Pre-Earnings Announcement Drift

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Abstract

We present evidence of a predictable drift in stock prices before the earnings announcements of firms that announce their earnings later than other firms in their industry. We form portfolios based on the returns of later announcers that are implied by the abnormal returns of earlier announcers and the historical pair-wise covariance of the abnormal earnings announcement date returns of earlier and later announcers. A long-short trading strategy based on these implied returns generates monthly returns of more than 100 basis points. The drift is neither due to the well-known momentum effect nor a manifestation of post-earnings announcement drift; it is evident both *between* the earlier announcers' earnings announcement dates and the later announcers' earnings announcement dates and *at* the later announcers' earnings announcement dates. The continued under-reaction after later announcers' earnings announcements is shown to be an under-reaction to the later announcers' own earnings announcements (i.e., post-earnings announcement drift) rather than a continued under-reaction to the earnings news of earlier announcers (i.e., pre-earnings announcement drift). We show that transaction costs explain the predictability of later announcers' returns.

1. Introduction

We present evidence of a predictable drift in stock prices *before* the earnings announcements of firms that announce their earnings later than other firms in their industry. This phenomenon, which we call pre-earnings announcement drift, is similar to post-earnings announcement drift inasmuch as there is an under-reaction to the news in the earnings announcement. Pre-earnings announcement drift occurs after the (earlier) announcement of earnings of related firms but before the earnings announcement of later announcers. Post-earnings announcement drift occurs after the firm's own earnings announcement.[1]

Within each of the thirty industries identified by Fama and French (1997), for a sample of firms making regular earnings announcements in the preceding five years, we estimate the pair-wise covariance of three-day earnings-announcement-period abnormal returns.[2] We use the returns of the earlier announcers in the industry and the historical covariance to calculate firm-level future implied returns for each of the later announcers in the industry. We refer to these returns as "covariance implied returns".[3] We form portfolios based on the firm-level covariance implied returns and we conduct tests of efficient asset pricing.

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[1] Earnings announcements provide information about earnings of the announcing firms themselves, of peer firms in the same industry, and of related firms in other industries. Beaver (1968) and Ball and Shivakumar (2008) provide evidence on information revealed by quarterly earnings announcements. Cohen and Frazzini (2008), and Menzly and Ozbas (2007) show that earnings news from one industry may affect security returns in another industry. We focus on the dynamics of information transfer in a setting where firms within an industry make quarterly earnings announcements sequentially. The earnings news from earlier announcers may contain information relevant to later announcers, and thus this information may affect the prices of later announcers (Foster, 1981; Freeman and Tse, 1992; Ramnath, 2002).

[2] The covariance is based on the 16 earnings announcement period returns from the first four years of this five year period. We avoid the possibility of capturing earnings momentum effects by eliminating the fifth year (i.e., the year prior to the current earnings announcement).

[3] The words "earlier" or "later" in this paper describe the relative sequence of earnings announcements. They do not mean that a firm announces earnings earlier or later than what is scheduled or usual. We do, however, conduct some analyses of sub-samples of firms where the earlier announcers are both earlier relative to other firms in the industry and either earlier or later relative to their own earnings announcement in the same quarter of the previous year.

Our primary observation is that the returns implied by the covariance contain information about individual stock-level future returns; in other words, the market does not fully incorporate the information contained in the earnings news from earlier announcers. For example, a long-short portfolio strategy, which begins immediately after the earlier announcers' earnings announcements, that consists of buying the stocks with the highest covariance implied returns and short-selling the stocks with the lowest covariance implied returns earns 105 basis points per month (t-statistic of 4.02); the long-short portfolio returns remain essentially the same after risk adjustment. The return spread of the long-short portfolio is evident both *between* the earlier announcers' earnings announcement dates and the later announcers' earnings announcement dates and *at* the later announcers' earnings announcement dates. There is only very limited evidence of return continuation or and no evidence of reversals after the earnings announcements of later announcers. In fact, we show that the continued under-reaction after the later announcers' earnings announcement dates is an under-reaction to the later announcers' own earnings announcement (i.e., post-earnings announcement drift) rather than a continued under-reaction to earnings news of the earlier announcers (i.e., pre-earnings announcement drift).

We attribute the pre-earnings announcement drift to transaction costs. We show that earlier announcers on average have lower transaction costs while later announcers have substantially higher transaction costs. The time-series patterns of portfolio returns based on covariance implied returns are consistent with this explanation. First, the observed returns to the long-short strategy are economically small and statistically weak for the sample of stocks with low transaction costs. The returns mainly come from later announcers, which have larger transaction costs. Second, the return predictability ceases to exist after the earnings announcements of later announcers. This is consistent with the view that value relevant earnings news from earlier announcers is incorporated in the prices of later announcers only when the gains from trading on the cumulative effects of the news outweigh the associated transaction costs (Constantinides, 1986).

Our paper adds to the literature in several ways. First, many prior studies document inefficiency in investors' reactions to a firm's own past earnings information (Ball and Brown, 1968; Foster, Olsen, and Shevlin, 1984; Bernard and Thomas, 1989 and 1990; Mendenhall, 1991; and Chan, Jegadeesh, and Lakonishok, 1996); but there is little work that systematically investigates the efficiency with which investors incorporate earnings news into the prices of peer firms in the same industry prior to their (later) earnings announcements. The notable exception is Ramnath (2002), who investigates how information from the very first earnings announcer within each industry affects the prices of later announcers.[4] Using eleven quarters of data on 428 stocks and adopting an event-time approach, Ramnath (2002) finds that the earnings information for the earliest announcing firm within an industry may be used to predict both the earnings surprise and the returns of other firms within the industry. Ramnath (2002) and our paper differ in terms of empirical research design, sample selection and coverage, and interpretation of results.[5]

Since Ramnath's (2002) paper is most closely related to ours, we provide further detail regarding the differences. First, Ramnath (2002) focuses on *the first* announcer's return implications for *all* subsequent announcers' earnings announcement period returns. We consider the effect of *all* earlier announcers' information on the returns of *all* subsequent announcers; this

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[4] Excluding the very first earnings announcer(s) of each industry-group does not change our results. In other words, the cross-sectional return predictability derives from both the first announcer(s) in the industry and from subsequent announcers.

[5] Our work is also related to Thomas and Zhang (2008) who find that late announcers' own earnings announcement period returns are on average negatively correlated with the late announcers' returns during the early announcers' announcement window. Essentially, Thomas and Zhang (2008) are concerned about a security's return at two points in time: the firm's own earnings announcement interval, and the early announcers' announcement interval. Their results focus on the return autocorrelation at the individual stock level whereas we focus on return predictability from cross-sectional correlations.

exercise is possible because our analyses are based on the covariance implied returns, which facilitates analysis of the relation between the returns of all earlier announcers and those of all subsequent announcers. Second, in addition to an analysis of announcement period returns, we provide evidence on the evolution and resolution of the information transfer. We focus on pre-, during and post-earnings announcement period returns. We show that the under-reaction is not just during later announcers' earnings announcement periods, but prior to earnings announcement dates as well; in other words, we show evidence of a drift. Interestingly, the intra-industry information transfer resolves almost completely by the actual earnings announcement date, although there is some evidence of continuing under-reaction for the following week. Third, we provide evidence that transaction costs likely explain the drift in returns. Fourth, instead of relying on a sample of stocks followed by analysts, our research design/question allows us to use a much larger sample and a much longer time period.

The paper proceeds as follows. Section 2 presents the concept of covariance implied returns, and describes the empirical tests based on these covariance implied returns. Section 3 discusses the data and sample selection. Section 4 analyzes the performance of the portfolios constructed on the basis of covariance implied returns and provides evidence of pre-earnings announcement drift.[6] Section 5 explores transaction costs as a possible explanation for the drift. Section 6 concludes.

2. Covariance Implied Returns

In this section, we introduce the concept of covariance implied returns and show how the

[6] We include numerous robustness checks in section 4. For instance, we address the concern that capturing the earnings news via the covariance of announcement date returns is somewhat crude and our results may be a spurious effect of measurement error or data mining. Using simulated data in which we randomly generate the co-variations among earnings announcement period returns, we reject the hypothesis that spurious co-variation may drive our empirical results.

covariance implied returns for later announcers are derived from the earlier announcers' earnings announcement period returns. This concept facilitates our analysis of all earlier announcers and all later announcers. We describe the formation of our portfolios based on these covariance implied returns and provide details of our asset pricing tests.

2.1. Covariance Implied Returns: Computation

We compute the covariance implied returns as follows. First, at the end of quarter T, for each pair of firms (*i*, *j*) within each of the Fama and French (1997) thirty-industry classifications, we estimate the sample covariance of average daily abnormal returns during the three-day earnings announcement periods in the 16 quarters for the four years ending a year before the quarter Q of interest (in other words we do not include the most recent four quarters):[7]

$$\hat{C}_{i,j} = \frac{1}{16} \sum_{q=Q-20}^{Q-5} \left(R_{iq} - \bar{R}_i\right)\left(R_{jq} - \bar{R}_j\right) \qquad (1)$$

where $\hat{C}_{i,j}$ is the sample covariance of the average daily abnormal returns, R_{iq} is the average daily abnormal return of firm i in the earnings announcement period for quarter q, $\bar{R}_i$ is the sample mean of the average abnormal daily returns for firm i in earnings announcement periods for the past 16 quarters,

$$\bar{R}_i = \frac{1}{16} \sum_{q=Q-20}^{Q-5} R_{iq}$$

Second, on each subsequent earnings announcement day during quarter Q, we assume that the abnormal returns on the earnings announcement day of earlier announcers contain useful information about those of later announcers and that this is captured in the abnormal return covariance (equation (1)). It follows that we can use the following approximation to estimate the

[7] These recent quarters are excluded in order to ensure that we are not capturing the well-known momentum effect. Chan, Jegadeesh, and Lakonishok (1996) show that an earnings momentum strategy based on the cumulative earnings announcement period abnormal returns is profitable within a one year horizon (see Table IV of their paper) but not beyond one year.

abnormal return of a later announcer *j* in the same quarter:

$$\hat{C}_{i,j} = \left(ER_{i,Q} - \bar{R}_i\right)\left(IR_{j,Q} - \bar{R}_j\right) \tag{2}$$

where $\hat{C}_{i,j}$ is the sample covariance estimate from equation (1), $ER_{i,Q}$ is the daily abnormal return of firm *i* on its earnings announcement day in quarter *Q*, $IR_{j,Q}$ is the implied abnormal return of firm *j* on an unknown later earnings announcement date in quarter *Q*. Thus, the covariance implied return ($IR_{j,Q}$) for firm *j* is defined as:[8]

$$IR_{j,Q} = \frac{\hat{C}_{i,j}}{ER_{i,Q} - \bar{R}_i} + \bar{R}_j \equiv \frac{1}{16}\sum_{q=Q-20}^{Q-5}\left(\frac{R_{iq} - \bar{R}_i}{ER_{i,Q} - \bar{R}_i}\right)\left(R_{jq} - \bar{R}_j\right) + \bar{R}_j \tag{3}$$

The ratio term within the summation operator, $\frac{R_{iq} - \bar{R}_i}{ER_{i,Q} - \bar{R}_i}$, essentially compares an earlier announcer's earnings announcement period abnormal return during the new quarter, $ER_{i,Q} - \bar{R}_i$, to its historical earnings announcement period abnormal return, $R_{iq} - \bar{R}_i$. This ratio serves as a scaling factor to scale the historical earnings announcement period abnormal return, $R_{jq} - \bar{R}_j$, of a later announcer.

On each earnings announcement date of the earlier announcers, we use the estimate from equation (3) to compute the covariance implied returns of the firms that have not yet reported their earnings (i.e., the "later announcers").

2.2. Computing Covariance Implied Returns with Multiple Earlier Announcers

When there are multiple firms announcing earnings on the same day, we modify equation (3)

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[8] As shown in equation (3), the total implied returns of later announcers *j* comes from two components: a covariance and an average abnormal return. Since our focus is on the effect of the covariance, we attempt to minimize the effect of the average abnormal return component; we do this because there is empirical evidence that past earnings have considerable predictive power for future returns, especially for average abnormal returns from the most recent four quarters' earnings announcements. To achieve this objective, we skip the most recent four quarters when we compute the abnormal return covariance and the average abnormal return. In Appendix A, we show that using average earnings announcement period abnormal returns during the past 20 quarters, excluding the most recent four quarters, effectively removes the return predictability due to the past average abnormal returns. Thus, we can claim that our results are not a manifestation of the earnings momentum effect.

by using the absolute values of the t-statistics of the covariance estimates as the weights to calculate the implied returns of later announcers.[9] For example, suppose that firms *i* and *m* have announced earnings on the same date, while firms *j* and *n* have not yet announced; in this case the implied returns are calculated as:

$$
\begin{aligned}
NR_{j,Q} &= w_{ij}\left(\frac{\hat{C}_{i,j}}{ER_{i,Q}-\bar{R}_i}+\bar{R}_j\right)+w_{mj}\left(\frac{\hat{C}_{m,j}}{ER_{m,Q}-\bar{R}_m}+\bar{R}_j\right) \\
NR_{n,Q} &= w_{ij}\left(\frac{\hat{C}_{i,n}}{ER_{i,Q}-\bar{R}_i}+\bar{R}_n\right)+w_{mj}\left(\frac{\hat{C}_{m,n}}{ER_{m,Q}-\bar{R}_m}+\bar{R}_n\right)
\end{aligned}
\tag{4}
$$

where the weights w_{ij}, w_{mj}, w_{in} and w_{mn} are the weighted averages of the *t*-statistics of the abnormal return covariance estimates across the pairs, or[10]

$$
\begin{aligned}
w_{ij} &= \frac{|t_{ij}|}{|t_{ij}|+|t_{mj}|},\ w_{mj} = \frac{|t_{mj}|}{|t_{ij}|+|t_{mj}|}, \\
w_{in} &= \frac{|t_{in}|}{|t_{in}|+|t_{mn}|},\ w_{mn} = \frac{|t_{mn}|}{|t_{in}|+|t_{mn}|}.
\end{aligned}
\tag{5}
$$

2.3. Portfolio Construction Based on the Covariance Implied Returns; Partitioning on the "Goodness" of the News

For each firm satisfying the data requirements, we calculate the average abnormal return over

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[9] The t-statistic is derived under the null hypothesis that the covariance is equal to zero. This same weighting scheme is used to facilitate analysis of early earnings announcement intervals longer than a day. We expand the interval one day at a time up to 15 days. Although the results of all of our analyses are weaker when we use intervals longer than one day, the long/short portfolio abnormal returns remain significant at the one percent level.

[10] Alternatively, we use the weighted averages of the abnormal return covariances across the pairs to compute the weights, or

$$
\begin{aligned}
w_{ij} &= \frac{|\hat{C}_{ij}|}{|\hat{C}_{ij}|+|\hat{C}_{mj}|},\ w_{mj} = \frac{|\hat{C}_{mj}|}{|\hat{C}_{ij}|+|\hat{C}_{mj}|}, \\
w_{in} &= \frac{|\hat{C}_{in}|}{|\hat{C}_{in}|+|\hat{C}_{mn}|},\ w_{mn} = \frac{|\hat{C}_{mn}|}{|\hat{C}_{in}|+|\hat{C}_{mn}|}.
\end{aligned}
\tag{6}
$$

An advantage of the weighting scheme in (5), compared to (6), is that the t-statistics of the covariance estimates reflect the precision of the estimates by assigning more weight to more precise estimates and less weight to less precise estimates. Results using the weighting scheme in (6) are qualitatively similar to those using the weighting scheme in (5), but the portfolio returns produced by the weighting based on *t*-statistics are about ten to fifteen basis points higher per month.

the three-day event window, (-1, 0, +1), surrounding the earnings announcement date. We use the CRSP value-weighted market index to obtain the daily abnormal returns.[11] That is, we compute the average abnormal return as follows:

$$R_i = \frac{1}{3}\sum_{d=-1}^{+1}\left(R_{i,d} - BR_d\right)$$

where R_{id} is the daily stock return of the earnings announcement firm on day d, BR_d is the return on the CRSP value-weight index on day d.

After obtaining each firm's average abnormal returns in the 16 quarters of the four years prior to the previous year, we estimate the pair-wise covariance $\hat{C}_{i,j}$, the average abnormal returns among the firms within the same industry, and the average abnormal return over these quarters $\overline{R}_j$.

Next we form portfolios based on the covariance implied returns. Specifically, in each calendar quarter Q, we form portfolios immediately after the first earnings announcement in that quarter. On each earnings announcement date τ, we compute the covariance implied returns $IR_{i,\tau}$ for all stocks with later earnings announcements (see equation (3)).[12] We use these covariance implied returns to place each later announcer into one of the five portfolios as at the close of trading on date τ. The first portfolio ($p = 1$) consists of the later announcers with the lowest covariance implied returns, and the fifth portfolio ($p = 5$) consists of the later announcers with the highest covariance implied returns. Portfolio 1 may be described as the "bad" news portfolio, and the news may be seen as getting better as we move from portfolio 1 to portfolio 5. The long-short portfolio strategy buys in the highest covariance implied return ("good" news) portfolio and short-sells the lowest covariance implied return ("bad" news) portfolio.

2.4. Calculation of Monthly Portfolio Returns

[11] Since daily expected returns are close to zero, the choice of benchmark portfolio to adjust the daily return is a relatively unimportant issue (Fama, 1998).

[12] If there are multiple early announcers, we use the weighting procedure described in equation (5) and (6).

After determining the composition of each quintile portfolio as of the close of trading on date τ, we compute the value-weighted return for date τ+1. Each portfolio *p's* return on day $\tau+1$ is denoted as $R_{p\tau+1}$, and calculated as:

$$R_{p\tau+1} = \sum_{i=1}^{n_{p\tau}} \omega_{i\tau} R_{i\tau+1}$$

where $\omega_{i\tau}$ is the market capitalization for later announcer *i* divided by the sum of market capitalization of all later announcers in portfolio *p*, both of which are computed as of the close of trading on date τ; $R_{i\tau+1}$ is the return on the common stock of later announcer *i* on date $\tau+1$; and $n_{p\tau}$ is the number of later announcers in portfolio *p* on date τ. Daily buy-and-hold portfolio returns are accumulated into monthly returns.[13]

We hold the portfolios until the occurrence of a later earnings announcement, and rebalance them at this later earnings announcement date. We rebalance for either of the following two reasons: (1) in order to completely remove the well-known post-earnings announcement drift effect (Ball and Brown, 1968; Foster, Olsen, and Shevlin, 1984; Bernard and Thomas, 1989, 1990), we immediately exclude earlier announcers in our trading strategy when forming portfolios; and/or (2) the covariance implied returns -- and the rankings based on these covariance implied returns -- of the later announcers can change, so that some of the later announcers yet to announce their earnings, may move from one quintile to another upon a new earnings announcement.

[13] We use value-weights rather than equal-weights in the calculation of daily portfolio returns for the following three reasons: (1) equal-weighting of daily returns leads to portfolio returns that may be overstated because of the so-called "bid-ask bounce effect" (see Blume and Stambaugh, 1983; Barber and Lyon, 1997; Canina et al., 1998; and Lyon, Barber and Tsai, 1999); (2) equal-weighting of daily returns essentially assumes daily rebalancing of portfolios, which could further overstate the economic magnitude of the returns: and, (3) value-weighting of daily returns better captures the economic significance of the covariance implied returns because equal-weighting of returns over-represents smaller firms. Value-weighting may bias against finding any evidence of abnormal returns, since stocks with larger market capitalization are more likely to be informationally efficient -- including efficiency in the incorporation of information from the early announcers. Our method for aggregating daily portfolio returns to obtain monthly returns is also adopted in Barber et al. (2001).

We also maintain the following criteria in our portfolio strategy in order to continuously accumulate daily returns: (1) if the first trading date in a three-month announcing period is not an earnings announcement date, we invest in T-bills until the first earnings announcement; (2) if on any particular earnings announcement date, we have less than five stocks in either the top or bottom quintile portfolio, we also invest in T-bills; and, (3) we complete the portfolio strategy on the last trading date of the three-month announcing period.

2.5. Illustration of Implementation of the Covariance Implied Return Strategy

We illustrate the implementation of the covariance implied return portfolio strategy via an example described in Figures 1 and 2. In this example, there are 11 firms from two industries with earnings announcements in October. Industry 1 contains firms A, B, C, D, E, and F, and industry 2 contains firms u, w, x, y, and z.

- On the first earnings announcement date (10/3), firm A is an early announcer from industry 1. We calculate the implied returns for all late announcers (B, C, D, E, and F) based on the pair-wise covariance $\hat{C}_{i,j}$ and A's abnormal earnings announcement day return $ER_{i,t}$. Then we form quintile portfolios and hold them until the next earnings announcement. Since no firms from industry 2 have made earnings announcements yet, we do not use their returns in the portfolio formation at this stage.
- On the second earnings announcement date (10/6), firms B and C become early announcers for industry 1, and firm u becomes an early announcer from industry 2. Again we first calculate the implied returns for late announcers within each industry (i.e., stocks D, E, F, G, w, u, x, y, and z). Computation of the covariance implied returns for industry 2 is straightforward; however, a complication arises for industry 1 because there are multiple (two) early announcers -- firms B and C -- making earnings announcements on the same day.

As described in equations (4) and (5), we use the corresponding t-statistics as the weights to compute the implied returns for firms D, E, and F. Then we form quintile portfolios based on the ranking of implied returns of all remaining later announcers across these two industries. In this case, we form quintile portfolios using firms D, E, and F from industry 1, and firms w, x, y, and z from industry 2.

- On the third earnings announcement date (10/7), firm D is the only one announcing earnings. Thus, we calculate the implied returns for firms E and F from industry 1 together with the implied returns of firms from industry 2 calculated on the last earnings announcement date to form quintile portfolios. At that point, after the earnings announcement by firm D, our portfolios contain firms E and F from industry 1, and firms w, x, y, and z from industry 2.
- On the last earnings announcement date in our example (10/11), firms E and w make their earnings announcements. Since we do not have enough stocks to form quintile portfolios, we invest in T-bills from this point.

Figure 2 illustrates the calculation of portfolio monthly returns during a three-month earnings announcement period from October to December. Because the first earnings announcement date is 10/3, we hold T-bills until this date. Then, we start our covariance implied return strategy. On each earnings announcement date, we form quintile portfolios and calculate the daily portfolio buy-and-hold returns. The portfolio returns are value-weighted based on the market capitalization at the time of portfolio formation. If on a particular earnings announcement date, we are not able to form quintile portfolios, we hold T-bills. Similarly, we obtain the portfolio monthly return in October by accumulating the daily buy-and-hold returns within that month. Repeating the same procedure each month, we obtain a time-series of monthly returns for each quintile portfolio. The monthly returns of these quintile portfolios are the basis of our asset pricing tests.[14]

2.6. Estimation of Abnormal Returns

We calculate three estimates of abnormal returns for each of the five portfolios, as well as for a long-short portfolio: (1) the intercept from the Capital Asset Pricing Model (CAPM); (2) the intercept from the Fama and French (1993) three-factor model; and (3) the modification of the three-factor model by Carhart (1997), which adds a zero-investment portfolio related to the price momentum. Details of these abnormal return calculations are provided in Appendix C.

3. Data, Sample Selection and Summary Statistics

3.1. Data and Sample Selection

Stock prices, number of shares outstanding, and stock returns are obtained from the Center for Research in Security Prices (CRSP). Our sample consists of common stocks (share code 10 or 11) traded on NYSE, AMEX, and NASDAQ with quarterly earnings announcement dates available from the Compustat quarterly files.

To implement the portfolio strategy starting at the end of each calendar quarter from the third quarter of 1976 to the first quarter of 2008, we require that the stocks have prices greater than or equal to five dollars, that they have existed in the CRSP-Compustat merged file for at least five years, and that they have all 20 quarterly earnings announcements during these years. We require that the firm makes four quarterly earnings announcements each year, and has an earnings

[14] All of the analyses are repeated with daily returns rather than monthly returns as follows. During the 45 days of the earnings announcement period (for fiscal quarters 1, 2, and 3) and during the 90 days of the earnings announcement period for fiscal quarter 4, we implement the following covariance implied return strategy. On each earnings announcement date, we compute the covariance implied returns for all later announcers and rank them into quintile portfolios. Quintile 1 (5) contains the stocks with the lowest (highest) covariance implied returns, and the long/short hedge portfolio (5-1) is constructed by buying the stocks in quintile 5 and short-selling the stocks in quintile 1. We exclude all days when the number of stocks within quintile 1 and quintile 5 is less than thirty stocks. Results based on these daily returns are qualitatively very similar to those reported herein for monthly returns.

announcement during the three-month period after the end of each fiscal quarter. We call a firm with such an earnings announcement pattern as a "regular earnings announcement" firm.[15]

To compute some of the descriptive summary statistics, we obtain accounting information from the Compustat quarterly files and analyst forecast information from I/B/E/S. We use the Trade and Quote (TAQ) database to derive some of the spreads measures. Shane Corwin, Joel Hasbrouck, and Paul Schultz provided their transaction costs measures developed in Corwin and Schultz (2008), and Hasbrouck (2007).

3.2. Descriptive Statistics

3.2.1. Abnormal Returns at Earnings Announcement Dates

Table 1 summarizes the three-day earnings announcement period abnormal returns for all regular earnings announcers.[16] The average three-day abnormal return is 12 basis points and the median is 4 basis points. These numbers are very similar to those reported in Cohen et al. (2007).[17]

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[15] For example, a regular earnings announcement firm with December as fiscal year end must report its first quarterly earnings during April to June; a regular earnings announcement firm with February as fiscal year end must report its first quarterly earnings during June to August. Since we impose these criteria at the time of portfolio formation, the portfolio strategy can be implemented in real time, and this data filter does not introduce any look-ahead bias. In terms of coverage by market capitalization (number of stocks) for all common shares traded on NYSE, AMEX and NASDAQ with end of prior quarter's price greater than or equal to five dollars, the time-series average of regular announcers account for 79.2 (43.6) percent, non-regular announcers account for 20.2 (33.1) percent, and the excluded stocks account for the rest 0.6 (23.3) percent. Except for the finance industry (Fama-French industry classification code, 29), the number of unique non-regular announcers is always less than the number of unique regular announcers. For the finance industry, the number of unique non-regular announcers is 1,503 stocks, and the number of unique regular announcers is 1,348 stocks.

[16] The average three-day abnormal return is 14 basis points for non-regular earnings announcers. A comparison of the earnings announcement period return of regular announcers with that of non-regular announcers shows that the return difference, though small, is statistically significantly different from zero. The t-value is 3.20 from a simple two-sample mean comparison test, and the p-value for the nonparametric sign rank test is 0.01. A closer look at the same difference by industry reveals that the difference is primarily driven by a small set of industries. The t-tests (non-parametric sign tests) show that for 6 (4) out of the thirty industries, the earnings announcement period returns of regular announcers differ from those of non-regular announcers at the 10 percent significance level..

[17] Table 2 of Cohen et al. (2007) documents the three-day earnings announcement period return at the actual

3.2.2. Persistence of being Earlier or Later Announcers

Table 2 provides evidence that the quarterly earnings announcement sequence is persistent. We summarize this persistence via transition matrices that describe the conditional distribution based on the relative sequence of earnings announcements. Panel A reports the conditional distribution of the next quarter's earnings announcements for all stocks across all industries making announcements during both quarter *Q-1* and quarter *Q*. We compute this conditional distribution as follows. At the end of each quarter *Q-1*, all announcers are first ranked into ten groups based on the sequence of their quarterly earnings announcement dates; group 1 comprises the earliest announcers and group 10 comprises the latest announcers. This procedure is repeated for quarter *Q*. Then, for each announcement-date-decile for quarter *Q-1*, we calculate the percentage of announcements in each of the announcement-date-deciles for quarter *Q*. This calculation is repeated each quarter, and the time-series average is determined.

To take account of the possibility that some industries may announce earnings systematically earlier than other industries, we also compute the conditional distribution across all stocks within an industry and then we calculate the cross-sectional average across all industries. The latter results are reported in Panel B, Table 2.[18]

Table 2 shows that, for earlier announcers as well as later announcers, there is a considerable amount of persistence in the relative sequence of earnings announcements. For example, Panel A reports that for the earliest 10 percent of announcers during quarter *Q-1*, 53 percent are also in the

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announcement between 1980 and 2001 is 14 basis points for their sample of stocks.

[18] We also consider an alternative way of classifying earlier and later announcers. Specifically, all earnings announcers are first sorted into ten equally-spaced time intervals based on the date of earnings announcement; interval 1 is the earliest ten percent of the days of the quarter; and interval 10 the last ten percent of the days of the quarter. Using this alternative definition, we compute the results reported in Table 2; this alternative definition generates very similar results to those that we report.

earliest 10 percent of announcers in quarter *Q*. Similarly, for the latest 10 percent of announcers in quarter *Q-1*, more than 60 percent are also in the latest 10 percent in quarter *Q*. Comparing Panel A and Panel B, we observe that some industries announce earnings systematically earlier than other industries, while some industries announce earnings systematically later than other industries. For example, Panel B reports that for the earliest 10 percent of announcers in quarter *Q-1*, about 44 percent of the earliest announcers in quarter *Q-1* are also among the earliest 10 percent of announcers in quarter *Q*. Similarly, Panel B reports that for the latest 10 percent of announcers in quarter *Q-1*, 55 percent are also in the latest 10 percent of announcers in quarter *Q*. The difference between Panel A and Panel B arises because earnings are announced systematically earlier or later than other industries.

3.2.3. Characteristics of Earlier and Later Announcers

Table 3 presents a number of stock-specific characteristics of earlier and later announcers grouped into deciles according to the sequence of their quarterly earnings announcement dates (as in the previous section).[19] In general, later announcers are firms with smaller market capitalization, higher book-to-market ratio, lower past one-year returns, more negative quarterly earnings surprises (where the earnings forecasts are obtained from the seasonal random walk model and from consensus analysts' forecasts), higher accounting accruals, greater long-term earnings growth-rate forecasts, and higher forecast uncertainty. These differences are pervasive and pronounced, and not driven by the very early and the very late announcers. In fact, the differences between the earliest 10 percent and the latest 10 percent of the announcers, or the earliest 30 percent and the latest 30 percent of the announcers, as well as the earlier half and the latter half of the announcers are all statistically significantly different from zero. The difference between the analyst forecast

[19] Details of the calculation of the characteristic variables are provided in Appendix C.

dispersions for the quarterly earnings forecasts is small and statistically insignificant.

Table 3 also provides some details on the transaction costs and liquidity measures associated with trading earlier and later announcers. The first set of transaction cost measures are computed from the NYSE TAQ database; including the proportional quoted spreads and the proportional effective spreads. The high frequency direct transaction cost measures derived from the tick-by-tick NYSE TAQ database did not start until 1993; hence, we also consider the second set of indirect transaction costs estimates derived from the CRSP daily file, which cover the period starting from the third quarter of 1976 and ending with the last quarter of 2005. These estimates are the Amihud (2002) illiquidity measure, the Hasbrouck (2007) transaction costs estimates (γ_0 and γ_1), and the Corwin and Schultz (2007) high-low spreads measure.[20]

The most salient feature of Table 3 is that later announcers on average have much higher transaction costs than earlier announcers, and they are much less liquid. For example, in terms of direct transaction cost measures, the difference in the proportional effective spreads (PESPR) between the earliest 10 percent of announcers and the latest 10 percent of announcers is 60 basis points; the difference in the proportional quoted spreads (PQSPR) is 80 basis points. Using indirect transaction cost measures portrays essentially the same picture. The difference in the Amihud (2002) illiquidity measure is 0.76, the differences in the Hasbrouck (2007) transaction costs estimates (γ_0 and γ_1) are 2.31 and 0.88 respectively, and the difference in the high-low spreads is 50 basis points. All these differences are statistically significant at the one percent level. Comparing the earliest 30 percent of announcers and latest 30 percent of announcers, or the first half and the second half of the announcers, has little or no effect on the conclusions.

3.2.4. Summary Statistics; Pair-wise Correlation Estimates

[20] These estimates are described in Appendix C.

Table 4 describes the pair-wise correlations of average abnormal returns by industry and across all industries, estimated from the average earnings announcement period returns in the past earnings announcement periods. The correlations are, on average, positive. Across all industries, the average correlation is 0.015 (both sample mean and median), and 52 percent of the estimated correlations are positive. Out of the 30 Fama-French industry groups, only five of them have negative mean and median correlations. The standard deviation of the estimated correlations across industries is 0.273. This cross-sectional variation is not concentrated among a small number of industries; the industry standard deviations of the estimated correlation coefficients are similar, ranging from 0.250 to 0.281. Across all estimated pair-wise correlations, 12 percent are statistically different from zero at the 10 percent significance level or better. The proportion of statistically significant correlation coefficient estimates is similar across industries, ranging from eight percent for industry 2 (beer and liquor), to 15 percent for industry 20 (utilities).[21]

4. Results

4.1. Characteristics of Portfolios Sorted on Covariance Implied Returns

Table 5 reports the characteristics of the portfolios sorted on individual stock covariance implied returns. The “bad news” portfolio of stocks with the lowest covariance implied returns is denoted as portfolio 1; the “good news” portfolio of stocks with the highest covariance implied returns is denoted as portfolio 5. The good news portfolio has slightly larger market capitalization, lower book-to-market ratios, higher accounting accruals, higher long-term earnings growth rate

[21] The lack of precision in the estimates of correlation coefficients introduces noise into our analyses, biasing against the possibility of finding statistically significant results. To formally address the issue of measurement error, and to gauge the extent to which measurement error may influence our results, we conduct a simulation study in which we randomly sample pair-wise covariances, use them to compute covariance implied returns, and to form portfolios. Results from the simulation are summarized in Appendix B; the evidence supports the conclusion that noisy estimates and measurement error do not explain the main findings of our paper.

forecasts, and lower dispersions of analysts' forecasts of quarterly earnings and long-term growth rates. These differences, though statistically significant at the one percent level, are economically small.

Some of these characteristics are shown in the prior literature to be associated with stock returns. Fama and French (1992) show that smaller stocks, and stocks with higher book-to-market ratios, earn higher returns. In our sample, the portfolio of stocks with the highest covariance implied returns has higher market capitalization and lower book-to-market ratios. Evidence in the extant literature suggests that this portfolio is expected to earn a lower return than the portfolio of stocks with the lowest covariance implied returns. This includes: (1) evidence from Sloan (1996) suggests that the portfolio of stocks with the highest covariance implied returns is expected to earn a lower return than the portfolio of stocks with the lowest covariance implied returns - as the former portfolio has higher accruals; (2) La Porta (1996) illustrates that stocks with higher levels of long-term growth rate forecasts earn lower subsequent returns - thus the portfolio of stocks with the highest covariance implied returns is expected to earn a lower return than the portfolio of stocks with the lowest covariance implied returns; and, (3) stocks with larger analyst forecast dispersions, on average, earn lower returns than stocks with smaller analyst forecast dispersions (see Diether, Malloy, and Scherbina, 2002).

In summary, most of the characteristics of the portfolios formed on the basis of the covariance implied returns suggest that the portfolio of stocks with the highest covariance implied returns will earn a lower return than the portfolio of stocks with the lowest covariance implied returns. However, the differences in characteristics across these portfolios are small. Since we observe differences among the stock characteristics, some of which may be related to returns, we use the Fama-French (1993) three-factor model and the Carhart (1997) four-factor model to control for the effects of the differences in characteristics we observe in Table 5.

Table 5 also reports the average transaction costs estimated as the proportional quoted spreads and effective spreads, as well as the Amihud (2002) liquidity measure, the Hasbrouck (2007) transaction costs estimates (γ_0 and γ_1), and the Corwin and Schultz (2007) high-low spreads measure. Except for the Hasbrouck's measure (γ_0), we find no economically or statistically significant differences among these transaction costs and liquidity measures.

Table 6 identifies the Fama-French (1997) thirty-industry composition of portfolios 1 and 5. For portfolio 1, the largest fraction of stocks come from industry 18 (coal), and the smallest fraction come from industry 29 (finance and banking). For portfolio 5, the largest fraction of stocks come from industry 2 (beer and liquor), and the smallest fraction come from industry 29 (finance and banking). No single industry dominates either of these portfolios.

4.2. Evidence re Later Announcer Returns

Table 7 reports the performance of the portfolios formed on the basis of covariance implied returns. The first column in Panel A reports the returns from each quintile portfolio formed on the basis of stock-level covariance implied returns, as well as the return from the long/short hedge portfolio. Portfolio 1, which has the lowest covariance implied returns (the “bad” news portfolio), earns about 25 basis points per month, which is not statistically different from zero (t-statistic of 0.76). In contrast, portfolio 5, which has the highest covariance implied returns (the “good” news portfolio), earns about 130 basis points per month, which is highly significantly different from zero (t-statistic of 4.18). The return spreads from the long-short portfolio are about 105 basis points and highly significantly different from zero (t-statistic of 4.02).

The large and statistically significant excess returns from the long-short hedge portfolio do not seem to be explained by the difference in beta, size, book-to-market, and price momentum between portfolios 5 and 1. The estimates of the intercepts from the CAPM (column 2), the Fama-French three-factor model (column 3), and the Carhart four-factor model (column 4) are all statistically significantly different from zero. In every case, these intercepts indicate that the portfolio of stocks with the highest covariance implied returns has higher abnormal returns than the portfolio with the lowest covariance implied returns. For instance, the monthly excess return on portfolio 5 varies between 69 basis points under the CAPM and 83 basis points under the Fama-French and the Carhart four-factor models. In sharp contrast, the monthly abnormal returns on portfolio 1 range from a low of -36 basis points under the CAPM to a high of -24 basis points under the Fama-French and Carhart four-factor model. A strategy of purchasing the stocks with the highest covariance implied returns and short-selling the stocks with the lowest covariance implied returns, generates statistically significant abnormal returns between 106 basis points and 111 basis points per month.[22]

Panel B of Table 7 reports the regression coefficients from the Carhart four-factor model. For portfolios ranked on the basis of covariance implied returns, the factor loadings on the market factor are close to one; this is an attribute of a well-diversified portfolio. Portfolio 1 loads positively and significantly on the SMB factor (t-statistic of 2.40); but the loading is small (coefficient estimate of 0.18). Interestingly, the factor loading on the momentum factor is small and negative. Portfolio 5 loads negatively on the HML factor (t-statistic of -2.32); but the loading is again small (coefficient estimate of -0.18). The factor loadings on the long-short portfolio are small and statistically insignificant, ranging from -0.024 for the market factor to 0.041 for the momentum factor.

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[22] Throughout the paper, when computing the later announcers' covariance implied returns, we only consider the most recent earlier announcers. As a robustness check, we have extended the early earnings announcements backwards to include more early announcers as the basis for the covariance implied return computation; we have used intervals extending back as far as fifteen days from the portfolio formation date. The (un-tabulated) results are qualitatively similar, although the return differences between the long and the short portfolio are generally smaller. For example, when we include additional early announcers from the previous five days, the long-short portfolio return is 73 basis points per month (t-statistic of 2.76); from the previous ten days, the return is 66 basis points per month (t-statistic of 2.64); from the previous fifteen days, the return is 81 basis points per month (t-statistic of 2.84).

In order to shed more light on the time-series properties of the returns from the portfolios formed on the basis of covariance implied returns, we plot the annual returns and the annual Sharpe ratios of the long-short hedge portfolio in Figure 3. Similar to many market neutral strategies, the downside risk of portfolio returns is relatively small, whereas we observe a considerable amount of upside return potential.

4.3. Returns Prior to and at the Later Earnings Announcement Dates

Table 8 shows the decomposition of the covariance implied returns into two components. Panel A summarizes the returns accrued of the later announcers prior to their actual earnings announcement dates. Panel B summarizes the returns of the later announcers at their earnings announcement dates. Both components contribute to the abnormal returns of the covariance implied return portfolio strategy.

As shown in Panel A, the "good" news portfolio 5 earns a return in excess of risk free rate of about 112 basis points per month (t-statistic of 3.54) prior to the earnings announcements of these later announcers, while the "bad" news portfolio 1 earns 33 basis points per month. The long-short portfolio earns 79 basis points per month (t-statistic of 3.15). Applying the CAPM, the Fama-French three-factor model, and the Carhart four-factor model does not change the conclusion. Panel B shows that portfolio 5 continues to outperform portfolio 1 at the date of the later earnings announcement. For example, portfolio 5, on average, outperforms portfolio 1 at the date of later earnings announcement by 2.73 percent per month before applying factor model adjustments (t-statistic of 2.74), and at least 2.85 percent per month after applying factor-model adjustments (t-statistic of 2.83).[23]

[23] The returns reported in Table 8 are not attainable in real time because the actual dates of earnings announcements are not known ex ante. Nevertheless, the point remains that both pre-earnings announcement period returns and the earnings announcement period returns contribute to the outperformance of the stocks with the highest covariance

4.4. Late Announcer's Post Earnings Announcement Effect

In this section we ask the question: when is the earnings information from the early announcers completely incorporated into the prices of later announcers given the correlation channel we identify? We analyze the returns of the covariance implied return strategy after the later earnings announcements. Panel A of Table 9, reports the returns over the five trading days after the earnings announcement (i.e., days *t+2* to *t+6*). Similarly, Panel B reports the returns over the next five days (i.e., *t+7* to *t+11*).

Panel A shows the returns of a long-short hedge portfolio constructed by purchasing the stocks with the highest covariance implied returns on day *t+2*, short-selling the stocks with the lowest covariance implied returns, and holding this position until day *t+6*. This portfolio earns about 72 basis points per month (t-statistic of 2.07). The hedge strategy implied by the intercepts from the CAPM and the Fama-French three-factor model are 77 and 84 basis points per month, respectively, and remain statistically significant (t-statistics of 2.21 and 2.34). Analogous to Panel A, Panel B shows that the returns from the long-short hedge portfolio constructed on day *t+7* and held until day *t+11* are neither statistically nor economically significant.[24] This evidence suggests that the earnings information of earlier announcers is incorporated into the prices of later announcers very soon (within a week) after their earnings announcements.

4.5. Covariance Implied Returns and Post-Earnings Announcement Drift

In this section we investigate the possible connection between the pre-earnings announcement drift, which we have demonstrated in this paper, and the well-known post-earnings announcement

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implied returns.

[24] In an unreported analysis, we also confirm that there is essentially no return spread from the long-short portfolio going forward an additional two or three months. Neither do we observe any patterns of return reversals.

drift. We observe, in the previous section, that the earnings information from early announcers is incorporated in the prices of later announcers by the end of the first week after the later earnings announcements. This observation suggests the earnings information from early announcers is not likely to contribute to post-earnings announcement drift. If, however, there are common underlying factors driving both the under-reaction by later announcers to earlier announcers' earnings information, and a stock's under-reaction to its own earnings information, these two types of return predictabilities may be related.

We use a double-sort procedure to explore the relation between pre-earnings announcement drift and post-earnings announcement drift. At the end of each month from October 1976 to May 2008, we sort all firms making earnings announcements within the month into five quintiles based on their earnings surprise (i.e., ES1 to ES5, where ES1 (ES5) is the portfolio of stocks with the lowest (highest) earnings surprise). The earnings surprise of each firm is defined as the abnormal return of the three-day earnings announcement period. We independently assign firms to five quintiles based on the ranking of their covariance implied returns (i.e., IR1 to IR5, where IR1 (IR5) is the portfolio of stocks with the lowest (highest) implied return). This implied return ranking is determined at the last portfolio formation date prior to the earnings announcement date. This double sort procedure generates 25 portfolios.

Table 10 summarizes the average monthly returns for these 25 portfolios for holding periods of one month (Panel A), three months (Panel B), and six months (Panel C). For the holding periods of three and six months, we, following Jegadeesh and Titman (2001), adopt an independently managed portfolio approach and calculate the portfolio monthly returns by averaging the returns to all outstanding portfolios formed during the previous three or six months. For comparison purposes, we also report the returns of portfolios formed on the basis of earnings surprise alone.

We observe a post-earnings announcement drift effect in our sample. The average monthly return of the portfolios formed on the basis of earnings surprise alone is 61 basis points for the holding period of one month (t-statistic of 2.85); 47 basis points for the holding period of three months (t-statistic of 3.27); and 29.7 basis points for the holding period of six months (t-statistic of 3.23). The Carhart four-factor model adjusted returns are slightly lower. The monthly factor model adjusted return is 52.4 basis points for the holding period of one month (t-statistic of 2.32); 35.5 basis points for the holding horizon of three months (t-statistic of 2.45); and 21.5 basis points for the holding horizon of six months (t-statistic of 2.29).

The post-earnings announcement drift effect seems be concentrated among the most extreme implied return portfolios. Consider, for example, the holding period of one month. The left-most columns of Panel A show that the post-earnings announcement drift effect for the portfolio of stocks with the lowest (highest) implied returns is 116 (78) basis points per month (t-statistic of 2.49 (2.13)). In contrast, the post-earnings announcement drift effect is much weaker and statistically insignificant for the middle three quintiles of covariance implied returns; the spreads range from 12 basis points (t-statistic of 0.30) to 39 basis points (t-statistic of 1.22). These observations regarding the post-earnings announcement drift effect are robust to the Carhart four-factor model adjustment.

These results suggest that the two earnings-based return predictability phenomena are related. A possible link is transactions costs. The results in Table 5 suggest transactions costs as an explanation for pre-earnings announcement drift; work by others (e.g., Ng, Rusticus, and Verdi, 2008) suggests transactions costs as an explanation for post-earnings announcement drift.[25]

4.6. Decomposing the Predictive Power of Correlated Returns

[25] We will return to this point in Section 5.

Table 11 provides evidence that most of the predictive power of covariance implied returns comes from the covariance component rather than the average abnormal return component. Panel A summarizes the return from the portfolio sorted on the basis of the average abnormal return component of equation (3); Panel B describes the return from the portfolio sorted on the basis of the covariance component of equation (3).

The long-short portfolio constructed by sorting on the average abnormal return component generates about 47 basis points per month; this is not statistically significantly different from zero (t-statistic of 1.65). The estimate of the intercept from the CAPM is similar to the excess return of the long-short portfolio, and remains statistically insignificant. Oddly, the estimates of the intercepts from the Fama-French three-factor model, and the Carhart four-factor model are larger, and are statistically significantly different from zero.

The long-short portfolio constructed by sorting on the covariance component generates a statistically significant 66 basis points per month (t-statistic of 2.46). The estimates of the intercepts from the CAPM, the Fama-French three-factor model, and the Carhart four-factor model range from 59 basis points per month to 74 basis points per month and remain statistically significant.

4.7. Intra-industry Information Diffusion Effects when the Earlier Announcers are Unusually Early or Late

In the spirit of Chambers and Penman (1983), Cohen et al. (2007) and Lamont and Frazzini (2007), who examine the market reaction to earnings announcements that are earlier or later than they were in earlier years, we repeat the analyses of the long-short portfolio strategy for three sub-samples of our data: (1) observations where the earlier earnings announcement is earlier than usual (i.e., the announcement is three or more trading days earlier than it was in the same quarter of the previous year); (2) observations where the earlier earnings announcement is later than usual (i.e., the announcement is three or more trading days later than it was in the same quarter of the previous year); and, (3) all other observations, which we refer to as “normal”. On average, the monthly excess returns (not tabulated) of the long-short portfolio strategy for the 127 earlier-than-normal earlier earnings announcers are 7 basis points, which is not statistically different from zero; the monthly excess returns to the long-short strategy for the 177 later-than-normal earlier earnings announcers are 16 basis points, which is not statistically different from zero; while the monthly excess returns to the long-short strategy for the 1,070 “normal” earlier earnings announcers are 90 basis points, which is statistically significantly different from zero (t-statistic of 3.07). Results after controlling for the Fama-French-Carhart factors are very similar. These results are consistent with the notion that news that is released earlier or later than normal is much less relevant to other firms in the same industry than news that is released on the expected (or “normal) earnings announcement date.

4.8. Intra-industry Information Diffusion Effects and Uncertainty

Zhang (2006) presents evidence consistent with the notion that greater information uncertainty produces relatively higher expected returns following good news and relatively lower expected returns following bad news. Based on this evidence and the arguments in Zhang (2006), we expect that the effects of slow information diffusion will be greater for later announcers where the information uncertainty is greater. To examine this idea, we assign later announcers into three equal-sized groups based on the average analyst forecast dispersion in the prior quarter. On average, the monthly excess returns (not tabulated) of the long-short portfolio strategy for the later announcers with the lowest information asymmetry (i.e., the smallest forecast dispersion) are -4 basis points, which is not statistically different from zero; the monthly excess returns of the long-short portfolio strategy for the later announcers in the middle group of information uncertainty are 116 basis points, which is statistically different from zero (t-statistic of 3.56); and the monthly excess returns of the long-short portfolio strategy for the later announcers with the highest information uncertainty (i.e., largest forecast dispersion) are 132 basis points, which is statistically significantly different from zero (t-statistic of 3.75). Results after controlling for the Fama-French-Carhart factors are very similar. These results are consistent with the notion that more news is conveyed in an environment with more information uncertainty and this information diffuses slowly.

5. Slow Information Diffusion, Transaction Costs, and Returns

The observation that the returns of earlier earnings announcers may be used to predict the returns of later earnings announcers is consistent with the notion of slow information diffusion (Hong and Stein, 1999); we suggest transaction costs as a possible explanation. Transaction costs limit arbitrageurs' ability to exploit the seemingly profitable return predictability. In this section, we provide some evidence consistent with this view.

First, the most salient feature of Table 3 is that later announcers have much larger transaction costs than earlier announcers. In fact, there is an almost monotonic relation between the relative sequence of quarterly earnings announcements and the magnitude of transaction costs. For example, the proportional effective spreads - which take into account potential price improvements - average 80 basis points (0.008, 0.008, and 0.008) for the earliest 30 percent of announcers. In sharp contrast, the proportional effective spreads average 140 basis points (0.013, 0.014, and 0.015) for the latest 30 percent of announcers. Although spread measures may not fully take into account the costs of price impact, the Amihud (2002) illiquidity measure - or price impact – more than doubles, between the earliest 30 percent of announcers (0.394, 0.366, and 0.410) and the latest 30 percent of announcers (1.039, 1,158, and 1.151).

Second, to see the effect of transaction costs on the speed of information diffusion, we compare the pay-off of the long-short portfolio strategy from the firms with different relative sequences of earnings announcements. Consistent with the trend of increasing transaction costs, the return to the long-short strategy increases as the lateness of the late announcement increases. The long-short portfolio comprising the earliest 30 percent of announcers earns about 44 basis points per month (t-statistic of 1.50); the long-short portfolio comprising the middle 40 percent of announcers earns about 94 basis points per month (t-statistic of 2.46); and the long-short portfolio comprising the last 30 percent of announcers earns 177 basis points per month (t-statistic of 2.88).[26]

Third, as shown in Table 5, although the extreme news portfolios (i.e., portfolios 1 and 5) are similar in terms of liquidity and transaction costs attributes, these two portfolios are much less liquid and have much higher transaction costs than those of the less extreme news portfolios (i.e., portfolios 2, 3, and 4). For example, the difference in the Amihud (2002) illiquidity measure between the extreme and the less extreme portfolios is 0.4. Similarly, the difference in the proportional quoted spreads (PQSPR) between the extreme and the less extreme portfolios is 0.005. In addition, the difference in the proportional effective spreads (PESPR) between the extreme and the less extreme portfolios is 0.004. In all cases, these differences are statistically significant at, at least, the one percent level. If illiquidity and transaction costs are responsible for the slow diffusion of early announcers' earnings announcement information into the stock prices of later announcers, the same illiquidity and transaction costs also constrain the diffusion of a firm's own earnings information into stock prices. The latter observation is consistent with the evidence in Ng, Rusticus and Verdi (2008), who show that informed trades are kept at bay due to large transaction

[26] These results are not tabulated.

costs.

Fourth, Table 9 shows that the return predictability in essence ceases to exist after the quarterly earnings announcements of later announcers. This finding is consistent with the view that value relevant earnings news from earlier announcers is only incorporated into the prices of later announcers when the gains from trading on the cumulative effects of the news outweigh the associated transaction costs (Constantinides, 1986). This observation lends further support to our interpretation that transaction costs may be directly related to the slow information diffusion. Constantinides (1986) makes the point that investors rebalance their portfolio periodically rather than instantaneously due to transaction costs. This result gives rise to the possibility that individual stock prices may not incorporate all the valuation relevant information. The relevance in our context is that, when later announcers announce their earnings, there will be sufficient news and a sufficient change in value to move the value of the stock outside of the bounds caused by transactions costs; a trade will occur, and the effect of news announced prior to the earnings announcement (in our setting the news from earlier announcers), which has not yet diffused into prices, will be incorporated in stock prices at the later announcer's earnings announcement date.

Fifth, Table 10 shows an interesting commonality between the pre-earnings announcement drift and the post-earnings announcement drift effect. The post-earnings announcement drift effect seems to be evident only in the most extreme news portfolios. This finding is consistent with the view that transaction costs are the main underlying factor driving these two different return predictabilities.

Finally, direct transaction costs may, to a large extent, eliminate the possibility of making arbitrage profits by taking advantage of the apparent return predictability, including the covariance implied return strategy we consider here.[27] This strategy involves substantial portfolio turnover, which comes from two major sources: (1) the exclusion of later announcers when they make their (subsequent) earnings announcements; and (2) the rebalancing due to the change of relative ranking of later announcers (who have yet to make announcements) due to arrival of new earnings news. In fact, the average monthly portfolio turnover rates for the highest and lowest covariance implied return portfolios is 112 percent. The average proportional effective spread, which captures the average transaction costs for these two portfolios, is approximately 160 basis points. Therefore, the direct transaction costs amount to 179 basis points per month, which easily overwhelms the profits from both the long-side and short-side of the portfolio. Though it may be possible for some skillful arbitrageurs, who can efficiently control transaction costs, or market-makers for these stocks, or investors who already hold the stocks to take advantage of the return predictability, it would be difficult for outside investors to systematically make profits from the apparent return predictability.

6. Conclusions

We investigate the extent to which the market efficiently processes the information in the co-variation of the returns associated with earnings news among firms in the same industry. We find that the market on average under-reacts to this co-variation; this under-reaction generates statistically significant return predictability for later earnings announcers. We show that buying a portfolio of stocks with the highest covariance implied returns ("good' news stocks), and selling a portfolio of stocks with the lowest covariance implied returns ("bad" news stocks), yields

[27] We do not consider brokerage commissions, costs of price impact, short-selling costs, and borrowing costs. We only focus on the relatively transparent and direct bid-ask spread transaction costs. All other costs clearly matter for the actual implementation of the strategy. Since we only focus on the bid-ask spreads, one may view our calculation as an upper bound for payoffs from implementing the covariance implied return strategy.

significant spreads. The returns of our portfolio strategy are largely unaffected in either magnitude or significance by controlling for the factors in the Fama-French three-factor or Carhart four-factor model.

We attribute the pre-earnings announcement drift – that is, the slow diffusion of quarterly earnings news from earlier announcers into the prices of later announcers -- to transaction costs. First, we show that transaction costs increase monotonically from earlier announcers to the later announcers in the industry, which is consistent with the intra-quarter patterns of return predictability. On average, the profits from the covariance implied return strategy are lower at the beginning of the quarter, but higher at the end of the quarter. Second, we find that the return predictability ceases to exist after quarterly earnings announcements of the later announcers; this lends additional support to our conjecture that transaction costs are responsible for the slow information diffusion. Value relevant news from earlier announcers appears to be incorporated into the prices of later announcers when the gains from trading on the cumulative effects of the news outweigh the associated transaction costs.

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Table 1: Summary statistics re three-day earnings announcement period returns

This table reports the first quartile, mean, median, the third quartile, and the standard deviation of the earnings announcement period returns for stocks with regular earnings announcements in the past five years. All summary statistics are expressed in percent, except for the column 'N', which is the number of unique stocks satisfying the data requirements. We report these summary statistics for each of the Fama-French 30 industries and across all industries.

On each firm's quarterly earnings announcement date during 1976/09 to 2008/03, we calculate the three-day (days -1, 0, and +1) earnings announcement window average abnormal returns. We impose the following sample selection criteria: (1) the firm exists in the CRSP-Compustat merged files for at least five years; (2) the firm has share price that is not less than $5 at the end of the month prior to the month when the earnings are reported; and (3) the firm makes four timely earnings announcements in each of the previous five years.

The Fama-French 30-Industry classification includes the following. 1: Food; 2: Beer; 3: Smoke; 4: Games; 5: Books; 6: Household; 7: Clothes; 8: Health; 9: Chemicals; 10: Textiles; 11: Construction; 12: Steel; 13: Fabricated products; 14: Electrical equipment; 15: Autos; 16: Carry; 17: Mines; 18: Coal; 19: Oil; 20: Utilities; 21: Telecom; 22: Service; 23: Business equipment; 24: Paper; 25: Transportation; 26: Wholesale; 27: Retail; 28: Meals; 29: Finance; 30: Other.

Industry	Q1	Median	Mean	Q3	Std	N
1	-0.82	0.01	0.04	0.82	1.81	180
2	-0.93	0.02	-0.03	0.84	1.92	29
3	-0.46	0.12	0.13	0.66	1.08	12
4	-1.04	0.01	0.10	1.19	2.42	159
5	-0.70	0.04	0.11	0.86	1.71	108
6	-0.79	0.06	0.08	0.94	1.99	161
7	-0.96	0.07	0.11	1.12	2.31	104
8	-1.12	0.08	0.11	1.28	2.72	606
9	-0.72	0.06	0.11	0.92	1.77	149
10	-0.84	0.03	0.15	1.06	2.18	76
11	-0.87	0.04	0.14	1.04	2.03	347
12	-1.02	-0.02	0.04	0.94	2.00	140
13	-0.94	0.01	0.14	1.06	2.29	326
14	-1.08	0.07	0.17	1.32	2.78	203
15	-0.86	0.01	0.06	0.96	1.91	121
16	-0.82	0.06	0.06	0.89	1.76	57
17	-0.96	-0.08	0.00	0.83	1.82	57
18	-0.96	0.00	-0.03	0.86	1.64	15
19	-0.82	-0.03	0.04	0.84	1.71	256
20	-0.48	0.01	0.02	0.54	1.11	221
21	-0.75	0.03	0.05	0.88	1.96	178
22	-1.14	0.12	0.23	1.57	2.99	813
23	-1.25	0.07	0.17	1.53	2.99	799
24	-0.78	0.05	0.04	0.82	1.73	134
25	-0.93	0.05	0.10	1.10	2.03	177
26	-0.94	0.08	0.20	1.26	2.55	325
27	-0.91	0.10	0.19	1.22	2.29	463
28	-0.91	0.04	0.11	1.15	2.01	160
29	-0.65	0.03	0.08	0.79	1.60	1348
30	-0.88	0.12	0.21	1.19	2.32	162
All	-0.85	0.04	0.12	1.01	2.21	7134

Table 2: The persistence of earnings announcement sequences

This table reports the persistence of earnings announcement sequences via transition matrices. The sample firms are those in the covariance implied return portfolio strategy. Panel A reports the conditional distribution of next quarter's earnings announcement dates for all stocks making announcements in both the prior quarter (*Q-1*) and the current quarter (*Q*). To calculate the conditional probability, at the end of each quarter (*Q-1*), all earnings announcers are ranked into 10 groups based on the sequence of their announcements: interval 1 is the earliest 10 percent of announcers; and interval 10 is the last 10 percent of the announcers. We similarly rank the announcers into 10 groups based on their sequence of earnings announcements at the end of the current quarter (*Q*). We compare the distribution of the relative sequence of last quarter's earnings announcers with respect to the current quarter. This calculation is repeated each quarter, and the time-series average is reported. Panel B shows the time-series average conditional distribution of next quarter's earnings announcement for each industry, and then reports the cross-sectional means by averaging across industries. In Panel B, if the average number of stocks within an industry is less than 20, this industry is excluded from the calculation. The rows and columns represent the time intervals of quarter *Q-1* and quarter Q, respectively.

	Sequence of Next Quarter's Earnings Announcements									
	1 (Early)	2	3	4	5	6	7	8	9	10 (Late)
Panel A: Conditional distribution of next quarter's earnings announcements, average by all stocks										
1 (Early)	0.530	0.192	0.095	0.056	0.035	0.028	0.025	0.022	0.014	0.003
2	0.182	0.305	0.169	0.126	0.078	0.047	0.041	0.028	0.021	0.004
3	0.081	0.160	0.272	0.150	0.118	0.094	0.059	0.036	0.026	0.006
4	0.038	0.098	0.155	0.272	0.131	0.115	0.102	0.049	0.031	0.008
5	0.027	0.061	0.103	0.160	0.247	0.151	0.125	0.076	0.038	0.012
6	0.023	0.041	0.088	0.106	0.165	0.249	0.146	0.108	0.058	0.017
7	0.021	0.033	0.051	0.086	0.106	0.157	0.274	0.143	0.101	0.028
8	0.019	0.027	0.037	0.045	0.072	0.100	0.173	0.295	0.163	0.068
9	0.012	0.019	0.026	0.032	0.040	0.052	0.096	0.164	0.358	0.200
10 (Late)	0.003	0.004	0.007	0.009	0.015	0.021	0.037	0.080	0.223	0.601
Panel B: Conditional distribution of next quarter's earnings announcements, average by industry										
1 (Early)	0.439	0.192	0.102	0.076	0.058	0.037	0.035	0.030	0.020	0.012
2	0.149	0.276	0.165	0.120	0.099	0.060	0.053	0.037	0.028	0.012
3	0.076	0.166	0.223	0.162	0.120	0.092	0.076	0.045	0.029	0.012
4	0.048	0.104	0.161	0.211	0.161	0.110	0.092	0.064	0.030	0.020
5	0.035	0.074	0.101	0.169	0.212	0.145	0.117	0.081	0.046	0.020
6	0.027	0.056	0.077	0.113	0.172	0.189	0.154	0.111	0.066	0.035
7	0.024	0.045	0.058	0.080	0.117	0.152	0.207	0.161	0.103	0.053
8	0.023	0.033	0.041	0.057	0.078	0.098	0.165	0.233	0.174	0.097
9	0.013	0.026	0.027	0.031	0.044	0.057	0.097	0.186	0.287	0.231
10 (Late)	0.006	0.010	0.012	0.014	0.021	0.030	0.054	0.099	0.205	0.550

Table 3: Means of firm characteristics in each group of quarterly earnings announcers sorted by the sequence of announcements

In each three-month earnings announcement period from 1976Q3 to 2008Q2, we rank all announcers into 10 groups based on their relative sequences of earnings announcements. Group 1 (10) consists of the early (late) announcers. Within each group, we first obtain each firm's market equity ME (in millions), market equity decile ranking (ME rank) by NYSE decile breakpoints, share price (Price), book-to-market equity (B/M), book-to-market equity decile ranking (B/M rank) by NYSE decile breakpoints, return momentum, earnings surprise (ES) determined via the seasonal random walk (SRW) model, accruals, one-quarter ahead EPS forecast error (FE), long-term growth rate forecast (FLTG), one-quarter ahead EPS forecast dispersion (σ(FEPS)), long-term growth rate forecast dispersion (σFLTG)), Amihud (2002) illiquidity measure (Ahimud), Hasbrouck (2007) spreads measure (γ_0 and γ_1), Corwin and Schultz (2007) spreads measure (High-Low), proportional quoted spreads (PQSPR) and proportional effective spreads (PESPR) by the end of the previous quarter. Then we take averages across all firms within each group. In the top panel, we report the time-series averages of these group characteristics; and in the bottom panel, we report the time-series averages and *t*-value of the difference of characteristics across different groups. '10-1' is the group 10 minus group 1, '(8,9,10)-(1,2,3)' is the average of the last three groups minus that of the first three groups. '(6 to 10)-(1 to 5)' is the average of the last five groups minus that of the first five groups.

	ME	ME Rank	Price	B/M	B/M Rank	Return Momentum	SRW ES	Accruals	FE (Median)	FLTG (Median)	σ(FEPS)	σ(FLTG)
1 (early)	5,363	5.892	33.683	0.777	4.971	0.144	0.001	-0.036	-0.019	0.135	0.031	0.032
2	4,097	5.784	31.690	0.794	5.075	0.135	0.002	-0.036	-0.020	0.134	0.035	0.033
3	3,611	5.686	30.713	0.814	5.166	0.129	0.001	-0.036	-0.020	0.134	0.040	0.035
4	3,359	5.483	30.012	0.839	5.297	0.120	0.002	-0.036	-0.032	0.132	0.052	0.035
5	2,854	5.293	28.987	0.859	5.381	0.116	0.001	-0.035	-0.021	0.133	0.052	0.037
6	2,345	5.089	27.707	0.883	5.545	0.109	0.000	-0.036	-0.056	0.132	0.057	0.038
7	1,900	4.583	36.822	0.914	5.694	0.108	-0.001	-0.034	-0.069	0.136	0.046	0.039
8	1,576	4.062	51.802	0.923	5.712	0.106	-0.002	-0.032	-0.058	0.148	0.051	0.041
9	1,711	3.862	64.762	0.883	5.423	0.113	-0.002	-0.028	-0.090	0.159	0.062	0.038
10 (late)	1,304	3.829	28.824	0.845	5.295	0.113	-0.001	-0.027	-0.039	0.156	0.033	0.036
10-1	-4,059	-2.063	-4.859	0.068	0.324	-0.031	-0.003	0.008	-0.020	0.021	0.002	0.004
t-value	[-12.70	[-38.11]	[-1.13]	[4.93]	[4.58]	[-4.80]	[-4.14]	[8.12]	[-1.73]	[21.83]	[0.83]	[7.53]
(8,9,10)-(1,2,3)	-2,827	-1.869	16.434	0.089	0.406	-0.025	-0.003	0.007	-0.043	0.020	0.013	0.005
t-value	[-14.82	[-54.11]	[3.61]	[9.62]	[8.64]	[-5.25]	[-6.92]	[10.47]	[-4.17]	[25.99]	[1.67]	[12.43]
(6 to 10)-(1 to 5)	-2,086	-1.343	10.973	0.073	0.356	-0.019	-0.003	0.004	-0.041	0.013	0.008	0.004
t-value	[-14.48	[-50.51]	[3.72]	[11.13]	[10.38]	[-5.33]	[-6.69]	[9.13]	[-4.25]	[17.03]	[1.75]	[13.08]

Table 3, continued.

	Amihud Illiquidity	γ_0 (LCF, x 10^3)	γ_1 (LCF, x 10^3)	High-Low Spreads	PQSPR	PESPR
1 (early)	0.394	4.640	5.437	0.014	0.011	0.008
2	0.366	4.598	5.702	0.014	0.010	0.008
3	0.410	4.645	5.857	0.014	0.011	0.008
4	0.421	4.720	5.873	0.014	0.011	0.008
5	0.504	4.984	6.013	0.015	0.012	0.009
6	0.557	5.095	6.019	0.015	0.012	0.009
7	0.754	5.723	6.107	0.017	0.015	0.011
8	1.039	6.441	6.125	0.018	0.017	0.013
9	1.158	7.020	6.335	0.019	0.019	0.015
10 (late)	1.151	6.945	6.315	0.019	0.019	0.014
10-1	0.757	2.305	0.878	0.005	0.008	0.006
t-value	[15.88]	[19.68]	[11.53]	[15.50]	[9.23]	[9.54]
(8,9,10)-(1,2,3)	0.726	2.174	0.593	0.005	0.008	0.006
t-value	[19.61]	[24.91]	[9.42]	[20.27]	[11.19]	[11.87]
(6 to 10)-(1 to 5)	0.512	1.529	0.405	0.003	0.005	0.004
t-value	[18.54]	[24.83]	[8.39]	[20.71]	[11.22]	[11.89]

Table 4: Pair-wise correlations: Summary statistics

This table reports the summary statistics of the pair-wise correlations estimated from the average abnormal returns in the past earnings-announcement periods. During the ending month of each calendar quarter from 1976Q3 to 2008Q1, we retain only the common shares that have traded in NYSE/AMEX/NASDAQ, with stock prices not less than five dollars, have existed in CRSP-Compustat merged files for at least five years, and have regular earnings announcements in each of past 20 quarters. Within each of the Fama-French 30 industries, we calculate the average abnormal return pair-wise correlations (we exclude the most recent four quarters). We report the lower quartile, mean, standard deviation, median, the upper quartile, the number of stocks, and the number of pairs. In addition, among all pair-wise correlations we calculate the percentage of positive/negative correlations and the percentage of significant correlations. We report the time-series average of these statistics over 127 months. The last row 'All' reports the summary statistics of all firms across all industries.

Industry	Q1	Mean	Std	Median	Q3	Pos. Cor.	Neg. Cor.	Sig. Cor.	No. Stock	No. Pairs
1	-0.182	0.010	0.272	0.013	0.202	0.52	0.48	0.12	44	953
2	-0.170	-0.001	0.250	-0.003	0.168	0.49	0.51	0.08	8	27
3	-0.180	-0.028	0.271	-0.041	0.127	0.46	0.54	0.14	5	10
4	-0.185	0.003	0.268	0.003	0.192	0.50	0.50	0.11	25	349
5	-0.181	0.008	0.275	0.011	0.199	0.51	0.49	0.12	33	523
6	-0.181	0.007	0.269	0.006	0.194	0.51	0.49	0.12	44	992
7	-0.176	0.013	0.267	0.011	0.201	0.51	0.49	0.12	25	319
8	-0.181	0.005	0.267	0.005	0.191	0.51	0.49	0.11	98	6,926
9	-0.176	0.011	0.270	0.011	0.200	0.52	0.48	0.12	43	924
10	-0.188	0.011	0.278	0.018	0.214	0.52	0.48	0.14	16	157
11	-0.184	0.004	0.267	0.004	0.191	0.51	0.49	0.11	84	3,605
12	-0.173	0.013	0.266	0.012	0.199	0.52	0.48	0.11	37	710
13	-0.179	0.010	0.270	0.009	0.199	0.51	0.49	0.12	79	3,148
14	-0.189	-0.003	0.265	-0.004	0.183	0.49	0.51	0.11	33	637
15	-0.165	0.024	0.270	0.026	0.214	0.53	0.47	0.12	35	602
16	-0.171	0.017	0.265	0.014	0.202	0.52	0.48	0.11	16	121
17	-0.203	-0.006	0.263	-0.009	0.177	0.49	0.51	0.11	13	90
18	-0.125	0.024	0.253	0.010	0.164	0.54	0.46	0.12	4	5
19	-0.161	0.031	0.273	0.032	0.224	0.54	0.46	0.13	59	1,796
20	-0.134	0.063	0.281	0.066	0.266	0.59	0.41	0.15	101	5,497
21	-0.170	0.021	0.278	0.025	0.214	0.54	0.46	0.13	26	374
22	-0.185	0.004	0.269	0.004	0.193	0.51	0.49	0.12	119	10,526
23	-0.179	0.008	0.267	0.008	0.194	0.51	0.49	0.11	157	14,085
24	-0.187	0.005	0.274	0.007	0.198	0.51	0.49	0.12	43	895
25	-0.179	0.008	0.266	0.008	0.194	0.51	0.49	0.11	44	983
26	-0.188	-0.001	0.267	-0.001	0.186	0.50	0.50	0.11	59	1,992
27	-0.172	0.014	0.267	0.015	0.201	0.52	0.48	0.11	89	4,140
28	-0.188	0.005	0.271	0.007	0.194	0.51	0.49	0.12	32	575
29	-0.176	0.017	0.275	0.017	0.211	0.52	0.48	0.13	245	43,165
30	-0.175	0.010	0.267	0.009	0.196	0.51	0.49	0.11	29	445
All	-0.176	0.015	0.273	0.015	0.207	0.52	0.48	0.12	1,642	104,572

Table 5: Portfolio characteristics: Summary statistics

On each earnings announcement date over the three-month period during which we implement our covariance implied return strategy, we first obtain each firm's size decile ranking (Size Rank), book-to-market equity decile ranking (B/M Rank) both using the NYSE decile breakpoints, accounting accruals (Accruals) computed using the most recent fiscal year end data, one-quarter ahead earnings per share forecast dispersion (σ(EPS)), long-term growth rate forecast (LTG), and the long-term growth rate forecast dispersion (σ(LTG)). All of these measures are computed as of the end of previous month. We also include several liquidity and transaction cost measures, including the Amihud (2002) illiquidity measure (*Amihud Illiquidity*), Hasbrouck (2007) liquidity measures (γ_0 and γ_1, multiplied by 10^3 respectively), Corwin and Schultz (2007) High-Low spreads (Hi-Low Spreads), proportional effective spreads (PESPR) and proportional quoted spreads (PQSPR) derived from NYSE TAQ database. The Amihud (2002) illiquidity measure, Hasbrouck (2007) liquidity measures are the annual measure computed as of the end of the previous year. The Corwin and Schultz (2007) High-Low spreads, effective and quoted spreads from TAQ are the monthly measure computed as of the end of the previous month. Then we take the average across the firms in each portfolio to obtain these reported portfolio characteristics. At the end of each month in the period of trading the covariance implied return portfolios, we average over all earnings announcement dates in that month to obtain the monthly portfolio characteristics (381 months during 1976/10 to 2008/06). Quintile 1 (5) contains the stocks with the lowest (highest) implied returns. We report the time-series average of the portfolio characteristics and t-values of the differences in characteristics between quintile 5 and quintile 1.

	Size Rank	B/M Rank	Accruals	σ(EPS)	LTG	σ(LTG)	Amihud Illiquidity	γ_0 (LCF, x 10^3)	γ_1 (LCF, x 10^3)	Hi-Low Spreads	PQSPR	PESPR
1 (low)	3.6	5.6	-0.033	0.0080	0.1565	0.0400	1.178	7.240	6.712	0.020	0.020	0.016
2	4.2	5.6	-0.032	0.0049	0.1422	0.0349	0.913	6.208	5.956	0.018	0.018	0.013
3	4.5	5.5	-0.029	0.0029	0.1399	0.0328	0.797	5.753	5.713	0.017	0.016	0.012
4	4.3	5.3	-0.025	0.0029	0.1505	0.0346	0.893	6.108	6.003	0.018	0.017	0.013
5 (high)	3.7	5.2	-0.021	0.0040	0.1642	0.0380	1.215	7.126	6.656	0.020	0.021	0.016
5-1	0.1	-0.4	0.013	-0.0041	0.0079	-0.0020	0.037	-0.114	-0.056	0.000	0.000	0.000
t-value	[6.28]	[-18.14]	[21.67]	[-2.44]	[11.14]	[-4.46]	[1.49]	[-2.44]	[-1.57]	[0.42]	[0.42]	[0.33]

Table 6: Industry distribution of the lowest/highest covariance implied return portfolios

This table reports the industry composition of the lowest covariance implied return portfolio (Q1) and of the highest covariance implied return portfolio (Q5). On each earnings announcement date over a three-month period in which we form the covariance implied return portfolios, we count the number of stocks from each industry. By the end of period of the portfolio strategy, within the top/bottom quintile we calculate the average number of stocks from each industry in the past three months. Then we compute the percentage of the average number of stocks in the quintile to the total number of stocks within each industry. This calculation is repeated for each portfolio strategy period (127 periods during 1976/10 to 2008/06). We obtain the time-series average of these frequencies (in percent) and rescale them across all industries to report the industry composition in the table.

Industry Code	Industry Name	Q1	Q5
1	Food Products	3.0	2.9
2	Beer & Liquor	5.0	5.5
3	Tobacco Products	4.7	3.6
4	Recreation	3.7	4.2
5	Printing and Publishing	2.9	3.0
6	Consumer Goods	2.8	2.8
7	Apparel	3.9	4.2
8	Healthcare, Medical Equipment, Pharma. Products	2.7	2.7
9	Chemicals	2.4	2.4
10	Textiles	4.8	4.8
11	Construction and Construction Materials	2.4	2.6
12	Steel Works Etc	3.2	2.9
13	Fabricated Products and Machinery	2.6	2.7
14	Electrical Equipment	3.3	3.3
15	Automobiles and Trucks	2.9	3.0
16	Aircraft, ships, and railroad equipment	3.9	4.0
17	Precious Metals, Metallic, and Industrial Metal Mining	4.5	4.5
18	Bituminous coal	6.4	4.2
19	Petroleum and Natural Gas	2.6	2.4
20	Utilities	2.3	2.0
21	Communication	3.5	3.8
22	Personal and Business Services	2.9	3.0
23	Business Equipment	2.8	2.9
24	Paper - Business Supplies and Shipping Containers	2.5	2.6
25	Transportation	3.0	2.9
26	Wholesale	3.2	3.5
27	Retail	3.4	4.0
28	Restaurants, Hotels, Motels	3.5	4.0
29	Banking, Insurance, Real Estate, Trading	1.8	1.9
30	Everything Else	3.5	3.7

Table 7: Monthly portfolio returns and alphas of the covariance implied return strategy

At the end of each quarter during 1976Q3 to 2008Q1, we select all firms meeting the following criteria: (1) common shares are traded in NYSE/AMEX/NASDAQ with stock price not less than five dollars; (2) existed on the CRSP-Compustat merged files for at least five years; and (3) regular quarterly earnings announcements in past five years. Within each of the Fama-French 30 industries, we calculate the sample means and pair-wise sample covariance of the average abnormal return during the three day earnings announcement period in the past 20 quarters, skipping the most recent four quarters. During the subsequent three-month earnings announcement period, we implement the covariance implied return strategies. On each earnings announcement date of earlier announcers, we compute the implied returns for all later announcers and rank them into quintile portfolios. Quintile 1 (5) contains the stocks with the lowest (highest) covariance implied returns, and the long-short hedge portfolio (5-1) is constructed by buying the stocks in portfolio 5 and short-selling the stocks in portfolio 1. To obtain the portfolio monthly returns, we compound the value-weighted daily portfolio returns. In the event of no earnings announcement at the beginning of the first month of the calendar quarter, or less than five stocks in either protfolio1 or portfolio 5, we invest into T-bills using daily risk-free rate. Panel A reports the mean excess monthly returns and alphas (in percent), and panel B reports the loadings from the Fama-French-Carhart four-factor model and regression R-squares. The average number of stocks in each quintile portfolio is 99.

	Panel A: Intercepts				Panel B: Loadings and R^2				
	Excess Return	CAPM alpha	FF3 Alpha	FF4 alpha	MKTRF	SMB	HML	UMD	R^2
1	0.253	-0.364	-0.341	-0.241	1.052	0.180	-0.106	-0.099	0.574
	[0.76]	[-1.64]	[-1.50]	[-1.04]	[18.17]	[2.40]	[-1.20]	[-1.86]	
2	0.750	0.229	0.200	0.125	0.902	0.244	-0.003	0.074	0.616
	[2.74]	[1.30]	[1.13]	[0.69]	[19.94]	[4.16]	[-0.05]	[1.79]	
3	0.697	0.182	0.182	0.199	0.921	0.043	-0.014	-0.017	0.603
	[2.61]	[1.07]	[1.03]	[1.10]	[20.47]	[0.73]	[-0.20]	[-0.42]	
4	0.571	0.051	0.031	0.131	0.928	0.078	-0.002	-0.098	0.598
	[2.09]	[0.29]	[0.17]	[0.71]	[20.09]	[1.30]	[-0.03]	[-2.33]	
5	1.302	0.691	0.770	0.829	1.028	0.104	-0.179	-0.057	0.635
	[4.18]	[3.58]	[3.92]	[4.10]	[20.44]	[1.59]	[-2.32]	[-1.24]	
5-1	1.048	1.055	1.112	1.069	-0.024	-0.076	-0.072	0.041	0.004
	[4.02]	[4.01]	[4.09]	[3.83]	[-0.34]	[-0.85]	[-0.68]	[0.65]	

Table 8: Return decomposition of portfolios sorted on covariance implied return.

Panel A reports the portfolio holding period returns when we exclude the later announcers' earnings announcement day returns. Panel B reports the portfolio holding period returns when we only consider the late announcers' earnings announcement day returns. On the earnings announcement date during a three-month period of implementing the covariance implied return portfolio strategy, we calculate the value-weighted daily returns of each quintile portfolio over its holding period; we then compound the daily returns over a month to obtain the portfolio monthly return. Quintile 1 (5) contains the stocks with the lowest (highest) implied returns for the late announcers. In panel A, we calculate the portfolio holding period daily returns excluding the earnings announcement day returns of the later announcers. In panel B, we calculate the portfolio holding period daily returns including only the earnings announcement day returns of later announcers. After compounding the daily returns into monthly returns for each quintile portfolio, we report the mean excess monthly returns and alphas from the CAPM and Fama-French factor models (in percent).

	Panel A: Excluding EA Firms				Panel B: Only EA Firms			
	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha
1	0.329	-0.278	-0.241	-0.179	0.547	0.039	-0.106	0.118
	[1.01]	[-1.26]	[-1.07]	[-0.78]	[0.77]	[0.06]	-0.15]	[0.16]
2	0.711	0.196	0.158	0.109	1.808	1.379	0.983	0.826
	[2.66]	[1.16]	[0.93]	[0.62]	[2.76]	[2.16]	1.51]	[1.23]
3	0.641	0.126	0.114	0.147	1.536	1.070	0.895	1.024
	[2.46]	[0.79]	[0.69]	[0.87]	[2.71]	[1.98]	1.62]	[1.81]
4	0.514	-0.014	-0.045	0.048	1.599	1.139	1.048	0.872
	[1.87]	[-0.08]	[-0.25]	[0.26]	[2.34]	[1.71]	1.55]	[1.25]
5	1.120	0.492	0.566	0.660	3.280	2.884	3.063	2.995
	[3.54]	[2.56]	[2.88]	[3.27]	[4.10]	[3.65]	3.83]	[3.64]
5-1	0.790	0.769	0.807	0.839	2.733	2.846	3.169	2.877
	[3.15]	[3.04]	[3.09]	[3.12]	[2.74]	[2.83]	[3.07]	[2.71]

Table 9: Late announcers' post-earnings announcement returns

On each earnings announcement date over a three-month period, we form the quintile portfolios based on the covariance implied returns for the late announcers. Quintile 1 (5) contains the stocks with the lowest (highest) implied returns for the late announcers. We calculate the post-earnings announcement daily returns of each late announcer for the first week (panel A) and the second week (panel B) after the earnings announcement date. The first day after earnings announcement is skipped. For each quintile portfolio on with late announcers' post-earnings returns, we calculate the value-weighted daily returns; if returns are not available (i.e., we do not have enough stocks in the quintiles) we invest in T-Bills at the daily risk free rate. Then we compound daily returns to compute the monthly return. This table reports the mean excess monthly returns and alphas from the CAPM, the Fama-French three-factor model, and the Fama-French and Carhart four-factor model. The returns are reported in percent, and the time-series *t*-statistics are reported below the portfolio returns.

	Panel A: Post EA [t+2, t+6]				Panel B: Post EA [t+7, t+11]			
	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha
1	0.508	-0.002	-0.181	-0.051	0.624	0.212	0.125	0.182
	[1.46]	[-0.01]	[-0.62]	[-0.17]	[2.01]	[0.80]	[0.46]	[0.65]
2	1.010	0.632	0.523	0.544	0.713	0.361	0.258	0.338
	[3.35]	[2.41]	[1.94]	[1.96]	[2.59]	[1.52]	[1.05]	[1.35]
3	0.911	0.473	0.270	0.370	0.670	0.268	0.228	0.312
	[3.03]	[1.92]	[1.09]	[1.45]	[2.39]	[1.16]	[0.96]	[1.28]
4	0.924	0.448	0.392	0.449	0.698	0.269	0.201	0.275
	[2.93]	[1.78]	[1.51]	[1.68]	[2.50]	[1.22]	[0.88]	[1.18]
5	1.224	0.768	0.662	0.659	0.567	0.161	0.114	0.315
	[3.53]	[2.58]	[2.16]	[2.09]	[1.94]	[0.66]	[0.45]	[1.23]
5-1	0.716	0.771	0.842	0.710	-0.056	-0.051	-0.010	0.133
	[2.07]	[2.21]	[2.34]	[1.92]	[-0.18]	[-0.17]	[-0.03]	[0.41]

Table 10: Monthly returns of Earning Surprise (ES) and Implied Return (IR) independently sorted portfolios

Table 11 reports the monthly returns from the earnings surprise (ES) and implied return (IR) independently sorted portfolios. ES1 (ES5) contains the stocks with the most negative (positive) earnings surprise. IR1 (IR5) contains the stocks with the lowest (highest) covariance implied returns. ES5-1 is a zero-cost long-short hedge portfolio constructed by buying the stocks in quintile ES5 and short-selling the stocks in quintile ES1. Stocks are held for one month (Panel A), three months (Panel B), and six months (Panel C). All the portfolio returns are value-weighted. The table reports the mean excess monthly returns (left side of each panel) and alphas estimated in the Fama-French-Carhart four-factor model (right side of each panel). For comparison purposes, we also report the monthly returns from the portfolios ("All Stocks") sorted on earnings surprise only. The time-series average number of stocks in each earnings surprise (ES) and implied return (IR) independently sorted portfolio ranges from 20 to 25, and the time-series average number of stocks from the portfolios sorted only on earnings surprise ranges from 103 to 104.

Panel A: Monthly returns of earnings surprises and implied return independently sorted portfolios with the holding horizon of one month

	Value Weighted Raw Returns						Fama-French and Carhart Model Adjusted Returns					
	1 (low IR)	2	3	4	5 (high IR)	All Stocks	1 (low IR)	2	3	4	5 (high IR)	All Stocks
1 (Low ES)	0.147	0.062	0.573	0.088	0.286	0.227	-0.418	-0.462	0.082	-0.344	-0.345	-0.298
2	0.578	0.405	0.498	0.657	0.485	0.456	0.012	-0.292	-0.081	0.241	-0.172	0.016
3	1.025	0.621	0.616	0.812	0.379	0.562	0.286	-0.016	0.063	0.202	-0.390	-0.009
4	0.769	0.916	0.629	0.170	0.370	0.560	-0.093	0.201	-0.061	-0.418	-0.126	-0.048
5 (High ES)	1.255	0.434	0.723	0.477	1.065	0.837	0.874	-0.465	-0.060	-0.241	0.452	0.226
5-1 (High – Low)	1.161	0.371	0.117	0.389	0.779	0.610	1.375	-0.003	-0.167	0.103	0.797	0.524
t-statistics	[2.49]	[1.03]	[0.30]	[1.22]	[2.13]	[2.85]	[2.77]	[-0.01]	[-0.40]	[0.30]	[2.04]	[2.32]

Panel B: Monthly returns of earnings surprises and implied return independently sorted portfolios with the holding horizon of three months

	Value Weighted Raw Returns						Fama-French and Carhart Model Adjusted Returns					
	1 (low IR)	2	3	4	5 (high IR)	All Stocks	1 (low IR)	2	3	4	5 (high IR)	All Stocks
1 (Low ES)	0.178	0.424	0.950	0.453	0.434	0.510	-0.368	-0.059	0.518	-0.047	-0.198	-0.020
2	0.638	0.707	0.656	0.758	0.776	0.547	0.176	0.083	0.185	0.310	0.203	0.167
3	0.844	0.680	0.613	0.751	0.520	0.602	0.102	0.072	0.020	0.207	-0.088	0.094
4	0.748	0.708	0.747	0.688	0.503	0.655	-0.013	0.107	0.144	0.169	-0.054	0.090
5 (High ES)	0.808	0.759	0.824	1.002	1.202	0.980	0.292	0.011	0.143	0.267	0.526	0.335
5-1 (High – Low)	0.631	0.334	-0.125	0.549	0.768	0.470	0.660	0.069	-0.374	0.314	0.723	0.355
t-statistics	[2.44]	[1.58]	[-0.55]	[2.43]	[3.60]	[3.27]	[2.40]	[0.31]	[-1.59]	[1.33]	[3.28]	[2.45]

Panel C: Monthly returns of earnings surprises and implied return independently sorted portfolios with the holding horizon of six months

	Value Weighted Raw Returns						Fama-French and Carhart Model Adjusted Returns					
	1 (low IR)	2	3	4	5 (high IR)	All Stocks	1 (low IR)	2	3	4	5 (high IR)	All Stocks
1 (Low ES)	0.526	0.456	0.687	0.458	0.514	0.447	-0.029	-0.063	0.191	-0.098	-0.118	-0.086
2	0.606	0.677	0.574	0.570	0.805	0.474	0.077	0.094	0.071	0.100	0.211	0.079
3	0.833	0.637	0.651	0.725	0.724	0.635	0.236	0.025	0.118	0.189	0.092	0.134
4	0.642	0.760	0.674	0.682	0.764	0.664	-0.036	0.199	0.057	0.155	0.332	0.166
5 (High ES)	0.692	0.844	0.793	0.763	0.809	0.744	0.073	0.144	0.123	0.085	0.135	0.129
5-1 (High – Low)	0.166	0.388	0.106	0.305	0.294	0.297	0.102	0.208	-0.068	0.183	0.253	0.215
t-statistics	[0.85]	[2.50]	[0.67]	[1.88]	[1.90]	[3.23]	[0.49]	[1.27]	[-0.41]	[1.06]	[1.57]	[2.29]

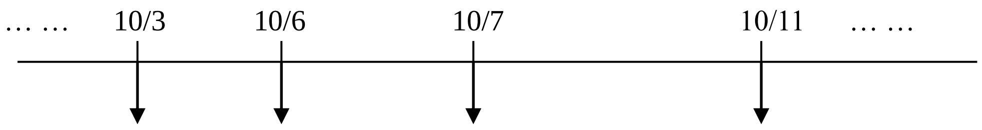
Table 11: Mean excess monthly returns and alphas for the portfolio strategy based on the individual component of the covariance implied return

Panel A reports the mean excess return and the intercepts from time-series regressions of the monthly returns of the portfolios sorted on the mean of earnings announcement abnormal returns -- i.e., the second component of the implied return equation (3) -- over the past 20 quarters, skipping the most recent four quarters. Panel B reports the mean excess return and the intercepts from time-series regressions of the monthly returns of the portfolios sorted on the covariance term -- i.e., the first component of the implied return. *t*-statistics are in parenthesis. The average number of stocks in each quintile is 99.

	Panel A: Mean Component				Panel B: Covariance Component			
	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 Alpha	FF4 Alpha
1	0.466	-0.183	-0.307	-0.230	0.404	-0.193	-0.120	-0.117
	[1.32]	[-0.77]	[-1.30]	[-0.95]	[1.25]	[-0.88]	[-0.55]	[-0.52]
2	0.516	0.020	0.003	0.010	0.560	0.001	0.008	0.028
	[1.93]	[0.11]	[0.01]	[0.05]	[1.96]	[0.00]	[0.05]	[0.15]
3	0.856	0.377	0.349	0.369	0.834	0.356	0.309	0.367
	[3.41]	[2.33]	[2.09]	[2.15]	[3.12]	[1.90]	[1.61	[1.86]
4	0.714	0.178	0.150	0.176	0.495	-0.040	-0.023	-0.083
	[2.61]	[1.06]	[0.87	[0.99]	[1.70]	[-0.20]	[-0.11	[-0.40]
5	0.931	0.263	0.471	0.474	1.065	0.479	0.468	0.623
	[2.74]	[1.25]	2.29]	[2.24]	[3.49	[2.46]	[2.37]	[3.10]
5-1	0.465	0.446	0.778	0.704	0.661	0.672	0.589	0.740
	[1.65]	[1.57]	[2.74]	[2.41]	[2.46]	[2.48]	[2.11]	[2.59]

Figure 1: Diagram of covariance implied return portfolio strategy

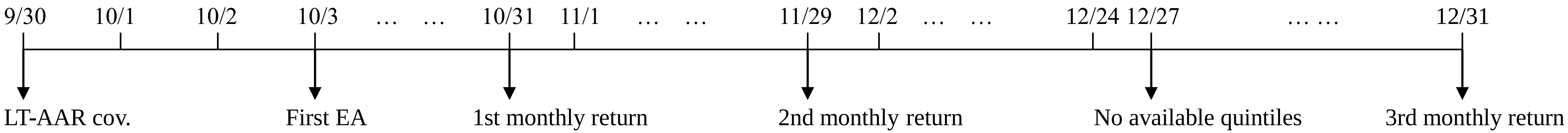
Industry 1 contains firms A, B, C, D, E and F, and industry 2 contains firms u, w, x, y, and z. All of these 11 firms make earnings announcements in October. The first announcement starts on October 3rd. For simplicity, we only illustrate the procedures up to the earnings announcement date on October 11th, and require at least five stocks available to form quintiles at each time.



Sequence of announcements: A B,C,u D E,F,w,x

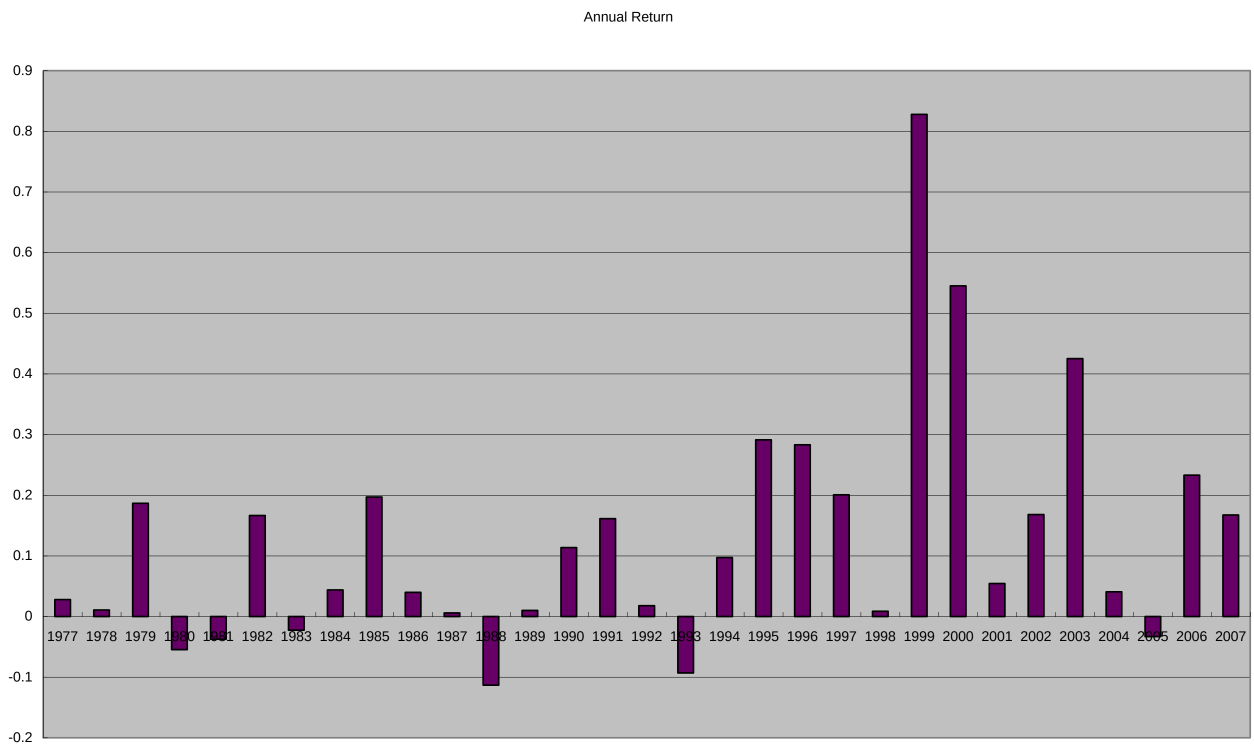
EA date	Early announcer(s)	Pairs with late announcers	Firms entered into portfolios	Procedure description
10/3	A (industry 1)	(A,B), (A,C), (A,D), (A,E), (A,F)	B, C, D, E, F (industry 1)	Calculate the covariance implied returns within industry 1 and form quintiles
10/6	B,C (industry 1)	(B,D), (B,E), (B,F), (C,D), (C,E), (C,F)	D, E, F (industry 1)	A is dropped and its covariance with D,E, and F are not used to calculate implied returns
	u (industry 2)	(u,w), (u,x), (u,y), (u,z)	w, x, y, z (industry 2)	Calculate the covariance implied returns within industry 2
				Form quintiles over all late announcers across both industry 1 and 2
10/7	D (industry 1)	(D,E), (D,F)	E, F (industry 1)	B and C are dropped, and their covariance with E and F are not used
			w, x, y, z (industry 2)	Industry 2 has no firm announcing earnings, and use the implied returns from the last announcement date
				Form quintiles over all late announcers across both industry 1 and 2
10/11	E,F (industry 1)		Not enough number of stocks	All firms from industry 1 report their earnings
	w,x (industry 2)	(w,y), (w,z), (x,y), (x,z)		Calculate the implied returns within industry 2
				Retain these implied returns, and hold T-bills

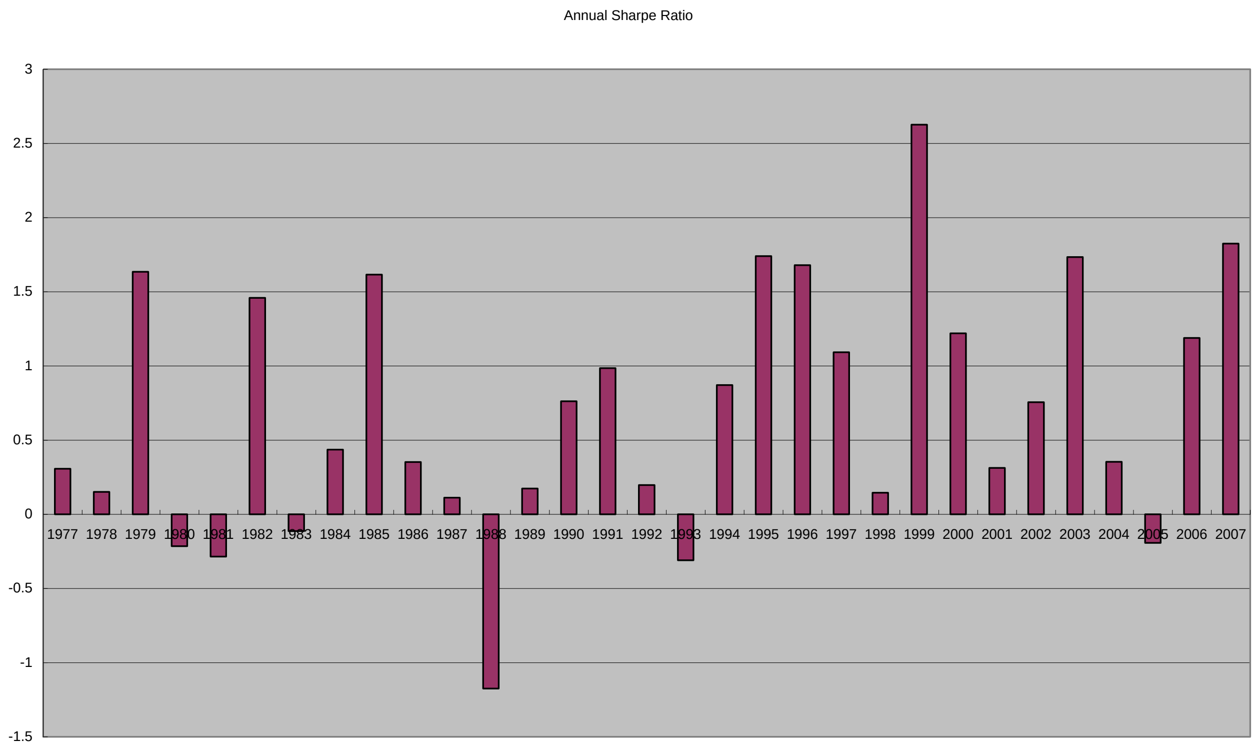
Figure 2: Diagram of calculating portfolio monthly returns using the fourth quarter of the calendar year as an example



At the ending month of 3rd quarter (9/30), we calculate the earnings announcement abnormal return covariance among all firms within each industry based on their past 20 quarterly earnings announcements (EAs) (skipping the most recent four announcements). The trading strategy begins at 10/1. On 10/1 we invest T-bills until the first EA date at 10/3. We form the quintiles on this date, hold the portfolios to the next EA date, and re-form the quintiles accordingly, all of which are described in the procedures in Figure 1. At the end of October (10/31), we calculate the portfolio monthly return by hypothetically closing our position and compounding the daily returns within that month. If this date also happens to be an EA date, we re-form the portfolios and start to calculate the daily returns into November. Otherwise, we reopen our position at 11/1 using the portfolio weights formed at the last EA date in October, and continue to hold the portfolios into November. At the end of November (11/29), we use the same method to calculate portfolio return in the second month. On the EA date 12/27, since we do not have enough stocks to form quintiles, we close our position and invest all proceeds into T-bills until the end of December. The trading strategy ends at 12/31 and we calculate the portfolio return in the third month. If on a particular EA date we don't have the enough stocks to form portfolios, we hold the T-bills until the date at which we can reformulate the quintiles to invest.

Figure 3: Annual return and Sharpe ratio of long-short hedge portfolios. The years 1976 and 2008 are excluded since we only have 3-6 months of portfolio returns.





Appendix A: Return Predictability of Earnings Announcement Period Returns

In this Appendix, we consider the monthly returns of several long-short hedge portfolios formed on the basis of the average abnormal returns over the three-day earnings announcement period in the most recent quarter (Panel A), the most recent four quarters (Panel B), and the most recent 20 quarters excluding the most recent four quarters (Panel C). The hedge portfolio is constructed by purchasing the stocks with the highest average abnormal returns during the earnings announcement period and short-selling the stocks with the lowest average abnormal returns.

Panels A and B show that short-term average abnormal returns during the three days surrounding the earnings announcement may be used to form portfolios with economically and statistically significant returns; especially for the equally-weighted portfolios. The monthly returns of the long-short portfolio formed on the basis of the most recent quarter's earnings announcement period return range from 25 basis points (value-weighted, t-statistic of 1.75) to 71 basis points (equally-weighted, t-statistic of 8.95). The monthly returns of the long-short portfolio formed on the basis of the most recent four quarter's earnings announcement period return ranges from 38 basis points (value-weighted, t-statistic of 2.71) to 67 basis points (equally-weighted, t-statistic of 7.61).

In contrast, Panel C shows that the portfolios based on the long-term average abnormal earnings announcement period returns have no economically and statistically significant return predictability for either the equally-weighted or value-weighted portfolios. The monthly returns of the long-short portfolios range from 4 basis points (value-weighted, t-statistic of 0.29) to 13 basis points (equally-weighted, t-statistic of 1.57). It follows that, if there is any predictability of returns, this predictability relies on the first component of equation (3).

The pair-wise abnormal return covariance estimates are based on the first 16 of the 20 quarterly earnings announcement period returns in the past five years (including the current quarter T). We exclude the returns of the recent four quarters in order to remove the effect of the return predictability shown in this Appendix. That is:

$$\hat{C}_{i,j} = \frac{1}{16}\sum_{q=T-19}^{T-4}\left(R_{iq} - \overline{R}_i\right)\left(R_{jq} - \overline{R}_j\right) \qquad \text{(A)}$$

where $\overline{R}_i = \frac{1}{16}\sum_{q=T-19}^{q=T-4} R_{iq}$.[28]

[28] Statistically, Fisher's z-transformation approaches normality rapidly as the sample size increases for any values of correlation coefficient, even for the sample size as small as 10 (Fisher, 1970, pp. 200-201). Under the null hypothesis that the correlation is equal to zero, the test based on the t-distribution is slightly more powerful than that on Fisher's approximate inference (Anderson, 1984). As a result, our sample covariance estimates based on 16 quarterly observations are reasonably precise.

Table A1: Return predictability from the most recent earnings announcement period return, short-term average abnormal returns (ST-AAR), and long-term average abnormal return (LT-AAR)

At the end of each month t from September 1976 to March 2008, all CRSP common stocks with price no less than five dollars are sorted into quintiles based on their average abnormal returns (AAR) over three-day earning announcement event-window. Panel A ranks all stocks with earnings announcements in the most recent quarter, Panel B ranks all stocks making earnings announcements in the most recent four quarters, and Panel C ranks all stocks making earnings announcement in the most recent twenty quarters but skipping the most recent four quarters. The table reports both equally-weighted and value-weighted mean monthly returns in excess of the risk free rate (in percent), in addition to the alphas from the CAPM and the Fama-French factor models (in percent). t-statistics are reported in parentheses. The last column reports the average number of stocks in each portfolio. "5-1" represents the long-short hedge portfolio, which is constructed by buying in stocks in quintile 5 and short-selling in stocks in quintile 1.

Panel A: Pre-earnings announcement drift based on the most recent quarterly earnings announcements. All firms with either December or non-December fiscal year end month are considered, requiring five-year existence in the CRSP-Compustat merged files and regular earnings announcements in the past 20 quarters.

	Equally Weighted Portfolio				Value Weighted Portfolio				
	Excess Return	CAPM alpha	FF3 Alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha	N
1	0.476	-0.144	-0.398	-0.212	0.472	-0.146	-0.171	-0.040	104
	[1.70]	[-1.13]	[-4.82]	[-2.86]	[1.74]	[-1.37]	[-1.58]	[-0.37]	
2	0.837	0.323	0.019	0.089	0.588	0.033	0.003	0.035	104
	[3.59]	[2.98]	[0.27]	[1.22]	[2.42]	[0.35]	[0.03]	[0.35]	
3	0.798	0.301	0.018	0.082	0.519	-0.003	-0.052	-0.051	104
	[3.57]	[2.99]	[0.24]	[1.08]	[2.30]	[-0.03]	[-0.69]	[-0.65]	
4	0.948	0.422	0.142	0.179	0.599	0.074	0.041	0.013	104
	[4.02]	[4.06]	[2.03]	[2.50]	[2.66]	[0.95]	[0.51]	[0.16]	
5	1.188	0.562	0.329	0.388	0.716	0.088	0.095	0.096	105
	[4.22]	[4.48]	[4.37]	[5.08]	[2.62]	[0.84]	[0.91]	[0.89]	
5-1	0.712	0.707	0.728	0.600	0.245	0.234	0.267	0.136	
	[8.95]	[8.80]	[8.82]	[7.50]	[1.75]	[1.65]	[1.83]	[0.92]	

Panel B: Pre-earnings announcement drift based on the mean of short-term average abnormal returns over the most recent four quarterly earnings announcements. All firms with either December or non-December as fiscal year end month are considered, requiring five-year existence in CRSP-Compustat merged files and regular earnings announcements in the past 20 quarters.

	Equally Weighted Portfolio				Value Weighted Portfolio				
	Excess Return	CAPM alpha	FF3 Alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 alpha	FF4 Alpha	N
1	0.566	-0.038	-0.311	-0.098	0.510	-0.090	-0.157	0.047	104
	[2.05]	[-0.29]	[-3.68]	[-1.35]	[1.92]	[-0.81]	[-1.38]	[0.43]	
2	0.737	0.227	-0.075	0.023	0.461	-0.058	-0.170	-0.097	104
	[3.20]	[2.15]	[-1.04]	[0.32]	[2.02]	[-0.64]	[-1.93]	[-1.09]	
3	0.788	0.285	0.002	0.071	0.494	-0.038	-0.051	-0.046	104
	[3.51]	[2.93]	[0.03]	[1.01]	[2.18]	[-0.50]	[-0.67]	[-0.60]	
4	0.919	0.384	0.115	0.116	0.668	0.113	0.135	0.064	104
	[3.84]	[3.67]	[1.58]	[1.54]	[2.81]	[1.38]	[1.60]	[0.74]	
5	1.240	0.608	0.381	0.418	0.890	0.238	0.250	0.203	105
	[4.36]	[4.73]	[4.93]	[5.28]	[3.18]	[2.43]	[2.56]	[2.03]	
5-1	0.674	0.646	0.691	0.516	0.379	0.329	0.406	0.156	
	[7.61]	[7.29]	[7.63]	[6.10]	[2.71]	[2.35]	[2.86]	[1.15]	

Panel C: Pre-earnings announcement drift based on the mean of long-term average abnormal returns over past 20 quarterly earnings announcements (skipping the most recent four quarters). All firms with either December or non-December as fiscal year end month are considered, requiring five-year existence in CRSP-Compustat merged files and regular earnings announcements in the past 20 quarters.

	Equally Weighted Portfolio				Value Weighted Portfolio				
	Excess Return	CAPM alpha	FF3 Alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 alpha	FF4 Alpha	N
1	0.837	0.250	-0.024	0.066	0.685	0.102	-0.021	-0.001	104
	[3.12]	[1.95]	[-0.33]	[0.90]	[2.69]	[1.03]	[-0.22]	[-0.01]	
2	0.794	0.281	-0.002	0.051	0.559	0.057	0.014	0.022	104
	[3.45]	[2.77]	[-0.03]	[0.68]	[2.51]	[0.61]	[0.16]	[0.24]	
3	0.831	0.319	0.013	0.093	0.686	0.159	0.096	0.095	104
	[3.59]	[3.02]	[0.18]	[1.27]	[3.02]	[1.94]	[1.15]	[1.10]	
4	0.830	0.286	-0.010	0.050	0.483	-0.084	-0.085	-0.061	104
	[3.40]	[2.66]	[-0.13]	[0.68]	[1.99]	[-1.03]	[-1.01]	[-0.70]	
5	0.963	0.335	0.139	0.272	0.724	0.050	0.177	0.211	105
	[3.42]	[2.70]	[1.71]	[3.47]	[2.50]	[0.50]	[1.90]	[2.21]	
5-1	0.126	0.085	0.163	0.206	0.039	-0.052	0.198	0.212	
	[1.57]	[1.07]	[2.03]	[2.51]	[0.29]	[-0.39]	[1.57]	[1.64]	

Appendix B: Robustness Check - Simulation Evidence on Covariance Implied Returns

As we reported in Table 4 in the main text, on average there are about 8 to 15 percent of sample correlation estimates that are statistically significantly different from zero at the 10 percent significance level or higher within each of the Fama-French industry groups. Thus, we may be concerned about the possibility that the relatively large spread of the long-short hedge portfolio is spurious. We show via a simulation that, although these correlation/covariance estimates are noisy, they are not completely random noise.

Our simulation focuses on the pair-wise correlations of the average earnings announcement period returns. If the pair-wise covariance we estimate in equation (2) is random noise, the estimated long-short hedged portfolio returns should not be statistically different from those of a similar portfolio where the pair-wise correlations are random numbers. To examine this possibility, we randomly generate pair-wise correlations, calculate the implied returns for later announcers, form the covariance implied return sorted portfolios, and examine the portfolio returns. The simulation procedure involves the following four steps.

1. At the ending month of each quarter from the third quarter of 1976 to the first quarter of 2008, we draw a random number r_{ij} from a uniform distribution over [-1, 1] for each pair of stocks (i, j) satisfying our data requirements. We calculate the t-statistics under the null hypothesis of the correlation equal to zero based on this pseudo-sample correlation and the sample size,

   $t = r_{ij}\dfrac{\sqrt{n-2}}{\sqrt{1-r_{ij}^{\,2}}}$, where t is the t-statistics under the null hypothesis that the correlation is zero, and

   n is the sample size used in calculating the pair-wise correlations.
2. On each earnings announcement date during the three-month announcing period, we calculate the implied returns for later announcers using the same components of equation (3) except for the pair-wise covariance C_{ij}. We replace the estimated sample covariance with the pseudo-covariance from the simulation $C_{ij}^{\,P} = \hat{r}_{ij} \times \sigma_i \times \sigma_j$, where $\hat{r}_{ij}$ is a random number drawn from step 1, $\sigma_i^{\,2}$ is the estimated of variance of firm i's obtained from the real data. Whenever there are multiple firms making earnings announcements on the same day, we use the pseudo-covariance and the pseudo t-statistics in place of their respective counterparts in equation (5).
3. We form the covariance implied return portfolios on each subsequent earnings announcement date, and we aggregate and compute the portfolio's monthly returns. Thus, we obtain a time-series of portfolio returns based on these pseudo pair-wise covariance estimates. This completes one run and we calculate the average monthly returns for long-short hedge portfolio in this simulation.
4. We repeat this simulation 1,000 times, and report the p-value in terms of the percentage of times the long-short hedge portfolio from the real data beats that from the simulated data.[29]

Figure B1 presents the return characteristics of the lowest covariance implied return portfolio (Panel A); the highest covariance implied return portfolio (Panel B); and the long-short portfolios (Panel C) in which all the covariance estimates are simulated random numbers. In Panels A to C, the solid line is the fitted normal density plot; the dashed line is the fitted Epanechnikov kernel density plot; and the bar chart is the histogram of the simulated long-short portfolio returns. Panel D provides some detailed summary statistics on the return characteristics (0.5-percentile, 1-percentile, first quartile, mean, median, third quartile, 99-percentile, and 99.5-percentile). While the return distributions of the lowest and the highest implied return portfolios

[29] We choose 1,000 times to achieve a balance between the sampling properties of the simulation results and computational time. It takes about 30 minutes for a single run of the simulation.

noticeably deviate from normal densities, the long-short portfolio returns seem to fit the normal distribution quite well.

Table B2 reports the performance of the simulated covariance implied returns sorted portfolios in which the covariance estimates are randomly drawn from a uniform distribution over [-1, 1]. Panel A and Panel B report the mean and median portfolio returns and t-statistics respectively across all the simulations. Means and medians of each of the portfolio's returns and t-statistics are similar, which illustrates that we achieve stable simulation outcomes. There are several noteworthy observations. First, the excess returns across all portfolios are similar. For example, Panel A shows that the portfolio returns range from 59 basis points per month (portfolio 3) to 89 basis points per month (portfolio 5). Panel B shows that the portfolio returns range from 58 basis points per month (portfolio 3) to 90 basis points per month (portfolio 5). The long-short portfolio constructed by purchasing portfolio 5 and short selling portfolio 1 generates average spreads of 10 basis points per month and median spreads of 12 basis points per month. However, the long-short spreads are not statistically different from zero (t-statistic of 0.40). Second, none of the returns for portfolios 1 to 5 is statistically significantly different from zero at the five percent level after we apply the CAPM, the Fama-French three-factor model, and Fama-French and Carhart four-factor model as the benchmark risk adjustment models. This is what we expect. By the design of the simulation, we randomly draw correlations from a uniform distribution and these correlations are expected to contain no useful information. In addition, we have argued earlier that the average abnormal returns contain no reliable information for determining the current quarter's earnings announcement period returns. Therefore, essentially, our simulation-based procedure selects stocks randomly from the CRSP universe, which should not earn excess returns. Third, we also compute the empirical distribution of the long-short portfolio returns from the random covariance estimates. The 99.5^{th} percentile return is about 80 basis points per month, and the return of 105 basis points per month from our sample is clearly beyond the 99.5^{th} percentile. Indeed, this implies a pseudo p-value of less than one percent, which rejects the null hypothesis that our results are sampled from the random covariance implied portfolios. In summary, the simulation provides empirical evidence that the covariance estimates from past earnings announcement period returns contain useful information, and the return predictability induced by the covariance implied returns is unlikely to be a chance result.

Table B2: Monthly portfolio returns and alphas of the earnings announcement covariance implied return strategies based on the simulated random covariance estimates

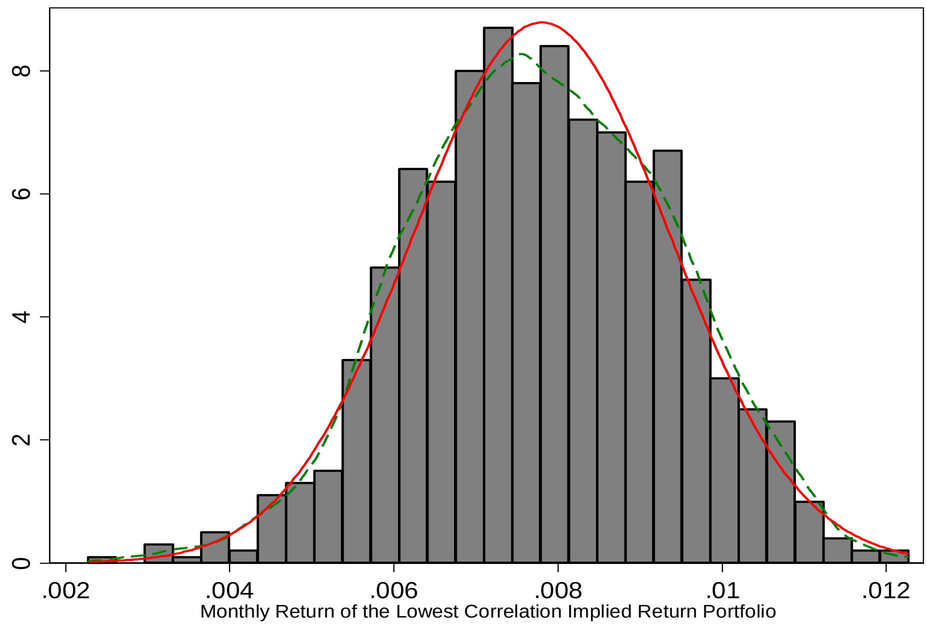
Panel A reports the mean excess monthly (in percent, first column) returns and alphas (in percent, second to fourth columns), and panel B reports the median excess monthly returns and alphas for the correlation implied portfolio strategy within the Fama-French 30-industry classification based on the mean and simulated random covariance earnings announcement abnormal returns over past 20 quarters (skipping the most recent four quarters). All firms with either December or non-December as fiscal year end-month are considered, requiring five-year existence in CRSP-Compustat merged files and regular earnings announcements in the past 20 quarters. "5-1" represents a long/short hedge portfolio, which is constructed by going long in stocks in quintile 5 (the highest implied returns for the late announcers) and short in stocks in quintile 1 (the lowest implied returns for the late announcers). *t*-statistics are the average *t*-statistics from the simulations. The average number of stocks in each quintile portfolio is 99 in each simulation.

	Panel A: Portfolio returns (mean)				Panel B: Portfolio returns (median)			
	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha	Excess Return	CAPM alpha	FF3 alpha	FF4 alpha
1	0.780	0.173	0.152	0.181	0.776	0.167	0.148	0.175
	[2.39]	[0.79]	[0.69]	[0.80]	[2.37]	[0.76]	[0.69]	[0.75]
2	0.566	0.044	-0.014	0.012	0.566	0.044	-0.014	0.013
	[2.01]	[0.23]	[-0.08]	[0.05]	[2.01]	[0.23]	[-0.07]	[0.06]
3	0.636	0.145	0.116	0.148	0.635	0.142	0.115	0.146
	[2.45]	[0.85]	[0.66]	[0.82]	[2.46]	[0.85]	[0.67]	[0.82]
4	0.703	0.166	0.177	0.209	0.700	0.165	0.178	0.384
	[2.50]	[0.91]	[0.95]	[1.09]	[2.51]	[0.93]	[0.96]	[1.80]
5	0.900	0.292	0.365	0.388	0.893	0.285	0.361	0.384
	[2.81]	[1.41]	[1.76]	[1.82]	[2.79]	[1.37]	[1.75]	[1.80]
5-1	0.120	0.119	0.213	0.207	0.120	0.120	0.220	0.212
	[0.46]	[0.45]	[0.79]	[0.75]	[0.46]	[0.45]	[0.80]	[0.76]

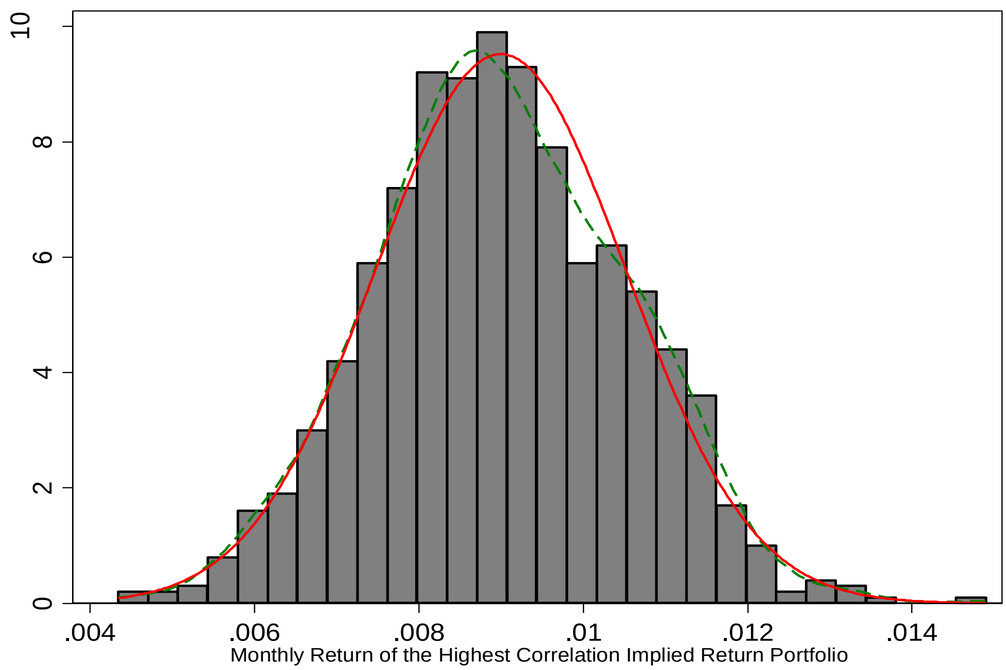
Figure B1: Distributional characteristics of the simulated covariance implied returns.

This figure illustrates the characteristics of the lowest (Panel A), the highest (Panel B) and the long-short portfolios (Panel C) constructed based on the simulated covariance implied returns as described in the text. The solid line is the fitted normal density plot, the dashed line is the fitted Epanechnikov kernel density plot, and the bar chart is the histogram of the simulated long-short portfolio returns. Panel D provides return distribution's summary statistics (0.5-percentile, 1-percentile, first quartile, mean, median, third quartile, 99-percentile, and 99.5-percentile).

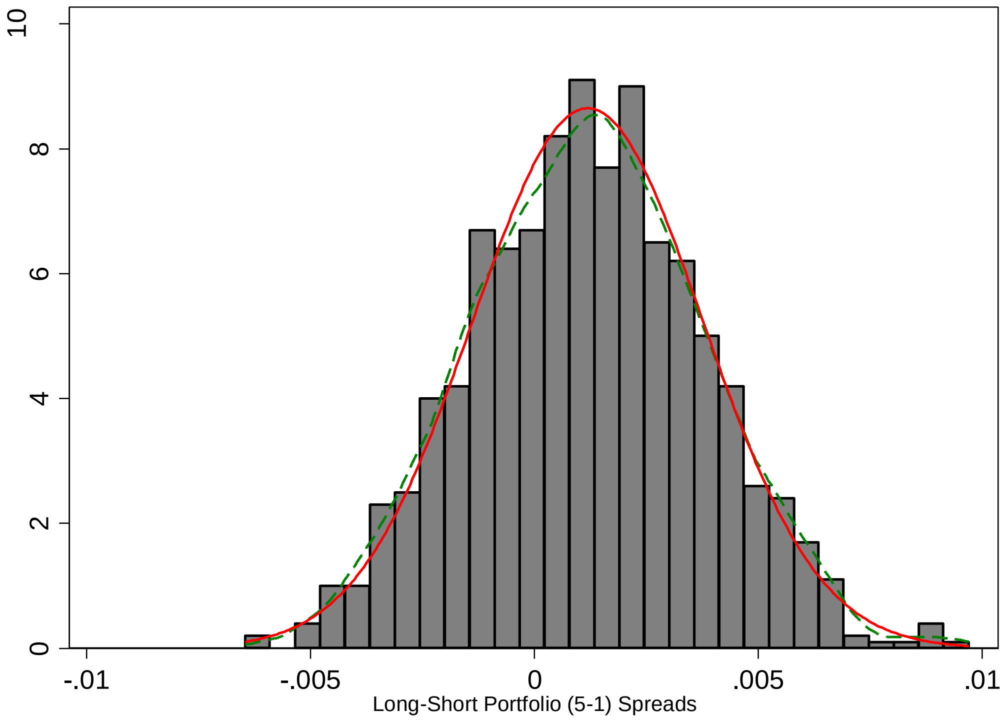
Panel A: Distributional characteristics of the returns from the simulated lowest covariance implied return portfolios



Panel B: Distributional characteristics of the returns from the simulated highest covariance implied return portfolios



Panel C: Distributional characteristics of the returns from the simulated long-short portfolios



Panel D: Portfolio Return Distributional Characteristics

	P0.5	P1	Q1	Mean	Std	Median	Q3	P99	P99.5
1	0.351	0.411	0.670	0.780	0.157	0.776	0.895	1.120	1.144
2	0.196	0.227	0.478	0.566	0.137	0.566	0.664	0.872	0.911
3	0.311	0.335	0.554	0.636	0.124	0.635	0.718	0.917	0.961
4	0.349	0.392	0.608	0.703	0.132	0.700	0.794	0.999	1.026
5	0.523	0.565	0.797	0.900	0.152	0.893	1.009	1.242	1.301
5-1	-0.505	-0.442	-0.065	0.120	0.257	0.120	0.293	0.682	0.851

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Appendix C: Definition and Construction of Variables

In this appendix, we provide details on the construction of various variables used in this paper.

"CAPM alpha": The estimate of the abnormal return based on the Capital Asset Pricing Model; we estimate monthly time-series regressions:

$$R_{pt} - R_{RFt} = \alpha_p + \beta_p(R_{mt} - R_{RFt}) + \varepsilon_{pt}$$

where R_{pt} is the portfolio *p's* return on month *t*, R_{RFt} is the T-bill rate for month *t*, α_p is the estimated CAPM adjusted return, β_p is the estimated beta, $(R_{mt} - R_{RFt})$ is the market excess return, and ε_{pt} is the regression error.

"FF3 alpha": The estimate of abnormal return based on the Fama and French (1993) three factor model: we estimate monthly time-series regressions:

$$R_{pt} - R_{RFt} = \alpha_p + \beta_p(R_{mt} - R_{RFt}) + s_p SMB_t + v_p HML_t + \varepsilon_{pt}$$

where SMB_t is the small minus big factor, the return of a spread portfolio during month *t* constructed by going long in the small market capitalization stocks ("small stock" portfolio) and short in the large market capitalization stocks ("big stock" portfolio); and HML_t is the value minus growth factor, which is the return of a spread portfolio during month t constructed by going long in the high book to market equity stocks and short in the low book to market equity stocks.

"FF4 alpha": The estimate of the abnormal return based on the modification of the three-factor model by Carhart (1997), which adds a zero-investment portfolio related to the price momentum:

$$R_{pt} - R_{RFt} = \alpha_p + \beta_p(R_{mt} - R_{RFt}) + S_p SMB_t + v_p HML_t + m_p MOM_t + \varepsilon_{pt}$$

where MOM_t is the momentum factor, which is the return of a spread portfolio during month t constructed by going long in the stocks with high past eleven month returns ("winner stock" portfolio) and short in the stocks with the lowest past eleven month returns ("loser stock" portfolio).

"ME": The market equity is the closing price times shares outstanding, measured as of the end of the month prior to the earnings announcement date.

"ME Rank": The market equity of the firm, measured at the end of the month prior to the earnings announcement date, is ranked into deciles based on the NYSE market capitalization decile breakpoints, where 1 is the smallest market capitalization decile and 10 is the largest market capitalization decile.

"Return Momentum": At the beginning of month t, we cumulate the past monthly returns over the period from t-12 to t-2, skipping the return in the last month *t-1* to avoid bid-ask bounce induced market microstructure noise, where *t* is the month of earnings announcement.

"B/M": we calculate the annual book-to-market equity following the definition in Fama and French (1992, 1993). The stockholder's equity (SEQ), common equity (CEQ), preferred stocks (PSTK), total assets (AT), total liabilities (LT), preferred stock redemption value (PSTKRV), preferred stock liquidating value (PSTKL), deferred taxes and investment tax credit (TXDITC), and post retirement benefit asset (PRBA) are extracted from COMPUSTAT XPF annually files. To get stockholder's equity, we use SEQ if it is not missing. If it is missing, then we use CEQ plus PSTK if both are available. Otherwise, we use AT minus LT if both are present. If none of these yields a valid stockholder's equity value, we treat the observation as missing. To determine preferred stock value, we use PSTKRV, PSTKL, or PSTK, in that order, according to data availability. If none of these yields a valid preferred stock value, then, again treat the observation as missing. To determine book equity, we subtract preferred stock value from stockholder's equity, add back TXDITC if available, and subtract PRBA if available. To ensure the availability of accounting data to the market, we require a six-month lag between the time of using these variables and the last fiscal year end date. The banks and industrial firms with negative book equity are excluded when we report the portfolio characteristics. Finally, to obtain the book-to-market equity, we use the price and shares outstanding at the end of month of firm's fiscal year ending date.

“B/M Rank”: The book-to-market equity ratio of a firm, measured at the end of month of firm's fiscal year ending date, is ranked into deciles based on the NYSE book-to-market equity ratio decile breakpoints, where 1 is the smallest book-to-market equity ratio decile and 10 is the largest book-to-market equity ratio decile.

“Accruals”: annual accruals are based on Sloan’s (1996) calculation. The current assets (ACT), cash and short-term investments (CHE), current liabilities (LCT), short-term debt (DLC), taxes payable (TXP), depreciation and amortization (DP), and total assets (AT) are extracted from COMPUSTAT XPF annually files. The annual accruals over the fiscal year T is the change of (ACT-CHE) minus the change of (LCT-DLC-TXP) minus the change of DP from the last fiscal year T-1. To make these variables comparable across the different size of firms, we scale each item by the average of total assets $(AT_T+AT_{T-1})/2$.

“Seasonal Random Walk Model Earnings Surprise (SRW ES)”: we calculate the earnings surprise based on seasonal random walk model (SRW) following the definition by Chan et al. (1996). The earnings per share (EPSPXQ) and cumulative adjustment factor (AJEXQ) are extracted from COMPUSTAT XPF quarterly files. The variable e_{iq}, the adjusted EPS for firm i during quarter q, is EPSPXQ divided by AJEXQ. To get the standardized unexpected earnings (SUE) in quarter q, we first subtract e_{iq-4} from e_{iq}, and then scale by σ_{iq}, and σ_{iq} is the standard deviation of unexpected earnings, e_{iq} - e_{iq-4}, over the preceding eight quarters.

“I/B/E/S Analyst Consensus Forecast Earnings Surprise (FE)”: we calculate the earnings surprise as the difference between the I/B/E/S analyst earnings per share (EPS) consensus forecasts made at the end of the month prior to the month of earnings reports, and the actual I/B/E/S reported actual earnings per share (EPS), then deflated by the stock price at the beginning of the quarter. All measures are adjusted for stock splits.

“I/B/E/S Analyst Consensus Long-term Earnings Growth Rate Forecast (FLTG)”: the I/B/E/S analyst earnings per share (EPS) long-term growth rate consensus forecasts made at the end of the month prior to the month of earnings reports.

“Amihud Illiquidity Measure”: defined as $\frac{1}{N}\sum_{t=1}^{N}\frac{|R_d|}{VOLD_d}$, where N is the number of trading days with available volume data during the year prior to earnings announcement, $|R_d|$ is the absolute value of the daily stock return on day d, $VOLD_d$ is the dollar trading volume on day d.

“Proportional Quoted Spreads (PQSPR)”: $PQSPR_t = (Ask_t - Bid_t)/Midpoint_t$, and $Midpoint_t = (Ask_t + Bid_t)/2$, where Ask_t equals the inside ask at time t, Bid_t equals the inside bid at time t. For each stock, the average proportional quoted spread for the day is defined as the weighted average spreads during the day, where the weight is the number of seconds it is in display. The monthly proportional quoted spread for each stock is defined as the average of daily proportional quoted spread for that stock during the month.

"Proportional Effective Spreads (PESPR)": $PESPR_t = 2 \times |P_t - Midpoint_t| / Midpoint_t$, and $Midpoint_t = (Ask_t + Bid_t)/2$, where P_t is the trade price at time *t*, Ask_t equals the inside ask at time *t*, Bid_t equals the inside bid at time *t*. For each stock, the average proportional effective spread for the day is defined as the trade-weighted average spreads during the day. The monthly proportional effective spread for each stock is defined as the average of daily proportional effective spread for that stock during the month.

"Hasbrouck (2007) Gibbs Measure Spreads (γ_0 and γ_1)": the spread measures derived from the CRSP daily stock file using Bayesian method. Hasbrouck (2007) provide details on the construction of the spreads.

"Corwin and Schulz (2007) High-Low Spreads": the spread measure derived from the CRSP daily stock files. Corwin and Schulz (2007) provide details on the construction of the spreads.