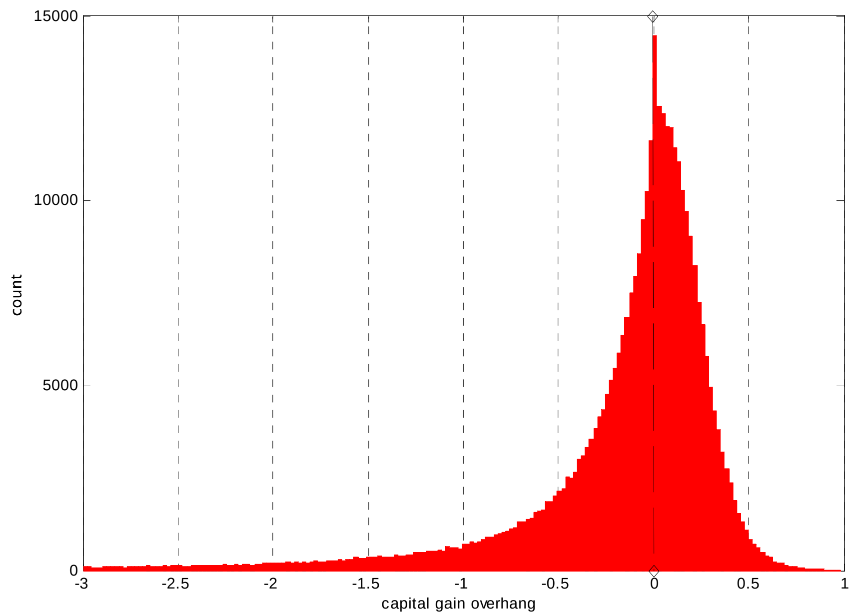

Figure 5. The funtion $q(\alpha, w)$.This table plot the function $q(\alpha, w)$ derived in the appendix for the parametyer values $(\alpha, w) \in (0, 1)$

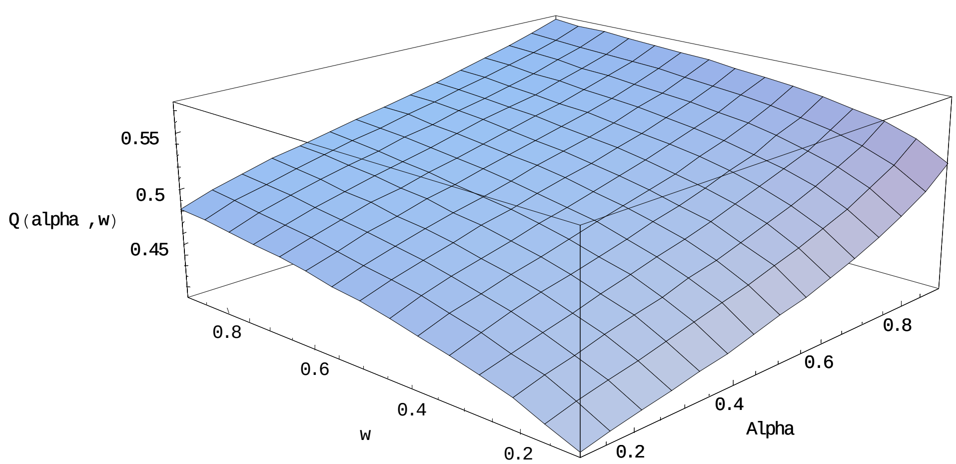

Figure 6. Instantaneous returns $\frac{dP}{dt}$ and the capital gains overhang following negative news. This figure reports the instantaneous returns and the capital gains overhang over time following a negative news for the parameters values $F = 5$, $\alpha = .9$, $w = 1/3$, $P_0 = 15$

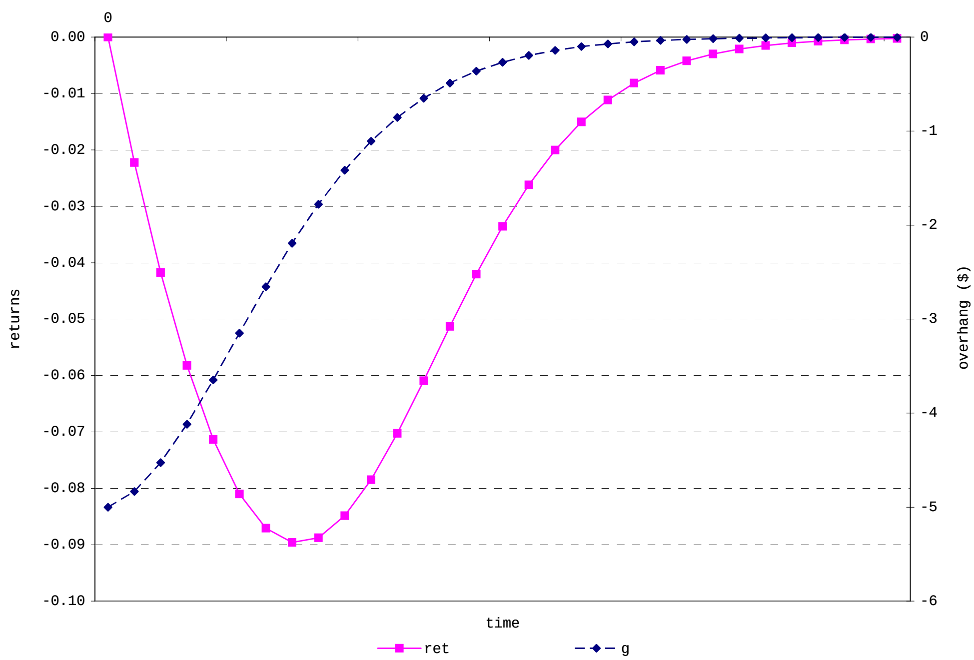

Figure 7. Instantaneous returns $\frac{dP}{dt}$ and the capital gains overhang following positive news. This figure reports the instantaneous returns and the capital gains overhang over time following a positive news for the parameters values $F = 15$, $\alpha = .9$, $w = 1/3$, $P_0 = 10$