The Disposition Effect and Under-reaction to News

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ABSTRACT

This paper analyzes the cross section of stock returns, stock price under-reaction to corporate news and event-driven return predictability generated by trading frictions of investors who display the tendency to realize gains and ride losses, otherwise known as the disposition effect. The disposition effect implies that stock prices under-react to bad news when more current holders are facing a capital loss, and under-react to good news when more current holders are facing a capital gain. I use a database of mutual funds holdings to construct a measure of reference prices for individual stocks. Using this novel measure of reference price, I show that post-event predictability is most severe when the disposition effect predicts the biggest under-reaction. I show that exposure to a disposition variable generates large differences in post-event returns: post-event drift is larger when the news and the capital gains overhang have the same sign and the magnitude of the post-event drift is directly related to the amount of unrealized capital gains (losses) experienced by the stock holders prior to the event date. An event-driven long/short equity strategy based on this effect yields average monthly (zero beta) abnormal returns around 200 basis points.

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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. 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 abnormal returns tend to have the same sign as subsequent stock returns 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[1].

In a recent paper Grinblatt and Han (2002) consider a model of equilibrium prices where a group of investors have preferences that combine Kahneman and Tversky (1979) "prospect theory" with Thaler (1985) " mental accounting". Agents use a separate mental account for each individual stock and each account employs the cost basis in a stock as the reference point to compute gains and losses. The combination of prospect theory and mental accounting generates a disposition effect, a tendency to hold on to losing stocks. If demand for a stock by rational investors is not perfectly elastic, then demand perturbations by the "behavioral" investors tend to generate price under-reaction to information and create a spread between a stock fundamental value and its equilibrium price. Spread convergence, arising from the evolution of fundamental values and updating of aggregate reference prices through trading, generates momentum in stock returns. This result paves the way to a line of empirical research exploring the relation between investor heterogeneity, unrealized capital gains or losses and the cross section of stock returns. Grinblatt and Han show that a variable proxying for unrealized capital gains generates the profitability of momentum strategy and that once this variable is controlled for past returns have no predictability for the cross-section of returns.

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.

In such a framework the key variable that forecast the cross section of stock returns is the distance between the current price and the market cost basis for a particular stock. In their empirical specification Grinblatt and Han estimate the reference prices from past trading volume, using turnover as a proxy for trading probabilities. Focusing exclusively on turnover Ferris, Haugen, and Makhija (1988) use a similar measure by computing, at a given point of time, the total volume that took place in the past at different stock price levels. They use such a variable to predict abnormal trading volume.

The major caveat of using turnover to estimate the reference prices is that such a measure will be only a noisy proxy for the stock cost basis of each individual shareholder at a given date. The implicit assumption is to treat all shares as symmetric and equally likely to be sold at a particular date. This approach neglects information regarding shareholders heterogeneity and the cross sectional distribution of their reference prices.

If agents have a separate mental account for each individual stock and use the purchase price as a the reference point to compute gains and losses, than the aggregate reference price and unrealized capital gains will continuously change as shares are exchanged among different investors. Since ultimately the reference price is updated through trading it will certainly be related to trading volumes; nevertheless, using volume to compute capital gain and losses makes it harder to distinguish the results from pure volume effect. It also ignores the possibility of a cross sectional relation between volume, the fraction of holders using past prices as an anchor point and the relative intensity of the demand distortion for each shareholder.

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

In this paper I propose an innovative method to compute a measure of the aggregate basis for individual stocks which rely on holdings data. I use a database of mutual funds holdings to construct a measure of reference prices for individual stocks. I then use the gain/loss measure to analyze the cross section of stock returns, stock price under-reaction to corporate news and event-driven return predictability generated by trading frictions from disposition-prone investors.

This paper makes several contributions to the existing literature on stock returns predictability, the behavior of mutual fund managers, the profitability of earnings and price momentum strategies and the post earnings announcement drift.

First I outline a novel method to compute aggregate reference prices for individual stocks which does not rely on trading volumes and it has the advantage of using information regarding the cross sectional distribution of the unrealized paper gains and losses of each individual shareholder. This measure can be constructed whenever holdings data are available for individual stocks.

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

Third I document the extent of the disposition affect among US mutual fund managers and present evidence consistent with an old Wall Street's dictum: "Cut you losers short and let your winners ride". Losers funds show signs of a disposition effect with magnitudes comparable to the ones observed in retail investors. The results confirms the intuition in Wermers (2003): managers of losing funds appear reluctant to sell their losing stocks. Conversely, successful managers realize losses at higher rates than gains.

Forth I use the gain/loss measure to empirically explore the role of unrealized capital gains/losses in causing stock price under-reaction to public news and event-driven return predictability. Using a portfolio approach I test the specific hypothesis that in the presence of disposition-prone investors, a wedge between the current and the reference price will hamper the transmission of information, thus generating post-event drift. I sort stocks into different classes for which capital gains are more likely to induce a sluggish response to corporate news and I use them to construct an event-driven long/short equity strategy. The central prediction is that exposure to a disposition proxy should forecast cross-sectional differences in post-event returns: event driven strategies should work best once stocks are sorted using their capital gains at the event date.

To understand why investor that realized gains at higher rates than losses may generate under-reaction to corporate news consider the following example. Stock XYZ is trading at \$13 and its aggregate cost basis is equal to \$16; that is, most of the current holders acquired their shares at a price around \$16 and the stock is currently trading at a capital loss. At date t bad news is released revealing a fundamental value of only \$11. In absence of frictions the stock price should promptly adjust to \$11. Nevertheless, if demand functions are not perfectly elastic and the current holders experiencing a paper loss are reluctant to realized it, than the supply of stock will be rationed and as a result the stock price will only fall between \$13 and \$11. Holders unwilling to trade restrict the available supply, hampering price impact.

After the initial price impact investors who did traded will update their reference point, bringing the aggregate cost basis closer to the current price. As references points are updates through trading, the stock price will approaches the fundamental value generating a negative post-event drift.

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

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

As disposition prone investors are more likely to realized gains than losses, a similar argument can be made for stock trading at a large capital gain. When good news is released and most of the current holders are trading at large paper gains there will be excess supply generating under-reaction to good news. Good news travel slowly across asset trading at large capital gains, generating post-event (positive) return predictability. This example is illustrated in figure (1) and (2) which report the impact of positive and negative news on stocks with unrealized capital gains and losses

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

Last, I use daily volume and returns around earnings announcement days to analyze the role on unrealized gains in propagating news around event dates. I present evidence consistent with the hypothesis that trading between disposition-prone investors and their counter-parts impact relative prices, thus generating post-event drift.

The rest of the article is organized as follows. Section I gives a brief introduction to the disposition effect. Section II defines the central variable: the capital gains overhang. I describe the data and the methodology and examine the cross sectional determinants of unrealized capital gains/losses. I also document the extent of the disposition effect among mutual fund managers. Section III analyze the relationship between aggregate unrealized capital gains and the cross section of stock returns. Section IV report results on event-driven predictability and under-reaction to public news. I first describe the hypothesis under scrutiny and the methodology used. I then report abnormal returns for the main test portfolios. Section V contains robustness checks. Section VI presents an extension by reporting returns for strategies based on stock analysts' recommendation revisions. Section VII presents evidence from price impact, volume and order imbalances around event dates. Section VIII concludes.

I. The disposition effect

The disposition effect was introduced into the finance literature by Shefrin and Statman (1985) and refers to the tendency of investors to ride losses and 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.

The available evidence[2] 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.

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.

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. 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[3], their common stock holdings can be used to construct a novel measure of aggregate reference prices for individual stocks and develop 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. Defining the central variable: the capital gains overhang

Previous research has focused on a measure of the cost basis for individual stocks that is based on past trading volume. I want to devise a measure of the aggregate stock basis for individual stocks which is based on the cross section of anchor points used by each individual shareholders to compute gains and losses.

Clearly any test of the presence of risk-adjusted returns induced by disposition-prone investors is undoubtedly a joint test both of an asset pricing model for expected returns and a mental accounting model used by market participants to update their anchor point.

I compute the reference price as

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

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

Whenever a stock is purchased at several time periods, then partially sold at different dates, investors are assumed to use the purchase price as the base to compute gains and losses and (when trading) to employ an historical cost-based mental accounting (FIFO, first-in-first-out) to associate a specific quantity of shares in their portfolio to the corresponding reference price[4].

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

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

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

Capital gains constructed using holdings are meant to be the best estimate of the stock's cost basis to the representative investor. The holdings approach to aggregate capital gains is an empirical alternative to capital gains inferred past volume. 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, thus taking into account shareholders heterogeneity in the anchor points.

In the empirical analysis I use mutual funds common stock holdings to compute capital gains and losses for individual stocks. This assumes that mutual fund managers are a representative sample of the cross section of shareholders but (1) and (2) are clearly general and can be applied whenever holdings data is available for individual stocks.

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 when testing for the presence of under-reaction to news or asset pricing dynamics induced by the disposition effect, since it would tend to bias the results against the null hypothesis.

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[5]. Prices and sh ares 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 using stocks prices at the report date (RDATE) as a proxy for the buying or selling price[6]. Clearly this will be a noise measure since the actual transaction price will be different from the price at the report date. Nevertheless, to the extent that stock prices are equally likely to increase or decrease after being purchased or sold by a mutual fund, a priori there is no reason to expect this measure to bias the results one way or the other.

B. Cross sectional determinants of the capital gains overhang

Table I provides summary statistics of the capital gains overhang in the full sample. Over the period 1980 - 2002 on average 72.7 % of the CRSP stocks have a valid capital gains 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 obtain further insight into the cross sectional determinants of the unrealized capital gains variable by regressing it, cross sectionally, on the stock's past short and long term cumulative returns, size, turnover and some fund-related variables.

Table II reports coefficients from Fama MacBeth (1973) regressions. Cross sectional regressions are run every calendar month between 1980 to 2002 and standard errors are adjusted for heteroskedasticity and autocorrelation.

In Model 1, capital gains are 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 . 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 12 months ($TURN$) 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.

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 2 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 3 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. If 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 retail investors.

Finally in Model 4 I regress the absolute value of capital gains 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 of either sign.

C. The disposition effect in mutual fund managers

Table III compares the aggregate Proportion of Gains Realized (PGR) to the aggregate Proportion of Losses Realized (PLR) for all the 29,812 mutual funds in the database. Each quarter any sale takes place between two report dates in a mutual fund portfolio, the current stock price is compared to the purchase price to determine whether the stock is trading at a gain or at a loss. If the current price is above the original purchase price then the stock is counted as trading at a gain, if below the historical price then the stock is trading at a loss. 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 III is that there is a statistically strong ($t-$statistics $= 44$)

tendency for mutual fund managers to sell a higher proportion of their winners than their losers. The magnitude of the aggregate difference (PGR - PLR) is around 3%, which is smaller than the average 5% reported by Odean (1998) for retail investors but still the same order of magnitude.

What is striking is the amount of variation that can be observed across the performance-based quintiles. 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 retail investors. Loser funds appear no different than retail 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.

III. Results: the cross section of stock returns

In this section I analyze the relationship between aggregate unrealized capital gains and the cross section of stock returns. I explores whether the capital gains overhang predicts the cross section of stock returns. I then run a horse race and show that this novel variable does indeed have a hedge in term of forecasting power over past returns and a competitor gains/losses variables constructed using past turnover.

I use Fama MacBeth (1973) regressions to disentangle the predictive power of the capital gains overhang and other variable that influences the cross section of short term returns. Every month between 1980 and 2002 I run a cross sectional regression of individual future stock returns on the prior 12 month returns skipping the last month[7], a measure of the most recent past earnings surprises (CAR) and various measures of the capital gains overhang.

The measure of earnings news surprises is the market model cumulative abnormal returns around the most recent earnings announcement date:

$$CAR_{it} = \sum_{h=-2}^{+1} (r_{i,h} - \overline{r}_{i,h}) \tag{3}$$

where r_h is the stock return on day h, with the earnings announcement date being at $h = 0$, and $\overline{r}_{i,h}$ is the CRSP equally weighted NYSE/AMEX/NASDAQ index[8].

The turnover-based overhang measure follows Grinblatt and Han (2002). The fraction of share purchased at month $t-n$ and held by the month $t-n$ purchasers through month t is computed as

$$V_{t,t-n} = TO_{t-n} \left[\prod_{\tau=1}^{n-1} (1 - TO_{t-n+\tau}) \right] \tag{4}$$

where TO_t is turnover in month t defined as volume standardized by shares outstanding. The reference price is then estimated as above :

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

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 (4) 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.

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

In model 1 to 3 I replicate the well know results by Jegadeesh, Chan, and Lakonishok (1996): prior returns and earnings surprises, taken separately, are strongly positively related to future returns. Moreover, both price and earnings momentum survive to each other: prior returns and earnings surprises both generate short term return continuation. The average slope from regressions of three months returns on prior returns is 4.1 percent (Panel A). Past earnings surprises give very similar slope averages (4.9 percent). When both regressor are used, earnings surprises are just as important as prior returns in predicting returns over the next quarter, with average coefficients of 3.9 and 3.7 respectively. In all cases the coefficients are large relative to their standard errors.

In model 4 to 5 I revisit the main Grinblatt and Han result: not only their capital gains overhang is a strong univariate predictor of future returns, but more importantly, past returns have no predictability for the cross section of stock returns once this variable is controlled for. The average slope of regressions of three months returns on capital gains alone is 3.3 percent. When earnings surprises, past returns and the capital gains overhang are added to the regressors, the average slope coefficient is not statistically different from zero: past returns have no predicting power for the cross section of returns. The coefficient on earnings surprises and capital gains are 3.4 and 4.5 percent and they are large with respect to their standard errors ($t-$statistics $= 9.32$ and 3.46).

Finally,in model 6 to 9 I run a horse race between past returns and the two measures of capital gains. First returns are regressed on size, book to market and the capital gains overhang constructed using holdings data. Past returns and the capital gains overhang computed from turnover are then added to the regressors. To the extent that capital gains constructed using holdings give a more precise measure of the aggregate cost basis to the marginal investor, we would expect such a variable to drive out the predictability of the competing forecasting variables.

Model 6 confirm that indeed the novel capital gains variable predict future returns: stocks with large unrealized gains have higher expected returns. The average slope coefficient is 4.9 percent and it is large with respect to its standard error ($t-$statistics $= 7.65$).

Model 7 and 8 show the novel results: when all the regressors are considered simultaneously, the inclusion of holdings-based overhang drives out both past returns and the alternative capital gain regressor as a predictor of future returns. The average slope coefficient for both past returns and turnover-based capital gains are not reliably different from zero. Moreover, both capital gains and earnings surprises have predictive power for the cross section of short term returns: the coefficient are respectively 4.5 and 2.1 percent and they are large with respect to their standard errors.

This results provides a stronger evidence that both price and earnings momentum are driven by disposition type effects and that past returns are indeed only a noisy proxy for unrealized capital gains experienced by the stock holders.

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

Table IV also show a related results regarding the relative strength of the capital gains overhang and past earnings surprises in predicting the cross section of stock returns. Not only the capital gain variable knocks out prior returns and the alternative overhang measure in explaining the cross section of stock returns, but it also cut the predictability of returns using past earnings surprises in half. Comparing model 1 and 9 shows that the inclusion of capitals gains knocks the estimated coefficient on past earnings surprises from to 4.1 to 2.1.

This suggest that the predictability of returns using the overhang measure and the one that stems from reaction to earnings news, are not separate phenomenona. In other words, although both variables forecast returns, there is an interaction between aggregate capital gains and returns following earnings surprises. This suggest that the stock's cost basis to the marginal investor influence markets reaction to earnings news. Earnings news may travel slowly in stocks with large unrealized capital gains/losses thus generating return continuation. This finding motivates the double sort portfolio approach in the following section which explores the interaction between capital gains and earnings surprises in generating the post earnings announcement drift.

The results for regressions for six - months returns are reported in Panel B of table IV and they are quantitative similar to the one reported in Panel A.

IV. Under-reaction to corporate news

I now turn to a portfolio approach and use the capital gains overhang to analyze stock price under-reaction to corporate news and design a derived investment rule. I analyze the specific hypothesis is that in the presence of disposition-prone investors, stock prices will under-react to corporate news generating post-event drift.

The appendix contains a simple toy model and a formal derivation of two propositions that can be used to motivate the testable hypotheses.

Hypothesis 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 capital gains overhang at the event date*

Hypothesis 2 *After an initial shock, aggregate unrealized capital gains tend to mean-revert to zero and the minimum (maximum) post-event returns occur approximately when the overhang has closed half of the initial gap.*

Hypothesis 1 states that *signed* overhang predicts future post-event returns. Stocks where most of current holders are experiencing large paper losses are expected to severely underreact to negative news releases as opposes to stocks with similar bad news trading at large unrealized capital gains. The opposite will be true for positive news stocks.

The example in the introduction reveals the intuition behind hypothesis 1: trading between disposition prone investor and their counterparts tend to hamper price impact. Positive (negative) earnings news travel slowly in stocks with large capital gains (losses) as disposition prone traders tend to dampen the transmission of information, thus generating return continuation.

Hypothesis 2 is a bit subtler. In the simple model used to motivate the empirical results, a single representative agent continuously updates his anchor point using both his past reference price and the current trading price. When a sufficiently large shock to the fundamental value occurs, initially the price changes will impact aggregate capital gains as the reference price is fixed at the pre-news level. Subsequently, the updating of the anchor point causes the capital gains overhang to mean-revert towards zero and post-event abnormal returns are generated as the stock price slowly drifts towards the new fundamental value. Hypothesis 2 relies on the assumption that following a large return (extreme news) the investor is initially slow to update his reference price but as time goes by he increase the weight on the current observed price. This causes 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.

More in general, there is intimate connection between the horizon at which abnormal returns will be observed and the speed at which shareholders update their anchor point through trading. The disposition-based under-reaction will generate abnormal returns at different horizons depending upon the degree of mean reversion of aggregate capital gains in the underlying stocks, which can be estimated.

To summarize, hypothesis 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 spread in the capital gains overhang between the long and the short side.

Since stocks with large gains under-react most to good news and stock with large losses under-react most bad news, the difference in capital gains between the long and the short side will forecast returns of a long/short news strategy.

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

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

In order to test the hypotheses 1 and 2 I use an investment rule which exploit the post earning announcement drift. Labelled 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[9] (hereafter PEAD). The profitability of rolling investment strategies based on the PEAD is extensively analyzed in Jegadeesh, Chan, and Lakonishok (1996).

Under hypothesis 1 the overhang spread should consistently earn higher returns than the negative overhang spread; that is, ceteris paribus, the wider the spread in capital gains between the long and the short side, the larger subsequent alpha.

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 trading at large paper gains under-react more to good news while stocks with large paper losses are predicted to under-react more severely to negative news. *Signed* overhang predicts future returns. Hypothesis 1 predicts more severe under-reaction if capital gains and the event have the same sign.

Second, the time profile of the post-event is directly related to the speed of mean reversion of the capital gains overhang: Hypothesis 2 implies that returns of an investment rule which exploit this pattern of under-reaction should be maximized when the holding period of the portfolios is calibrated to match the half-life of the capital gains overhang in the underlying stocks.

A. Methodology: calendar-time rolling portfolios

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. 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.

A caveat that arises when sorting stocks using the capital gains is that it is likely for winning (losing) stocks to exhibit large unrealized capital gains (losses). Ideally we would like the sub-samples to contain stocks with similar past performance but a wide spread in the capital gains overhang. Therefore, 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.

Standardized 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.

B. The holding period

As explained in section IV, the time pattern of the abnormal returns 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 the capital gains overhang 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 negative overhang spreads.

C. 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 V 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 V 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.

D. Bivariate sort: excess returns

Tables VI and VII 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.

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% positive news stocks with large paper gains (top 20% capital gains) and offset this position by shorting the bottom 20% bad news stocks with large paper losses (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 negative overhang spread is essentially zero beyond the one month horizon.

The results support hypotheses 1 and 2: bad news stocks trading at large paper losses exhibit a severe and significant negative post-event drift which is not matched by similar bad news stocks with large unrealized capital gains. Good news stocks trading at large paper gains display positive abnormal returns while I cannot reject the hypothesis that excess returns of good news stocks with large unrealized capital losses are different from zero.

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 0.788 percent after 12 months. There is little sign of reversal, which is consistent with under-reaction to the initial news content. The post-event drift is not significantly different from zero for the negative overhang spread.

Using residual rather than raw overhang delivers similar results. The average post-event abnormal return for the overhang spread is 2.145 % ($t-$statistics 6.35) while it is not significantly different from zero in negative overhang stocks. The results show that even after taking into account the recent movements in stock price in the sorting period, stocks with large unrealized capital gains/losses under-react to earnings news generating significant abnormal returns.

Table VII better illustrates the results by reporting returns for different 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 *negative overhang spread* which is the strategy with the minimum (negative) difference in overhang between the long and short side. Indeed the spread in capital gains between the long and the sort side forecast future returns. Average post-event excess returns decline monotonically across the quintiles portfolios as the spread in capital gains goes from maximum (positive) to minimum (negative). The average excess return generated by the overhang spread is statistically different from the negative overhang spread profits ($t-$statistics 3.58). The induced difference is remarkable, being 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. The findings are consistent with the profits generated by an incomplete price discovery at the event date. Excess returns 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 overhang sort, is large enough to make an earnings momentum neutral spread (loser - loser or a winner - winner) 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 since it includes only bad news stocks. Similar spreads can be constructed across different overhang quintiles and news stocks.

The results above show that the bulk of the profitability of the PEAD is concentrated in high overhang stocks and that, consistent with the hypotheses 1 and 2, signed overhang, conditional on extreme returns on earnings releases, predicts future returns. Stocks with large unrealized capital gains tend to under-react to, and only to, positive earnings surprise while negative overhang stocks under-react to, and only to, negative earnings news thus inducing dramatic differences between the abnormal returns of the overhang and negative overhang portfolio.

Finally, 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 CAMP), 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 strategy while maintaining a market neutral risk profile.

E. 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.

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[10]:

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

Table VIII reports factors loadings and alphas for the overhang and the negative 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 large capital losses has persistently low returns even though is tilted toward small stocks which would tend to raise expected returns. Good news portfolios with large capital gains tend to have higher returns but have a negative loading on HML which, ceteris paribus, should decrease expected returns.

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 negative 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 VIII 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 2.469 % ($t-$statistics $= 6.50$).

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[11]. To the extent that the results above do not simply reflect a size effect or are not limited to illiquid or low priced stocks we would expect the differential between overhang and negative overhang strategies to hold across size sub-samples and for an adjusted dataset which excludes illiquid stocks. Moreover the results should be stronger for stocks where price discovery is more likely to be slower, such as small stocks or stocks with low or no analysts' coverage.

The next section contains results for sub-samples based on size. An extensive battery of robustness tests is reported in Appendix (B). Those include size, book to market and momentum adjusted returns, a liquidity-adjusted dataset, a different definition of earnings surprises based on standardized unexpected earnings, sub-samples based on mutual fund ownership and finally, in-sample and out-of-sample results using an alternative measure of the overhang estimated from past turnover.

All the results are in line with the previous findings: signed overhang predict future returns. The post-event drift is larger when the news and the capital gains overhang have the same sign: bad (good) news travel slowly among negative (positive) overhang stocks, generating post-event return predictability.

A. Results for sub-samples based on size

This section reports results based on size sub-samples[12]. 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 A, table IX, show that the difference between the overhang and the negative 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 negative overhang strategy. These results 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[13]. 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 IX 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 9.2% 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[14] and have exchange traded option written on them.

VI. Extension: analysts' stock recommendation revisions

The under-reaction hypothesis I analyze it 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 a different investment strategies: 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[15]. In particular, upgraded stocks outperform downgraded stocks, implying that stock prices do not adjust immediately to a recommendation revision.

Brokers' and analysts' recommendations are from the I/B/E/S database. The 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. As above, independent sorts are used to construct long/short overhang and negative overhang spreads. Fama and French (1993) three factors alphas are reported in table XI.

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. Negative 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.

VII. Price impact and trading volume

The results above show that the capital gains overhang predicts cross-sectional differences in post-event monthly returns. This evidence is consistent with the hypothesis that trading between disposition-prone investors and their counter-parts impact relative prices, 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.

Trading volume should be lower stocks with large unrealized losses, as disposition-prone investors are reluctant to unload stocks at a loss. Conversely, volume should be higher for stocks trading at 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 standardized unexpected earnings (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

$$\tau_t = \log\left(V_t/S_t\right) \tag{7}$$

Abnormal turnover AT is calculated as

$$AT = \tau - \sum_{t=-40}^{-11} \tau_t.. \tag{8}$$

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 XII shows average abnormal turnover across overhang quintiles 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 0.31, 43% below average in the bottom overhang quintile ($t-$statistics $= 34.4$) while it reaches 1.18, 63% above average for stocks with large unrealized gains ($t-$statistics 45.4). Similarly, after positive earnings news (top 20% SUE) turnover for stocks with the largest overhang is 36% higher with respect to stocks in the bottom overhang quintile (1.71 and 1.25, $t-$statistics 21.3 and 30.48)

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.

To further 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 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 prior to the event date. If the capital gains overhang tends to hamper the price response to earnings news, we should expect to see a negative coefficient.

Results reported in table XIII 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 analyzes the cross section of stock returns, stock price under-reaction to corporate news and event-driven return predictability generated by trading frictions 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 tend to under-react to news, generating short term returns continuation (price momentum) and post-event drift. I propose an innovative method to compute a measure of the aggregate basis for individual stocks which relies on holdings data. I use a database of mutual funds holdings to construct a measure of reference prices for individual stocks. I then use the gain/loss measure to analyze the cross section of stock returns and stock price under-reaction to corporate news. The bulk of the evidence suggests that this novel variable drives the gradual market response to new information thus predicting short term returns.

Cross sectional results reveal that the capital gain overhang is a univariate predictor of returns and appears to drive both price and earnings momentum. Moreover, the inclusion of holdings-based overhang drives out both past returns and an alternative capital gains regressor constructed from past turnover as a predictor of future returns, which is consistent with more precise estimates of the stock's cost basis to the current shareholders being better predictors of stock returns.

Returns from an event-driven long short equity strategy reveal that exposure to a disposition proxy generates large differences in post-event returns: stocks with large unrealized capital gains/losses: bad (good) news travel slowly among stock with large unrealized capital losses (gains) implying that event-driven strategies work best once stocks are sorted using their capital gains overhang on 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/losses 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.

Further results on trading volume and returns around earnings announcement dates provide evidence consistent with the hypothesis that trading between disposition-prone investors tends to hamper price impact.

The findings are consistent with a world in which trading frictions 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 B. 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.

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Notes

[1]Events for which such a phenomenon has been detected include, but are not limited to: earnings announcements Mendenhall (1991), Abarbanell and Bernard (1992), stock splits Grinblatt, Masulis, and Sheridan (1984), Desai and Prem (1997) and David Ikemberry and Stice (1996), tender offer and open market repurchases Lakonishok and Vermaelen (1990), Ikenberry, Lakonoshok, and Varmaelen (1995), analysts' recommendations revisions Groth, Lewellen, Scharbaum, and Lease (1979), Bjerring, Lkonishok, and Vermaelen (1983), Elton, Grueber, and Gultekin (1984), Womack (1996), SEOs Lougran and Ritter (1995), Teoh, Welch, and Wong (1998), public announcements of insider trades Seyhun (1986), Seyhun (1988), venture capital share distributions Gomper and Lerner (Forthcoming) and more recently headline news Chan (2003) and R&D expenses increases Eberhart, Maxwell, and Siddique (2004).

[2]See Odean (1999), Barber and Odean (2000, 2001, 2002) , Grinblatt and Keloharju (2000), Brown, Chappel, da Silva Rosa, and Walter (2002), Dhar and Zhou (2002)

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

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

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

[6]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

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

[8]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

[9]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)

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

http://mba.tuck.dartmouth.edu/pages/faculty/ken.french

[11]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. This result is consistent with under-reaction caused by slow diffusion of information as proxy by firm size or analysts' coverage.

[12]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

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

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

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

A. Appendix

In section I motivate the empirical predictions using a particular continuous time version of the Grinblatt and Han (2002) model. Assume a risky stock in fixed unit supply. Public news reveals the fundamental value F at date 0, just prior to trading and there is no uncertainty subsequent to date 0. The date t demand function for the representative investor is given by

$$d(t) = 1 + b(t)[(F - P(t)) + \lambda(RP(t) - P(t))] \tag{9}$$

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

$$P(t) = wF + (1 - w)RP(t) \tag{10}$$

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

$$\frac{dRP}{dt} = v(t)\,[P(t) - RP(t)] \tag{11}$$

The reference price is then a weighted average of past prices with time varying coefficients

$$RP(t) = \int_0^t v(u)P(u)du \tag{12}$$

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

$$v(t) = 1 - \alpha^t \tag{13}$$

where $\alpha \in (0, 1)$. Equation (13) 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 (10), (11) and (13) admit a closed form solution for the dynamic evolution the stock price, the reference price and post event returns.

Combining (10), (11) and (13) yields the ordinary differential equation:

$$\begin{aligned} \frac{dP}{dt} &= (1-w)\left(1-\alpha^{t}\right)[P(t) - RP(t)] \qquad (14) \\ &= w\left(1-\alpha^{t}\right)[F - P(t)] \qquad (15) \end{aligned}$$

with the initial condition

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

The solution to (14) is given by:

$$P(t) = F - k_1(t)\,[P(0) - RP(0)] \tag{16}$$

where

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

Equation (16) implies that negative (positive) overhang stock will initially under-react to bad (good) news while eventually the stock price will drift towards the new fundamental value since

$$\lim_{t \to \infty} P(t) = F \tag{17}$$

The path of post-event returns is given by:

$$\begin{aligned} ret(t) &= \frac{dP}{dt} \\ &= k_2(t)\left[P(0) - RP(0)\right] \end{aligned} \tag{18}$$

where

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

Equations (16) and (18) allow to prove the two main propositions regarding the price dynamics after the initial announcement.

Proposition 1 *Signed capital gains overhang at date 0 predicts future returns. Returns following bad (good) news have a unique minimum (maximum) at a date* $\tau^* > 0$*.*

Proof. Since $k_2(t) > 0$ then $sign\left[ret(t)\right] = sign\left[P(0) - RP(0)\right]$. From 18 we have:

$$\frac{dret}{dt} = \frac{dk_2}{dt}\left[P(0) - RP(0)\right] \tag{19}$$

$$= \frac{w}{1-w}\frac{dk_2}{dt}\left[F - P(0)\right] \tag{20}$$

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

$$\lim_{x\to\infty} ret(t) = 0 \tag{21}$$

$$\lim_{x\to 0} ret(t) = 0 \tag{22}$$

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

Proposition 2 *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 (16) and (10) yields:

$$P(t) - RP(t) = -k_3(t)\left[P(0) - RP(0)\right] \tag{23}$$

where

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

Since we have

$$\lim_{t\to\infty} k_3(t) = 0 \tag{24}$$

$$\frac{dk_3}{dt} = -w(1-\alpha^t)e^{w\frac{\alpha^t - t\log\alpha - 1}{\log\alpha}} < 0 \tag{25}$$

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 :

$$P(\tau^*) - RP(\tau^*) - q(\alpha, w)\left[P(0) - RP(0)\right] = 0 \tag{26}$$

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 (3) while the values are tabulated in table XIV. 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 $(F > P_0)$ are plotted in figure (4) and (5).

B. Appendix: Additional robustness checks

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.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[16]. Also results in table IV show that prior returns are just a noisy proxy for unrealized capital gains with no residual explanatory power once capital gains are accounted for. I use a conservative approach and adjust returns anyway; 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 B of table X show that even after controlling for past returns, security prices tend to under-react to public news and that the magnitude of such post-event drift 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 $= 5.60$) and 2.083% a month (residual overhang, $t-$statistics $= 5.21$) 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 to control for liquidity is to exclude stocks with high transactions costs or price impact. I repeat the analysis in section D 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 C of table X are similar to those of table VI. The capital gains overhang spread reaches 2.485% a month ($t-$statistics = 5.12) while the no-overhang spread is not significantly different from zero.

C. 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[17] 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

$$SUE_t = (e_t - e_{t-4})/\sigma \tag{27}$$

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 D in table X 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 (1.393%, $t-$statistics = 4.03). The lower magnitude of the drift may be due to the fact that overhang spreads based on accounting earnings surprises and market impact on earnings releases, exploit market under-reaction to separate pieces of information embedded in different earnings news proxies.

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 retail investors. The variable of interest is really the cost-based reference price to the representative investor and for stocks mostly held by retail investors, mutual fund holdings will be a noisy measure for the portfolio of the marginal investor.

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 XI 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 significant and larger for high mutual fund ownership stocks than for low mutual fund ownership stocks

E. Estimating the capital gains overhang from turnover: 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 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 use the turnover-based measure of capital gains overhang computed in section III and analyze under-reaction to earnings news for the period 1962 - 1979 not covered by the mutual fund database.[18]

In panel B of table XI I split the sample into the two sub-periods 1962 - 1979 and 1980 - 2002 and compute excess returns 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.

Table I: Summary statistics for the capital gains overhang

This table report summary statistics for the capital gains negative overhang. The capital gains negative overhang is defined as the percentage deviation of the aggregate 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 negative overhang, % MV is the percentage of total market value of stocks with a valid capital gains negative overhang.

Year	Mean	Median	Stdev	Skew	P20	P80	%STOCKS	%MV
1985	-0.08	0.01	0.42	-2.55	-0.26	0.18	64.5	95.9
1990	-0.27	-0.11	0.55	-1.99	-0.54	0.10	62.2	96.9
1995	-0.07	0.03	0.44	-2.61	-0.24	0.20	83.6	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 II: Determinants of capital gains overhang, Fama MacBeth regressions 1980 - 2002

This table reports coefficients from Fama MacBeth regressions of the capital gains negative 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 12 months, MF_OWN is the percentage of shares outstanding owned by mutual funds and $HOLD\_RET$ is the average return in the previous twelve months of all funds holding the stocks. Prior funds returns are weighted by the percentage of ownership in the stock. $NASD$ is a NASDAQ dummy. Cross sectional regressions are run every calendar month and standard errors are adjusted for heteroskedasticity and autocorrelation using a Bartlett kernel. In model 4 the absolute value of the negative 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 III: 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 V: Fama-MacBeth Regressions of returns on prior returns, prior earnings surprises and the capital gains negative overhang

This table reports Fama MacBeth regressions of individual stocks returns on compounded returns in the previous 12 month, computed skipping the last months (R12), the abnormal returns relative to the equally weighted market index cumulated from two day s before to two one day after the recent earnings announcement date (CAR), the capital gains negative overhang constructed using mutual fund holdings and the capital gain negative overhang constructed using from turnover. The capital gains negative overhang is defined as the percentage deviation of the aggregate 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. To compute the holdings-based negative overhang measure, 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. Individual stock holdings are then used to calculate $V_{t,t-n}$. To compute the turnover based negative overhang $V_{t,t-n}$ is estimated 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 dependent variable is the stock's buy-and-hold return either over the subsequent three (Panel A) or six months (Panel B). Each explanatory variable is expressed in term of its percentile rank and scaled to fall between zero and one. Cross sectional regressions are run every calendar month from January 1980 to December 2002 and standard errors are adjusted for heteroskedasticity and autocorrelation using a Bartlett kernel. The sample includes all domestic firms with CRSP coverage.

Table IV: Fama-MacBeth Regressions of returns on prior returns, prior earnings surprises and the capital gains overhang

Model #	1	2	3	4	5	6	7	8	9
RHS variable	Panel A: Dependent variable: Three-Months Return								
CAR	**0.041**		**0.039**		**0.034**		**0.020**	**0.029**	**0.021**
(event date)	(10.43)		(10.46)		(9.32)		(7.95)	(8.05)	(8.71)
R12		**0.049**	**0.037**		0.019			0.013	
		(6.98)	(4.78)		(1.71)			(1.48)	
Overhang				**0.033**	**0.035**		0.006	0.003	
(turnover-based)				(5.24)	(3.46)		(0.93)	(0.40)	
Overhang						**0.049**	**0.040**	**0.034**	**0.045**
(holdings-based)						(7.65)	(5.20)	(4.52)	(5.73)
RHS variable	Panel B: Dependent variable: Six-Months Return								
CAR	**0.062**		**0.058**		**0.046**		**0.044**	**0.042**	**0.038**
(event date)	(11.31)		(10.52)		(8.32)		(6.99)	(6.98)	(8.05)
R12		**0.102**	**0.085**		0.017			0.034	
		(8.87)	(6.99)		(1.60)			(1.86)	
Overhang				**0.081**	**0.039**		0.021	0.013	
(turnover-based)				(10.16)	(4.94)		(1.37)	(1.17)	
Overhang						**0.099**	**0.079**	**0.063**	**0.090**
(holdings-based)						(10.38)	(6.53)	(5.05)	(8.49)

Table V: Post earnings announcement drift profits, monthly 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. 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. L/S is the average (raw) return on a zero cost portfolio which holds the top 20% good news stocks and sells short the bottom 20% bad news stocks. 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 VI: PEAD profits: capital gains overhang and negative overhang spread returns

This table reports the time series averages of monthly returns obtained using calendar-time rolling portfolios for the negative overhang spread and the negative overhang spread. At the beginning of every calendar month stocks are ranked in ascending order on the basis of their cumulative abnormal returns at the most recent earnings announcement date and the most recent capital gains negative overhang. The negative overhang spread is defined as a zero cost portfolio which holds the top 20% good earnings news stocks in the top negative overhang quintile and sells short the bottom 20% bad earnings news stocks in the bottom negative overhang quintile. The negative overhang spread is defined as a zero cost portfolio which holds the top 20% good news stocks in the bottom negative overhang quintile and sells short bottom 20% bad news stocks in the top negative overhang quintile. The residual negative overhang is obtained by regressing (cross sectionally) the raw negative 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, in excess of the CRSP NYSE/AMEX/NASDAQ market index. L/S is the average (raw) return on the zero cost portfolio, $t-$statistics are shown below the coefficient estimates. "Months" is the holding period of the rolling strategy.

	overhang spread			negative overhang spread			residual overhang spread			negative 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**	**1.456**	0.220	0.110	-0.110
	(-2.52)	(5.41)	(4.98)	(-0.20)	(-0.07)	(0.08)	(-2.35)	(5.54)	(4.33)	(1.33)	(0.65)	(-0.46)
+12	**-0.225**	**0.564**	**0.788**	-0.029	0.138	0.167	-0.118	**0.595**	**0.713**	0.070	0.206	0.136
	(-1.03)	(3.45)	(2.93)	(-0.19)	(0.78)	(0.81)	(-0.65)	(3.97)	(2.49)	(0.49)	(1.38)	(0.70)

Table VII: PEAD: monthly profits by overhang quintiles

This table reports the time series averages of monthly returns for post earnings announcement strategies obtained using calendar-time rolling portfolios for different negative 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 negative 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 negative overhang quintile and sell short the bottom 20 % bad earnings news stocks in the $(6-j)th$ negative overhang quintile. The last column report the difference between the negative overhang spread and the negative overhang spread. The residual negative overhang is obtained by regressing (cross sectionally) the raw negative 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, in excess of the CRSP NYSE/AMEX/NASDAQ market index. L/S is the average (raw) return on the zero cost portfolio, $t-$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 (negative overhang spread)	5 - 1	5 (overhang spread)	4	2	3	1 (negative 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 VIII: Three factors time series regressions: alphas and factor loadings

This table reports Fama-French three factors loadings and alphas for the negative overhang spread and the negative overhang spread strategy. The dependent variable is the monthly excess return of the treasury bill rate from rolling strategy obtained by sorting stocks according to their cumulative abnormal return around the most recent earnings announcement date and the most recent capital gains negative 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.

	negative overhang spread			negative 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 IX: Robustness checks 1

This table reports the time series averages of monthly returns obtained using calendar-time rolling portfolios for the negative overhang spread and the negative overhang spread. The holding period for the rolling strategy is three months. "Raw" refers to a sort based on the raw capital gains negative overhang, "residual" indicates a sort based on the residual negative 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 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. 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. The table reports returns on the long/short zero cost portfolios. Returns are in monthly percent, $t-$statistics are shown below the coefficient estimates.

Panel D: results based on size

	negative overhang spread					negative 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)

	Panel A: matched returns			**Panel B: liquidity adjusted returns**			**Panel C: SUE sort**		
	overhang	negative overhang	difference	overhang	negative overhang	difference	overhang	negative overhang	difference
Raw	**1.851**	-0.025	**1.876**	**2.485**	-0.348	**2.833**	**1.680**	0.287	**1.393**
	(5.60)	(-0.04)	(4.76)	(7.41)	(-1.23)	(5.12)	(5.64)	(0.95)	(4.03)
Residual	**2.083**	0.576	**1.507**	**1.799**	-0.135	**1.934**	**1.632**	0.359	**1.273**
	(5.21)	(1.85)	(4.01)	(5.41)	(-0.47)	(4.01)	(5.24)	(1.08)	(3.99)

Table X: Robustness checks

This table reports the time series averages of monthly returns obtained using calendar-time rolling portfolios for the overhang spread and the negative 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 negative 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. The table reports returns on the long/short zero cost portfolios. 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	negative overhang	difference	overhang	negative overhang	difference
2.054	**1.050**	**1.004**	**2.118**	-0.265	2.383
(5.22)	(3.23)	(2.76)	(6.14)	(-0.86)	(4.71)

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

1963 - 1979			1980 - 2002		
overhang	negative overhang	difference	overhang	negative 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 XI: Analysts' revisions: overhang and no-overhang alphas

This table reports three factors Fama and French alphas a post analysts' revision drift strategies for the negative overhang and the negative overhang spread. The negative overhang spread is defined as a zero cost portfolio which holds the best 20% good news stocks in the top negative overhang quintile and sells short the bottom 20% negative news stocks in the bottom negative overhang quintile. The negative overhang spread is defined as a zero cost portfolio which holds the top 20% positive news stocks in the bottom negative overhang quintile and sells short the bottom 20 % bad news stocks in the top negative overhang quintile. The ranking variable 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.

	Analysts' recommendations revisions $\alpha(\%)$		
Months	negative overhang	negative overhang	difference
+1	**1.822**	**-2.013**	**3.835**
	(2.10)	(-2.70)	(3.64)
+2	**1.848**	-1.225	**3.073**
	(2.12)	(-1.71)	(2.41)
+3	**1.787**	-1.214	**3.001**
	(2.27)	(-1.87)	(2.99)

Table XII: 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 negative overhang. The table shows average abnormal turnover across capital negative 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: abnormal turnover, bottom 20% SUE					Panel B: abnormal turnover, top 20% SUE				
days	Overhang quintiles					Overhang quintiles				
	1 (low)	2	3	4	5 (high)	1 (low)	2	3	4	5 (high)
-5	-0.17	-0.20	-0.13	0.14	0.28	-0.02	-0.01	0.04	0.20	0.22
-2	-0.23	-0.25	-0.14	0.18	0.35	0.14	0.23	0.25	0.43	0.41
-1	-0.10	-0.06	0.07	0.42	0.59	0.52	0.59	0.65	0.85	0.85
0	0.31	0.47	0.64	1.01	1.18	1.25	1.37	1.46	1.68	1.71
1	0.76	1.04	1.25	1.63	1.80	2.02	2.19	2.25	2.50	2.53
2	1.00	1.36	1.62	2.01	2.15	2.44	2.63	2.71	2.96	3.04
5	1.28	1.89	2.15	2.59	2.62	3.05	3.32	3.48	3.81	3.91
	t statistics					t statistics				
-5	0.20	0.94	1.92	1.81	2.26	-1.90	-1.60	-0.07	1.22	2.43
-2	6.21	7.43	8.24	6.88	6.97	-1.19	-0.10	0.23	1.72	2.98
-1	17.37	18.77	19.91	20.75	22.59	7.71	10.17	10.52	11.86	12.23
0	34.37	40.36	40.30	43.08	45.36	21.30	28.07	28.59	29.06	30.48
1	36.02	42.53	40.16	41.45	43.92	23.36	29.27	29.92	29.25	31.90
2	20.48	23.32	23.45	24.65	27.72	11.99	17.57	18.75	19.01	18.48
5	6.79	10.15	10.38	12.36	12.57	4.13	7.25	7.02	8.71	5.53

Table XIII: 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 negative 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 negative 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 XIV: 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 news. The initial stocks price is 13$. At date 0 public news reveals a fundamental value of 11$

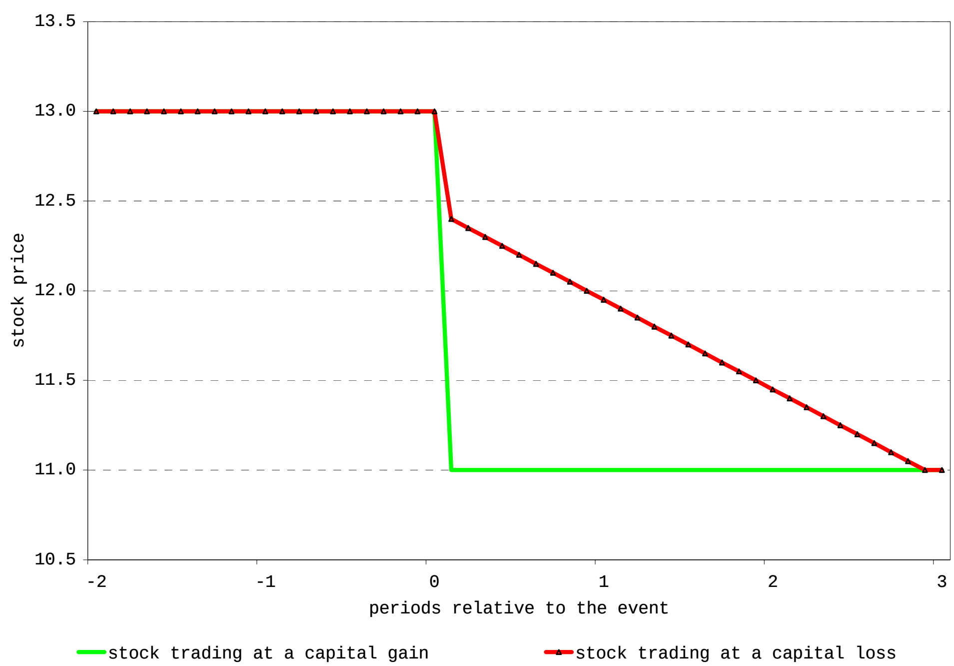

Figure 2. An example of stock price response to positive news releases. This figure shows an example of a stock price response to a negative news. The initial stocks price is 11$. At date 0 public news reveals a fundamental value of 13$

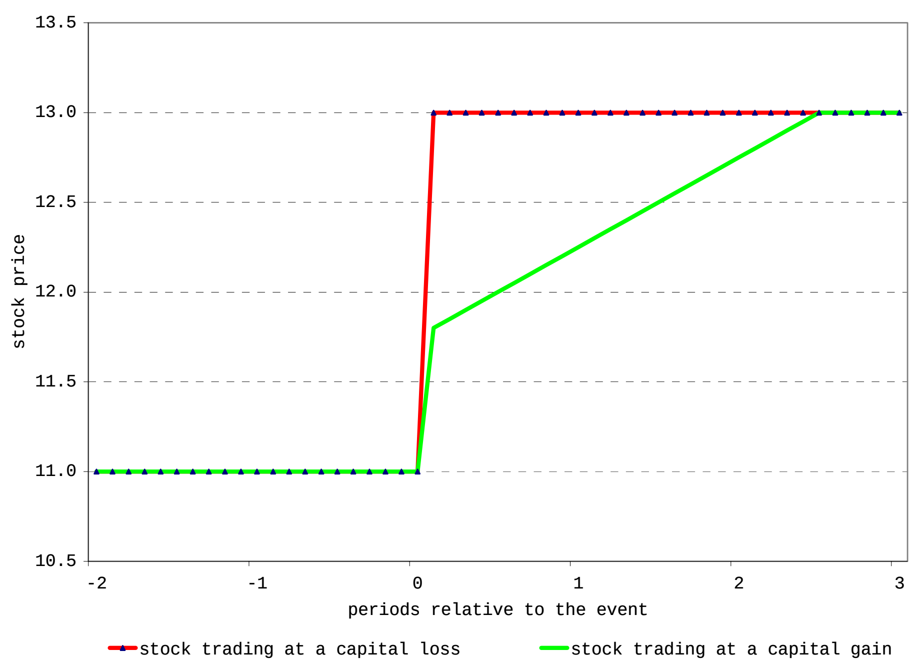

Figure 3. The function $q(\alpha, w)$. This table plots the function $q(\alpha, w)$ derived in the appendix for the parameter values $(\alpha, w) \in (0, 1)$

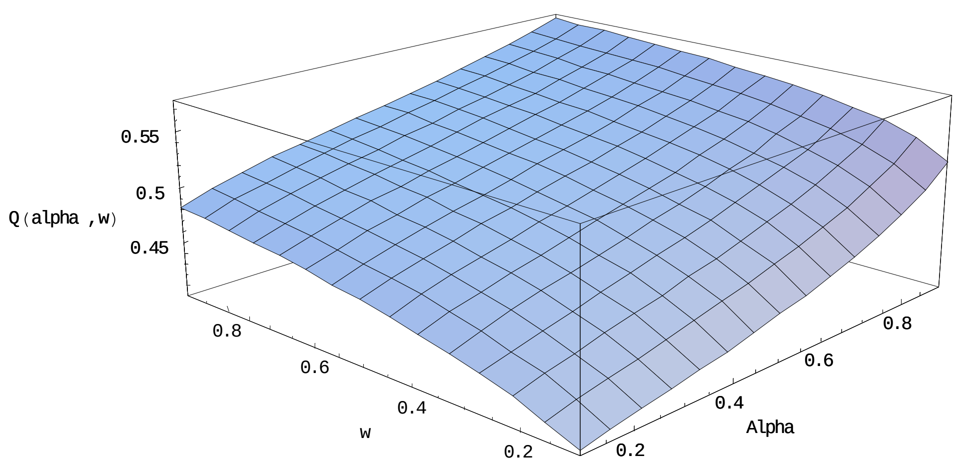

Figure 4. Instantaneous returns $\frac{dP}{dt}$ and the capital gains overhang following negative news. This figure reports the instantaneous returns and the capital gains overhang over time following a negative news for the parameters values $F = 5$, $\alpha = .9$, $w = 1/3$, $P_0 = 15$

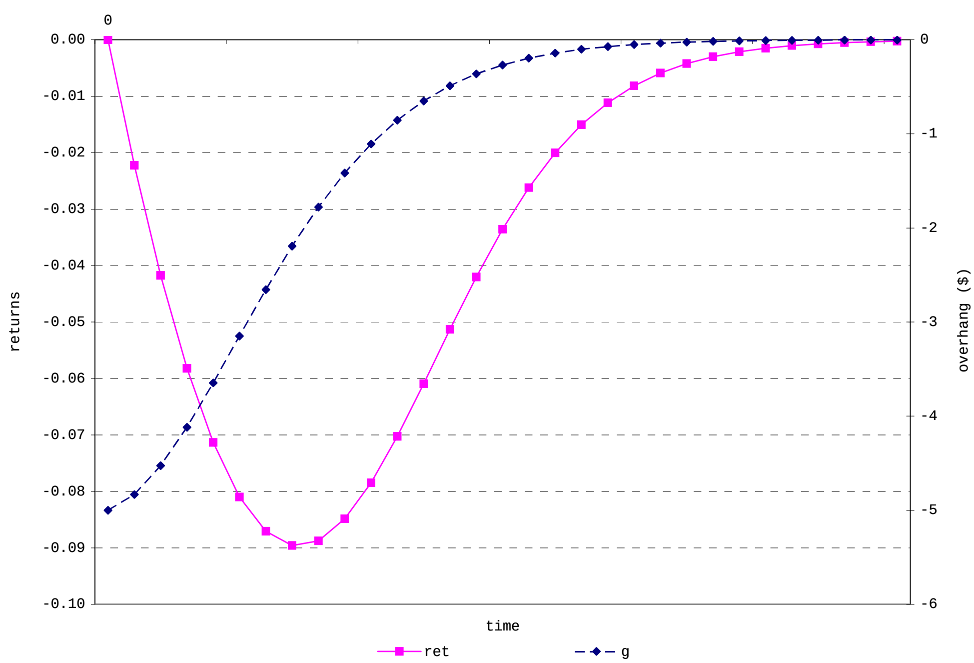

Figure 5. Instantaneous returns $\frac{dP}{dt}$ and the capital gains overhang following positive news. This figure reports the instantaneous returns and the capital gains overhang over time following a positive news for the parameters values $F = 15$, $\alpha = .9$, $w = 1/3$, $P_0 = 10$