

# The Effect of Information Releases on the Pricing and Timing of Equity Issues

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*With time-varying adverse selection in the market for new equity issues, firms will prefer to issue equity when the market is most informed about the quality of the firm. This implies that equity issues tend to follow credible information releases. In addition, if the asymmetry in information increases over time between information releases, the price drop at the announcement of an equity issue should increase in the time since the last information release. Using earnings releases as a proxy for informative events, we find evidence supporting these propositions*

Recent research emphasizes asymmetric information as an explanation for the behavior of stock prices

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when firms issue new seasoned equity.<sup>1</sup> In this article, we argue that asymmetric information also has implications for the timing of new issues and for the relation between the pricing and timing of new issues. We test these implications on a sample of NYSE, AMEX, and Over-the-Counter (OTC) firms that issued equity over the period 1978-1983. We find evidence consistent with adverse selection affecting the pricing and timing of equity issues.

Corporations experience an approximately 3 percent decline in the price of their shares at announcement of a new share issue [Asquith and Mullins (1986) and Masulis and Korwar (1986)] with a further drop of 0.65 percent at the actual issue [Mikkelsen and Partch (1988)]. One explanation for this is that insiders with superior information about the firm have an incentive to issue shares when the firm is overvalued. Consequently, outsiders lower their evaluation of the issuing firm's quality. This creates a "lemons market" [Akerlof (1970) and Myers and Majluf (1984)] in new equity issues.

Previous authors [e.g., Leland and Pyle (1977) and Myers and Majluf (1984)] have studied new issues in a one-period setting, hence taking the degree of information asymmetry as given. In practice, however, the information asymmetry between insiders and outsiders is not fixed over time. For example, firms regularly disclose information in the form of earnings releases and audited annual reports.<sup>2</sup> If a firm can issue risky securities when the market is most informed, it will do so since the share price decline from an equity issue will be lower when information is more symmetric. Thus, to the extent that firms have discretion in the timing of issues of risky securities, we should expect to see these issues clustered after information disclosures such as annual reports or quarterly earnings releases. Since the price drop at the equity issue announcement is increasing in the degree of information asymmetry, this argument also implies that the price drop should be smaller immediately following information releases than at other times.

In Section 1, we expand on this line of reasoning. We argue that these results are fairly robust implications of the basic adverse selection model of equity issues. In Section 2, we discuss the data, and, in Sections 3-5, we examine empirically three hypotheses concerning the influence of information releases on the pricing and timing of equity issues using earnings releases as a proxy for information releases.

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<sup>1</sup> For a summary of the evidence on stock price behavior around the time of equity issues and a review of theoretical explanations, see Korajczyk, Lucas, and McDonald (1990a).

<sup>2</sup> An additional possibility is that firms may voluntarily disclose information at the time of a new issue. One would expect voluntary disclosures both to be costly and to suffer from problems of verifiability. If such disclosures were costlessly verifiable, then models based upon asymmetric information could not explain the equity price drop at the time of an issue.

Specifically, we look for evidence that (i) there is a clustering of equity issues following earnings releases; (ii) earnings releases preceding an equity issue are more informative and convey better news than earnings releases after an equity issue; and (iii) the magnitude of the price drop at issue announcement and issue date is related to the timing of the issue.<sup>3</sup>

We find strong evidence that equity issues cluster in the first half of the period between information releases. In particular, firms almost never issue equity just prior to an earnings release.

The earnings release preceding an equity issue is unusually informative. This is consistent with the argument that the incentive to delay an equity issue is greater the greater the informativeness of the pending earnings release. In addition, we find that earnings releases preceding an equity issue convey unusually good news about the firm. This is consistent both with our explanation for equity-issue timing and with the finding of Asquith and Mullins (1986) that there is on average a price run-up preceding equity issues.

Finally, we examine the relation between the timing of the issue and the price drops at issue and issue announcement. The magnitude of the price drop at issue announcement is increasing in the time since the preceding earnings release. The point estimates are marginally statistically significant but economically important: delaying announcement of an issue by one month leads to an adverse announcement day price reaction of 0.44 percent. In addition, the magnitude of the price drop at issue is increasing in the time since the issue announcement. This result is both statistically significant and economically important.

## **1. Implications of Time-Varying Asymmetric Information for the Timing and Pricing of Equity Issues**

In this section, we discuss the problem of a firm wishing to issue equity and faced with time-varying asymmetric information. The discussion draws heavily on the results of a more formal model [Korajczyk, Lucas, and McDonald (1990b)]. For clarity, we will make specific assumptions about information and the firm, but we will argue that the implications for the pricing and timing of equity issues are fairly robust.

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<sup>3</sup> Choe, Masulis, and Nanda (1990) and Dierkens (1991) also examine the timing of equity issues. Dierkens (1990) presents empirical evidence relating the timing of equity issues and the magnitude of the announcement-day price drop to measures of informational asymmetry using different measures of asymmetry. Her results are also consistent with the implications of adverse selection in the market for new equity issues. Choe, Masulis, and Nanda (1990) study the timing of equity issues relative to the business cycle.

### 1.1 Firm behavior with time-varying adverse selection

Suppose that firms have assets in place and that they also may receive a positive net present value project. The firm's manager can have private information about the stochastic value of assets in place, but the existence and value of a new project is public information.<sup>4</sup> The firm's private information is revealed to the market at regular intervals, which we refer to as information release dates. Examples of such information releases would be earnings releases, annual reports, or credible policy announcements by the firm; We will suppose for simplicity that these releases are fully informative. The manager acquires new private information about the value of assets in place at some time prior to each information release date. This information arrival to managers is stochastic, so an increasing fraction of managers becomes informed over the interval. In this sense, information becomes more asymmetric over the time between information release dates.

Suppose that new projects arrive randomly and uniformly over time. Consider a firm that has received a project and for which an equity issue is the optimal way to finance the project.<sup>5</sup> Assume that if there is an issue some shares will be purchased by investors who are not currently shareholders, and that the manager behaves so as to maximize the value of shares held by existing shareholders. The information asymmetry then gives rise to a lemons market for equity as In Myers and Majluf (1984). In deciding whether and when to issue equity, the manager weighs the lemons cost of issuing against whatever cost there is of delaying the issue (e.g., the project could depreciate). The lemons cost of issuing is endogenous, in that it depends on the distribution of firm types that choose to issue equity at a point in time.

To take one extreme case, suppose that projects are lost if deferred. Immediately after an information release, few firms have acquired new information, so the adverse selection problem is relatively mild. As time passes, however, more firms acquire new information and the degree of adverse selection worsens. Thus, we would expect to see an increasing fraction of higher quality firms, (i.e., firms that have acquired good private information) choose to forgo an equity issue. rather than suffer the dilution in value to existing shareholders from selling stock at a low price. The lowest quality firms always issue. Since firms that choose to issue equity are of below-average quality,

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<sup>4</sup> For example, in the Myers and Majluf (1984) model, if new projects have nonnegative net present value, then the asymmetric information must be about the value of the firm's existing assets.

<sup>5</sup> For simplicity, we will say that equity issue proceeds are used to finance "projects." This need not be new capital investment, however, it could be an increase in working capital, debt reduction or other changes in capital structure.

these firms will experience a price drop at the announcement of the issue.<sup>6</sup> Over time, the market lowers its valuation of firms that announce an equity issue; hence, the price drop is increasing over time. Because the project is lost if not taken, this description of equilibrium is a straightforward extension of the single-period analysis of Myers and Majluf (1984).

To consider the other extreme, suppose that the project can be deferred indefinitely with no loss in value. In this case, if there is any asymmetric information when a project arrives, firms other than those with the worst private information will wait until the next information release before issuing equity. Only firms with the worst private information will issue at other times.<sup>7</sup> The market's valuation of firms issuing equity is greatest immediately after an information release; hence, the magnitude of the price drop at issue announcement is smallest at that time. At other times, only the lowest-quality firms issue, so the price drop is constant over time.

In both of these cases, there are two empirical predictions: (a) the stock price change associated with announcing an equity issue is nonincreasing over the time between information releases; and (b) the quantity of equity issues will be greatest immediately following an information release.

More realistically, there will be some finite cost to delaying the equity issue. In this case, we would expect the pricing of the issue and the behavior of firms to be between the two extremes above. Korajczyk, Lucas, and McDonald (1990b) characterize the equilibrium when the expected cost of delay increases with the length of delay, and show that there is both clustering of equity issues following an information release and that the price drop on announcement of an equity issue increases in the time since the last information release. Thus, having a cost of delay does not affect the basic empirical predictions.

The adverse selection explanation of equity issue timing also implies that firms issuing equity will, on average, have released good news prior to the issue. There are two types of firms that experience a project arrival during an interval: those that have received private information that their true value is below their market price, and those that have received private information that their true value is above their market price. The firms with private bad news gain nothing from waiting for this information to become public and, therefore, issue immediately. Since private information is by definition unpre-

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<sup>6</sup> Since the existence and value of a project is assumed to be public knowledge, the price premium reflects only the market's inference about the value of assets in place.

<sup>7</sup> A similar kind of unraveling occurs in the adverse selection models of Grossman (1981) and Milgrom (1981)

dictable, these firms will, on average, have disclosed average news at the previous information release. In contrast, the firms with private good news may choose to wait until their news becomes public. These firms will have disclosed good news at the information release prior to the equity issue. Therefore, averaging across both types of firms, good news precedes equity issues.<sup>8</sup>

For expositional convenience, we have made a number of simplifying assumptions. However, most of these assumptions do not affect the empirical predictions discussed above. For example, we assumed that the value and existence of the project are known. If the existence of a project is not publicly known and if equity issues are costly, equity issuance can serve as a signal that a project exists. Even with adverse selection, the stock price can rise at the issue announcement if the good news about project value is greater than the bad news conveyed by the willingness to issue equity when there is adverse selection. Nevertheless, the increasing information asymmetry implies that the average quality of firms that choose to issue equity is decreasing over time. Therefore, holding the value of the project fixed over time, the price reaction will be less positive as the time since the last information release increases.

If the information release does not fully reveal the manager's information, the story is also essentially unchanged. The chief difference is that firms may delay issues for longer, since managers may have good information that spans multiple information releases.

Firms release information in a variety of ways, but for purposes of empirical work, we will use regular quarterly earnings releases as a proxy for information releases. Earnings releases have several desirable properties for testing the implications of time-varying adverse selection: (a) their timing tends to be fairly predictable, (b) earnings releases are mandatory and (eventually) audited, and (c) evidence suggests that earnings releases do in fact have informational content and that management generally knows whether the market will perceive the announcements as good or bad news.<sup>9</sup>

When examining these implications using data, it can be important to account for other characteristics of the firm and the equity issue that can affect the importance of adverse selection as a factor in issue timing. Other things equal, firms about which the market is better informed will have less benefit to waiving until an information release. Similarly, taking project value as fixed, the larger is the required issue,

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<sup>8</sup>This point is made more generally in Lucas and McDonald (1990).

<sup>9</sup>The existing literature finds significant stock price movements upon earnings releases, on average (see, e.g., Wilson (1987) and the studies cited in Foster (1986, chap. 11)). In addition, Seyhun (1986) provides evidence that insiders can forecast the stock price.

the more important is the adverse selection problem. However, as project value becomes larger, holding fixed the required investment, the cost of delay becomes greater.

### **1.2 Heterogeneous information releases**

Information releases may not all be equally informative. If an upcoming earnings release is relatively uninformative, waiting to issue may be undesirable. If an earnings release is likely to be very informative, there is a greater incentive for the firm to wait. On average, therefore, we would expect to see equity issues follow earnings releases that are more informative than average. If annual reports are more informative than quarterly earnings reports, we would expect to see relatively more clustering following annual reports.

### **1.3 Issue versus announcement date**

So far, we have assumed that the issue and announcement dates coincide. In practice, these dates are usually several weeks apart. The informational asymmetry on the issue date determines the degree of adverse selection since that is the date on which the equity is actually sold. If all firms that announced an issue actually issued, we would expect no further price decline on the issue date. However, Mikkelsen and Partch (1988, note 19) present evidence that 10 percent of firms announcing equity issues withdraw the issue. One possible reason for the withdrawal is that management acquires new information after the issue announcement that the firm is undervalued. Thus, going ahead with the issue conveys new information and the price should be expected to drop further on the issue date.<sup>10</sup> In line with our previous reasoning, we would also expect the price drop at issue to be larger the longer the time since announcement of the issue.

Thus, there are three dates of interest (equity announcement, equity issue, and information release) and two possible alignments of these dates: the firm may announce and then issue equity without an intervening information release, or there may be an information release between the announcement of the equity issue and the actual issue. In the adverse selection story, the price drops at issue announcement in anticipation of asymmetric information at the actual issue. Thus, these two cases are logically distinct (in particular, the length of time between announcement and issue have different meanings) so we treat them separately in the empirical work.

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<sup>10</sup> Mikkelsen and Partch (1988) find that firms that withdraw their issues experience a price rise, in accord with this line of reasoning. Korajczyk, Lucas, and McDonald (1990b) model the case where firms rationally withdraw from an announced issue.

### 1.4 Alternative explanations

A variety of institutional factors could explain cycles in equity issues. (a) Firms may have a natural operating cycle in which decisions about security issuance would be decided at the end of quarters; for a similar reason underwriters may prefer to underwrite at particular times. (b) The firm may also prefer to issue following earnings releases to minimize legal liability from having an issue followed by subsequent bad news. (c) Managers may not know whether external finance is necessary until they have compiled the information required for an earnings release. We will lump these explanations together as the "operating cycle" hypothesis.

Both the adverse, selection hypothesis and the operating cycle hypothesis predict equity issue clustering. However, we have also argued that the size of the price drop at issue announcement should be related to the timing of the issue. The operating cycle hypothesis does not predict such price effects and thus is empirically distinguishable from the adverse selection explanation for timing.

### 1.5 Summary of predictions

To summarize, time-varying adverse selection implies (a) a clustering of, issues following information releases, and few issues preceding information releases; (b) a larger price drop at announcement and issue the longer the time since the last information release; and (c) unusually positive and informative information releases preceding equity issues.

## 2. Data-Overview

### 2.1 Sources

We obtained the dates of seasoned underwritten primary and secondary equity issues by industrial firms (banks and utilities are excluded) for the period 1978-1983 from Drexel Burnham Lambert's *Public Offerings of Corporate Securities* (various years). Announcement dates for the equity issue were obtained from the *Wall Street Journal Index*. The reported company names were used to match issue dates with company stock return, price, and financial data from the CRSP daily files (NYSE/AMEX and NASDAQ), and Quarterly Compustat (Industrial and Full Coverage) files. Dates of first public announcement of quarterly earnings are from Compustat. Where Compustat was unavailable or unreliable, some dates were taken from the *Wall Street Journal Index*. The sample includes 1247 equity issue dates (646 are for NYSE/AMEX firms and 601 are for OTC firms) obtained from Drexel's *Offerings*, although a smaller sample remains

after matching and screening for missing observations.<sup>11</sup> Observations are omitted for any of the following reasons: inability to match company name with CRSP or Compustat, missing data, or apparent data errors (e.g., the second quarter earnings release date preceding the first quarter earnings release date).<sup>12</sup>

## 2.2 Summary statistics

Summary statistics are presented in Table 1. About half of the firms in our sample have a December fiscal-year end;<sup>13</sup> nevertheless, issues occur throughout the year, and are least likely to occur in the first calendar quarter. Table 1 also shows that issues follow issue announcements fairly closely: 75 percent of issues occur within 40 calendar days following the issue announcement. Because 51 percent of the firms have December fiscal-year ends, we treated December and other fiscal-year end firms separately in some of the tests. Since we found no qualitative differences, these results are not reported.

The stock price behavior of the firms in our sample is similar to that observed in other studies of equity issues, such as Asquith and Mullins (1986), Masulis and Korwar (1986), and Barclay and Litzenberger (1988). For the announcement of the equity issue, we define the event day (day 0) as the day on which the earliest announcement related to the issue appears in the *Wall Street Journal*. For the actual issue, we define the event day to be the issue date. We define abnormal returns on asset  $i$  on day  $t$ ,  $A_{it}$  as the difference between the rate of return on asset  $i$  on day  $t$ ,  $R_{it}$  and the return on an equal-weighted market portfolio on that day,  $R_{mt}$  (i.e.,  $A_{it} = R_{it} - R_{mt}$ ).  $R_{mt}$  is defined as the equal-weighted portfolio of NYSE/AMEX/OTC stocks. The average abnormal returns,  $\bar{A}_n$  for the 21-day period surrounding the announcement day and issue day are listed in Table 2.  $\bar{A}_t$  is the abnormal return on an equal-weighted portfolio of stocks in the sample. Table 2 shows  $t$ -statistics for price behavior around the announcement and Issue days. They are calculated for each day using a cross-sectional estimate of the variance of abnormal returns.<sup>14</sup>

There are significant negative average abnormal returns of -2.26 and -0.43 percent on the day preceding and the day of the *Wall Street Journal* article, respectively. In addition, there are significant negative average abnormal returns of -0.94 percent on the day pre-

<sup>11</sup> For each test, as many observations were retained as was feasible. Thus, sample size varies substantially across tests. There were missing earnings release dates on the quarterly Compustat tapes for more than half of the sample.

<sup>12</sup> We required that successive earnings releases be no less than 40 and no more than 180 days apart. Observations not meeting this criterion were omitted.

<sup>13</sup> Fiscal year ends were obtained from Compustat.

<sup>14</sup> Simulation results in Collins and Dent (1984) indicate that this method of calculating  $t$ -statistics leads to appropriate inferences in experimental designs similar to ours.

**Table 1**  
**Unconditional distributions**

Distribution of fiscal year end by month

|     | Jan.      | Feb.      | Mar.      | Apr.      | May       | June       | July      | Aug.      | Sept.     | Oct.      | Nov.      | Dec.        |
|-----|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-------------|
| (%) | 37<br>5.8 | 11<br>1.7 | 37<br>5.8 | 15<br>2.4 | 23<br>3.6 | 68<br>10.7 | 26<br>4.1 | 18<br>2.8 | 44<br>6.9 | 20<br>3.1 | 12<br>1.9 | 326<br>51.2 |

Distribution of issue dates by month

|     | Jan.      | Feb.      | Mar.       | Apr.      | May        | June        | July       | Aug.      | Sept.      | Oct.       | Nov.       | Dec.       |
|-----|-----------|-----------|------------|-----------|------------|-------------|------------|-----------|------------|------------|------------|------------|
| (%) | 78<br>6.3 | 73<br>5.9 | 101<br>8.1 | 97<br>7.8 | 109<br>8.7 | 146<br>11.7 | 114<br>9.1 | 99<br>7.9 | 100<br>8.0 | 111<br>8.9 | 102<br>8.2 | 117<br>9.4 |

Distribution of calendar days between announcement of issue and issue date (% of firms)

| Days | 1-10 | 11-20 | 21-30 | 31-40 | 41-60 | 61-80 | 81-100 | >101 |
|------|------|-------|-------|-------|-------|-------|--------|------|
| (%)  | 19.8 | 25.4  | 21.8  | 10.8  | 12.3  | 4.6   | 2.2    | 3.1  |

Dates of seasoned underwritten primary, secondary, and combined equity issues by industrial firms for the period 1978-1983 are from Drexel Burnham Lambert's *Public Offerings of Corporate Securities*. Announcement dates for the equity issue are obtained from the *Wall Street Journal Index*.

**Table 2**  
**Abnormal returns around announcement and issue days**

| Day relative to the event <sup>1</sup> | Announcement abnormal return | t-statistic | n <sup>2</sup> | Issue abnormal return | t-statistic | n <sup>2</sup> |
|----------------------------------------|------------------------------|-------------|----------------|-----------------------|-------------|----------------|
| -10                                    | 0.16                         | 1.80        | 1017           | -0.10                 | -0.93       | 738            |
| -9                                     | 0.19                         | 1.94        | 1017           | 0.04                  | 0.33        | 778            |
| -8                                     | -0.01                        | -0.10       | 1019           | -0.05                 | -0.54       | 820            |
| -7                                     | 0.03                         | 0.36        | 1020           | 0.07                  | 0.71        | 855            |
| -6                                     | 0.31                         | 3.19        | 1019           | -0.00                 | -0.02       | 887            |
| -5                                     | 0.16                         | 1.82        | 1021           | -0.13                 | -1.42       | 930            |
| -4                                     | 0.09                         | 0.96        | 1022           | -0.24                 | -2.73       | 957            |
| -3                                     | -0.07                        | -0.72       | 1023           | -0.17                 | -1.93       | 994            |
| -2                                     | -0.19                        | -1.84       | 1023           | -0.52                 | -5.90       | 1025           |
| -1                                     | -2.26                        | -20.64      | 1021           | -0.94                 | -9.99       | 1045           |
| 0                                      | -0.43                        | -3.74       | 1024           | -0.29                 | -3.36       | 1064           |
| 1                                      | 0.11                         | 1.00        | 1029           | 0.18                  | 2.27        | 1073           |
| 2                                      | 0.14                         | 1.45        | 1029           | 0.01                  | 0.09        | 1074           |
| 3                                      | 0.28                         | 3.25        | 1028           | 0.16                  | 1.99        | 1074           |
| 4                                      | 0.22                         | 2.37        | 1030           | 0.13                  | 1.74        | 1076           |
| 5                                      | 0.07                         | 0.76        | 1034           | 0.20                  | 2.70        | 1076           |
| 6                                      | 0.11                         | 1.21        | 1037           | 0.29                  | 3.67        | 1078           |
| 7                                      | 0.06                         | 0.66        | 1037           | -0.05                 | -0.71       | 1077           |
| 8                                      | 0.05                         | 0.60        | 1040           | 0.08                  | 0.99        | 1078           |
| 9                                      | 0.10                         | 0.99        | 1041           | 0.07                  | 0.93        | 1080           |
| 10                                     | 0.04                         | 0.43        | 1042           | 0.16                  | 2.14        | 1081           |

<sup>1</sup> For the announcement of the issue, day 0 is the day of earliest appearance, in the *Wall Street Journal*, of news of the issue. For the issue date, day 0 is the issue day (from *Public Offerings of Corporate Securities*).

<sup>2</sup>  $n$  is the number of firms with observed returns on that day relative to the event. For the issue day abnormal returns, only observations after the announcement are included.

ceding the issue and -0.29 percent on the day of the issue. There are also significantly negative abnormal returns on days prior to the issue and significantly positive returns after the issue date.

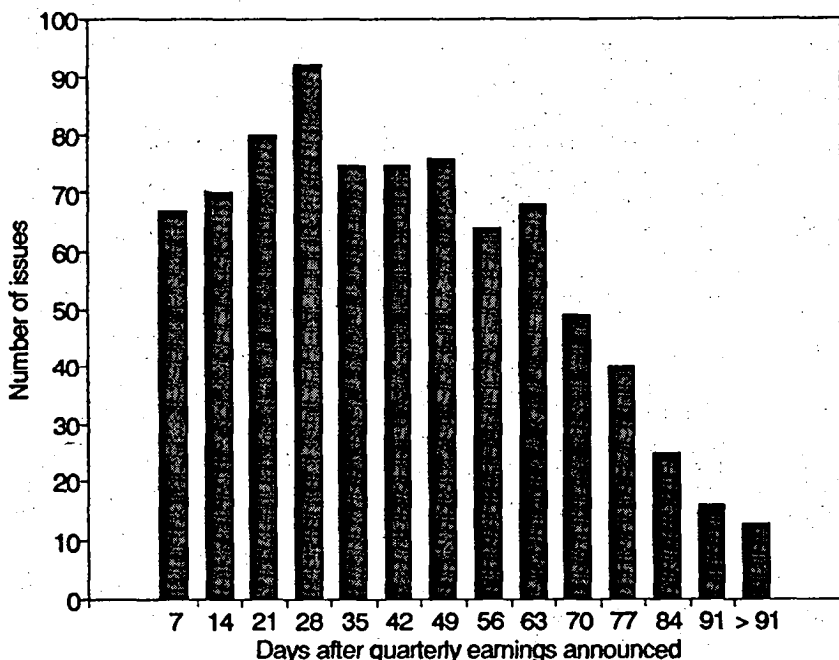
### 3. The Timing of Equity Issues Relative to Earnings Releases

We have argued that equity issues should cluster following earnings releases and that few issues should directly precede earnings releases. This suggests the following hypothesis.

**Hypothesis 1: The timing of equity issues.**  $H_n$ : Within an  $n$ -day window around an equity issue date, there will be an equal number of earnings releases before and after the equity issue.

$H_a$ : Earnings releases are more likely to precede than to follow equity issues.

$H_n$  denotes the null hypothesis and  $H_a$  the alternative hypothesis. We expect to reject  $H_n$  in favor of  $H_a$ .



**Figure 1**  
Distribution of equity issues relative to quarterly earnings announcements—for all quarters

Figures 1-4 are histograms of issue frequency relative to quarterly and annual earnings releases. They are basically consistent with the alternative hypothesis: issues trail off toward the end of each quarter and at the end of the year.<sup>15</sup> However, while we expect to see many issues shortly after an earnings release, the histograms show that issues are fairly evenly distributed over the early to middle part of most quarters. This suggests that while firms avoid issuing equity shortly before an earnings release, they do not hurry to issue immediately after an earnings release.

The histograms show that there are few issues at the end of the fourth quarter and the beginning of the first quarter. Because of more detailed reporting and auditing requirements, fiscal year-end earnings releases and the annual report together may resolve more of the asymmetry in information than intra-year quarterly announcements. The releases of the annual report and 10-K on average follow the

<sup>15</sup> We constructed separate histograms for December fiscal-year ends and all other fiscal-year ends. We found no significant difference. We also examined histograms based upon the fraction of the time between earnings releases rather than days after the previous earnings release. The histograms are similar except for the first quarter, in which there are outliers caused by firms with a brief time between earnings releases. If these firms are omitted, the histogram is similar to Figure 2.

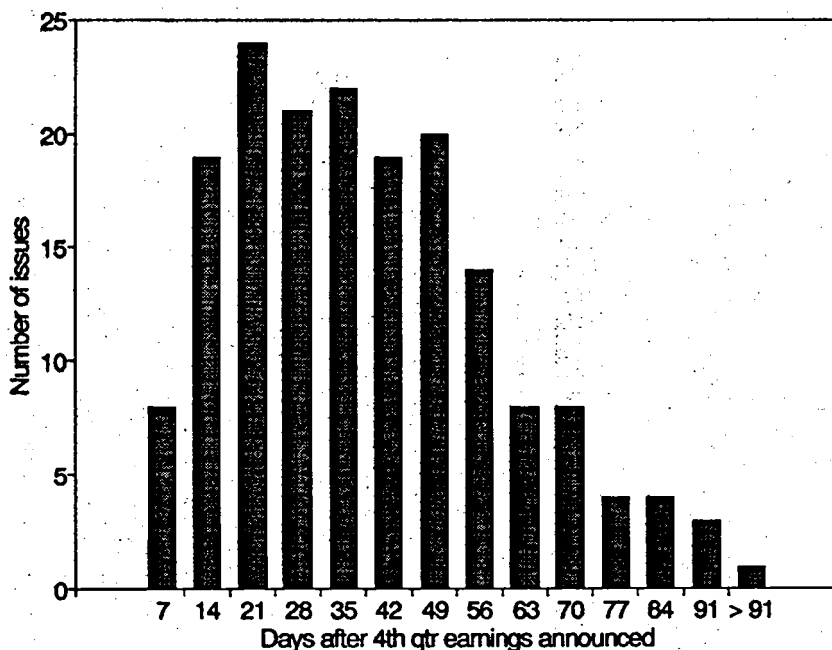


Figure 2  
Distribution of equity issues relative to quarterly earnings announcement – first quarter

earnings release for the fourth quarter by several weeks [Wilson (1987)]. Good quality firms about to issue an informative annual report would not issue stock, so this potentially explains the early first quarter lull.

We can test the null hypothesis more formally. Hypothesis 1 implies that, on average, the earnings release date preceding the issue should be closer to the issue date than the earnings release following the issue. Thus, we can test whether the distribution of earnings releases around issue dates is skewed to the left, using a one-sided Wilcoxon rank-sum test [Mood, Graybill, and Boes (1974)].

Let  $D$  be the number of days between an equity issue and the closest earnings release.  $D$  is negative if the preceding earnings release is closer to the Issue than is the subsequent earnings release. The null hypothesis is that  $D$  is symmetric around zero (i.e., that the distribution of earnings releases following the issue is the same as the distribution of earnings releases preceding the issue). To perform the test, observations are ranked by the absolute value of  $D$ , and the sum of the ranks for which  $D$  is positive is computed. This is compared to the expected sum of ranks under the null hypothesis. We perform the test for windows of 10, 20, 30, and 40 days from issue date to nearest quarterly earnings release, and for 60, 100, 140, and 180 days

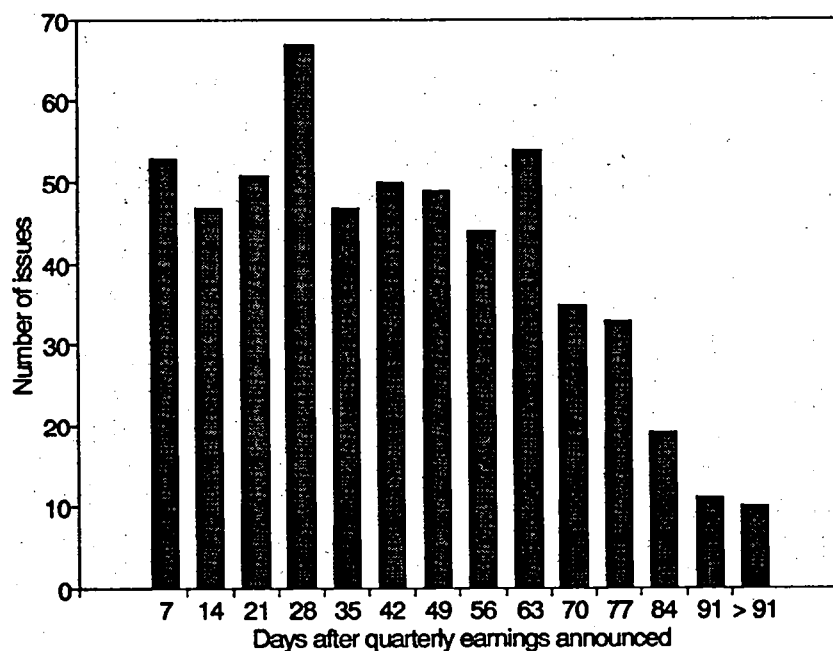


Figure 3  
Distribution of equity issues relative to quarterly earnings announcement-second, third, and fourth quarters

from issue date to nearest annual earnings release (our proxy for the annual report).

The results are summarized in Table 3. Sample size varies because of earnings data availability. The null hypothesis of a symmetric distribution of earnings releases around issue dates is rejected for the combined quarterly data, the annual data, and for many of the individual quarters.

We might expect firms to differ in the costs and benefits of deferring equity issues. Large firms, for example, may gain less from timing since they are more closely scrutinized by the market and hence face a less severe adverse-selection problem. The larger the issue size relative to the firm (holding the value of the project fixed), on the other hand, the more severe the adverse selection problem and the greater the incentive to wait to issue until after the next earnings release.

To see whether firm size and issue size affect issue timing, we regress  $D_I$  (days between issue and *preceding* earnings release) and  $D_I/D_{BR}$  ( $D_{BR}$  is the number of days between earnings releases) on firm size, as measured by  $\ln(\text{market value of equity})$ , and issue size, as

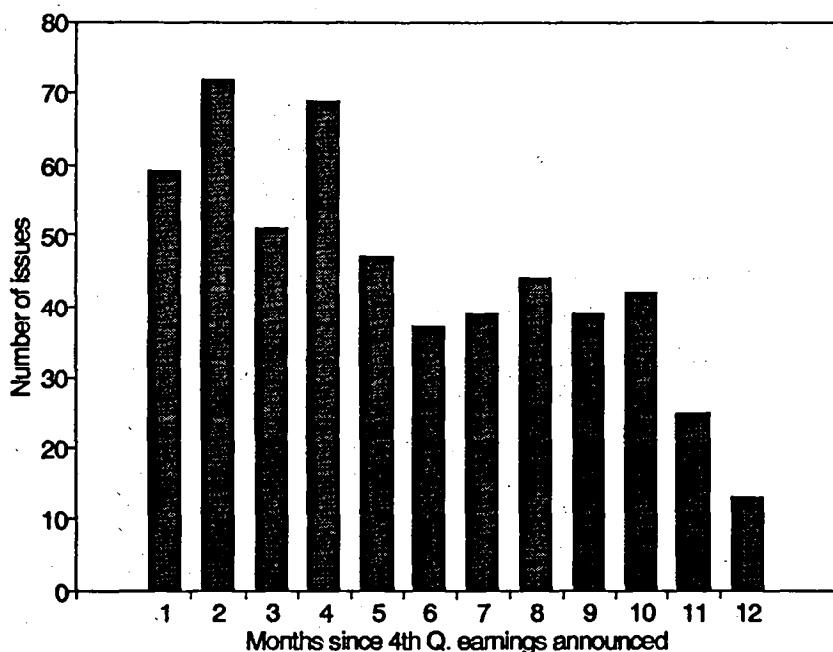


Figure 4  
Distribution of equity issues (in months) relative to announcement of fourth-quarter earnings

measured by  $\ln(\text{size of the primary issue})$ . The use of  $\ln(\text{size})$  instead of size emphasizes size differences among small firms relative to large firms. The results are reported in Table 4.

As expected, on average, larger firms issue later, while firms with larger issues issue sooner. Although the coefficients on firm size and issue size are of similar magnitude, the hypothesis that only the ratio of issue size to firm size is significant is rejected at the 1 percent level.

#### 4. Earnings Informativeness and the Timing of Equity Issues

It is unlikely that all information-revealing events convey the same amount of information to the market. For example, earnings announcements in some quarters may be more informative than earnings announcements in other quarters. Other things equal, delaying an equity issue is most valuable for firms when (a) the market perceives the current degree of asymmetry to be great; (b) the manager believes the asymmetry will be resolved soon; and (c) the manager has good private information about the firm. This implies that equity issues should, on average, be preceded by earnings releases that (a)

Table 3  
One-sided Wilcoxon test for symmetry of earnings releases around issue dates

|                   | No. of days around<br>issue date | No. of observations | Significance level <sup>1</sup> |
|-------------------|----------------------------------|---------------------|---------------------------------|
| Combined quarters | 10                               | 124                 | .999                            |
|                   | 20                               | 305                 | .995                            |
|                   | 30                               | 529                 | .997                            |
|                   | 40                               | 703                 | .988                            |
| First quarter     | 10                               | 25                  | —*                              |
|                   | 20                               | 85                  | —*                              |
|                   | 30                               | 152                 | —*                              |
|                   | 40                               | 191                 | .904                            |
| Second quarter    | 10                               | 41                  | .992                            |
|                   | 20                               | 81                  | —*                              |
|                   | 30                               | 146                 | .999                            |
|                   | 40                               | 186                 | —*                              |
| Third quarter     | 10                               | 23                  | .979                            |
|                   | 20                               | 70                  | .994                            |
|                   | 30                               | 116                 | —*                              |
|                   | 40                               | 163                 | .999                            |
| Fourth quarter    | 10                               | 25                  | .980                            |
|                   | 20                               | 48                  | .941                            |
|                   | 30                               | 82                  | .995                            |
|                   | 40                               | 108                 | .999                            |
| Annual            | 60                               | 168                 | .999                            |
|                   | 100                              | 304                 | .999                            |
|                   | 140                              | 427                 | .999                            |
|                   | 180                              | 528                 | .971                            |

<sup>1</sup>Number reported is 1 minus the  $p$  value. The test statistic is the normal approximation to the distribution of the positive rank sum under the null hypothesis.

\*Significant at less than the 90% level.

are more informative than average and (b) convey better than average, news about the firm. This can be summarized in the following hypothesis.

**Hypothesis 2:** Earnings informativeness around equity issues.  $H_n$ : The earnings releases preceding an equity issue (a) convey the same amount of information as earnings releases after the equity issue, and (b) convey the same news about the firm as those after the issue.  $H_n$ : Earnings releases preceding an equity issue (a) are more informative than earnings releases following the equity issue, and (b) convey more positive information than earnings releases following the issue.

Based on the foregoing argument, we would expect to reject  $H_n$  in favor of  $H_a$ . The information effects associated with earnings releases in the eight quarters surrounding the issue day are summarized in Table 5. As discussed above, the abnormal return for an asset on day  $t$  is the return on that asset less the return on an equally weighted

Table 4  
Effect of firm size and issue size on the timing of issues

| Dependent variable | Constant           | ln(size)              | ln(issue size)         | R <sup>2</sup> | $\chi^2_{df}$ | No. of observations |
|--------------------|--------------------|-----------------------|------------------------|----------------|---------------|---------------------|
| $D_i$              | 40.263*<br>(1.273) | 0.321*<br>(0.060)     | -0.397*<br>(0.030)     | 0.008          | 79.6*         | 563                 |
| $D_i/D_{it}$       | 0.444*<br>(0.016)  | 0.00312*<br>(0.00078) | -0.00365*<br>(0.00031) | 0.005          | 49.9*         | 563                 |

$D_i$ : number of days between the equity issue and the preceding earnings release;  $D_{it}$ : number of days between preceding and following earnings release; size: number of shares before issue times offer price. from Drexel's Public Offerings, Issue size: number of shares issued times offer price. Standard errors (in parentheses) are adjusted for heteroskedasticity as in White (1980a).

$\chi^2_{df}$  statistic for the test that the coefficients on ln(size) and ln(issue size) are of equal magnitude and opposite in sign. The subscript denotes the degrees of freedom.

\*Significant at 1% level (two-tailed).

portfolio of stocks. The first line in Table 5 shows the average cross-sectional abnormal return for a two-day period, including the day of the earnings release and the previous day. There are significantly positive stock returns for all four earnings releases preceding the equity issue. Three of the four earnings releases following the equity issue are accompanied by small and insignificant excess returns. The earnings release immediately following the issue is associated with a positive abnormal return, which is puzzling since it suggests a profit opportunity. On the whole, it seems clear that earnings releases preceding an equity issue convey better news on average than earnings releases after the equity issue.

The earnings releases preceding the issue should also be more informative than average, regardless of the direction (i.e., good or bad) of the news. We use the following variance ratio as a measure of information content for the earnings release of firm  $i$ :

$$F(i) = \frac{1}{2} A(i)^2 / s^2(i),$$

where  $A(i)$  is the two-day (day -1 plus day 0) abnormal return for firm  $i$  at the earnings release, and  $s^2(i)$  is an estimate of the normal daily variance of firm  $i$ 's abnormal return.<sup>16</sup>

Under the null hypothesis that the earnings release conveys no extra information, the variance on earnings release days should be the same as on other days. If this is true, and if abnormal returns are normally distributed, the ratio has an  $F_{2, v_2}$  distribution, where  $v_2$  is the number of degrees of freedom for the sample variance  $s^2(i)$  [see

<sup>16</sup>For the earnings releases before the issue, we estimate the typical variance over the 200-day period from 250 days to 51 days before the issue is announced. For the earnings releases after the issue, we estimate the typical variance over the 200-day period from 51 days to 250 days after the issue is announced.

Table 5  
Abnormal returns at earnings release dates

|                               | Quarters relative to issue day |        |        |        |        |         |        |         |
|-------------------------------|--------------------------------|--------|--------|--------|--------|---------|--------|---------|
|                               | -4                             | -3     | -2     | -1     | 1      | 2       | 3      | 4       |
| Average abnormal return (%)   | 0.50                           | 0.94   | 1.20   | 0.33   | 0.81   | -0.10   | 0.10   | -0.25   |
| t-statistic                   | (2.38)                         | (4.34) | (6.10) | (1.85) | (4.77) | (-0.52) | (0.48) | (-1.21) |
| No. of observations           | 495                            | 552    | 658    | 739    | 756    | 710     | 641    | 608     |
| Average excess variance ratio | 0.45                           | 0.73   | 0.61   | 0.79   | 0.53   | 0.52    | 0.65   | 0.70    |
| t-statistic                   | (3.01)                         | (4.08) | (4.06) | (5.06) | (5.02) | (4.96)  | (4.31) | (3.89)  |
| No. of observations           | 409                            | 454    | 541    | 598    | 627    | 590     | 533    | 502     |

Average abnormal return is a cross-sectional average of the two-day abnormal return around earnings releases. The excess variance ratio is the ratio of the announcement period variance to non-announcement-period variance, less  $(n - 1)/(n - 3)$ , where  $n$  is the number of observations used to estimate non-announcement-period variances.

Johnson and Katz (1970, pp. 75-76)]. The expected value of  $F(i)$  is  $v_2/(v_2 - 2)$  (for  $v_2 > 2$ ), and the excess variance ratio is

$$F^*(i) = F(i) - E[F(i)].$$

Under the null  $F^*(i)$  has a mean of zero.

The average values of  $F^*$  and their associated  $t$ -statistics are reported in the third and fourth lines of Table 5. All of the earnings releases are informative relative to a typical trading day. The earnings release just preceding the equity issue also has the largest mean excess variance ratio, suggesting that it is unusually informative even when compared to other earnings releases.

We repeat the excess variance ratio test, computing the informativeness of the earnings release immediately prior to the issue to that of all other earnings releases in the eight-quarter window around the issue date. The mean excess variance for that earnings release is 1.22 with a  $t$ -statistic of 2.72 ( $p$  value = 0.0066). Thus, the earnings release immediately preceding an equity issue is significantly more informative than a typical earnings release.<sup>17</sup>

## 5. Announcement and Issue Price Effects

In Section 1, we argued that since, the degree of asymmetric information increases over time, the price drop at announcement of an equity issue should be larger for firms that issue equity later following an earnings release. This leads to the following hypothesis.

**Hypothesis 3:** *The stock price reaction to the timing of issue announcements and issues.  $H_n$ : The fall in the stock price upon announcement of the equity issue is independent of the timing of the issue announcement relative to the earnings release. Also, the price drop at issuance is unrelated to the timing of the issue relative to announcement or earnings release.*

**$H_a$ :** *The fall in stock price upon announcement of the issue is smaller the more closely the issue is expected to follow an earnings release. Also, the fall in the stock price on the issue date is smaller the more closely issuance follows the preceding informative event (either earnings release or issue announcement; depending on the case).*

We expect to reject  $H_n$  in favor of  $H_a$  for each case.

In Case 1 (in which an earnings release is followed by an issue announcement, which is followed by an issue), we expect the drop

<sup>17</sup>The use of a  $t$ -statistic relies on the central limit theorem. We also performed a  $\chi^2$  test, which is exact if daily abnormal returns are normally distributed. The results were virtually identical.

at announcement to increase in the time since the earnings release, and the drop at issue to increase in the time since the issue announcement.

In Case 2 (in which an issue announcement is followed by an earnings release, which is followed by the issue), the drop at issue should increase in the time since the previous earnings release (the preceding informative event). It is less clear how to treat the drop at the issue announcement, however. *If* the forthcoming earnings release were to be fully revealing, and *if* investors knew the issue would occur after the earnings release, there would be no announcement period price drop due solely to adverse selection. In practice, however, investors may not be sure whether the issue will occur before or after the next earnings release. In addition, earnings releases do not eliminate all informational asymmetries. Thus, we use the time since the previous earnings release to reflect the degree of asymmetric information, but we consider this case to be problematic.

There are several econometric issues in testing to see whether the price drop increases in the time since the last earnings release. First, time-varying adverse selection implies that this relation should be monotonic but not necessarily linear. Thus, these regressions can be viewed as a linear approximation to a monotonic function. [White (1980b)].

Second, both the price drop and the number of days since the earnings release are noisy measures of the quantities they are meant to represent. The price drop measures the abnormal return due to the event as well as abnormal returns associated with other unrelated events over a two-day window. Since we have no reason to believe this other news will be systematic, this extra noise causes a loss in power but, no bias. The error in using the number of days since the last earnings release as a measure of informational asymmetry is more problematic. There are other sources of information besides earnings reports. If the timing of these other information releases is uncorrelated with the timing of earnings releases; then we should still see the hypothesized relations, although the coefficients will be biased toward zero because of errors in the variables. If the timing of these other information releases is correlated with the timing of earnings releases, then the bias in the coefficients could go in either direction. An additional errors-in-the-variables problem is caused by the fact that investors may not know with certainty at the time of announcement whether there will be an intervening earnings release before the issue. This should bias the results against those implied by the existence of time-varying adverse selection.

Finally, the variability of abnormal returns is likely to differ across different firms, so we estimate the regressions using weighted least

Table 6

Weighted least-squares regression of two-day announcement abnormal return and two-day issue abnormal return on explanatory variables

| Explanatory variables                                                                    | Case 1 (no earnings release between announcement and issue) |                     | Case 2 (earnings release falls between announcement and issue) |                   |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------|----------------------------------------------------------------|-------------------|
|                                                                                          | Announcement                                                | Issue               | Announcement                                                   | Issue             |
| Constant $\times 10^{-3}$                                                                | -2.251**<br>(0.306)                                         | 0.315<br>(0.262)    | -3.612**<br>(1.216)                                            | -1.160<br>(0.590) |
| Days between issue announcement and previous earnings release $\times 10^{-3}$           | -0.147*<br>(0.085)                                          |                     | 0.044<br>(0.173)                                               |                   |
| Days between the issue day and announcement of the issue $\times 10^{-3}$                |                                                             | -0.513**<br>(0.134) |                                                                |                   |
| Days between the issue day and earnings release preceding the issue day $\times 10^{-3}$ |                                                             |                     |                                                                | 0.122<br>(0.209)  |
| No. of observations                                                                      | 435                                                         | 442                 | 88                                                             | 91                |
| R <sup>2</sup>                                                                           | 0.054                                                       | 0.031               | 0.087                                                          | 0.003             |

All two-day abnormal returns are sum of abnormal returns relative to equally weighted NYSE/AMEX/NASDAQ portfolio, on event days -1 and 0. Size: number of shares before issue times offer price, from Drexel's Public Offerings Primary issue size: number of shares issued times offer price, from Drexel's Public Offerings. Standard errors (in parentheses) are adjusted for heteroskedasticity as in White (1980a).

\*Significant at 10% level (two-tailed).

\*\*Significant at 1% level (two-tailed).

squares: each asset's observations are weighted by the inverse of the standard deviation of its abnormal return. This standard deviation is estimated from the time series of abnormal returns from days +50 to +250 relative to the announcement of the issue.<sup>18</sup>

Table 6 shows the results from regressing the two-day 'issue announcement price drop on the time since the last earnings release and from regressing the two-day issue period price drop on the time since the last release of information (either issue announcement in Case 1 or previous earnings release in Case 2). For the announcement period and Case 1, where the earnings release precedes the announcement of the issue, there is a negative relationship, significant at the 10 percent level, between the announcement day drop and the time since the earnings release. While the coefficient is marginally statistically significant, the point estimate implies a relation between timing and pricing that seems economically important. The coefficient

<sup>18</sup> We use days following the issue announcement since there is ample evidence that price behavior preceding the announcement is unusual. As a diagnostic check, the squared residuals from ordinary least-squares regressions are regressed on the time-series estimates of the variance. The *F*-statistics on the variance are on the order of 2 to 3. This verifies the presence of heteroskedasticity.

implies that delaying announcement of an issue by one month leads to an adverse announcement day price reaction of 0.44 percent.<sup>19</sup>

For Case 2, where the earnings release is between the announcement and issue, there is no significant relation between the announcement period price drop and the time since the last earnings release. As we mentioned earlier, it is unclear whether there should be a price effect in this case. Also, the smaller sample in Case 2 leads to less precise estimates.

For the issue-day price drop our proxy for informational asymmetry depends on whether there is an intervening earnings release. We use the time between the issue date and the issue announcement in Case 1 and the time between the issue date and the previous earnings release in Case 2. In Case 1, the timing coefficients are significant and have the predicted sign, whereas they are insignificantly different from zero in Case 2.<sup>20</sup>

There is an alternative explanation for the negative relation between the issue-day price drop and the time since the issue announcement. The market could infer that firms which wait longer to issue following an announcement are more likely to withdraw from the issue. In this case, the issue-day price drop would be increasing in the time since the issue announcement. This explanation is indistinguishable from the adverse selection hypothesis.

The interpretation of the issue-day regressions is complicated by puzzling stock price behavior *following* the issue. As in Barclay and Litkenberger (1988) there is a positive stock price trend in the month following the issue. While the price drop at issue is potentially explained by adverse selection, the price recovery afterward is not. The recovery may be accounted for by the bid-ask spread or the "price-pressure" hypothesis (Barclay and Litkenberger (1988); Lease, Masulis, and Page (1989)]. These explanations are complementary to our adverse selection story in that they account for some aspects of the observed issue period price behavior, but they do not predict the negative relation between time since the issue announcement and the issue price drop.

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<sup>19</sup>This estimate comes from  $-0.0147 \times 30 \text{ days} = -0.44 \text{ percent}$ . This is obviously a rough approximation given the linear approximation and errors-in-variables problems associated with the regressions.

<sup>20</sup>We know from Table 4 that firm size and issue size are related to the timing of issues, so we also controlled for those variables. To the extent that firm size and issue size are proxies for the probability of the withdrawal of an announced issue, they will be associated with the price drop. While the coefficients on these size variables are statistically significant in some of the regressions, their inclusion leaves the coefficient on our proxy for informational asymmetry basically unaffected. Because of this, we do not report these extra regressions.

## 6. Conclusions

In this article, we present evidence that time-varying adverse selection affects the timing and pricing of equity issues. Here is a broad summary of our findings.

(1) Firms tend to issue equity earlier within a quarter rather than later, and are least likely to issue at the end of the fourth quarter.

(2) Almost no firms issue equity in the first few weeks after the announcement of the fourth quarter's earnings. This may be due to the lag of several weeks between that earnings release and the release of the annual report.

(3) Earnings releases in the year prior to an equity issue convey good news (generate positive stock returns), and are more informative than average. By contrast, three of the four earnings releases in the year following an issue generate zero abnormal returns.

(4) The stock price decline at the announcement of an issue 'Is increasing in the time since the last information release. This result is marginally statistically significant and of a magnitude that seems important in economic terms. Also, the stock price decline at issue is increasing in the time since issue announcement (in Case 1).

The earnings and price drop findings are of special interest, since they distinguish our hypothesis from the alternative that, for logistical reasons, firms find it easiest to issue equity at the end of the fiscal year or following a quarterly review.

We have focused upon earnings releases as information-revealing events, but firms can, of course, release information in other ways. Earnings releases are appealing because there is ample evidence that they do convey information, they are mandated, and there is only a limited degree to which they can be manipulated. Firms can also engage in voluntary information releases, for which credibility problems arise. An interesting extension of this article would be to study the effects of other information releases<sup>21</sup> on the timing and pricing of equity issues.

## References

- Akerlof, G.. 1970, 'The Market for 'Lemons'; Qualitative Uncertainty and the Market Mechanism,' *Quality Journal of Economics* 84, 488-500.
- Asquith, P., and D. W. Mullins, Jr., 1986, "Equity Issues and Offering Dilution." *Journal of Financial Economics* 15, 61-89.
- Barclay, M. J., and R. H. Litzenberger, 1988, "Announcement Effects of New Equity Issues and the Use of Intraday Price Data," *Journal of Financial Economics* 21, 71-99.
- Choe, H., R. W. Masulis, and V. Nanda, 1990, "On the Timing of Seasoned Common Stock Issues:

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<sup>21</sup>Loderer and Mauer (1989) investigate timing relative to dividend announcements.

Theory and Evidence." Working Paper 90-M. Financial Markets Research Center, Vanderbilt University.

Collins, D. W., and W. T. Dent, 1984, "A Comparison of Alternative Testing Methodologies Used In Capital Market Research," *Journal of Accounting Research*, 22, 48-84

Dierkens, N.. 1991. "Information Asymmetry and Equity Issues," *Journal of Financial and Quantitative Analysis*, 26, 181-99.

Drexel Bumham Lambert, 1974-1983, *Public Offerings of Corporate Securities*

Poster, G., 1986, *Financial Statement Analysis* (2d ed.), Prentice-Hall, Englewood Cliffs, NJ.

Grossman, S. J., 1981, "The Informational Role of Warranties and Private Disclosure About Product Quality," *Journal of Law and Economics* 24, 461-483.

Johnson, N.L, and S. Kotz, 1970, *Distributions in Statistics Continuous Univariate Distributions*, vol. 2, Wiley, New York.

Korajczyk, R. A., D. Lucas, and R. L McDonald, 1990a. "Understanding Stock Price Behavior Around the Time of Equity Issues." in R G. Hubbard (ed.), *Asymmetric Information, Corporate Finance, and Investment*, University of Chicago Press, Chicago.

Korajczyk, R. A., D. Luas, and R. L McDonald, 1990b. "Equity Issues With Time-Varying Asymmetric Information," Working Paper 84, Department of Finance, Northwestern University; forthcoming in *Journal of Financial and Quantitative Analysis*

Lease, R: C., R. W. Masulis, and J. R. Page, -1989, "Impacts of Seasoned Equity Offerings on Market Microstructure and the Stock Return Generating Process," working paper, Southern Methodist University.

Leland, H.E., and D. H. Pyle, 1977, "Informational Asymmetric, Financial Structure, and Financial Intermediation," *Journal of Finance*, 32, 371-387.

Loderer, C.. and D. C. Matter, 1989, "Corporate Dividends and Seasoned Equity Issues: An Empirical Investigation." working paper, Purdue University.

Lucas, D. J., and R. L. McDonald, 1990. "Equity Issues and Stock Price Dynamics," *Journal of Finance*, 45, 1019-1043.

Masulis, R. W., and A. N. Korwar, 1986, "Seasoned Equity Offerings: An Empirical Investigation," *Journal of Financial Economics*, 15, 91-118.

Mikkelson, W. H., and M. M. Partch. 1988, "Withdrawn Security Offerings," *Journal of Financial and Quantitative Analysis*, 23, 119-133.

Milgrom, P. R.. 1981; "Good News and Bad News: Representation Theorems and Appliations," *Bell Journal of Economics* 12, 380-391.

Mood, A. M., F. A. Graybill, and D. C. Boes, 1974, *Introduction to the Theory of Statistics* (3d ed.), McGraw-Hill, New York.

Myers. S. C. and N. S. Majluf, 1984, "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have," *Journal of Financial Economics* 13, 187-221.

Seyhun,H. N., 1986, "Insiders Profits, Costs of Trading, and Market Efficiency," *Journal of Financial Economics*, 16, 189-212.

White, H., 1980a, "'A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica*, 48, 817-838.

White, H., 1980b, "Using Least Squares to Approximate Unknown Regression Functions," *International Economic Review*, 21, 149-170.

Wilson, G. P., 1987, "The Incremental Information Content of the Accrual and Funds Components of Earnings After Controlling for Earnings." *Accounting Review*, 62, 293-322.