

# Earnings Announcement Premia and the Limits to Arbitrage<sup>\*</sup>

Daniel A. Cohen  
Stern School of Business  
New York University

Aiyesha Dey  
Graduate School of Business  
University of Chicago

Thomas Z. Lys<sup>\*\*</sup>  
Kellogg School of Management  
Northwestern University

Shyam V. Sunder  
Kellogg School of Management  
Northwestern University

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\*\* Corresponding Author (847) 491-2673, [tlys@kellogg.northwestern.edu](mailto:tlys@kellogg.northwestern.edu)

# Earnings Announcement Premia and the Limits to Arbitrage

## Abstract

We reexamine the existence of earnings announcement-day premia and find that they persist beyond the sample period of earlier studies, over different disclosure environments and remain robust to the refinement of using the expected announcement day rather than the actual announcement day. We provide evidence that the premia are reduced in the presence of earnings pre-announcements. We document that a portfolio of announcing firms yields returns in excess of the corresponding risk. Excluding announcers from a well-diversified portfolio, while reducing the standard deviation of that portfolio, also reduces its Sharpe ratio, indicating that this strategy results in a less favorable risk-return trade-off. Finally, we find that the limits to arbitrage are a likely explanation for the persistence of the announcement premia.

## 1. Introduction

Prior literature has documented positive abnormal returns around predictable news announcements (Penman, 1984; Kalay and Lowenstein, 1985; Chari, Jagannathan and Ofer, 1988, Ball and Kothari, 1991).<sup>1</sup> The explanation offered for the abnormal returns is that it is a compensation for holding securities during a period of increased uncertainty when valuation relevant information is expected to be released. Assuming investor rationality and mean-variance pricing, investors would require higher announcement returns when: (1) an announcement is expected, and (2) the resolution of uncertainty (risk) is non-diversifiable.<sup>2</sup>

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<sup>1</sup> Although a few empirical studies have documented results that conflict with the presence of an earnings announcement-day premium (Peterson, 1990; Brown and Kim, 1993), the majority of the evidence supports the presence of higher returns on predictable disclosure events indicating that investors require an announcement-day premium.

<sup>2</sup> Robichek and Myers (1966) illustrate this phenomenon with the following story: A ship sets out on a two-year voyage in search of gold. At its departure, the prices of all financial claims on the payoffs of this journey reflect all the available information. Suppose no information reaches the market while the ship is away. Until the point the ship reaches the port, expected return on all financial claims related to the payoffs from the journey will be free of additional risk, because there is no information that would lead investors to change their valuations. Hence, during the voyage, the investment should earn the risk-free rate. However, the uncertainty is resolved once the ship returns with cargo. Therefore, if the risk were not diversifiable,

The first of these two conditions is satisfied: as a consequence of the Securities Acts and Stock Exchange rules mandating that publicly traded companies issue annual and quarterly statements, investors can reasonably expect periodic resolutions of uncertainty. However, on the surface, it appears that the associated risk should be diversifiable and not reflected in higher returns for two reasons. First, the risk is likely to be idiosyncratic because documented premia are measured after controlling for market movements. Second, the number of announcing firms on any particular day is a miniscule fraction of a well-diversified portfolio.<sup>3</sup> Indeed, our results discussed below suggest that for sufficiently large portfolios, the risk associated with the resolution of uncertainty is diversifiable. As a result, the presence of elevated announcement-period returns is a puzzle.

Our primary objective is to reexamine the phenomenon of the earnings announcement premia for several reasons. First, the disclosure environment, and hence the disclosure risk, has changed since the publication of the most recent study on the announcement premia (Ball and Kothari 1991, hereafter referred to as B&K).<sup>4</sup> Specifically, there has been an increase in the occurrence of pre-announcements, earnings guidances, and conference calls, all of which reduce announcement risk. As a result, the announcement period premia should also decrease. Second, the research methodology employed in prior studies did not control for the timing of the announcements (specifically, B&K use the actual rather than the expected announcement dates to measure the premia). As we

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the expected return would be higher on the day the market receives information about the claims' likely payoff.

<sup>3</sup> Fama (1986) documents that the risk of a portfolio converges rapidly towards that of a fully diversified portfolio as the number of securities increases, and that the number of securities necessary to achieve diversification is relatively small, typically less than 30.

<sup>4</sup> The sample period in B&K ended in the first quarter of 1988.

discuss below, this approach is likely to result in an upward bias of the measured announcement-period premia.<sup>5</sup> Thus, controlling for timing is important in order to obtain accurate measures of the magnitude of the premia. Finally, we investigate whether limits to arbitrage are responsible for the continued presence of earnings announcement premia.

Consistent with prior research, we find significant announcement premia. However, we also find that the premia are significantly smaller than those documented in prior research by a factor of three (0.07 percent versus 0.24 percent). One reason for this finding is that measuring the premia on the actual announcement date rather than the expected announcement date in prior research biases the estimate upwards. Specifically, the return on the actual earnings announcement dates for early announcers reflects both the announcement premium and the fact that firms with good news are more likely to announce early (Chambers and Penman, 1984). Conversely, the return for late announcers only partially reflects the fact that firms with bad news tend to announce late, since that effect was partially anticipated on the expected date when those firms did not announce. As a result, the combined return for both early and late announcers is an upwardly biased estimate of the announcement period premia.

Our results indicate that after controlling for this bias, earnings-announcement premia, while still statistically significant, have declined by a factor of two in the period since 1988 (0.07 percent versus 0.04 percent). Part of the decline is explained by the fact that since 1997 the incidence of earnings pre-announcements has increased and, as expected, earnings announcement premia for pre-announcers are low. However, most of

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<sup>5</sup> We conduct two sets of tests described in detail in Section 4.

that decline in announcement period premia is not likely to have been caused by changes in the disclosure environment. Specifically, consistent with recent empirical evidence documenting an increase in stock return volatility over time (e.g., Campbell, Lettau, Malkiel and Xu, 2001; Rajgopal and Venkatachalam, 2005), we find that the variance of the announcement period abnormal returns actually increased significantly from 0.031 in the period 1980-1988 to 0.047 in the period 1989-2001. This increase in abnormal return volatility indicates that earnings announcements have, on average, become more informative, implying that changes in the disclosure environment are not likely to entirely explain the decline of the earnings announcement risk premia.

While the premia are reduced in magnitude, their continued existence remains a puzzle. Therefore, we specifically investigate whether the premia continue to exist simply because it is not worthwhile to arbitrage them. In other words, the question is whether the announcement premia compensates investors for the increased risk of holding announcer firms on the announcement days (the risk-return tradeoff of announcement risk). Our results indicate that portfolios comprising announcer firms earn a significant excess return (Jensen's alpha) of between 0.008 percent and 0.039 percent per day. Further, we show that excluding announcing firms from an otherwise fully diversified portfolio, while reducing the portfolio total risk (standard deviation) by 3.1 percent, results in lower Sharpe ratios. Thus, excluding announcing firms results in a less favorable return-risk tradeoff. We interpret these results as indicating that it is worth attempting arbitrage of these returns.

We conclude our analysis by investigating whether announcement premia are being arbitrated, given that it is worthwhile to do so. Our investigation reveals that limits to

arbitrage explain the amount of announcement-period abnormal returns that remain un-arbitrated. Specifically, we find that the remaining premia are positively associated with the costs of arbitrage, including idiosyncratic risk and bid-ask spreads. We document a negative association between the premia and the float on announcement days – consistent with arbitrage being more likely when a sufficient number of shares are available for trading. We also find that the premia are higher on days when greater concentrations of firms announce their earnings – consistent with the hypothesis that arbitrage capital is limited. Finally, our results indicate a negative association between the announcement premia and the trading volume on announcement days. We interpret these results as supportive of the hypothesis that when the barriers to arbitrage activity are high, the premia are also high.

Taken together, our results are important for several reasons. First, they establish the continued existence of an earnings announcement premia in the current time period. This result is obtained even after methodological refinements, including controlling for the timing of the announcements. Second, our result that the premia are eliminated through pre-announcements, establishes that the premia are indeed a compensation for risk. Third, our computations imply that earnings announcements returns are “worth” the risk. Finally, the evidence that the magnitude of the premia is related to limits to arbitrage indicates that the phenomenon of an announcement-day premia is likely to continue to exist.

The remainder of the paper is organized as follows. Section 2 discusses the research objectives. Section 3 describes the data used in the analysis. Section 4 contains a detailed analysis of the announcement premia, including the magnitude of the

announcement premia after controlling for the timing of the announcements, and the effect of the changing disclosure environment on the announcement premia. Section 5 presents an analysis of the risk-return tradeoff of earnings announcements, and Section 6 explores limits to arbitrage as an explanation for the continued existence of the announcement premia. Finally, Section 7 concludes.

## **2. Research Objectives and Design**

B&K is the latest study investigating the announcement-period returns, documenting significant abnormal returns even after controlling for the change in betas during earnings announcement periods. Thus, the presence of announcement period abnormal returns is a puzzle, and investigating potential explanations for this puzzle remains an interesting research topic.

Our main research objective is to reexamine the phenomenon of the earnings announcement premia. Several issues warrant such a reexamination. First, considerable time has elapsed since the last study documenting the existence of earnings announcement premia. As a result, we would expect arbitrageurs to profit from this phenomenon, resulting in a decrease, or even the elimination, of the premia.

Second, the disclosure environment has changed considerably since B&K's sample period which ended in 1988 resulting from an increase in voluntary disclosures especially earnings pre-announcements. Pre-announcements reduce the announcement risk on the final earnings announcement date. If the increased return on earnings-announcement dates indeed relate to earnings-announcement risk, then pre-announcements provide a natural experiment to test this phenomenon, because they are likely to reduce the earnings

announcement risk and premia. In addition to pre-announcements, we also examine the effect on the announcement premia of the information content of earnings announcements, relative to all other sources of information.

Third, we refine the empirical methodology used in prior research. These studies measure the premia at the actual announcement dates rather than the expected announcement dates. As mentioned earlier, this approach is likely to lead to erroneous inferences because by definition, the announcement risk occurs because of the uncertainty on an expected announcement date. However, the timing of the announcement per se is likely to convey information (Chambers and Penman, 1984). Specifically, firms with good news are more likely to announce early, while late announcers tend to be firms with bad news.<sup>6</sup> For an earnings announcement that occurred (unexpectedly) prior to its expected date, the return on the actual announcement date reflects the information associated with good news (Chambers and Penman, 1984) plus the announcement period premium.

Similarly, the return for late announcers is likely to contain the information value of announcing late, and this is likely to be reflected in the earnings announcements period premium. However, this effect is partially anticipated when the firms have failed to announce on the expected earnings announcement date. As a result, the combined portfolio of early, on-time, and late announcers on the actual announcement date is likely to overstate the announcement period premium. To address this issue, we analyze the earnings announcement premium by relying on a model to estimate the expected

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<sup>6</sup> See McNichols (1988), Patell (1976), Penman (1980), Waymire (1984), Lev and Penman (1990), and Begley and Fischer (1998) for further evidence in support of this conjecture. In contrast, Skinner (1994, 1997), Kasznik and Lev (1995) and Soffer, Thiagarajan, and Walther (2000) document that bad news firms announce early to mitigate litigation risk.

announcement date (see Appendix). However, the use of a model to estimate the expected announcement date introduces measurement error in the analysis by inclusion of some “expected dates” when investors actually did not expect an announcement. Inclusion of those dates biases the measured announcement premia towards zero. As a result, the research design hinges on the reliability of the expectation model and the “true” premia are bound between the (lower) premia measured on the expected announcement date and the (higher) premia measured on the actual announcement date.

Untabulated results indicate that our expectation model performs well relative to data gathered from the “Earnings Calendar” published by the Wall Street Journal.<sup>7</sup> Moreover, Bagnoli, Kross and Watts (2002) show that the Chambers-Penman effect is stronger for bad-news announcing firms than documented in prior literature and that good news firms do not tend to announce early. As a result, the upwards bias of measuring the premia on the actual date is likely to be more important than the downward bias of measuring premia on the expected date. (We provide evidence on these effects in section 4.)

The continued presence of an earnings announcement premium leads us to conduct the following analyses. We first investigate whether holding announcing firms through the day of the announcement is worth the additional risk it entails. An inadequate risk-return trade off would indicate that investors would have no incentives to arbitrage the announcement premia. As an alternative explanation, we explore whether the limits to

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<sup>7</sup> To assess the reliability of the expectation model, we hand collected expected earnings announcement dates from the “Earnings Calendar” published in the Wall Street Journal for July 2005 ([http://online.wsj.com/public/Markets\\_Calendar.htm](http://online.wsj.com/public/Markets_Calendar.htm)). We found a total of 2,047 expected earnings announcement dates compared to 2,735 actual announcements in COMPUSTAT in the same period in 2004. Thus, the Earnings Calendar provides expectations for roughly 75 percent of the announcing firms. We find that 59 percent of the 2,047 firms announced within 1 day of the expected date as published in the Earnings Calendar compared to 62 percent on-time announcements using our expected announcement date model (see appendix). However, using proprietary data from First Call for a subset of 4,434 firms in the January 1995 to July 1998 period, Bagnoli et al. (2002) report that 85 percent of firms report within one day of the expected announcement date collected by First Call as of two weeks of the expected date.

arbitrage explain the continued existence of the announcement day premia.<sup>8</sup> In particular, we examine whether idiosyncratic risk, bid-ask spreads, float (average trading volume scaled by the average number of shares outstanding), trading volume, and concentration of announcing firms are related to the earnings announcement premium. Evidence supporting the limits to arbitrage theory also implies that the announcement risk premia is likely to persist.

### 3. Data

Quarterly earnings announcement dates are collected from the COMPUSTAT quarterly file for the period 1980 to 2001 to yield a maximum of 88 quarters for each of the sample firms. We collect all firms with a December fiscal year end and available quarterly earnings announcement dates on COMPUSTAT, resulting in 12,377 firms and 297,426 firm-quarter observations. We only retain firms with at least 10 firm-quarter observations, resulting in 8,493 firms and 275,820 firm-quarter observations. Finally, after merging the COMPUSTAT sample with CRSP daily files, we are left with 7,260 firms and 227,281 firm-quarters.

Earnings-announcement dates are obtained from COMPUSTAT. As per COMPUSTAT, this date corresponds to “the date in which quarterly earnings and earnings per share figures are first publicly reported in the various news media (such as

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<sup>8</sup> Shleifer and Vishny (1997) point out that frictions and risks in execution of the arbitrage in practice results in “risk arbitrage” that requires substantial commitment of capital on part of arbitrageurs. In turn, arbitrageurs are likely to face capital constraints or have to raise capital from investors who may not have the required appetite to sustain risk positions. These factors deter arbitrage activities and can lead to persistent anomalous returns in the market. Further, Mashruwala, Rajgopal and Shevlin (2004) argue that for a riskless hedge to exist, the arbitrageur needs to find close substitute stocks whose returns are highly correlated with the returns of the firms subject to anomalous mispricing. However, identifying such substitutes is a difficult task in practice. In their study, they find that the well documented “accruals anomaly” is persistent because it is difficult to arbitrage.

the Wall Street Journal or newswire services)”<sup>9</sup>. As a result, the information is likely to have been impounded into security prices on days -1 or 0 for events where the announcement date is from the news media and on days 0 or +1 when the earliest date is from newswire services. Therefore, we define the earnings announcement period as the three days centered on the COMPUSTAT earnings announcement date (days -1, 0, and +1).

For our analyses of the effect of the disclosure environment on the announcement premium, we gather data on pre-announcements of quarterly earnings. The pre-announcement data is obtained from the Company Issued Guidance (CIG) database maintained by First Call. First Call collects data about earnings pre-announcements from press releases and interviews by company officials.<sup>10</sup> An analysis of the database shows that the data are broadly available from 1998 (although First Call claims to have data going back to 1990). We restrict our pre-announcements sample to observations over the period 1998 to 2001 because the data for prior periods is less complete. This sub-sample consists of 70,073 firm-quarter observations for 5,178 firms. Of these, 46,184 firm quarters representing 5,121 firms had pre-announcements.

#### **4. Analysis of the Announcement Risk Premia**

We begin our analysis by computing the earnings-announcement premia. Section 4.1 analyses the premia for the entire 1980-2001 sample period and two sub-periods: 1980-

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<sup>9</sup> Ball and Bartov (1995) state that COMPUSTAT relies on data sources such as, the Wall Street Journal, for earnings dates and they suggest that the errors are likely to be “small in number”.

<sup>10</sup> Other studies that have used the database are Soffer, Thiagarajan and Walther (2000) and Cotter, Tuna and Wysocki (2002). Anilowski, Feng, and Skinner (2005) explain in detail the origin and data collection approaches of First Call in compiling this data. According to them, 1998 is the earliest year with a significant number of available firm observations of earnings guidance in the database.

1988 (corresponding to the period investigated by B&K) and the 1989-2001 period (corresponding to the period subsequent to B&K). Section 4.2 discusses the premia relative to the timing of announcements, investigating the consequences of measuring the premia on the actual versus the expected announcement dates. Finally, Section 4.3 discusses the effect of changes in the disclosure environment, including the effect of pre-announcements on the earnings-announcement premia.

#### *4.1 Premia over the Sample Period*

We begin our analysis by computing the earnings announcement premia in the entire 1980-2001 period and two sub-periods (1980 to 1988, 1989 to 2001), both on the expected as well as the actual announcement dates (the latter to allow comparison with B&K). As indicated in Section 3, by definition the earnings announcement premium (if it exists) is a return that compensates investors for the increased risk of holding a security in a period when release of information that is likely to affect the security's value is expected.

We estimate the expected earnings announcement date for each firm in each quarter using the procedure described in the Appendix. We compute the premia for the three-day expected earnings announcement period (days -1, 0 and +1), where day 0 represents the expected earnings announcement day.<sup>11</sup> For each firm  $j$  and quarter  $q$ , we subtract the mean return in non-announcement periods using the firm as its own control. We also use the returns on all non-announcing firms on the announcer's date as a second control: for each announcement in period  $t$  and quarter  $q$ , we compute the mean daily return for firms

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<sup>11</sup> As a sensitivity check, our results remain qualitatively unchanged when we define on-time announcements as those occurring on the expected announcements date (as opposed to the three-day window centered on the expected announcement date).

that did not announce.<sup>12</sup> Our results are materially the same using either method. Therefore, for brevity, we only discuss the results using the firm as its own control and for the 3-day announcement period. To compare our results with B&K, we also compute the returns on the actual earnings announcement date, using the same controls described above.

Row 1 of Table 1 reports the premia for the entire sample, for the expected and the actual earnings-announcement periods. For both periods, we find a positive and statistically significant (at conventional levels) announcement premia of 0.05 percent ( $t = 2.99$ ) and 0.14 percent ( $t = 11.24$  percent). While the premia are small in absolute magnitude, it is important to understand that they represent the un-arbitraged premia. That is, the premium represents the returns that remain after arbitrage activity has been undertaken by arbitrageurs.

As these results indicate, measuring the premia on the actual announcement date increases the premia threefold with the difference statistically significant at the 0.01 level. To investigate the effect of changes in the disclosure environment since B&K, we divide the sample into two sub-periods. Row 2 reports the premia for the period corresponding to the B&K sample period (1980-1988) and Row 3 the premia for the subsequent period (1989-2001).

The results indicate that the premia are statistically significant (at conventional levels) for both sub-periods for both the expected and the actual announcement window, with the

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<sup>12</sup> While our major results are invariant to the specific benchmark, the following trade-off exists. Using the firm as its own control (the first benchmark) has the advantage that it is likely to provide a better control for risk to the extent that firms within an industry announce in close proximity (and hence the non-announcer portfolio is likely to consist of firms from other industries). However, the second benchmark (using non-announcing firms as a benchmark) controls for market movements.

premia for the actual announcement dates being significantly larger (at the 0.01 level) than those on the expected announcement dates (by a factor of three). However, we also find that the premia are significantly larger (at the 0.01 level) in the earlier sub-period for both the expected and the actual announcement window (by roughly a factor of two). We investigate the effect of timing of the earnings announcements on the announcement period return next.

#### *4.2 Premia Relative to the Timing of Announcements*

Table 2 reports the announcement period abnormal returns on the actual and expected announcement dates based on whether the firms announced early, on-time or late. On-time announcements are those which occurred in the expected announcement periods. Late announcements are those which occurred subsequent to the expected announcement periods, and early announcements are those which occurred prior to the expected earnings announcement periods.

Our results indicate that early announcers have an abnormal return of 0.29 percent on the actual announcement date. Since these firms announced prior to the expected date, this return is likely to represent the effect that firms with good news have a propensity to announce early (Chambers and Penman, 1984). Interestingly, we still find a significantly elevated abnormal return for these firms on the expected announcement date, a result for which we have no rational explanation.<sup>13</sup>

On-time announcers have a highly statistically significant abnormal return of 0.13 percent on the expected (and, by definition, the actual) announcement date. However,

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<sup>13</sup> This could be explainable as resulting from a drift in reaction to news similar to that observed in case of the post-earnings announcement drift documented in Ball and Brown (1968) and others.

this return is also a biased estimate of the announcement premium, as some firms that were expected to announce ended up announcing late and their return is significantly lower in the expected announcement period (the difference is significant at the 0.01 level). Thus, the return of on-time announcers is comprised of two effects: first, a positive announcement risk premium for the on-time announcement and second, the negative return of firms that are announcing late. Notice that for late announcers, the measured return in the expected announcement period is the sum of the announcement-date premium and the informational effect of announcing late. Since the evidence indicates that the premium is positive, the measured return on the expected announcement date suggests, consistent with the Chambers and Penman hypothesis, that the late-announcement effect is negative. Using the on-time announcers' estimate of the announcement premium (i.e., 0.13 percent) implies that announcing late is associated with an abnormal return of roughly -0.13 percent (0.00 percent – 0.13 percent). Finally, from an ex-ante perspective, the correct approach to measure the premium is to focus on on-time and late announcers. As indicated in the last row of Table 2, our analysis indicates that the premium for these announcers is 0.05 percent ( $t = 4.37$ ).

The above results (coupled with the results in the previous section) establish that the magnitude of the announcement premia documented (measured in the relatively short announcement-period window) in prior research (relying on the actual as opposed to the expected announcement periods) was most likely overstated, as the Chambers-Penman effect (good-news firms announce early, bad-news firms announce late) is larger for early announcers than for late announcers. Indeed, the abnormal return for the entire portfolio is much higher when computed for the actual announcement periods as compared to the

expected announcement periods (0.14 percent compared to 0.05 percent): a large component of the premia on the actual announcement period is contributed by the early announcers (0.29 percent). To provide a comprehensive analysis, the remaining analyses use returns for on-time and late announcers measured on the expected announcement date and the returns for all sample firms on their actual announcement date. Recall that the premium on the expected date is likely to be biased towards zero, while the premia measured on the actual announcement date is likely to be biased upwards. Therefore the “true” premium is likely to lie between these two estimates and the regression coefficients in the subsequent analysis provides a lower and upper bound of the likely magnitude of the underlying economic constructs.

Our next goal is to investigate potential reasons for the decrease in the announcement risk premia over time. In particular, we study the effect of the changing disclosure environment on the premia. We provide two tests of the impact of changes in the disclosure environment on the earnings announcement premia: we analyze the effect of earnings pre-announcements, and the effect of differential information content of earnings announcements on the announcement premia. This evidence is discussed in the next section.

#### *4.3 The Effect of Changing Disclosure Environment on Announcement Risk Premia*

The disclosure environment has substantially changed over time, in particular since the period studied in B&K, which ended in 1988. The significant changes in the disclosure environment include an increase in voluntary disclosures, especially earnings pre-announcements (e.g., Soffer et al., 2000). Pre-announcements reduce the

announcement risk on the final earnings announcement date and therefore are likely to reduce the earnings announcement premia. However, while pre-announcements and issuances of earnings guidances reduce the magnitude of earnings surprises, there is also evidence of an increase in idiosyncratic volatility over time (Rajgopal and Venkatachalam, 2005). Consistent with this result, Campbell, Lettau, Malkiel and Xu (2001) show that stock returns of individual firms have become more volatile in the U.S. since 1960. One likely interpretation of this evidence is that firms respond to the increased information flow by increasing the occurrence of pre-announcements and earnings guidances.

Increased occurrences of pre-announcements reduce the announcement period risk, while the increased information flow at earnings announcements (and the related stock-price volatility) increases disclosure risk. As a result, it is not clear what the net effect on announcement period premia will be. We begin this inquiry by analyzing the change in announcement period return variance from the B&K period to the post-B&K period. Consistent with Rajgopal and Venkatachalam (2005), Table 3 indicates that the return variance increased for both the expected and the actual announcement periods by approximately 50 percent, and the associated F-statistics are significant at a 0.01 level. This evidence suggests that the announcement risk has increased, which should lead to an increase in earnings announcement premia, rather than to a decrease in premia as documented in Table 1. We first test whether pre-announcements indeed result in a decrease in earnings announcement premia, and then, in the next section, return to the question of why overall premia have fallen while earnings announcement volatility has increased.

We expect to see a reduction in the earnings announcement premia in the presence of pre-announcements, because the earnings news is no longer a surprise. In other words, pre-announcements provide us with a natural experiment to test whether the increased returns documented in Table 1 indeed represent announcement-risk premia.

To analyze the effect of pre-announcements on the announcement premia, we gather data on pre-announcements dates from First Call for the period 1998 through 2001. The results are reported in Table 4. We first analyze the announcement period returns for on-time and late announcing firms in the 1998-2001 period (Row 1): for firms that issued pre-announcements, the announcement period premium is 0.01 percent ( $t = 2.41$ ). In contrast, the returns are 0.05 percent ( $t = 3.75$ ) for firms that did not issue pre-announcements in the same period. Row 3 reports that the differences between rows 1 and 2 are statistically significant at conventional levels ( $t = -4.02$ ).

Next, as a robustness check, we investigate whether the differences between pre-announcing and non-pre-announcing firms were due to some firm-specific differences. We compare the announcement period returns, for the sample of firms that did and did not pre-announce earnings in the 1998-2001 period, during the period 1980-1997 when these firms are unlikely to have pre-announced earnings. As reported in Row 4 of Table 4, the announcement period return in the 1980-1997 period for those firms that did pre-announce in 1998-2001 are 0.06 percent ( $t = 4.12$ ). The announcement period returns in 1980-1997 for firms that did not pre-announce earnings in the 1998-2001 are 0.07 ( $t = 5.03$ , Row 5). However, as reported in Row 6 of Table 4, the difference across these two portfolios is not statistically significant at conventional levels. Thus, we find no evidence

that the lower announcement period return of pre-announcing firms is due to firm-specific characteristics.

Jointly, these results reported in Table 4 imply that pre-announcements reduce the announcement-period returns. Because pre-announcements are likely to reduce the earnings announcement risk, we interpret these results as being consistent with the presence of an announcement-period risk premium.

However, there exists at least one alternative explanation for the results reported in Table 4. Specifically, the changing informativeness of earnings announcements, relative to other sources of information, may have offset the effect of pre-announcements on the announcement premia over time. To further explore this hypothesis, we compute a metric, which we term the Relative Information Content (RIC). The RIC captures the informativeness of the earnings announcements across firms and over time. Relying on Beaver (1968), we define RIC as the volatility of stock returns in the announcement periods relative to the volatility in non-announcement periods.<sup>14</sup> Specifically, for each firm-quarter we define the relative information content of an announcement ( $RIC_{jq}$ ) as the ratio of the sum of squares of returns in the announcement period relative to the sum of squares of returns in the entire quarter, or:

$$RIC_{jq} = \frac{\sum_{t \in A_j} [R_{j,t \in A_j} - \bar{R}_{jq}]^2}{\sum_{t \in q_j} [R_{j,t \in q_j} - \bar{R}_{jq}]^2} \quad (1)$$

where for firm  $j$  and quarter  $q$ ,  $A_j$  represents the three-day announcement period and  $q_j$  represents the entire quarter, commencing on day +2 relative to the  $q-1$  earnings

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<sup>14</sup> The measure we use focuses on the relative, rather than the absolute, informativeness of financial disclosures. See Brown, Lo and Lys (1999) for a discussion of whether financial statements became more informative over time.

announcement and ending on day +1 of quarter  $q$ 's earnings announcement. Because the number of days between quarterly announcements varies, we normalize (1) by dividing the denominator by the actual number of days and multiplying by 63 (the average number of trading days in a quarter).

We perform two tests to investigate whether changes in the relative information content of earnings are related to the announcement period premia. First, we divide the sample into three groups based on RIC and compare the difference in premia between the high and low RIC portfolios. The results (untabulated) indicate that the premia are significantly higher for the high RIC portfolio. Second, we compute the correlation between RIC and the announcement period premia, and obtain positive and significant (at the 1 percent level) correlations for both benchmarks. These results support the claim that the higher the information content of earnings announcements relative to all other sources of information (i.e., the higher the risk associated with the announcements), the higher will be the announcement premia.

For a more formal analysis of the impact of the disclosure environment on the announcement premia, we estimate the following regression to measure the effect of pre-announcements and the informativeness of earnings on the earnings announcement premia:

$$AP_{jq} = a + b \times RM_{jq} + c \times PreAnn_{jq} + d \times RIC_{jq} + \varepsilon_{jq} \quad (2)$$

where for security  $j$  and quarter  $q$ ,  $AP_{jq}$  represents the announcement premium, and  $RM_{jq}$  is the value-weighted CRSP return on the market on the announcement period. B&K document that firms' betas increase in the announcement window. Recall that our measure of dependent variable is the firm's event period return minus its non-event

period returns. Therefore, including the market return as an independent variable controls for this shift in betas in the event window.  $PreAnn_{jq}$  is a dummy variable that equals 1 if a company made a pre-announcement in that quarter, and 0 otherwise, and  $RIC_{jq}$  is the relative informativeness measure. We expect a negative association between  $PreAnn_{jq}$  and  $AP_{jq}$ , and a positive association between  $RIC_{jq}$  and  $AP_{jq}$ .

Table 5 summarizes the results of regression (2) using both the returns on the expected (on-time and late announcers) and the actual (total sample) announcement dates as the dependent variables. The results of the multivariate analysis are consistent with the univariate results. We find that the coefficient estimate corresponding to  $PreAnn_{jq}$  is negative and significant (-2.16,  $t = -5.51$ ), suggesting that the announcement risk premium is lower for firms that pre-announced their earnings. Moreover, consistent with the univariate results of Table 4, the  $PreAnn_{jq}$  dummy variable has the same order of magnitude as the intercept, indicating that the announcement premium is actually zero for pre-announcing firms. The coefficient estimate corresponding to  $RIC_{jq}$  is positive and significant (7.77,  $t = 23.92$ ), supporting the argument that the greater the information content of the earnings announcements, the higher the announcement risk premia.<sup>15</sup> Finally, we re-estimate regression (2) using the Fama and MacBeth (1973) approach. As expected, because our sample has only minimal time-series clustering (the mean, median, and maximum number of firms announcing on a given day being 0.75%, 0.45%, and 6.47% respectively), none of our conclusions is changed.

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<sup>15</sup> In order to ensure that the above results are not being driven by unobservable characteristics of firms that pre-announce in this period but are a function of the pre-announcement, we repeat the analysis for the period prior to 1998, and include a dummy variable for the firms that pre-announced in the 1998-2001 period. In unreported results we find that the dummy variable is not significant, which provides greater confidence in the above results. Finally, in untabulated results we find, consistent with B&K, a small but significant increase in beta-risk on expected earnings announcements dates. However, the overall tenor of our results remains unchanged.

When we measure the announcement premium using the actual announcement date, the results are similar to those discussed above. The magnitudes of the coefficients of the dependent variable are larger than those reported using the expected announcement date premium. The analysis indicates that apart from the scale effects measuring the premium using the actual or the expected announcement dates does not affect the economic significance of the relationships between announcement premium and changes in the disclosure environment over time.

In summary, our analysis indicates that the earnings announcement premia are significantly lower for firms that pre-announce earnings and are significantly higher for firms with more informative earnings announcements. However, the persistence of the announcement period excess returns is puzzling given the assumption that markets are efficient. There could be two potential explanations for the persistence of these premia. The first explanation is that the compensation for the increased risk on announcement date does not provide sufficient incentives to arbitrage these premia. The second explanation is that arbitrageurs find it hard to take positions in the announcement premium stocks to arbitrage away the excess returns. In the following sections we investigate both explanations.

## **5. Risk-Return Trade-Off: Are Earnings-Announcements Premia Worth the Risk?**

To investigate the risk-return trade-off of earnings announcements, we compare the three-day announcement-period returns to their standard deviations. On some days, however, very few firms are expected to announce, resulting in an announcer portfolio of only one or two securities. For example, of the 5,638 trading days in the sample period,

211 trading days included none of the expected three-day announcement periods for any of the sample firms. Moreover, while announcement periods overlapped, for an additional 1,014 trading days, the market capitalization of the announcing firms comprised less than 0.1 percent of the market capitalization of the sample. Therefore, we analyze announcer portfolios consisting of trading days, which include at least one firm's expected announcement period; and seven portfolios consisting of trading days on which the market capitalization of the expected announcers exceed 0.1 to 1.3 percent (by 0.2 percentage points) of the market capitalization of the entire sample. To allow a meaningful comparison, all securities in each portfolio are value-weighted, with 100 percent of the funds invested in the respective securities.<sup>16</sup>

Our results are reported in Table 6. Panel A of Table 6 reports results of analysis using the expected announcement date and Panel B reports results using the actual announcement day similar to the methodology in B&K. Column (1) reports the results for all 5,427 trading days that include an expected three-day announcement-period of at least one firm. Columns (2) through (8) summarize the results for the restricted portfolios. For comparison purposes, we compute all statistics on day -10 relative to the expected announcement date. We chose a date that preceded the expected announcement date to avoid using the actual announcement date for late announcers.

The average combined market capitalization of the announcing firms is 1.457 percent corresponding to \$938,509,000 for the entire sample period. This figure ranges from 2.087 percent corresponding to \$1,449,021,000 for portfolio (2) to 3.841 percent and \$2,353,049,000 for portfolio (8).

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<sup>16</sup> The resulting analysis does not correspond to an implementable trading strategy because we exclude days on which either no firms announced, or days when less than 0.1 to 1.3 percent of the sample firms (by market capitalization) announced.

The first three rows report the value-weighted returns for the entire sample and each of seven announcer portfolios. The results indicate larger premia remaining unarbitrated on days when many firms announce. We will return to this issue in Section 6 when we analyze whether limits to arbitrage are related to announcement-period premia. Next we analyze portfolio risk. The results in the next two rows in Table 6 indicate that for columns (1) through (5) the standard deviations of the returns are significantly higher (at the 0.05 percent level or better) on expected announcement dates than on non-announcement dates (Beaver, 1968). However, the differences in risk between announcement and non-announcement dates declines monotonically and, beginning with column (6), the standard deviation is no longer significantly higher on expected announcement dates. In fact, for the last column, we find a standard deviation that is significantly lower (at the 0.10 level) on the expected announcement date. This evidence indicates that, while announcement risk is diversifiable, it takes relatively large announcer portfolios to diversify that risk.

So is the increase in return worth the risk? To answer this question, we compute the Sharpe ratios for the announcer and non-announcer portfolios. Two results are noteworthy.<sup>17</sup> First, comparing the non-announcers portfolios to the corresponding entire portfolios indicates that the Sharpe ratios always decline when we exclude the announcers by between 1.13 percent and 1.55 percent. Second, the Sharpe ratios of the announcer portfolios exceed the Sharpe ratios of the non-announcers portfolios. This indicates that excluding announcers reduces the return-risk tradeoff.

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<sup>17</sup> The Sharpe ratio is defined as the ratio of the portfolio excess return to the portfolio standard deviation, i.e.,  $Sharpe\ Ratio(P) = \frac{R_p - R_F}{\sigma(R_p)}$ , where  $R_p$ ,  $R_F$  and  $\sigma(R_p)$  are, respectively, the portfolio return, the risk-free rate and the standard deviation of the portfolio return.

Finally, we compute Jensen's Alpha for the announcer portfolios.<sup>18</sup> The results, reported in the last three rows of Table 6 indicate that beginning with column (5), the expected announcer portfolios earn a significant excess return of between 0.008 percent and 0.039 percent per day (significant at the 0.05 level of better). Ignoring transactions costs, these daily excess returns correspond to annualized excess returns between 2.12 and 10.63 percent. These results imply that it is worthwhile to arbitrage the announcement risk premia. It is important to point out that our estimates of announcement premium and the returns to announcer's portfolios are those that remain after arbitrage. Thus the estimates of announcement premium and the Jensen's Alpha are smaller in magnitude than what is the "true" earnings announcement premia before any arbitrage.

Finally, the results in Table 6, Panel B showing analysis of the announcers portfolio on the actual announcement date is materially similar to results when the announcement date is the expected date. Consistent with the announcement premium being large when using the actual announcement date, we find that the announcement period return for the announcers (.0921 percent), the Sharpe ratio (.0784) and the Jensen's Alpha (4.4) is larger when using the announcement date as compared to similar computations using the expected announcement date. In the last section we analyze whether the continued existence of the premia is due to limits to arbitrage.

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<sup>18</sup> Jensen's Alpha is defined as the intercept in a regression of a securities excess return (return minus risk-free rate) on the market's excess return.

## 6. Limits to Arbitrage and the Persistence of Announcement Risk Premia

Shleifer and Vishny (1997) suggest that documented stock market anomalies exist because arbitrageurs fail to exploit them due to constraints on their ability to raise arbitrage capital. They predict that volatility acts as a deterrent and limits arbitrage activities, resulting in the continuing presence of excess returns. We, thus, investigate whether limits to arbitrage are a potential explanation for the persistence of the announcement period premia.

We use five proxies to capture the costs of executing arbitrage transactions for each firm  $j$  and quarter  $q$ : idiosyncratic risk ( $Div\_Risk_{jq}$ ), bid-ask spread ( $Spread_{jq}$ ), trading volume ( $Volume_{jq}$ ), float ( $Float_{jq}$ ), and the concentration of announcing firms ( $Weight_{jq}$ ) for a given announcement period window.<sup>19</sup>

Following Mashruwala, Rajagopal, and Shevlin (2004), Wurgler and Zhuravskaya (2002), and Pontiff (1996), we use the idiosyncratic part of a stock's volatility to proxy for the absence of close substitutes while assuming arbitrage positions. Idiosyncratic risk is relevant to arbitrageurs because arbitrageurs can only hold relatively few positions at a time due to limited capital. Several papers (e.g., Pontiff, 1996; Shleifer and Vishny, 1997; Wurgler and Zhuravskaya, 2002; Ali, et al., 2003) that explore explanations related to barriers to arbitrage make similar assumptions. Thus, we predict that the higher the idiosyncratic risk associated with a firm, the harder it will be for arbitrageurs to diversify the risk. We measure idiosyncratic risk as the residual variance from a regression of firm-specific stock returns on the value-weighted CRSP stock index for 12 months preceding the quarterly earnings announcement.

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<sup>19</sup>The bid-ask spread, volume and float have been commonly used in the literature as proxies for limits to arbitrage, e.g., Ali, Hwang, and Trombley (2003).

The bid-ask spread ( $Spread_{jq}$ ) captures a large portion of the round-trip transactions costs. We measure  $Spread_{jq}$  in the announcement window by computing the average daily bid-ask spread scaled by the mid-point of the spread reported by CRSP for each firm and quarter.

The variable  $Float_{jq}$  measures the number of shares that are available for trading in a particular stock. Depending on the nature of investors and the characteristics of the firm, certain stocks may have fewer shares that are actively traded in the market. Arbitrageurs would then be limited in their ability to take positions if there were not enough floating stock available for a particular firm. We measure  $Float_{jq}$  as the average trading volume of a firm in each quarter scaled by the average shares outstanding for the firm.

The variable  $Volume_{jq}$  is a proxy for the impact of arbitrageurs' taking advantage of the premia. For each firm and quarter, we measure  $Volume_{jq}$  as the average of the daily trading volume in the earnings announcement window reported by CRSP. By purchasing the stock, arbitrageurs would drive down the premia. Thus, we expect a negative association between  $Volume_{jq}$  and the observed announcement-period premia. However, note that volume is also a proxy for the arrival of new information (Beaver, 1968). Thus, absent arbitrage, volume will be positively correlated with the announcement-period premia if volume is indicative of the arrival of new information.

Our final variable,  $Weight_{jq}$ , represents the market capitalization of all firms announcing earnings concurrently with firm  $j$ . We include  $Weight_{jq}$  as a measure of the number of arbitrage positions available on a given day. We assume that arbitrage capital is limited. Therefore, higher values of a  $Weight_{jq}$  imply that a given arbitrage capital is

spread across more deals, leaving a larger portion of the announcement-period return unarbitrated.<sup>20</sup> All other variables are as defined before.

We test whether limits to arbitrage are associated with the announcement period premia by estimating the following pooled time-series, cross-sectional regression for the sample of on-time and late announcers:

$$AP_{jq} = a + b \times RM_{jq} + c \times Div\_Risk_{jq} + d \times Spread_{jq} + e \times Volume_{jq} + f \times Float_{jq} + g \times Weight_j + h \times PreAnn_{jq} + k \times RIC_{jq} + \varepsilon_{jq} \quad (3)$$

If limits to arbitrage contribute to the existence of the announcement premia, then controlling for the other factors that affect the announcement premium, firms with higher values for  $Div\_Risk_{jq}$ , higher values for  $Spread_{jq}$ , lower values for  $Volume_{jq}$ , lower values for  $Float_{jq}$ , and higher values for  $Weight_{jq}$  will have higher premia.

Table 7 reports the Pearson correlations among these independent variables for the entire sample period above the main diagonal, and for the 1998-2001 period when we have information regarding pre-announcements (the pre-announcement sample) below the main diagonal. The five arbitrage variables are significantly correlated in the expected directions, but have fairly low correlations with each other.

The regression results reported in Table 8 are consistent with the hypothesis that the un-arbitrated announcement-period premia are higher when limits to arbitrage are higher.<sup>21</sup> We report results for announcement premium computed using the expected announcement date as well the actual announcement date. The results for the entire

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<sup>20</sup> An alternative metric for concentration of announcers could be constructed by counting the total number of firms that announced as a percentage of all the sample firms traded on that day (equal-weighted measure of clustering). This metric is frequently used in the literature (Chambers and Penman, 1984; Brown, Clinch and Foster, 1992). This equal-weighted metric, however, overemphasizes firms with small capitalizations and hence is not representative for investors holding diversified portfolios.

<sup>21</sup> We also estimate regression (3) by replacing  $RIC_{jq}$  with the variance in the three-day announcement period. The results are similar to those obtained on using  $RIC_{jq}$ .

sample are discussed first. The coefficient for  $Div\_Risk_{jq}$ , is positive and significant (5.75,  $t = 4.78$ ) indicating that announcement premia are higher for firms with higher idiosyncratic risks. Similarly, the coefficient estimate for  $Spread_{jq}$  is positive and significant (7.47,  $t = 4.06$ ), consistent with our expectation that announcement premia are higher for firms with higher trading costs (and greater information asymmetries). The coefficients for  $Volume_{jq}$  and  $Float_{jq}$  are negative and significant (-2.81,  $t = -2.42$  and -5.04,  $t = -4.19$ , respectively), indicating that announcement premia are higher for firms that are thinly traded and when there is not enough floating stocks available for arbitrage.

Consistent with the limits to arbitrage hypothesis, the coefficient on  $Weight_{jq}$  is positive and significant (6.57,  $t = 3.54$ ), indicating arbitrage capital is not sufficient to exploit the premia when there are numerous available arbitrage positions. Finally, consistent with the earlier results, the coefficients on  $RIC_{jq}$  and  $RM_{jq}$  are positive and significant (9.97,  $t = 47.42$  and 7.71,  $t = 62.49$ , respectively), indicating that premia are higher when the information content of the earnings announcements (relative to other sources of information) is high and when earnings announcements have a higher  $\beta$ -risk relative to non-announcement days (B&K).

Next, we repeat the analysis for the 1998-2001 sub-sample where we have information on pre-announcements. The correlations among the variables used for this sample are reported in Table 7 below the main diagonal. As in the previous case, the five arbitrage variables are significantly correlated in the expected directions with each other, but the magnitudes of the correlations are fairly low.

The results for the pre-announcement sample reveal that the dummy variable  $PreAnn_{jq}$  has a negative and significant coefficient (-1.41,  $t = -3.01$ ), indicating that pre-

announcers have a lower announcement premium. The variables  $Div\_Risk_{jq}$  (1.14,  $t = 3.89$ ),  $Volume_{jq}$  (-4.23,  $t = -3.33$ ),  $Spread_{jq}$  (2.23,  $t = 5.37$ ),  $Float_{jq}$  (-5.03,  $t = -6.87$ ), and  $Weight_{jq}$  (2.93,  $t = 4.62$ ) continue to have the expected signs and are significant at conventional levels in explaining the announcement premium. The coefficient estimates for  $RIC_{jq}$  and  $RM_{jq}$  also continue to be positive and significant (7.13,  $t = 25.63$  and 6.99  $t = 27.33$ ). Taken together our evidence indicates that the continued existence of the announcement premia is related to the difficulty that arbitrageurs face in trying to exploit the anomaly.<sup>22</sup>

The results from the announcement premium computed using the actual announcement date are similar to the results discussed above. However, the magnitude of the coefficients for our proxies indicating difficulty in taking arbitrage positions (Diversifiable Risk, Spread, Volume, and Float) load up with larger coefficients than those reported when announcement premium is computed using the expected announcement date.

## 7. Summary and Conclusions

This paper reexamines the existence and the magnitude of the earnings announcement premia after controlling for the timing of the announcements and the disclosure environment. Next, we investigate whether the announcement premium is commensurate with the increased risk on earnings announcement days. Finally, we examine if the limits

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<sup>22</sup> As an additional sensitivity test, we re-estimate the regressions in Table 7 by including size as a control variable (defined as the market value of equity). B&K find that smaller firms have larger announcement premia. While the coefficient of size is negative and significant at the 5% level, inclusion of this variable does not materially affect any of our variables of interest.

to arbitrage theory explains the continued existence of the earnings announcement premia.

Our results can be summarized as follows. First, our analysis establishes the existence of an announcement premia even after controlling for the timing of earnings announcements (early, on-time or late announcements), although we find that the magnitude of the premia has declined significantly over time. Our evidence also suggests that the premia documented in prior research was overstated. Second, we find that the premia are significantly lower for firms that pre-announce earnings and are significantly higher for firms with relatively more informative earnings announcements. Both of those results are consistent with the presence of an announcement risk premium.

Next, we find that a portfolio strategy of excluding announcers from a daily-rebalanced market portfolio reduces the standard deviation of the portfolio. However, this strategy also reduces the Sharpe ratio, which indicates that excluding announcers reduces the return-risk tradeoff. Moreover, returns on expected earnings announcement dates “earn” significantly positive Jensen’s Alphas, corresponding to an annualized return between 2.1 percent and 10.6 percent. Finally, we document that announcement-period premia are positively correlated with the costs to arbitrage, suggesting that the limits to arbitrage theory could explain the persistence of earnings announcement premia over time.

In summary, while prior research has consistently documented a higher return on scheduled information release dates, there has not been any direct evidence on whether those higher returns represent announcement risk premia. We contribute to this literature by providing evidence that the premia are dramatically reduced when the announcement

risk is reduced through pre-announcements. Additionally, we provide evidence indicating that the continued presence of this premia result from limits to arbitrage. Jointly, our findings are consistent with the view that the announcement period returns, indeed, constitute compensation for bearing announcement risk.

## Appendix

### Analysis and Prediction of Corporate Earnings Announcement Dates

This appendix provides a detailed discussion of a model of expected quarterly earnings announcement dates, which we develop and use in our analyses. In practice, firms can announce earnings on a particular day of the week or choose the day of the week based on the content of news to be disclosed (Watts, 1978; Patell and Wolfson, 1982; Penman, 1987; Ball and Bartov, 1995; Brown, et al., 1992). Additionally, firms often follow complicated algorithms such as “the first Tuesday, three weeks following the end of the fiscal quarter,” and it may not be easy to detect those rules because actual announcement dates often deviate from expected announcement dates.<sup>23</sup>

Various models for prediction of earnings announcement dates have been used in the literature. A widely used model, introduced by Givoly and Palmon (1982), uses a firm’s prior-period announcement date as a proxy for the current year’s announcement date.<sup>24,25</sup> However, this approach results in measurement errors for any announcement that deviates from the ‘normal’ disclosure strategy. For example, if  $Q_t$  were to be late, then  $Q_{t+4}$  is likely to be classified as early, even when in reality it were announced ‘on time.’ Similar problems are present with the other models used in the literature. Essentially, the use of any expectation model that relies on actual announcement dates introduces measurement error to the analysis.

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<sup>23</sup> We thank the referee for pointing this out.

<sup>24</sup> Analysis in Givoly and Palmon (1982) is based on the reporting lag relative to the fiscal year end, rather than the reporting date. However, because the fiscal year end does not vary in their analysis, there is a one-to-one relation between the expected reporting lag and the expected announcement date.

<sup>25</sup> Chambers and Penman (1984) and Begley and Fischer (1998) use the same model to analyze quarterly as well as annual earnings announcements. Chambers and Penman (1984) use two additional models to estimate the expected earnings announcement date. They report that their results were not sensitive to which model they used.

To develop the expected announcement date model, we analyze the distribution of actual earnings announcement dates.<sup>26</sup> First, the distribution of the fourth quarter announcement days differs from those of the preceding three fiscal quarters. While using separate models for Q4 and for the other three quarters (Q1, Q2 and Q3) could be efficient, the expected announcement dates for the first three fiscal quarters would be more precise (by virtue of a larger sample size) and possibly affect some of the subsequent analyses. Therefore, we decided to estimate a separate model (by firm) for each of the four fiscal quarters. Second, there is an upward trend in the announcement dates for Q1 through Q3 and an increase in the standard deviation of the Q4 announcement dates. To account for these over-time changes in the distribution of the announcement dates, we divide the 22 year period into 6 sub-periods, 5 sub-periods of 4 years and 1 sub-period of 2 years. We also repeat our analysis by dividing the period into 4 sub-periods, 3 sub-periods of 6 years and 1 sub-period of 4 years.

For each sample firm and each fiscal quarter, we use the median announcement date as the proxy for the expected announcement date. We select the median because this statistic is least likely to be affected by individual deviations for the normal disclosure schedule. For each firm and each quarterly earnings announcement, we compute the median announcement date for each four-year sub-period. Each quarter is divided into 63 trading days. Using the quarterly earnings-announcement data from COMPUSTAT, we identify each firm-quarter earnings-announcement date with the day of the quarter (i.e., day 1 to day 63). For each sample firm and each fiscal quarter, we compute the median day of announcement ( $Med_{jq}$ ).

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<sup>26</sup> Detailed results of the analysis are available from the authors and are not reported here in the interest of brevity.

Using the median as a proxy for the expected announcement date, we compute the deviation from the expected announcement day ( $Dev_{jq}$ ) as the absolute difference between the actual announcement day and the median announcement day:

$$Dev_{jq} = |D_{jq} - Med_{jq}|$$

where for firm  $j$  and quarter  $q$ ,  $D_{jq}$  represents the actual announcement day. Thus,  $Dev_{jq} = 0$  corresponds to firm  $j$  having announced quarter  $q$  earnings on the expected day,  $Dev_{jq} = 1$  represents instances where corporations have announced on either a day earlier or a day later than expected, etc.

Overall, in our sample 39.26 percent of the firm-quarter announcements are on the expected announcement day, and 62.22 percent are within one day of the expected date. In fact, 86.64 percent of the firm-quarter announcements fall into the 11-day window centered on the expected announcement day. The announcement dates for the first three fiscal quarters are more predictable than the announcement dates for the fourth fiscal quarter. For the first three fiscal quarters, the percentages of announcements that are released on the expected date range from, 39.90 percent (Q1) to 39.71 percent (Q3), while approximately 64 percent are released in the three-day window centered on the expected announcement date. In contrast, only 37.54 percent of Q4 announcements are on the expected release date, and 57.14 percent are within one day of the expected release date.

To investigate the sensitivity of our proxy to the length of the estimation period, we also use 4 sub-periods (3 sub-periods of 6 years and 1 sub-period of 4 years) and one sub-period (of 22 years) to compute the expected announcement date and  $Dev_{jq}$ . The results indicate a drop of overall on-time announcements to 35.03 percent for four sub-periods

and to 23.98 percent for one sub-period. The decrease in on-time announcements is most pronounced for Q4. Thus, the percentage of on-time announcements is approximately 36 percent for Q1 through Q3 for 4 sub-periods and 25.01 percent for one sub-period. In contrast, for Q4, the frequencies are 32.12 percent and 20.39 percent, respectively. We get similar results (although slightly higher for on-time announcements) when we use the integral value of the mean (rather than the median) as the proxy for the expected announcement date.

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**TABLE 1**  
**Earnings-Announcement Return Premia in the 1980-2001 Period on**  
**Expected Earnings and Actual Announcement Dates**

<b>Sample Period</b>	<b>N</b>	<b>Expected Announcement Date (-1, 0, +1)</b>	<b>Actual Announcement Date (-1, 0, +1)</b>
1980-2001	227,281	0.05 (2.99)	0.14 (11.24)
1980-1988 (Ball and Kothari)	57,974	0.07 (3.81)	0.24 (12.74)
1989-2001(time period subsequent to Ball and Kothari)	169,307	0.04 (2.91)	0.11 (13.21)

This table reports the announcement-day premia and the associated t-statistics in parenthesis for the entire time period and two sub-periods: the time period studied by Ball and Kothari (1980-1988), and the time period subsequent to Ball and Kothari (1989-2001). We use the return on the firm on non-announcement days as a benchmark. Virtually identical results are obtained when we use the return on non-announcing firm on the same day as a control.

**Performing two sample t-tests for differences across Columns:**

Testing for equality between the abnormal return at the expected and the actual announcement dates (0.05 and 0.14) results in a t-statistic of 10.18.

Testing for equality between the abnormal return at the expected and the actual announcement dates in the Ball and Kothari sub-period (0.07 and 0.24) results in a t-statistic of 8.75.

Testing for equality between the abnormal return at the expected and the actual announcement dates in the post Ball and Kothari sub-period (0.04 and 0.11) results in a t-statistic of 6.41.

**Performing two sample t-tests for differences across rows:**

Testing for equality of the abnormal return at the expected announcement dates between the Ball and Kothari sub-period and the post Ball and Kothari sub-period (0.07 and 0.04) results in a t-statistic of 3.65.

Testing for equality of the abnormal return at the actual announcement dates between the Ball and Kothari sub-period and the post Ball and Kothari sub-period (0.24 and 0.11) results in a t-statistic of 7.93.

**TABLE 2**  
**Announcement-Return Premia Relative to the**  
**Timing of the Earnings Announcement**  
**1980-2001**

<b>Portfolio</b>	<b>N</b>	<b>Expected Announcement Date (-1, 0, +1)</b>	<b>Actual Announcement Date (-1, 0, +1)</b>
Entire Portfolio	227,281	0.05 (2.99)	0.14 (11.24)
Early Announcers	85,912	0.05 (2.49)	0.29 (15.18)
On-time Announcers	56,018	0.13 (5.49)	0.13 (5.49)
Late Announcers	85,351	-0.00 (-0.31)	-0.00 (-0.94)
On-time and Late Announcers	141,369	0.05 (4.37)	0.05 (2.53)

This table reports the announcement-day premia for the expected announcement window and the actual announcement window. The premia are computed for all firm years (Entire Portfolio), for those firms that announce ahead of the expected announcement date (Early Announcers), for those firms that announce either on the expected announcement date or after the expected dates (On-time and Late Announcers), for those firms that announce on the expected announcement date (On-time Announcers), and those firms that are neither early nor on-time announcers (Late Announcers). We use the return on the firm on non-announcement days as a benchmark. Virtually identical results are obtained when we use the return on non-announcing firm on the same day as a control.

**Two sample t-tests for differences between abnormal returns at the expected announcement dates for the different sub-samples, results in the following t-statistics:**

- Early announcers versus on-time announcers (0.05 versus 0.13):  $t = -6.53$ .
- Early announcers versus late announcers (0.05 versus -0.00):  $t = 5.68$
- Early announcers versus on-time and late announcers (0.05 versus 0.05):  $t = 0.92$ .
- On-time announcers versus late announcers (0.13 versus -0.00):  $t = 8.11$ .

**Two sample t-tests for differences between abnormal returns at the actual announcement dates for the different sub-samples, results in the following t-statistics:**

- Early announcers versus on-time announcers (0.29 versus 0.13):  $t = 6.42$ .
- Early announcers versus late announcers (0.29 versus -0.00):  $t = 13.87$
- Early announcers versus on-time and late announcers (0.29 versus 0.05):  $t = 8.42$ .
- On-time announcers versus late announcers (0.13 versus -0.00):  $t = 8.09$ .

<b>TABLE 3</b>			
<b>Announcement-Return Variance on the Actual versus Expected Earnings Announcement Dates</b>			
<b>Time Period</b>	<b>N</b>	<b>Expected Announcement Date (-1, 0, +1)</b>	<b>Actual Announcement Date (-1, 0, +1)</b>
1980-1988 (Ball and Kothari)	57,974	0.031 (4.65)	0.039 (6.13)
1989-2001 (subsequent to Ball and Kothari)	169,307	0.047 (5.28)	0.051 (9.76)
<p>This table reports the announcement-day returns variance and the associated F-statistics in parenthesis for two different time periods: the time period studied by Ball and Kothari (1980-1988), and the time period subsequent to Ball and Kothari (1989-2001). We use the return on the firm on non-announcement days as a benchmark. Virtually identical results are obtained when we use the return on non-announcing firm on the same day as a control.</p> <p><b>Testing for differences in event-window variances results in the following F-statistics:</b>  Abnormal returns on the expected announcement dates in the Ball and Kothari period versus post Ball and Kothari period (0.031 versus 0.047): F = 8.91.  Abnormal returns on the actual announcement dates in the Ball and Kothari period versus post Ball and Kothari period (0.039 versus 0.051): F = 6.99.</p>			

**TABLE 4**  
**The Relation between Announcement-Return**  
**Premia and Pre-Announcements**

Row	Portfolio	Expected Announcement Date (-1, 0, +1)	Actual Announcement Date (-1, 0, +1)
1	Abnormal Returns for firms that pre-announced 1998-2001	0.01 (2.41)	0.02 (2.96)
2	Abnormal Returns for firms that did not pre-announce 1998-2001	0.05 (3.75)	0.06 (3.79)
3	Difference between Rows 1 and 2	-0.04 (-4.02)	-0.04 (-4.57)
4	Abnormal Returns in 1980-1997 for firms that pre-announced in 1998-2001	0.06 (4.12)	0.07 (4.97)
5	Abnormal Returns in 1980-1997 for firms that did not pre-announce in 1998-2001	0.07 (5.03)	0.08 (7.48)
6	Difference between Rows 4 and 5	-0.01 (-1.22)	-0.01 (-1.03)

This table analyses the relation between the earnings announcement premia, and pre-announcements for the sample of on-time and late announcers on the expected announcement date and for the entire sample on the actual announcement date. We use the return on the firm on non-announcement days as a benchmark. Virtually identical results are obtained when we use the return on non-announcing firm on the same day as a control. Rows 1 (Row 2) reports the returns for pre-announcing (non-pre-announcing) firms on expected announcement dates in the 1998-2001 period. Row 4 reports the returns on expected announcement dates in the 1980-1997 for firms that pre-announced earnings in the 1998-2001 period. Row 5 reports the returns on expected announcement dates in the 1980-1997 for firms that did not pre-announce earnings in the 1998-2001 period.

**TABLE 5**  
**The Relation between Announcement-Return Premia, Pre-Announcements and Informativeness of Earnings On-time and Late Announcers 1998 – 2001**

**N = 40,224**

$$AP_{jq} = a + b \times RM_{jq} + c \times PreAnn_{jq} + d \times RIC_{jq} + \varepsilon_{jq}$$

Independent Variables		Dependent Variable: Announcement Premium on	
		Expected	Actual
	$Constant \times 10^{-3}$	2.41 (4.81)	2.78 (4.50)
Value-weighted CRSP return on the market in the announcement period	$RM_{jq}$	0.877 (18.42)	0.932 (28.70)
Dummy variable which takes the value of 1 if the firm made a pre-announcement in that quarter, and 0 otherwise	$PreAnn_{jq} \times 10^{-3}$	-2.16 (-5.51)	-2.87 (-6.21)
Sum of squared returns in the three-day announcement period divided by the sum of squared returns in the entire quarter	$RIC_{jq} \times 10^{-2}$	7.77 (23.92)	8.02 (24.21)
<i>F-statistic (p-value)</i>		473.28 (<0.0001)	487.39 (<0.0001)
<i>Regression R<sup>2</sup></i>		0.035	0.042

This table analyses the relation between the earnings announcement premia, pre-announcements and the informativeness of earnings announcements for the sample of on-time and late announcers. The dependent variable,  $AP_{jq}$ , is the return on announcement dates minus the return of the firm on non-announcing days. Virtually identical results are obtained when we use the return on non-announcing firm on the same day as a control. The table reports the regression coefficients and the associated t-statistics in parenthesis. The expected (actual) announcement period corresponds to days 1-, 0, and +1 relative to the date predicted by the expected date model (actual date as per COMPUSTAT).

**TABLE 6 – Panel A**  
**Analysis of the On-time and Late Announcer Portfolio on the Expected Announcement Date**

	(1) Entire Portfolio	Trading days with the market capitalization of expected announcers as a percentage of the entire portfolio of at least						(8)
		(2) 0.1%	(3) 0.3%	(4) 0.5%	(5) 0.7%	(6) 0.9%	(7) 1.1%	
Trading Days	5,427	3,234	2,565	2,192	1,908	1,678	1,500	884
Average Market Cap. (%)	1.457	2.087	2.547	2.914	3.012	3.241	3.657	3.841
Average Market Cap. (\$10 <sup>3</sup> )	938,509	1,449,021	1,707,814	1,937,677	2,115,691	2,186,927	2,276,663	2,353,049
Return	0.0293	0.0301	0.0324	0.0328	0.0348	0.0354	0.0361	0.0381
(%)	0.0511	0.0651	0.0692	0.0711	0.0748	0.0811	0.0839	0.0891
Stand.	0.0452	0.0472	0.0481	0.0483	0.0482	0.0483	0.0482	0.0483
Dev. (%)	0.0491	0.0528	0.0515	0.0503	0.0493	0.0485	0.0479	0.0472
Sharpe	0.0481	0.0574	0.0681	0.0742	0.0796	0.0847	0.0892	0.0928
Ratio	0.0512	0.0614	0.0768	0.0795	0.0869	0.0912	0.0981	0.1029
Jensen's	0.0081	0.012	0.019	0.023	0.028	0.031	0.033	0.039
Alpha	2.12	3.16	5.04	6.14	7.52	8.36	8.92	10.63
t = 0	0.45	1.48	1.64	1.83	1.97	2.09	2.18	2.32

This table reports results for value weighted portfolios on days when at least 0.1, 0.3, 0.5, 0.7, 0.9, 1.1, and 1.3% percent of firms by market capitalization are expected to announce earnings. Column (1) reports returns by including the portfolio of expected announcers independent of the market capitalization of the announcing firms. Columns (2) through (8) report results of excluding expected announcers when the announcers constitute at least 0.1 percent to 1.3 percent by 0.2 percent of the market capitalization of the sample. The last three rows report Jensen's Alpha, the corresponding annualized returns (assuming 259 trading days per annum) and the associated t-statistics for the announcer portfolio.

	<b>(1)</b> <b>Entire</b> <b>Portfolio</b>	<b>Trading days with the market capitalization of announcers as a percentage of the entire portfolio of at least</b>						<b>(8)</b>
		<b>(2)</b> <b>0.1%</b>	<b>(3)</b> <b>0.3%</b>	<b>(4)</b> <b>0.5%</b>	<b>(5)</b> <b>0.7%</b>	<b>(6)</b> <b>0.9%</b>	<b>(7)</b> <b>1.1%</b>	
Trading Days	5,453	3,239	2,568	2,192	1,917	1,682	1,512	892
Average Market Cap. (%)	1,462	2,083	2,549	2,918	3,021	3,264	3,684	3,852
Average Market Cap. (\$10 <sup>3</sup> )	938,532	1,449,089	1,707,896	1,937,841	2,115,905	2,186,988	2,276,701	2,353,307
Return (%)	0.0285	0.0297	0.0314	0.0319	0.0337	0.0349	0.0356	0.0372
Portfolio on t = 0	0.0921	0.0991	0.1012	0.1032	0.1054	0.1062	0.1087	0.1104
Stand. Dev. (%)	0.0448	0.0468	0.0472	0.0478	0.0481	0.0482	0.0485	0.0487
Sharpe Ratio	0.0584	0.0642	0.0614	0.0608	0.0587	0.0574	0.0561	0.0542
Jensen's Alpha	0.0504	0.0579	0.0692	0.0784	0.0801	0.0853	0.0899	0.0945
Annualized (%)	0.0784	0.0825	0.0914	0.0954	0.1087	0.1109	0.1257	0.1374
Daily (%)	0.017	0.038	0.040	0.042	0.045	0.049	0.053	0.061
t = 0	4.4	10.0	10.4	11.2	11.7	12.7	14.1	15.8
t-statistic	0.61	1.84	1.98	2.10	2.21	2.34	2.48	2.56

This table reports results for value weighted portfolios on days when at least 0.1, 0.3, 0.5, 0.7, 0.9, 1.1, and 1.3% percent of firms by market capitalization announce earnings. Column (1) reports returns by including the portfolio of announcers independent of the market capitalization of the announcing firms. Columns (2) through (8) report results of excluding announcers when the announcers constitute at least 0.1 percent to 1.3 percent by 0.2 percent of the market capitalization of the sample. The last three rows report Jensen's Alpha, the corresponding annualized returns (assuming 259 trading days per annum) and the associated t-statistics for the announcer portfolio.

**TABLE 7**  
**Correlation Table**  
**Total Sample (above the main diagonal)**  
**Pre-announcement Sample (below the main diagonal)**

	<i>API</i>	<i>AP2</i>	<i>RM</i>	<i>RIC</i>	<i>Weight</i>	<i>Div_Risk</i>	<i>Spread</i>	<i>Volume</i>	<i>Float</i>
<i>API</i>		0.927*	0.156*	0.091*	0.013*	0.007	0.022*	-0.005	-0.012
<i>AP2</i>	0.939*		0.126*	0.123*	0.009*	0.021*	0.046*	-0.021*	0.005
<i>RM</i>	0.188*	0.101*		0.004	0.011*	0.013*	0.009	0.004	0.011*
<i>RIC</i>	0.099*	0.148*	0.017		0.029*	-0.089*	-0.267*	0.031*	0.022*
<i>Weight</i>	0.021*	0.013*	0.031*	0.048*		0.129*	0.112*	0.138*	0.041*
<i>Div_Risk</i>	0.009	0.041*	0.027*	-0.097*	0.157*		0.554*	-0.071*	-0.214*
<i>Spread</i>	0.029*	0.087*	0.018	-0.328*	0.143*	0.498*		-0.076*	-0.143*
<i>Volume</i>	-0.009	-0.041*	0.008	0.064*	0.165*	-0.093*	-0.091*		0.158*
<i>Float</i>	-0.021	0.007	0.026*	0.042*	0.073*	-0.256*	-0.178*	0.213*	

\*Significant at the 1% level

This table reports the Pearson correlations of the variables used in the limits to arbitrage tests for the non-pre-announcement sample. *API* is the return in the announcement window minus the return on non-announcement dates for the same firm; *AP2* is the return in the announcement window minus the return of non-announcing firms in the announcement window; *RM* is the value-weighted CRSP return on the market in the announcement period; *RIC* is the sum of squared returns in the three-day announcement period divided by the sum of squared returns in the entire quarter; *Weight* represents the market capitalization of the firms announcing concurrently; *Div\_Risk* is the diversifiable risk of a security measured in the 12 month period prior to a quarter; *Spread* is the ratio of the high ask price minus the low bid price divided by the average of the high ask price and the low bid price; *Volume* is the average trading volume during the announcement period; *Float* is the average trade volume during quarter (excluding announcement window) divided by total number of shares outstanding.

**TABLE 8**  
**Earnings Announcement Premia and the Limits to Arbitrage**  
**Premium measured on the three-day announcement period**

$$AP_{jq} = a + b \times RM_{jq} + c \times Div\_Risk_{jq} + d \times Spread_{jq} + e \times Volume_{jq} + f \times Float_{jq} + g \times Weight_j + h \times PreAnn_{jq} + k \times RIC_{jq} + \varepsilon_{jq}$$

Independent Variable		Announcement Premium			
		Expected Date		Actual Date	
		Total Sample 1980-2001 N = 141,369	Pre-announcement Sample 1998-2001 N=40,224	Total Sample 1980-2001	Pre-announcement Sample 1998-2001
	<i>Constant</i> $\times 10^{-3}$	2.14 (4.25)	3.07 (2.58)	2.35 (3.84)	3.67 (2.94)
Value-weighted CRSP return on the market in the announcement period	$RM_{jq}$ $\times 10^{-1}$	7.71 (62.49)	6.99 (27.33)	8.78 (74.38)	7.93 (34.52)
Diversifiable risk of security j measured in the 12 month period prior to quarter q	$Div\_Risk_{jq}$ $\times 10^{-4}$	5.75 (4.78)	1.14 (3.89)	6.20 (5.24)	1.57 (4.01)
Ratio of the high ask price minus the low bid price divided by the average of the high ask and the low bid price	$Spread_{jq}$ $\times 10^{-3}$	7.47 (4.06)	2.23 (5.37)	7.89 (5.41)	2.68 (4.87)
Average trading volume during the announcement period	$Volume_{jq}$ $\times 10^{-10}$	-2.81 (-2.42)	-4.23 (-3.33)	-4.57 (-3.79)	-5.14 (-3.78)
Average trade volume during quarter (excluding announcement window) divided by total number of shares outstanding	$Float_{jq}$ $\times 10^{-5}$	-5.04 (-4.19)	-5.03 (-6.87)	-7.01 (-4.87)	-4.21 (-6.27)
Market capitalization of the firms announcing concurrently with firm j	$Weight_{jq}$ $\times 10^{-2}$	6.57 (3.54)	2.93 (4.62)	8.41 (4.08)	3.54 (4.93)
Dummy variable which takes the value of 1 if the firm made a pre-announcement in that quarter, and 0 otherwise	$PreAnn_{jq}$ $\times 10^{-3}$	NA	-1.41 (-3.01)	NA	-2.81 (-3.84)
Informativeness of earnings measured as the sum of squared returns in the three-day announcement period divided by the sum of squared returns in the entire quarter	$RIC_{jq}$ $\times 10^{-2}$	9.97 (47.42)	7.13 (25.63)	8.07 (51.02)	7.68 (27.23)
<i>F-statistic (p-value)</i>		909.12 (<.0001)	297.96 (<.0001)	1188.71 (<.0001)	322.73 (<.0001)
<i>Regression R<sup>2</sup> × 10<sup>-2</sup></i>		4.29	3.89	5.80	4.42

This table analyses whether limits to arbitrage arguments are a potential explanation for the existence of the announcement premia for the sample of on-time announcers as well as on-time and late announcers. The dependent variable,  $AP_{jq}$ , is the return on (expected) actual announcement dates minus the return on non-announcement dates for the same firm. Virtually identical results are obtained when we use the return on non-announcing firm on the same day as a control. The expected announcement date is as computed by our model (see Appendix A) and actual announcement date is as per COMPUSTAT.