Earnings News and Market Risk: Is the Magnitude of the Post-Earnings Announcement Drift Underestimated?

Leon Zolotoy, Melbourne Business School

Available at: https://works.bepress.com/leon_zolotoy/4/
Earnings News and Market Risk: Is the Magnitude of the Post-Earnings Announcement Drift Underestimated?

Leon Zolotoy*
Melbourne Business School, University of Melbourne

October 26, 2009

Abstract

The post-earnings announcement drift is the tendency of cumulative abnormal returns to drift in the direction of earnings surprise for several weeks after the earnings news is released. We show that a standard approach of measuring abnormal returns by using pre-announcement estimates of market risk (betas) causes the magnitude of this phenomenon to be significantly underestimated. Our key findings are as follows. First, we find that stock beta tends to rise (fall) following the release of "bad" ("good") earnings news. Second, we find that by not taking into account post-announcement shifts in betas prior studies are likely to underestimate the magnitude of the drift. A 60-days cumulative abnormal returns on hedge portfolio appear to be approximately 1.4% higher when the "leverage effect" is incorporated in the estimates of market risk. Our results are robust with respect to different model specifications as well as different earnings surprise measures.

JEL Code: G14, M41

Keywords: Post-earnings announcement drift; leverage effect; earnings news; stock betas

---

*Contact details: Melbourne Business School, University of Melbourne, Leicester Street 200, Carlton 3053, VIC, Australia. E-mail: l.zolotoy@mbs.edu. Fax: +61 3 9349 8144
1 Introduction

In this study we address the following research questions

- Does the nature of earnings news (i.e., "good" or "bad") affect betas of individual stock?

This is an extension of prior research on how stock betas are affected by the nature of past stock returns (i.e. positive or negative). Several studies report stock betas to fall (rise) for the stocks that experienced past positive (negative) returns.\(^ 1\) However, none of these studies examine a potential link between the nature of earnings news and stock betas. We hypothesize that such a link should exist since as equity value falls due to the release of negative earnings news, the weight attached to the debt rises and vice versa. As a result equity holders, who are exposed to the residual risk of a firm, consider their investment as being more risky. If stock beta is an appropriate measure of firm’s risk then we would expect stock betas to rise (fall) following the release of "bad" ("good") earnings news.

- How does taking into account a potential impact of the earnings news on stock betas affect the magnitude of the Post-Earnings Announcement Drift (PEAD)?

A standard event-study methodology of calculating PEAD involves assuming a particular factor model (usually a market model) as the one which appropriately captures the risk of a stock.\(^ 2\) Next, for each stock the parameters of market model are estimated using a pre-event time-window. These estimates are used to calculate cumulative abnormal stock returns (usually 60 days) following the event date to evaluate the impact of the event on stock prices. We argue that this approach induces a substantial measurement error in the estimates of the post-announcement stock betas and, consequently, in the magnitude of the Post-Earnings Announcement Drift. In particular, if stock betas rise (fall) after "bad"

\(^1\)We shall review these studies in Section 2.
\(^2\)See, for instance MacKinlay, 1997. An alternative approach suggests using portfolios with similar capitalization and/or book-to-market ratios as a benchmark to calculate the abnormal stock returns (e.g., Livnat and Mendenhal, 2006). However, this approach does not take into account a market risk.
("good") earnings news is released then the abnormal returns on the post-announcement hedge portfolio (i.e., buying stocks in the top and selling short stocks in the bottom surprise deciles) calculated using pre-announcement estimates of betas are likely to underestimate the true magnitude of the PEAD phenomenon.

Our major findings are as follows. First, we find that the post-announcement stock betas tend to rise (fall) for the firms with negative (positive) earnings surprise. This finding is robust with respect to different model specifications of beta as well as various definitions of the earnings surprise measure. Second, we find that the magnitude of the post-announcement drift calculated using a standard approach, that is, using constant pre-announcement estimates of betas, is substantially underestimated. More specifically, we find the 60-days abnormal returns on hedge portfolio (buying the stocks in the 10-th and selling short stocks in the 1-st earnings surprise decile) to be underestimated by about 140 basis points.

Our findings contribute to the asset pricing and event-study literature in a number of ways. First, we document a strong link between the earnings information and the market risk of a firm. That is, our results show that the nondiversifiable risk of a firm changes depending on the nature of earnings news, a finding which potentially bears important implications for the asset pricing literature. Second, we emphasize the economic significance of the post-announcement shift in the market risk sensitivities of individual stocks. More specifically, we show that, by not taking into account the impact of the earnings news on stock betas, previous studies are likely to underestimate the magnitude of the post-earnings announcement drift. As an alternative to a standard approach we propose a simple model which, while using pre-announcement window to estimate stock betas, accounts for the post-announcement shifts in market risk estimates. These findings emphasize economic significance of the post-earnings announcement drift phenomenon as the anomaly challenging the informational efficiency of stock markets.
2 Literature Review

Post-earnings announcement drift is the tendency for a stock price to drift in the direction of a recent earnings surprise for weeks and even months after the earnings news is released. Named by Fama (1998) "a granddaddy of underreaction events" the post-earnings announcement drift anomaly has been a subject of ongoing interest, both from academics and finance practitioners, since it has been first reported by Ball and Brown (1968). Since then, a drift has been subjected to a diverse battery of robustness checks by many studies. Early studies include, among others, Joy, Litzenberger and McEnally (1977), Latane and Jones (1979), Foster, Olsen and Shevlin (1984), Bernard and Thomas (1989) and Abarbanel and Bernard (1992). These studies report the abnormal returns on hedge portfolio (buying top-surprise decile stocks and selling short shares of bottom-surprise decile firms) to be between 5 to 6 percent per quarter. Among more recent studies are the papers by Bartov, Radhakrishnan and Krinsky (2000), Collins and Hribar (2000), Liang (2003), Francis et al. (2004), Batalio and Mendenhall (2005) and Livnat and Mendenhall (2006). Collins and Hribar (2000) reports the abnormal return of 7.1% for the two-quarter holding period during the 1988-1997 period. In contrast to these studies, most of which use time-series models to estimate the earnings surprise measures, Liang (2003) uses I/B/E/S data over the period of 1989-2000. He estimates the 60-days drift to be approximately 6%. Livnat and Mendenhall (2006) estimate one quarter drift to be 4.9% (3.8%) over the period of 1987-2003 when I/B/E/S analysts’ forecasts (time-series model) are used to estimate the earnings surprise measures.

While there is a consensus regarding the significance of the estimated drift the causes for the drifts are still subject of debates. A number of studies suggest that a post-earnings announcement drift is a real phenomenon caused by slow reaction to the information content of earnings. These studies include Bernard and Thomas (1989) and Ball and Bartov (1996) who suggest that investors tend to ignore a serial correlation in the earnings surprises which leads to a lagged reaction of stock prices to the earnings announcements. Hong, Lim and

---

3 An interested reader is referred to Kothari (2001) for an extensive review.
Stein (2000) reports the drift to be more pronounced for the firms with low market capitalization and/or for the stocks with low analysts' coverage. They interpret these findings as the evidence of a drift being caused by a gradual dissemination of information among the investors. In a more recent paper Frazzini (2006) shows how a disposition effect, namely the tendency of investors to "ride" losses and realize gains, may cause the drift.

Another strand of literature argues that significant post-announcement abnormal returns are due to methodological shortcomings or risk mismeasurement while estimating the drift. Using annual earnings announcement Ball, Kothari and Watts (1993) find that taking into account post-announcement shifts in the risk measures of stocks substantially reduces the magnitude of though does not eliminate completely the drift. They also report some preliminary evidence of stock betas rising (falling) in the year +1 following the release of "bad"("good") earnings news. Jacob, Lys and Sabino (2000) argue that the evidence of investors’ underreaction to the earnings news is an artifact induced by overdifferentiating already stationary earnings series. Sadka and Sadka (2004) find that a substantial part of the post-earnings announcement drift can be viewed as a compensation for liquidity risk.

The current paper can be viewed as a contribution to the second strand of literature discussed above. We argue that a standard approach of estimating post-announcement abnormal returns does induce measurement errors in market risk estimates due to change in firm’s leverage. However, these measurement errors cause the magnitude of the drift to be underestimated. A positive relation between equity beta and firms’ leverage was suggested, among others, by Hamada (1972), Appleyard and Strong (1989) and Monkhouse (1997). Braun et al (1995), Engle and Cho (1999), Brooks and Henry (2002) and Dean and Waff (2004) report stock betas to rise (fall) following negative (positive) stock returns. In particular, Engle and Cho (1999) point out that asymmetric response of stock betas to "bad"/"good" news may partially explain the mean reversal in stock prices reported by previous studies. Instead, in this paper we show how ignoring the impact of earnings news on stock betas leads to a substantial underestimation of the post-earnings announcement momentum phenomenon in stock prices. In context of a current study, we argue that
as a result of an increased leverage the pre-announcement estimates of stock betas are downward (upward) biased estimates of the post-announcement betas for the firms with "bad" ("good") earnings news. As a result, post-announcement abnormal returns on "bad" ("good") news portfolios are likely to be over- (under)-estimated and, consequently, the abnormal returns on the post-announcement hedge portfolio are likely to be underestimated as well.

Another contribution of this study is related to the aspect raised by Bekaert and Wu (2000) and Dean and Waff (2004). They point out that if both the market volatility and covariance between the stock and market returns rise (fall) following "bad" ("good") news, the impact of the latter on stock beta will be hard to detect. By focusing on the firms’ earnings announcements we study the link between stock betas and firms’ idiosyncratic news, thus, controlling for potential post-announcements shifts of the stock market volatility.

Our key findings are as follows. First, we find that stock betas tend to rise (fall) following the release of "bad" ("good") earnings news. Our findings remains robust with respect to both parametric and nonparametric model specifications as well as different methods of calculating the earnings surprise measures. This effect is substantially more pronounced for the "bad" earnings news when the post-announcement stock betas remain well above their pre-announcement level for, approximately, six months following the earnings announcement. Second, we find that a standard approach of using pre-announcement estimates of stock betas leads to substantial underestimation of the drift. The 60-days abnormal return on hedge portfolio (buying (selling short) stocks in 10-th (1-st) earnings announcement decile) is underestimated by approximately 1.4%.

Overall, our results re-emphasize economic significance of the post-earnings announcement drift phenomenon as well as the importance of taking into account the impact of earnings news on measures of nondiversifiable risk. In a more general context, our study also raises concern regarding the widely applied event study methodology and suggests taking into account potential post-event shifts in measures in the nondiversifiable risk. By using the sample of corporate earnings announcements our study illustrates how a standard
event study methodology results in substantial measurement errors in the post-event ab-
normal returns and, thus, may lead to wrong conclusion regarding the impact of the event
on firm’s value.

The remainder of this paper is organized as follows. In Section 3 we describe our data
and discuss some measurement issues. In Section 4 we discuss our methodology. Empirical
findings are described and discussed in Sections 5 and 6. Finally, in Section 7 we summarize
our findings and suggest some potential directions for further research.

3 Research Design

3.1 Sample Selection

Our initial sample consists of the quarterly earnings announcements of all the firms covered
firm-quarter observation includes actual earnings per share adjusted for splits, analysts’
consensus (median) earnings forecast and actual earnings per share for the same quarter a
year before. We use the Street earnings, reported by the I/B/E/S instead of the GAAP
earnings reported by Compustat following Livnat and Mendenhall (2006). They suggest
that due to policy of restating the earnings, the earnings figures reported by Compustat are
likely not to be the ones viewed by investors when the earnings news is released. We delete
from our sample all firms with less than 15 consecutive earnings announcements. This is
done for the purpose of calculating the earnings surprise measures, as it will clarified in the
following subsection. This procedure leaves us with a final sample of 2804 firms. A brief
description of these firms is provided in Table I.

Insert Table I approximately here

Next, for each firm we match the returns on firm’s stock and the equally weighted broad
market portfolio over the period of 60 trading days following the release of the earnings
news. This data is obtained from the Center for Research in Security Prices, CRSP. Similar
to actual earnings figures, the stock prices are adjusted for splits. Also, in order to calculate the earnings surprise measures for each firm we collect its’ closing stock price two days before the earnings announcement was made.

3.2 Earnings Surprise Measures

Doyle, Lundholm and Saliman (2003) and Livnat and Mendenhall (2006) report the magnitude of the post-earnings announcement drift being larger when defining the earnings surprise using analysts’ forecasts than when using time-series models. Moreover, Livnat and Mendenhall (2006) document that the returns patterns around the earnings announcements when using analysts’ consensus forecasts’ differ from those observed when using time-series models. Therefore, we consider both the time-series models and analysts’ forecasts as potential measures of market earnings forecasts. More specifically, the following earnings surprise measures are calculated

a) Standardized Unexpected Earnings (SUE). This measure, based on the assumption that quarterly earnings follow a seasonal random walk, was widely used in a previous literature (see Bernard and Thomas, 1989 and Ball and Bartov, 1996 among others) and is calculated as follows

\begin{equation}
SURP_{i,t} = \frac{e_{i,t} - \mu_i - e_{i,t-4}}{\sigma_i}
\end{equation}

Here, \( e_{i,t} \) \( (e_{i,t-4}) \) is quarterly earnings of the firm \( i \) in quarter \( t \) \( (t-4) \) and \( \mu_i \) \( (\sigma_i) \) is the mean (standard deviation) of the seasonally differenced earnings to be estimated from the data. In order to estimate this parameters for each firm we use all but the last observation as the estimation window while the last observation is used to calculate the SUE measure. For instance, if we have at our disposal 20 observations for the firm \( i \) over the period of January 1997-December 2001, then the first 19 observations over the period of January 1997-September 2001 will be used as the estimation sample while the earnings announcement for the last quarter of year 2001 will be used to
calculate the SUE measure.

b) Analysts’ consensus measure. Assuming that investors use analysts’ forecasts to predict future earnings, the analysts’ consensus forecast based earnings surprise is calculated as follows

\[ \text{SURP}_{i,t} = \frac{e_{i,t} - c_{i,t}}{p_{i,t}} \]  

(2)

Here, \( c_{i,t} \) is the analysts’ median forecast for the last month before the earnings news is released and \( p_{i,t} \) is closing stock price two days before the earnings announcement date. Analysts forecasts as the measure of market earnings expectations were used, among others, by Liang (2003), Mendenhall (2004) and Francis et al. (2004).

4 Methodology

To set forth notations, let \( r_s \) and \( r_m \) be the returns on a stock and market portfolio, respectively. Also, let \( h_{s,t} \) (\( h_{m,t} \)) be stock (market portfolio) return conditional volatility based on the information set \( \Omega_{t-1} \). Similarly, let \( \rho_{t} \) be a conditional correlation between the stock and market portfolio returns. In the following sections two equivalent representations of the conditional market beta will be used

\[ \beta_t = \frac{\text{cov}_t(r_s, r_m)}{h_{m,t}^2} \]  

(3)

\[ \beta_t = \frac{\rho_t h_{s,t}}{h_{m,t}} \]  

(4)

4.1 Nonparametric Cross-Sectional Model

Consider a simple case when the information set \( \Omega_{t-1} \) includes only information about the earnings news. That is, for each firm \( i \) we condition its’ market beta upon either its standardized unexpected earnings or the analysts’ consensus surprise, depending on definition of the earnings news. Then, the definition of conditional beta in eq.1 can be
reformulated as follows
\[ \beta_t = \frac{E(r_s \tilde{r}_m | SURP)}{\sigma_m^2} \]

where \( SURP \) is the earnings surprise, \( \tilde{r}_m \) is the return on market portfolio in excess of its’ unconditional mean and \( \sigma_m^2 \) is the unconditional variance of the market portfolio return both of which can be straightforwardly estimated from the sample. To estimate the conditional covariance, \( E(r_s \tilde{r}_m | SURP) \), we use a Nadaraya-Watson kernel estimate

\[ \hat{E}(r_s \tilde{r}_m | \mathbf{x}) = \frac{\sum_{i=1}^{N} r_{s,i} \tilde{r}_{m,i} K(\frac{x - SURP_i}{h})}{\sum_{i=1}^{N} K(\frac{x - SURP_i}{h})} \] (5)

where for each firm \( r_{s,i} \) and \( r_{m,i} \) are the post-announcement stock and market portfolio returns measured over the same time window (daily, weekly etc.) and \( N \) is the sample size. Also, \( K(\cdot) \) is a kernel function and \( h \) is a bandwidth parameter which determines the smoothness of estimate ( Pagan and Ullah, 1999). Within this methodological framework a conjecture that the post-announcement stock betas are not affected by the earnings news can be tested by testing the following null hypothesis

\[ H_0 : \frac{\partial \beta_t}{\partial SURP} = 0 \]

A primary advantage of using a nonparametric framework is that it does not require any assumptions regarding the functional form of the relation between the post-announcement betas and the earnings surprises which makes it fairly robust. On the other hand, since it uses a cross-section of observations some individual characteristics of firms may be disregarded. For instance, if the post-announcement betas do change following the release of earnings information, the magnitude and persistence of their response may vary for different firms.⁴ Taking this consideration into account we also study the relation between the

⁴For instance, Bartov et al. (2000) report the magnitude of the post-earnings announcement drift to be more pronounced for the firms with less institutional holdings.
post-announcement betas and earnings news within parametric framework, as described in the following subsection.

4.2 Parametric Time-Series Model

GARCH and EGARCH volatility models in their various modifications are, perhaps, the most widely used models in finance literature (Campbell, Lo and MacKinlay, 1997; Engle, 2001). Following these and other studies we assume that both stock and market portfolio return variances follow Exponential GARCH (EGARCH) processes (Nelson, 1991). More specifically, we assume that individual stock returns follow the ARMA(1,1) process with EGARCH (1,1) errors. The assumption of ARMA(1,1) process is consistent with partial adjustment model of Amihud and Mendelson (1987). If $AR(1)$ and $MA(1)$ loadings are jointly equal to zero, new information is fully reflected in stock prices. On the other hand, positive (negative) sign of the $AR(1)$ would suggest investors’ under-(over) reaction (Theobald and Yallup, 2004). Similarly, the returns on the market portfolio are modelled as AR(1)-EGARCH(1,1) process.

Finally, we consider two potential specification of the conditional correlation between the stock and market returns:

- **Constant correlation model.** In this model we assume that the conditional correlation between stock and market portfolio returns is time invariant, as in Bollerslev (1990). In this scenario, earnings news will effect the post-announcement betas only via stock volatility channel.

- **Time-varying correlation model.** This model specification allows both stock return volatility and correlation to be affected by earnings news. More specifically, we model conditional correlation as follows

$$\rho_t = F(z_t)$$  \hspace{1cm} (6)

$$z_t = \rho_0 + \rho_1 \rho_{t-1} + \rho_2 z_{s,t-1}$$
\[ F(x) = \frac{\exp(x) - 1}{\exp(x) + 1} \]

where \( z_{s,t-1} \) denotes lagged normalized stock return innovation and \( F(\cdot) \) keeps correlation parameter in \([-1,1]\) range (Patton, 2006). In this model lagged stock returns are allowed to affect correlation as well. Negative sign of \( \rho_2 \) implies that correlation between stock and market portfolio returns increases (decreases) following "bad" ("good") news.

Denoting by \( h_{s,t} \) and \( h_{m,t} \) the estimates of stock and market volatility, respectively the estimates of conditional betas will be

\[ \beta_t = \rho \sqrt{\frac{h_{s,t}}{h_{m,t}}} \text{ for the constant correlation model} \] (7)

\[ \beta_t = \rho_t \sqrt{\frac{h_{s,t}}{h_{m,t}}} \text{ for the time-varying correlation model} \] (8)

## 5 Empirical Findings

In this section we report and discuss our empirical findings. First, we report the results of the nonparametric analysis. Next, we turn to the estimates of parametric beta models.

### 5.1 Nonparametric Cross-Sectional Model

In Figures 1 and 2 we plot nonparametric estimates of the post-announcement betas against the analysts' consensus and the time-series based earnings surprises, respectively. To evaluate the persistence of the earnings news effect on stock betas we estimate post-announcement betas over four different time-windows: \([+1,+1]\), \([+6,+10]\), \([+11,+20]\) and \([+21,+30]\) trading days. That is, for each time window we use a cross section of stock and market portfolio returns for that specific time-period to estimate a nonparametric conditional beta as discussed in Section 4.1. \(^5\)

\(^5\)Throughout this paper a Gaussian (normal) kernel is used. Bandwidth was chosen based on Silverman "rule of thumb" (Silverman, 1986).
We start with Figure 1, where we plot nonparametric beta estimates against the analysts’ consensus earnings surprise. Each plot depicts a nonparametric estimate of beta (solid line) along with the 95% confidence bands (dotted line). The restricted estimates of beta under the null hypothesis of no relation between the earnings news and stock betas (that is, constant average post-announcement betas) are depicted by dashed lines. The null hypothesis is rejected if the restricted estimate of beta crosses the 95% confidence bands.

We find evidence of stock betas being affected by the earnings news. More specifically, we find strong evidence of inverse relation between the post-announcement betas and the analysts’ consensus earnings surprises. The impact of the earnings news on market beta is particularly pronounced during the first ten days following the release of earnings information (upper left and right plots). It gradually decays, though remaining quite pronounced, during next four trading weeks and, finally, dissipates about one month after the earnings news is released (lower right plot). The impact of earnings news on stock betas is economically significant as well. Next day after the earnings announcement market beta plummets from 5 to 0.1 within [-0.02,0.01] earnings surprise range. The effect of earnings shocks on stock market risk remains economically significant for later post-announcement periods as well. For instance, for the [+6,+10] days time window market beta falls from 2 to almost zero within [-0.02,0.01] earnings surprise range.

In Figure 2 we plot nonparametric estimates of market beta against the time-series based earnings surprise. Similar to our previous findings, post-announcement beta is decreasing as the earnings surprise increases. Interestingly enough, the effect of earnings news on post-announcement betas appears to be of a smaller magnitude when we use standardized unexpected earnings as the earnings surprise measure compared to the analysts’ consensus earnings surprise. Also, the standard errors of the estimate increase which leads to wider confidence intervals, compared to the ones depicted in Figure 1. However, the effect of earnings news on the post-announcement betas is still statistically significant for the [+1,+1] and
trading days windows (upper and lower left plots, respectively). The impact of earnings news on the post-announcement stock betas also remains economically significant. For instance, for a second week following the release of earnings information market beta declines from 2.5 to 1 when the standardized unexpected earnings increase from -2 to 2. The effect of earnings news on market beta remains pronounced for the [+11,+20] trading days window as well. Similar to our previous results when the analysts’ consensus forecasts were used, the impact of earnings announcements on market beta seems to dissipate four weeks after the earnings news is released.

Insert Figure 2 approximately here

Overall, based on the results of nonparametric analysis we find that the null hypothesis of market beta being unaffected by earnings news is strongly rejected. More specifically, market beta tends to increase (decrease) following negative (positive) earnings surprises. Curiously, the impact of earnings news on market beta appears to be more pronounced and persistent when we define earnings surprise based on the analysts’ consensus forecast compared to the one based on a random-walk model. This finding seems to complement the results of Doyle, Lundholm and Saliman (2003) and Livnat and Mendenhall (2006) by suggesting that conditioning upon different earnings surprise measures not only leads to different post-announcement drift patterns but also affects differently the post-announcement measures of market risk.

5.2 Parametric Time-Series Model

As discussed above, while being fairly flexible nonparametric model of conditional beta does not account for the characteristics of individual firms. Also, the flexibility of a nonparametric model achieved by not imposing any functional form on the relation between earnings news and stock betas comes at cost of relatively large standard errors as typical to the nonparametric estimators. Thus, to gain further insight into dynamics of post-earnings announcement stock betas we turn now to estimation results of parametric models described
in Section 4.2. We proceed as follows. First, following Livnat and Mendenhall (2006) we classify all firms into ten portfolios based either on the analysts’ consensus or time series earnings surprise. That is, first portfolio includes firms with the earnings surprises below 10-th percentile ("bad" news) while the last one includes all the firms with earnings news above 90-th percentile ("good" news). Throughout the following sections we shall focus on the firms included in the extreme earnings news deciles (that is "bad" and "good" news firms) since these firms will be used to form the post-announcement drift hedge portfolio. As a next step, for each firm included in either first or tenth earnings decile portfolio we collect its stock price data over the period of January 1996-December 2005. This data is matched with the returns on equally weighted CRSP portfolio over the same time period and used to calculate the estimates of a parametric time-series beta model described in Section 4.2. For all firms the models are estimated using a two-step approach (Patton, 2006).

The estimates (not reported for the sake of saving the space)\(^6\) are in line with previous studies. In particular, the mean estimate of the AR(1) loadings for the individual firms is positive and statistically significant, suggesting that the adjustment of security prices to new information is less than complete. Similar results are reported, among others, by Damodaran (1993) and Theobald and Yallup (2004). Mean estimate of the MA(1) loading is negative and statistically significant, a finding which consistent with negative serial correlation induced by the bid-ask spread (Roll, 1984). Both the stock return and market volatilities are highly persistent. Furthermore, the mean estimate of \(\rho_3\) is negative and statistically significant, a finding which suggests that following positive (negative) shocks correlation between the stock and market portfolio returns is declining (increasing).

To study the impact of the earnings news on stock betas, we compare average estimates of static versus dynamic betas over the period of 120 trading days following the earnings announcement. Static betas are estimated using a [-43,-1000] days period (approximately 4 years before the announcement)\(^7\) whereas the dynamic betas are estimated as discussed in Section 4.2. The estimates are depicted in Figure 3, where the upper (lower) plot depicts

\(^6\)We follow the suggestion of an anonymous referee on this issue.
\(^7\)Our conclusions remain robust with respect to different pre-announcement estimation windows.
average estimated betas for the 10-th (1-st) earnings surprise decile, calculated using analysts’ consensus forecasts. Average static (or the "long-run") betas are denoted by solid lines while average dynamic betas (estimated using a constant correlation model) are depicted by dotted lines.

Starting with the "good" news firms, conditional betas experience a substantial increase during the first couple of days following the release of earnings information due to an increase in stock return volatility following the release of new information. However, starting from the fifth trading day this tendency reverts and betas continuously decline approximately over the next 70 trading days and then gradually revert towards their long-run estimates, namely, static betas.

The impact of earnings news on stock betas is substantially more pronounced for the "bad" news firms. During first few days following the earnings announcement betas experience a dramatic (about 70%) increase in their values compared to their static estimates. As the initial information shock dissipates, stock betas slowly converge to their long-run values. It is noteworthy that due to stock return volatility being persistent, the impact of earnings news on betas is long living as well— even after 120 trading days conditional betas are still way above their long-run estimates.

The dynamics of the post-announcement betas is similar when using time-series based instead of the analysts’ consensus earnings surprise measure. The estimates are depicted in Figure 4. Interestingly enough, when measured using a random-walk model, the impact of earnings news on stock betas appears to be less pronounced compared to the one when the analysts’ consensus forecasts are used. This observation is consistent with our previous findings from the nonparametric analysis.
6 Earnings News, Stock Betas and the Post-Earnings Announcement Drift

Is the impact of earnings news on stock betas economically significant? To address this issue we ask the following question: what kind of measurement error (if at all) is induced by not taking into account the impact of the earnings news on stock betas while calculating the returns on the post-earnings announcement hedge portfolios? Let us recall that hedge portfolio is constructed by going long on firms in the upper earnings surprise decile ("good" news firms) and shorting those in the lower decile ("bad" news firms). For each firm risk-adjusted (or abnormal) returns are calculated using the risk measure (in our case, stock betas) estimated using pre-announcement sample. As a result, these static estimates of betas are likely to overestimate post-announcement market risk for the firms with extremely positive earnings news. Following the same line of reasoning, the post-announcement market risk of the firms who reported "bad" earnings news is likely to be underestimated. As a result, using static beta estimates will cause the abnormal return on the post-announcement hedge portfolio to be underestimated.

To assess economic significance of this measurement error we compare the returns on hedge portfolios calculated using both standard (static) and dynamic approaches of estimating betas. To set forth notations, let \( \hat{\alpha} \) and \( \hat{\beta} \) be the estimates of market model. Also, let \( \hat{\beta}_t \) be the estimate of dynamic beta calculated using the estimates of parametric model discussed in Sections 4.2 and 5.2. Then, for each firm the abnormal return, \( AR_t \), is calculated as follows

\[
AR_{t,s} = r_{s,t} - \hat{\alpha} - \hat{\beta} r_{m,t}
\]

when using static betas and

\[
AR_{t,d} = r_{s,t} - \hat{\alpha} - \hat{\beta}_t r_{m,t}
\]

when using dynamic beta estimates. Similarly, cumulative average abnormal return for the
In the time window \([t_1, t_2]\), the CAAR is calculated as

\[
CAAR_{t_1, t_2} = \frac{1}{N} \sum_{j=1}^{N} \sum_{t=t_1}^{t_2} (AR_{t,s,j})
\]

when using static market risk measure and

\[
CAAR_{t_1, t_2} = \frac{1}{N} \sum_{j=1}^{N} \sum_{t=t_1}^{t_2} (AR_{t,d,j})
\]

when using dynamic beta estimates.

The estimated CAAR’s are depicted in Figure 5. Here we plot cumulative average abnormal returns on hedge portfolio over 60 trading days (approximately one quarter) following the earnings announcement. Solid line denotes CAAR’s calculated using static betas, estimated over the time window of \([-43,-1000]\) days. Dotted and dashed lines denote CAAR’s calculated using dynamic betas with constant and time-varying correlations, respectively. CAARs of hedge portfolios constructed using the analysts’ consensus (time-series) based earnings surprise measures are depicted in the upper (lower) plot.

Overall, the dynamics of hedge portfolio returns is consistent with the notion of a post-announcement drift phenomenon reported in related studies. When the analysts’ consensus forecast is used to calculate earnings surprise measure an investment strategy which involves buying shares of "good-news" firms and selling short stocks of "bad-news" companies yields the abnormal return of 7.4% over the holding period of 60 days, when static beta estimates are used. On the other hand, when leverage effect is taken into account the magnitude of the post-announcement drift substantially increases. The abnormal return on hedge portfolio calculated using a dynamic beta specification with constant correlation is 8.8% which constitutes an increase of 1.4% compared to CAARs calculated using standard static beta approach. Allowing time-variation is conditional correlation between stock and market returns leads to further, though, limited increase in hedge portfolio returns.
Turning to the analysis of hedge portfolio returns constructed using time-series based earnings surprise proxy we find that, overall, our conclusions remain unaltered. The return on hedge portfolio is 2.9% over the 60-days holding period when static beta estimates are used. On the other hand, when the impact of the earnings news is taken into account, the estimated abnormal return increases to 3.6%. Furthermore, when the correlation coefficient between the stock and market returns is allowed to be affected by lagged returns as well the 60 day abnormal return on hedge portfolio is 4.3%.

We conduct some formal tests to compare the magnitude of static versus dynamic beta drift estimates. The results are reported in Table II. We calculate CAARs over different interval within [+1,+60] days time-window using three different specifications of stock betas: static (standard approach), dynamic with constant correlation (Dynamic I, eq.7), dynamic with time-varying correlation (Dynamic II, eq.8). The difference between the static and dynamic beta drift estimates is tested by means of $t$-test. Our results suggest that the magnitude of the post-earnings announcement drift is significantly larger when post-announcement shifts in stock betas are taken into account compared to the one estimated using a static beta approach. More specifically, the differences between the 60-days abnormal return on hedge portfolio calculated using static and dynamic beta models are 1.36% for the constant correlation model and 1.4% for the time-varying correlation model when the analysts’ consensus forecasts are used. Both differences are highly statistically significant. When the time-series model is used to calculate the earnings surprise measure, the differences between the static and dynamic beta 60-days CAARs with constant and time-varying correlations are 0.7% (significant at 10% level) and 1.46% (significant at 5% level), respectively.

Two notable observations should be mentioned. First, the magnitude of a post-earnings announcement drift (calculated using either static or dynamic beta specifications) appears to be substantially larger when the analysts’ consensus forecasts are used then when a
random-walk based earnings forecasts are used. This observation is consistent with findings of Doyle, Lundholm and Soliman (2004) and Livnat and Mendenhall (2006). While both our sample selection and calculation of earnings surprise measures differ from those used in these studies, our findings are consistent with their conclusions that the post-earnings announcement drift is more pronounced when the earnings surprise measure is calculated using analysts’ forecasts.

Second, the magnitude of the post-earnings drift (calculated using a standard static beta approach) differs from the one reported in previous studies. More specifically, when using analysts’ consensus forecasts the 60-days drift (7.4%) appears to be higher than the one reported by Liang (2003) and Livnat and Mendenhall (2006), who estimate the 60-days abnormal return on hedge portfolio to be approximately 6% and 4.9%, respectively. One potential reason for such a discrepancy is an increased tendency of firms to release earnings news after the stock market is closed (Berkman and Truong, 2008). Since, compared to these studies, we use a more recent time period, this may lead to potential overestimation of a drift. The abnormal return on hedge portfolio calculated starting from a second day following the earnings announcement (using static betas) is 4.3% which is close to the estimate reported by Livnat and Mendenhall (2006). However, this should cause the magnitude of a post-announcement drift calculated using a time-series model to be overestimated as well. Comparing our results (2.9%) with those reported by Livnat and Mendenhall (3.7%) we conclude that the discrepancy is not likely to be attributed to a wrong choice of "day zero" but rather to different ways of calculating the abnormal returns. More importantly, even if our sample selection procedure creates some sort of bias in the estimates of a post-announcement drift, this bias will equally affect both static and dynamic beta based estimates of a drift and, thus, should not affect the comparison of these two measures, which is the main purpose of this section.
7 Summary and Conclusions

In this paper we examine the impact of the earnings news on stock betas. Our research is motivated by previous studies, such as Braun et al. (1995) and Engle and Cho (1999), who report the presence of a leverage effect in market risk, namely, the tendency of stock betas to increase (decline) following the release of "bad" ("good") news. Based on these findings, we hypothesize that not taking into account leverage effect causes an upward (downward) bias in stock betas estimates for the firms with positive (negative) earnings surprises.

Our results suggest that the post-earnings announcement stock betas do change depending on the nature of the earnings news. More specifically, we find that betas tend to increase (decline) when the earnings surprise is negative (positive). This finding is consistent with a leverage effect theory (Black, 1976), which suggests that as the value of equity falls equity holders perceive the future income as being relatively more risky. Our findings are robust with respect to different earnings surprise measures and model specifications.

Furthermore, we find that not taking into account the impact of the earnings news on market risk causes the magnitude of the post-earnings announcement drift to be significantly underestimated. More specifically, the 60-days abnormal return on a hedge portfolio, which involves buying (selling short) stocks with the highest (lowest) earnings surprises is underestimated by approximately, 140 basis points when a standard approach of estimating betas using a pre-announcement window is used.

Our findings have important implications for the event-study literature. We point out the importance of controlling for changes in firms’ market risk characteristics following the release of earnings news. A failure to do so results in substantial underestimation of the post-announcement abnormal returns and, consequently, induces a downward bias in the magnitude of the drift which, in turn, may lead to wrong conclusion regarding informational efficiency of stock markets.

A number of promising research directions can be considered. First, it would be interesting to study the "leverage effect" in context of other linear factor models, such as
three-factor model of Fama and French (1993). The question of whether shifts in the post-announcement market risk sensitivities (CAPM betas) fully capture the "leverage effect" or whether it impacts the size and "value minus growth" factor betas as well may have important implications both for the asset pricing and accounting literature. A research methodology proposed in this paper can easily be extended to address this question. Second, a relation between the magnitude and persistence of the "leverage effect" in stock betas and firm specific factors can be addressed as well. In particular, informational environment characteristics such as the analysts' coverage may be considered as potential determinants of the earnings-market risk relation.
References


### Table I

**Descriptive Statistics**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>St.Dev.</th>
<th>10th Pctl.</th>
<th>25th. Pctl.</th>
<th>Median</th>
<th>75th. Pctl</th>
<th>90th. Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAR (-1, 0)</td>
<td>2804</td>
<td>0.127</td>
<td>7.7</td>
<td>-6.33</td>
<td>-2.56</td>
<td>0.072</td>
<td>2.63</td>
<td>6.21</td>
</tr>
<tr>
<td>Time-Series</td>
<td>2804</td>
<td>-0.135</td>
<td>2.82</td>
<td>-2.12</td>
<td>-0.68</td>
<td>0.19</td>
<td>0.87</td>
<td>1.67</td>
</tr>
<tr>
<td>Analysts</td>
<td>2804</td>
<td>-0.149</td>
<td>4.52</td>
<td>-0.012</td>
<td>-8.5\times10^{-4}</td>
<td>2.35\times10^{-4}</td>
<td>0.0015</td>
<td>0.005</td>
</tr>
<tr>
<td>Book Value&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>2769</td>
<td>1609.6</td>
<td>5317.1</td>
<td>47.9</td>
<td>118.8</td>
<td>323.3</td>
<td>989.5</td>
<td>3469.8</td>
</tr>
<tr>
<td>Market Value&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>2790</td>
<td>4446.3</td>
<td>17214</td>
<td>68.9</td>
<td>197.2</td>
<td>687.7</td>
<td>2289.9</td>
<td>8224.7</td>
</tr>
<tr>
<td>Total Assets&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>2770</td>
<td>9420.5</td>
<td>52347</td>
<td>96.5</td>
<td>264.5</td>
<td>866.1</td>
<td>3188.9</td>
<td>13849.5</td>
</tr>
</tbody>
</table>

In this Table we report selected descriptive statistics of the firms and announcements included in our sample. CAR (-1, 0) denotes cumulative abnormal return over the [-1,0] days window. Abnormal returns are calculated using market model. Descriptive statistics of the time-series and analysts’ consensus earnings surprise series are reported under "Time-Series" and "Analysts" headings, respectively. Book (Market) Value<sub>t-1</sub> denote book (market) value of equity at the end of a last fiscal year before the earnings announcement was released (in millions of dollars). This date was obtained from COMPUSTAT and CRSP. Total Assets<sub>t-1</sub> denote book value of total assets at the end of a last fiscal year before the earnings announcement was released (in millions of dollars). This data was collected from COMPUSTAT/CRSP merged database.
Table II

Hedge portfolio returns with static and dynamic betas

Panel A: Analysts’ consensus forecasts

<table>
<thead>
<tr>
<th>Window</th>
<th>Static</th>
<th>Dynamic I</th>
<th>Dynamic II</th>
<th>Dynamic I-Static</th>
<th>Dynamic II-Static</th>
</tr>
</thead>
<tbody>
<tr>
<td>[+1,+5]</td>
<td>0.0503** (5.29)</td>
<td>0.0532** (5.54)</td>
<td>0.0532** (5.55)</td>
<td>0.0029* (1.82)</td>
<td>0.0029 (1.56)</td>
</tr>
<tr>
<td>[+6,+20]</td>
<td>0.0241 (1.46)</td>
<td>0.0313* (1.88)</td>
<td>0.0312* (1.87)</td>
<td>0.0072** (2.61)</td>
<td>0.0071** (2.21)</td>
</tr>
<tr>
<td>[+1,+60]</td>
<td>0.0747** (2.27)</td>
<td>0.0883** (2.66)</td>
<td>0.0887** (2.67)</td>
<td>0.0136** (2.46)</td>
<td>0.014** (2.18)</td>
</tr>
</tbody>
</table>

Panel B: Time-series forecasts

<table>
<thead>
<tr>
<th>Window</th>
<th>Static</th>
<th>Dynamic I</th>
<th>Dynamic II</th>
<th>Dynamic I-Static</th>
<th>Dynamic II-Static</th>
</tr>
</thead>
<tbody>
<tr>
<td>[+1,+5]</td>
<td>0.0097 (1.37)</td>
<td>0.0116* (1.64)</td>
<td>0.0106 (1.49)</td>
<td>0.0019* (1.66)</td>
<td>0.0009 (0.67)</td>
</tr>
<tr>
<td>[+6,+20]</td>
<td>−0.0026 (−0.21)</td>
<td>0.0011 (0.089)</td>
<td>0.0006 (0.048)</td>
<td>0.0037* (1.86)</td>
<td>0.0032 (1.37)</td>
</tr>
<tr>
<td>[+1,+60]</td>
<td>0.0292 (1.19)</td>
<td>0.0362 (1.46)</td>
<td>0.043* (1.74)</td>
<td>0.007* (1.76)</td>
<td>0.0146** (3.13)</td>
</tr>
</tbody>
</table>

In this Table we report cumulative abnormal returns on hedge portfolio calculated using static pre-announcement and dynamic estimates of stock betas (eq. 7 and 8). Hedge portfolio is constructed by buying shares of firms in 10-th earnings surprise decile and selling short those in 1-st decile. In Panel A earnings surprise is calculated using the analysts’ consensus forecast (eq.1). In Panel B earnings surprise is calculated using a time-series (seasonal random walk with drift) model (eq.2). CARs estimated using dynamic betas with constant (time-varying) correlations are reported under "Dynamic I" ("Dynamic II") headings, respectively. Last two columns report the difference between CAR’s with static and dynamic betas. *(**) denote significance at 10 (5)% level, respectively.
Figure 1: In this Figure we plot nonparametric estimates of the post-announcement stock betas (solid line) over different time-windows against the analysts’ consensus earnings surprise. Restricted estimates of beta under the null hypothesis of no relation between the earning news and stock betas are depicted by dashed line. The null hypothesis is rejected if the restricted estimates of beta cross the 95% confidence interval (denoted by dotted lines).
Figure 2: In this Figure we plot nonparametric estimates of the post-announcement stock betas (solid lines) over different time-windows against the earnings surprise calculated using a seasonal random walk model. Restricted estimates of beta under the null hypothesis of no relation between the earning news and stock betas are depicted by dashed lines. The null hypothesis cannot be rejected if the restricted estimates of beta lie within the 95% confidence interval (denoted by dotted lines).
Figure 3: In this Figure we depict static versus post-announcement dynamic betas. 1-st (10-th) decile includes the firms with the lowest (highest) analysts’ consensus earnings surprises. Solid line-static beta, dotted line-dynamic beta.
Figure 4: In this Figure we depict static versus post-announcement dynamic betas. 1-st (10-th) decile includes the firms with the lowest (highest) standardized unexpected earnings. Solid line-static beta, dotted line-dynamic beta.
Figure 5: In this Figure we plot CAARs for the hedge portfolios calculated using static and dynamic estimates of market betas over a 60-days period following the release of earnings news. Solid line denotes CAARs estimated using static betas. CAARs estimated using dynamic betas with constant (time-varying) correlations are denoted by dotted (dashed) lines. All firms are ranked based on the analysts’ consensus (upper plot) or time-series earnings surprise (lower plot).