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ABSTRACT

This paper develops a formal model of the timing and pricing of new equity issues, assuming that managers are better informed than new investors about the quality of the firm. 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 information releases, such as earnings announcements. The model also predicts a relation between the timing and pricing of equity issues. The price drop at the time of the equity issue announcement should increase in the time since the last information release, and the price drop at issue should increase with the time since the last information release or issue announcement. We test the predictions of the theory on a sample of NYSE, AMEX and OTC firms who issued equity over the period 1978-1983. We find evidence that there is a clustering of equity issues following earnings announcements and annual reports, and also that the price drop at the time of the equity issue is increasing in the time since the announcement of the issue.

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1. Introduction

Recent research emphasizes the importance of asymmetric information in explaining the pricing of seasoned new equity issues. This paper develops a formal model that extends these ideas to suggest that asymmetric information also has interesting implications for the timing of new issues (when new equity issues will be announced and brought to market), and the relation between the pricing and timing of new issues. We test the predictions of the theory on a sample of New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and Over the Counter (OTC) firms who issued equity over the period 1978-1983.

The importance of asymmetric information in pricing equity issues is suggested by the fact that the stock price of a corporation issuing shares falls an average of approximately 3% at the announcement of the issue [Asquith and Mullins (1986) and Masulis and Korwar (1986)] and 0.65% at the actual issue [Mikkelson 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. Outsiders are aware of this, and consequently lower their evaluation of the issuing firm's quality, and thus the price they will pay for the firm's shares. 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 taking the degree of information asymmetry as given. Our model rests on the observation that the information asymmetry between insiders and outsiders is not fixed over time. For example, firms regularly disclose information in the form of earnings announcements and audited annual reports.[1] 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, quarterly earnings announcements, or dividend declarations.

Section 2 formalizes these ideas with a model in which firms with a positive NPV project choose whether or not to issue equity to finance the project. Some of these firms can also choose the timing of the equity issue. These firms have "durable" projects, while other projects "evaporate" if not undertaken immediately.[2] Project arrivals are observable, but outsiders do not know their durability. Firms also have assets in place, the true value of which is publicly revealed at regular information announcements, but which is otherwise known only to managers.

To understand the model, consider the case in which all projects are durable, so postponing an equity issue has no impact on project value. If all firms were to issue equity whenever a new positive NPV project arrived, the market price of equity would be the fair price for the average firm, and equity issues would coincide with project arrivals. However, firms with high quality assets in place will find it optimal to wait to issue equity until the market learns the true value of the firm, at which time the firm will receive a higher than average price for the newly-issued equity. Only low quality firms would ever issue before firm value is revealed, so the market price for new equity issues prior to an information release is below that for the average firm. It follows that in equilibrium all firms wait until information is released to issue equity when waiting is costless.

Matters are more complicated if some firms cannot costlessly wait before issuing equity. At least some firms with evaporating projects will issue equity immediately, despite an equity price decline, in order to avoid losing the project. The very best quality firms with evaporating projects may choose to forego the investment opportunity. Poor firms with durable projects can profitably masquerade as firms with evaporating projects by issuing equity prior to an information release, while the best firms with durable projects will wait until an information release before issuing equity.[3] The net effect is that equity issues are concentrated more heavily after information releases.

In this model pricing and timing are related. The model implies that the observed price of firms issuing equity declines with the time since the last information release. Thus, in equilibrium, the price of equity issued before an information release is lower than the average price of equity issued after an information release.

The theory leads to several readily testable hypotheses:

- On average, equity issues will be clustered after information releases such as annual reports, earnings announcements and dividend declarations. There should be few issues immediately prior to these events.

- The price drop at announcement of a new issue will be negatively related to the time between the announcement date and the last information release date. Similarly, the price drop at issue will be negatively related to the time since the last information release or issue announcement.

In Section 4 we test these and related hypotheses. In all four quarters, we find support for the hypothesis that equity issue dates are more frequent after earnings announcements than later in the quarter. We also test for an increase in the percentage price drop as a function of the time since the last earnings report. We find the that the time between announcement and previous information release has a positive but insignificant effect on the magnitude of the announcement price drop. The time between the announcement of the issue and the actual issue, however, has a positive and significant effect on the size of the issue price drop.

2. The Model

In this section we develop a model in which

1. Investors and managers are asymmetrically informed about the value of assets in place;
2. The degree of this asymmetry changes over time; and
3. An equity issue is necessary in order to undertake a project.

The information asymmetry gives rise to a lemons market for equity. Consequently, in deciding whether and when to issue equity, managers weigh the cost of issuing (which can change over time) against the value of new projects.

In this setting we are interested in answering two questions: first, what is the aggregate distribution over time of equity issues, and second, how are the price drops at announcement and issue related to the timing of information releases? Initially we assume that the announcement of an equity issue and the actual issue occur simultaneously. In Section 3 we relax this assumption. We allow only equity financing, but a similar analysis should apply to risky debt.

a. Assumptions

Firms offer to sell equity to investors, who attempt to infer the quality of the selling firm. We assume the following:

Investors. Investors are risk-neutral. They know the distribution of firm types, but they do not observe the type of a particular firm.

Firms. Firms are run by risk-neutral managers, who are assumed to act in the interests of existing shareholders.[4] Firms have assets in place with value α. They also potentially have new projects with a known positive[5] net present value of β, requiring K in outside capital.[6] Project arrivals are random and observable by investors, and firms have at most one project at a time. There are two kinds of projects. The fraction δ of firms are "type d" and have "durable" projects. Type d firms have a choice of either issuing equity immediately, or costlessly waiting to do so. The remaining fraction $(1-\delta)$ of firms are "type e", with "evaporating" projects that must be financed immediately or foregone. Project arrivals are uniformly distributed over time. The probability that a project is durable is independent of α and of the project arrival time. There are an infinite number of firms with projects arriving at each instant. Under these assumptions, investors know the distribution of firm types at each point in time.

Information. At fixed points in time $(t=0,1,2,...)$ firms make an announcement which fully reveals the true value of existing assets.[7] For example, between times 0 and 1, firms learn either that their assets in place are worth $\alpha_0 + \tau$ or $\alpha_0 - \tau$.[8] At any time t ($0 \le t \le 1$) within the interval, the fraction of firms with high or low asset quality is given by $\rho(t)/2$, with $d\rho(t)/dt > 0$. At time 1 there is a fully revealing announcement, and the process starts over again.[9]

Investors appraise firms conditional on their information release dates, so we need only consider a single pattern of release dates. Because the intervals are identical, and there is symmetric information at the end of each interval, we can restrict attention to the interval (0,1]. We assume a zero interest rate.

The probability distribution of asset values at time t ($0 \le t \le 1$) is given in Table 1:

Table 1: Distribution of the Value of Assets in Place

Value of assets in place	Fraction of Firms
$\alpha_0 + \tau$	$\rho(t)/2$
α_0	$1-\rho(t)$
$\alpha_0 - \tau$	$\rho(t)/2$

b. Equilibrium Equity Valuation

Here we show how the equilibrium price of new equity is determined as a function of when it is issued, and look at some properties of the equilibrium. First we define an equilibrium.

Definition: A rational expectations equilibrium is a set of prices and quantities at each time such that: (a) The value of the equity that investors buy is consistent with their expectation of its value, (b) all firms that can profitably issue equity at this price do so, and (c) investors buy all equity issues as long as they expect non-negative profits.

The nature of the equilibrium depends upon the parameter values. In order to focus on the simplest case which produces interesting dynamics, we assume that

$$\tau < \beta < 2\tau. \tag{1}$$

In Appendix A we describe the general case.

Let V_t denote the market's expectation at time t of a firm's total asset value net of new capital, conditional both on the arrival of a project and on the firm issuing equity at time t. V_t is given by

$$V_t = E_t(\alpha) + \beta \tag{2}$$

$E_t(\alpha)$ is the rational expectation of α, conditional on all available time t information, and conditional on equity being issued. Investors will provide K in return for a share of the firm s_t, if s_t solves the equation

$$K = s_t[E_t(\alpha) + \beta + K] \tag{3}$$

This implies that

$$s_t = K/(K+V_t) \tag{4}$$

At time 1, investors learn the true value of α, hence $E_1(\alpha)=\alpha_1$.

c. **The Decision to Issue Equity**

We now study the firm's decision about whether to issue equity. For type e firms, the choice is simple: given a price, they either issue equity immediately or not at all. For type d firms, the choice is more complicated: they either issue equity immediately, or defer the issue until some future time. Here we characterize the optimal decision for the different types of firms.

Consider first the decision to issue at the end of the interval, when managers and investors are symmetrically informed about the value of assets in place. Any type d firm which did not issue equity previously can profitably issue equity at time 1. The firm can issue shares worth K, and the value of the firm to existing shareholders will be $V_1 = \alpha + \beta$. Similarly, a type e firm with a project arriving at time 1 can issue shares worth K, yielding existing shareholders $\alpha + \beta$. Clearly the type e firm will always find it profitable to do so.

The decision rule for issuing equity prior to time 1 depends upon whether the firm is type d or type e.

Evaporating Projects. If type e firms do not issue equity at time t (when the project arrives), the project evaporates. These firms will issue equity if the value to existing shareholders from issuing exceeds the value from not issuing shares, i.e., if

$$(1 - s_t)[\alpha + \beta + K] > \alpha$$

Rewriting this using (4) gives

(5) $$\alpha < V_t - \beta + \beta(V_t + K)/K$$

Thus, for a given V_t, the incentive to issue equity is decreasing with α and K and decreasing with β.

<u>Durable Projects.</u> Firms with type d projects have the choice of issuing equity at time t, or at some later time. These firms plan to issue equity when they expect the market's valuation of their equity to be the greatest. At time 1, the true value of the firm is known, so a necessary condition for a type d firm to issue equity at time t′ prior to information release is that $V_{t'} > V_1$. From (2), this holds if

$$(6) \qquad \alpha < V_t - \beta.$$

Thus, a durable firm will issue equity prior to information release only if the market's expectation of its value for assets in place exceeds the true value. A sufficient condition for type d firms to issue equity at time t is that $V_t > V_{t'}$, for all t′ such that $t < t' \leq 1$.

d. **Description of the Equilibrium**

In order to describe the equilibrium, we need to know precisely which firms issue equity at each point in time, which in turn depends on the valuation function, V_t. Fortunately, the behavior of each firm type can be characterized.

Equations (5) and (6) have two major implications. First, the better a firm's type, the less incentive it has to issue equity, given V_t. Second, the incentive for type e firms to issue equity is greater than that for type d firms, since if a project will evaporate, there is a greater incentive to take it immediately. These implications are stated formally and proved in Lemma 1 (all lemmas are stated and proved in Appendix B).

Because the incentive to issue equity is decreasing with the true value of the firm, the equilibrium valuation of a firm issuing equity can never exceed that of the average firm with an investment project. Thus, $V_t \leq \alpha_0 + \beta$. As a result, firms with durable projects and with average or better-than-average asset quality never issue equity except when their asset quality is publicly revealed at an information release. The worst type e firms will always issue equity, because they can never be undervalued. Given assumption (1), Lemma 2 shows that type e firms with average quality assets always issue. The best type e firms, however, may either issue equity or allow their project to evaporate. These firms will not issue when the cost of pooling with lower quality firms is great relative to the value of the project.

The uncertainty about the behavior of the high quality type e firms raises the problem of non-uniqueness of the equilibrium at some points in time. The market's valuation of new issues is higher when the highest quality evaporators issue equity than when they do not issue. It can happen that if the high quality firms do not issue equity, then the equilibrium valuation of issuing firms is so low that it is not optimal for the high quality firms to issue. If they did issue equity, however, they might raise the average issuer quality enough to make it optimal for them to issue equity. In order to eliminate this multiplicity, we will focus solely on the highest price equilibrium, which is the equilibrium in which the best quality evaporators issue equity whenever, conditional on their issuing equity, it is optimal for them to issue.

We can now write down a candidate valuation function V_t. We know that type e firms with $\alpha = \alpha_0$ or $\alpha = \alpha_0 - \tau$ will issue equity immediately, while type d firms with $\alpha = \alpha_0$ or $\alpha = \alpha_0 + \tau$ never issue before time 1. Suppose that durable firms with $\alpha = \alpha_0 - \tau$ also issue equity. Then, if evaporating firms with $\alpha = \alpha_0 + \tau$ issue equity the equilibrium valuation at t is

$$(7) \qquad V_t = \frac{(\alpha_0-\tau+\beta)\rho(t)/2 + (\alpha_0+\beta)(1-\rho(t))(1-\delta) + (\alpha_0+\tau+\beta)\rho(t)(1-\delta)/2}{\rho(t)/2 + (1-\rho(t))(1-\delta) + \rho(t)(1-\delta)/2}$$

If the high quality evaporating firms do not issue equity, i.e., if V_t in (7) is less than $\alpha_0 + \tau$, the valuation is

$$(8) \qquad V_t = \frac{(\alpha_0-\tau+\beta)\rho(t)/2 + (\alpha_0+\beta)(1-\rho(t))(1-\delta)}{\rho(t)/2 + (1-\rho(t))(1-\delta)}$$

Theorem 1 shows that (7) and (8) indeed describe the equilibrium valuation function, with (8) in effect only if (7) falls below $\alpha_0 + \tau$.

Theorem 1: There exists a decreasing equilibrium valuation function on the interval [0,1) given by (7) and (8). This is the highest equilibrium valuation function.

Proof: At time 0 there is no asymmetric information. Thus, $\rho = 0$, and (7) reduces to $\alpha_0 + \beta$, which by (1) exceeds $\alpha_0 + \tau$. Thus, the best evaporating firms issue at time 0. Because $\rho'(t) > 0$, (7) [and (8)] are both decreasing in t. As ρ increases, V_t can become low enough that the high-quality evaporating firms no longer issue equity. This causes V_t to jump discretely downward, as (8) replaces (7). (For δ sufficiently large, as $\rho(t)$ approaches 1, V_t approaches $\alpha_0 - \tau + \beta$. Because of the assumption that $\beta < 2\tau$, the best type e firms then cease to issue equity.)

Thus, given the assumption that the worst type durable firms issue equity immediately, V_t strictly decreases over time. This implies that it is in fact optimal for the worst type durable firms to issue equity immediately, since they can not obtain a higher issue price by waiting. By construction, this equilibrium valuation function is the highest equilibrium valuation function.//

Note that for values of β and τ which do not satisfy (1), the valuation function will also be non-increasing on [0,1). Also, V_1 will be greater than the valuation over the previous interval (Lemma 3).

Theorem 1 characterizes the **price** behavior of firms issuing equity, but a related question is how the **quantity** of firms issuing equity behaves over the interval. At an information release (e.g., time 0 or 1), there will be a surge of equity issues as average and high-quality durable firms issue to finance projects that arrived over the previous interval (Lemma 3). Immediately thereafter, the number of issues decreases discretely, as the better durables receiving new projects again postpone their issues until the next information release. If the best type e firms stop issuing equity at time t', then there is another discrete fall in the number issuing at t'. (If the model permitted many values for assets in place, there would be smaller, more frequent drops in the quantity of firms issuing equity. Firms would cease to issue equity as the market valuation fell below the value of their assets.) Between these falls, however, the number of issues actually increases. This occurs because the proportion of the worst type d firms in the issuing population increases smoothly over time.

Finally, the greater the percentage of durable firms, the lower is V_t at any t on (0,1) (Lemma 4). On average, firms with durable projects which issue equity before time 1 have a smaller α than firms with evaporating projects which issue equity. Thus, an increase in δ has two effects: first, with no change in investment policy across types of firms, there is a decrease in the weight given to the higher quality firms in (7) and (8). Second, this decrease in V_t may cause higher quality firms not to issue equity, which further lowers V_t.

e. **The Price Drop at the Equity Issue Announcement**

Theorem 1 implies that the market valuation of a firm conditional on receiving a project and announcing an equity issue declines with the time since the last information release. The observed price drop at the announcement of an equity issue, however, is the difference between the valuation of the firm conditional upon receiving a project, and that conditional upon receiving a project and issuing equity. The valuation decline in Theorem 1, and the price drop at the equity issue, can differ if there are firms which receive a project but do not take it. In this section we study the price drop at the announcement of an equity issue and show that the magnitude of the drop increases with the time since the last information release.

We have seen (Lemma 2) that if $\beta > \tau$, the only type firm which would possibly forego a project in equilibrium is type e with $\alpha = \alpha_0 + \tau$. The condition for this firm to issue equity is that V_t from (7) exceeds the market valuation of these firms if they do not issue equity, $\alpha_0 + \tau$. (7) exceeds $\alpha_0 + \tau$ if

$$(9) \qquad \beta - \tau > \tau \frac{\delta\rho(t)/2}{(1-\delta)+\delta\rho(t)/2}$$

Given β, τ, and δ, whether high quality type e firms issue equity depends upon the fraction, $\rho(t)$, of firms which have learned their type. For $\rho(t)$ sufficiently small, the lemons problem is unimportant, since few bad type d firms will issue.

Consider a point in time when (9) holds, so that all projects are taken. Conditional only upon receiving a project, the average valuation of firms is $V'_t = \alpha_0 + \beta$; conditional upon issuing equity, the value is (7). Thus, the price fall from issuing equity prior to an information release is

$$(10) \qquad V'_t - V_t = \tau \frac{\delta\rho(t)/2}{(1-\delta)+\delta\rho(t)/2}$$

The price drop is increasing in ρ and hence in the time since the last information release.[10]

When (9) does not hold, high quality type e firms forego the equity issue. The valuation of a firm conditional upon project arrival, V'_t, reflects the fact that some projects will not be taken:

$$\begin{aligned} V'_t = \ & (\alpha_0 + \tau + \beta)\delta\rho(t)/2 + (\alpha_0 + \tau)(1-\delta)\rho(t)/2 + \\ & (\alpha_0 + \beta)(1-\rho(t))(1-\delta) + (\alpha_0 + \beta - \tau)\rho(t)/2 \\ = \ & \alpha_0 + \beta - \beta(1-\delta)\rho(t)/2 \end{aligned}$$

The valuation conditional upon the announcement in this case is given by (8), which may be rewritten as

$$(11) \qquad V_t = \alpha_0 + \beta - \frac{\tau\rho(t)/2}{\rho(t)/2 + (1-\rho(t))(1-\delta)}$$

The price drop at issue is thus

$$(12) \qquad V'_t - V_t = \frac{\tau\rho(t)/2}{\rho(t)/2 + (1-\rho(t))(1-\delta)} - \rho(t)\beta(1-\delta)/2$$

Using (9), (12) can be shown to be positive and increasing in t.

For the price drop to be increasing in the time since the last information release, it remains to show that the price drop is greater immediately after the high quality type e firms drop out than immediately before. This requires that (12) be greater than (10) when (9) holds as an equality.

Theorem 2: The magnitude of the price drop at the time of issue increases with the time since the last information release.

Proof: When high quality type e firms issue, (10) is the drop, which is increasing in t. When type e firms do not issue, (12) is the drop, which is increasing in t. Comparing (10) and (12) when (9) holds with equality, (12) can be shown to be larger.//

3. Price Behavior When the Announcement and Issue Do Not Coincide

In the previous section we examined the behavior of firms in deciding whether and when to issue equity, as well as the equilibrium path of the stock price, conditional on issuance, treating the announcement and the issue as occurring simultaneously. In practice, there are usually several weeks between the two dates. Hence before turning to the empirical tests, we must explicitly consider the price behavior at each of the dates.

In this section the model is modified with the assumption that there is an exogenously given interval between announcement and issue, but that the projects of evaporating firms do not lose value when waiting this fixed interval. There are two possible alignments of the three dates (equity announcement, equity issue, and information release), which must be considered separately. 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. Figure 1 shows these possibilities:

Figure 1

Possible Equity Issue/Announcement Configurations

I: Information Release Preceding Announcement and Issue

|----------------------------|----------------------------------|

t_a t_i

Information Release Equity Issue Announcement Equity Issue

II: Information Release Between Announcement and Issue

|----------------------------|----------------------------------|

t_a t_i

Equity Issue Announcement Information Release Equity Issue

We derive the equilibrium price drop for firms both at the announcement of an equity issue and at the actual issue. The ultimate price drop, as well as the decision to finally issue equity, depends upon whether there is an intervening information release. The model suggests that the price drop at announcement is larger, the longer the time between the announcement and the previous information release. Similarly, for firms which have an information release between the announcement and the issue, the price drop at issue is larger, the longer the time between the issue and the information release. We allow firms to withdraw from an announced issue if it is optimal to do so.

To anticipate the results, we show that there will be a price drop at the announcement of the equity issue if there will not be a fully revealing information release prior to the issue. Depending upon parameters, there may be a price drop at the actual issue. This can occur because a firm which announced an issue learns that its value has increased, leading it to withdraw. If there are withdrawals, the magnitude of the price drop will be increasing in the time between the announcement and issue.

a. Information Release Preceding Announcement and Issue

In this case, the only type d firms which announce the intention to issue are those with $\alpha = \alpha_0 - \tau$, since the other type d firms schedule the announcement so that the issue occurs immediately after an information release. Let t_a denote the time of the announcement and t_i the time of the issue. Since $\rho(t)$ is a deterministic function, it is known at t_a whether (9) will hold at the time of the issue. If (9) does hold at t_i, all type e firms will issue, and hence will announce their intention to issue. Thus, the price drop at announcement is given by (10). There is no subsequent price drop at the time of issue, since all firms issue which announced they would.

Suppose on the other hand that at t_a it is known that (9) will not hold at t_i. Then type e firms with $\alpha = \alpha_0 + \tau$ will not announce an issue. All other type e firms, as well as type d firms with $\alpha = \alpha_0 - \tau$, will announce an issue. The price at announcement will be given by (11). In between times t_a and t_i, however, some of the type e firms which had not previously learned their asset quality will learn that their assets are high quality. Since (9) does not hold, they will withdraw their announced equity issue. The valuation at t_i will also be given by (11), but with ρ evaluated at t_i rather than t_a. The price drop at issue will be

$$(13) \qquad V_{ti} - V_{ta} = \tau\rho(t_a)/[(1-\delta)(1-\rho(t_a)) + \rho(t_a)/2] - \tau\rho(t_i)/[(1-\delta)(1-\rho(t_i)) + \rho(t_i)/2]$$

which is negative since ρ is increasing in t. The magnitude of the price drop is increasing in $t_a - t_i$.

b. Information Release Between Announcement and Issue

In this case, when a firm announces an equity issue, it is known that the information asymmetry will be eliminated prior to the actual equity issue. To take an extreme case, suppose that it was announced that the firm would issue equity at the same time as the information release. In this case, there would be no drop in price at the announcement, because at the time of the issue there would be no information asymmetry.

The key insight is that firms which announce an equity issue at time $t_a < 1$ are no longer pooled at the time of the issue, $t_i > 1$, since their type is revealed at the information announcement. Hence, all firms with projects will announce an issue.[11] At the issue date the market evaluates them conditional upon their type as of time 1. The only relevant information asymmetry at the time of the issue is from news about assets in place which becomes known after time 1.

Since all firms announce the issue, in theory there should be no price drop. This result depends upon the information release fully revealing all information. In practice, there will always be some remaining asymmetry, and some firms know they will not issue, hence they will not announce an issue. Since there is now a pooling problem again, the price will drop at the announcement of the issue. Nevertheless, because of the intervening information release, the price drop should be less than if there were no intervening release.

Which firms will go through with the equity offering? The analysis is the same as before, except that all evaluations of type are relative to α_1, the asset quality which is revealed at time 1. The only type d firms which issue at t_i are those which learn they have $\alpha = \alpha_1 - \tau$. For the type e firms, some will learn that they have $\alpha = \alpha_1 + \tau$, and their issuance decision at t_a will depend upon whether (9) holds. Thus, there will generally be a price decline at the issue date, and the magnitude of the price decline will increase with $(t_i - 1)$, the time since the last information release.

We have seen in both cases in this section that firms may optimally withdraw from an announced issue. Mikkelson and Partch (1988) study withdrawals and find that 10% of announced common stock issues are withdrawn. They report that in 80% of the withdrawn security offers in their sample, "unfavorable market conditions or a low stock price" were cited as reasons for the withdrawal. This withdrawal of an announced offer can occur in our model when firms receive new private information, which increases the dilution from issuing shares at the pooled price. The price drop for firms which issue shares is offset by a price increase for firms which withdraw their offer.

4. Statistical Implications and Tests

a. Data Overview

We obtain the dates of seasoned underwritten primary and secondary equity issues for the period 1978-1983 from Drexel Burnham Lambert's *Public Offerings of Corporate Securities* (various years). The reported company names are used to match issue dates with company stock price and financial data from the CRSP daily master, returns (NYSE/AMEX, and NASDAQ), and Quarterly Compustat (Industrial and Full Coverage) files. 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.[12] Observations are omitted for any of the following reasons: inability to match company name with CRSP or Compustat, missing data, or apparent data errors (for example the second quarter earnings announcement date preceding the first quarter earnings announcement date).[13]

Table 2 reports the variables used and their source, while Table 3 presents summary statistics.

Table 2. Data Description

Earnings Announcement Date. Date of first public announcement of quarterly earnings (Compustat). If Compustat was unavailable or unreliable, dates were taken from the *Wall Street Journal* Index.

Month Fiscal Year End. (Compustat)

Value of Equity. Number of shares times end of quarter share price, for each quarter. (Compustat)

Daily Stock Returns. (CRSP daily stock returns and NASDAQ files)

Equity Issue Date. (*Public Offerings of Corporate Securities*)

Date of First Announcement of Equity Issue. (*Wall Street Journal* Index)

Table 3: Unconditional Distributions

Distribution of Fiscal Year End by Month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	37	11	37	15	23	68	26	18	44	20	12	326
(%)	5.8	1.7	5.8	2.4	3.6	10.7	4.1	2.8	6.9	3.1	1.9	51.2

Distribution of Issue Dates by Month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	78	73	101	97	109	146	114	99	100	111	102	117
(%)	6.3	5.9	8.1	7.8	8.7	11.7	9.1	7.9	8.0	8.9	8.2	9.4

Distribution of Time Between Announcement Of Issue and Issue Date

Mean	Standard Deviation	Minimum	Maximum
26.0	25.2	0	193

b. Hypotheses and Tests

We test the implications of the model by investigating the timing of equity issues relative to regular quarterly information releases, and by testing whether the announcement and issue date price effects of the offering depend on the timing of the offer date. The information releases on which we focus are quarterly earnings announcements.

The first set of tests concern the timing of equity issues. The hypotheses which we test are as follows (H_{ni} denotes null hypothesis i and H_{ai} denotes alternative hypothesis i):

Hypothesis 1: The Timing of Equity Issues

H_n: Equity issues are uniformly distributed over time. H_a: Equity issues are clustered in periods immediately following information releases.

The model implies that we should reject H_{n1} in favor of H_{a1} since a subset of firms (high value type d firms) will postpone equity issues in order to avoid being pooled with poorer firms, and high value type e firms may also forego projects when information becomes too asymmetric. The null hypothesis of a uniform distribution reflects our assumption that projects arrive randomly over time (although they are not necessarily funded when they arrive). Of course, the actual extent of clustering depends on the underlying distribution of project arrivals, the durability of projects, how relevant the information is, and the extent to which information release dates can be adjusted.

We test for whether the distribution of issues is uniform using the Kolmogorov-Smirnov statistic [Rao (1973, p. 421)]. For a given equity issue, let D_{BR} be the total number of days between the information release immediately prior to the issue and the information release immediately after the issue (BR denotes "Between Releases"). Also, let D_I be the number of days between the information release immediately prior to the issue and the date of the equity issue. Under the null hypothesis, D_I/D_{BR} ~ U(0,1) (where U(x,y) denotes a uniform distribution on the interval [x,y]). We test H_{n1} by comparing the cross-sectional distribution of D_I/D_{BR} to the U(0,1) distribution.

Results are reported for the following groupings of information events:

a. quarterly earnings reports (all quarters)

b. quarterly earnings reports (individual quarters: q1, q2, q3, q4)

c. annual reports

In each case days between releases (D_{BR}) is the actual number of days between the reported information events. Sample size varies because of earnings data availability, and because the quarter of the issue could not be determined for some firms. Table 4 summarizes the results. The null hypothesis of a uniform distribution is rejected for the combined quarterly data, the annual data, and in most of the individual quarters.

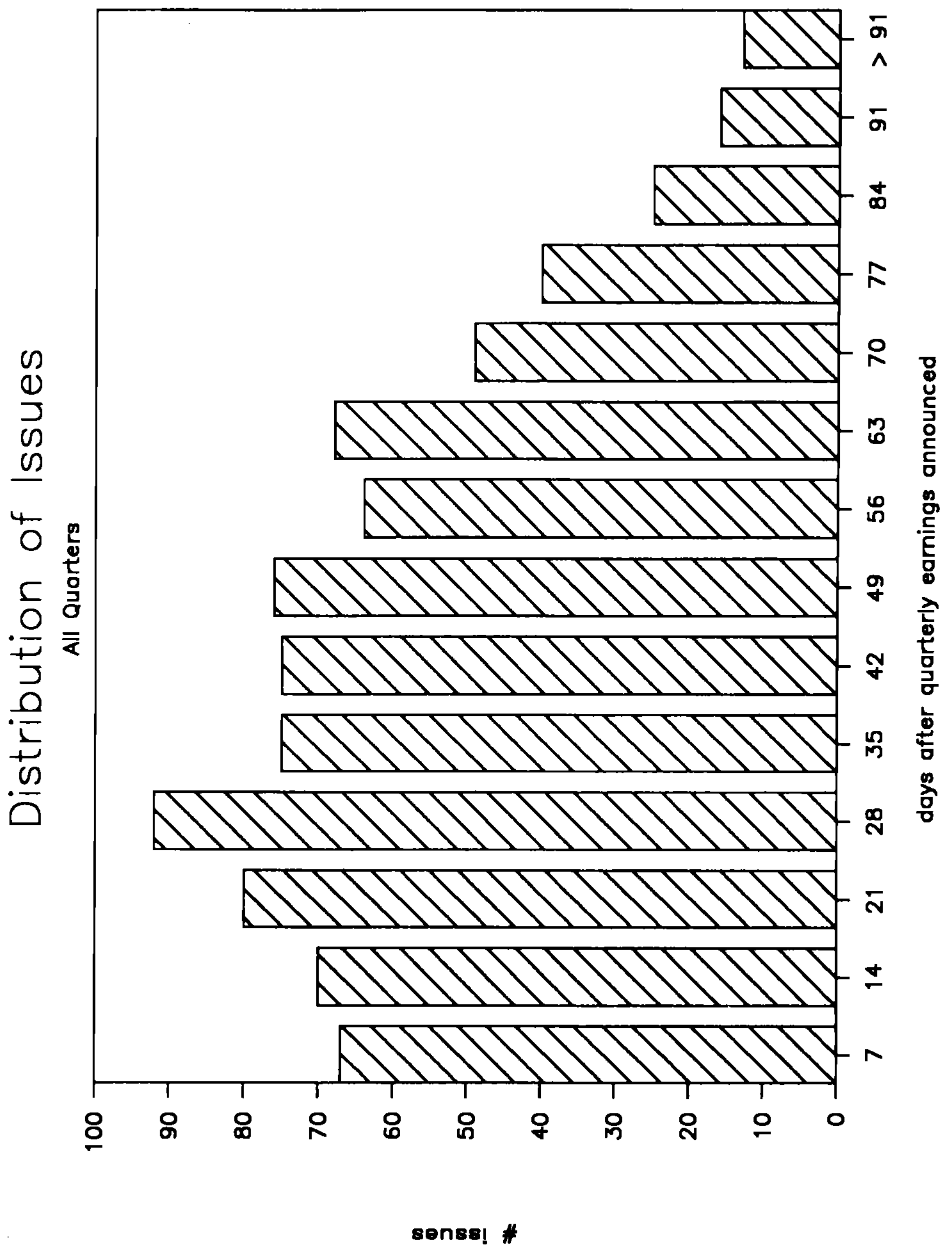
In the model there is no distinction between announcements which resolve more or less of the asymmetry. In reality one would expect to find measurable differences in the amount of information conveyed by different announcements. The finding that equity issues are not uniformly distributed across the year is consistent with the intuition that because of more detailed reporting and auditing requirements, fiscal year-end earnings announcements and the annual report together resolve more of the asymmetry in information than intra-year quarterly announcements.

Table 4. Kolmogorov-Smirnov Test Results

Event	# of Observations	K-S Statistic	Reject Null at 1%	Reject Null at 5%
a	745	3.137	yes	yes
b:q1	175	0.970	no	no
b:q2	218	1.921	yes	yes
b:q3	196	1.514	no	yes
b:q4	158	2.829	yes	yes
c	537	3.366	yes	yes

Although we reject the uniform distribution for earnings announcements, we also wish to know whether there is clustering after information events. If there is clustering, the density of D_I/D_{BR} should be skewed to the left, and hence histograms of issue dates relative to the last information release should be downward sloping. Figures 2-5 (corresponding to the events in Table 4) are basically consistent with this description: issues trail off toward the end of each quarter and at the end of the year.[14] However, while the theory suggests that we should see many issues shortly after an information release, the histograms suggest that issues are fairly evenly distributed over the early to middle part of most quarters. In fact, at the beginning of the first quarter the number of issues appears to be significantly below average. A potential explanation for the first quarter drop lies in the fact that the releases of the annual report and 10-K typically follow the earnings announcement for the fourth

Figure 2



Distribution of Issues
All Quarters
issues
0
10
20
30
40
50
60
70
80
90
100
7
14
21
28
35
42
49
56
63
70
77
84
91
> 91
days after quarterly earnings announced

FIGURE 3

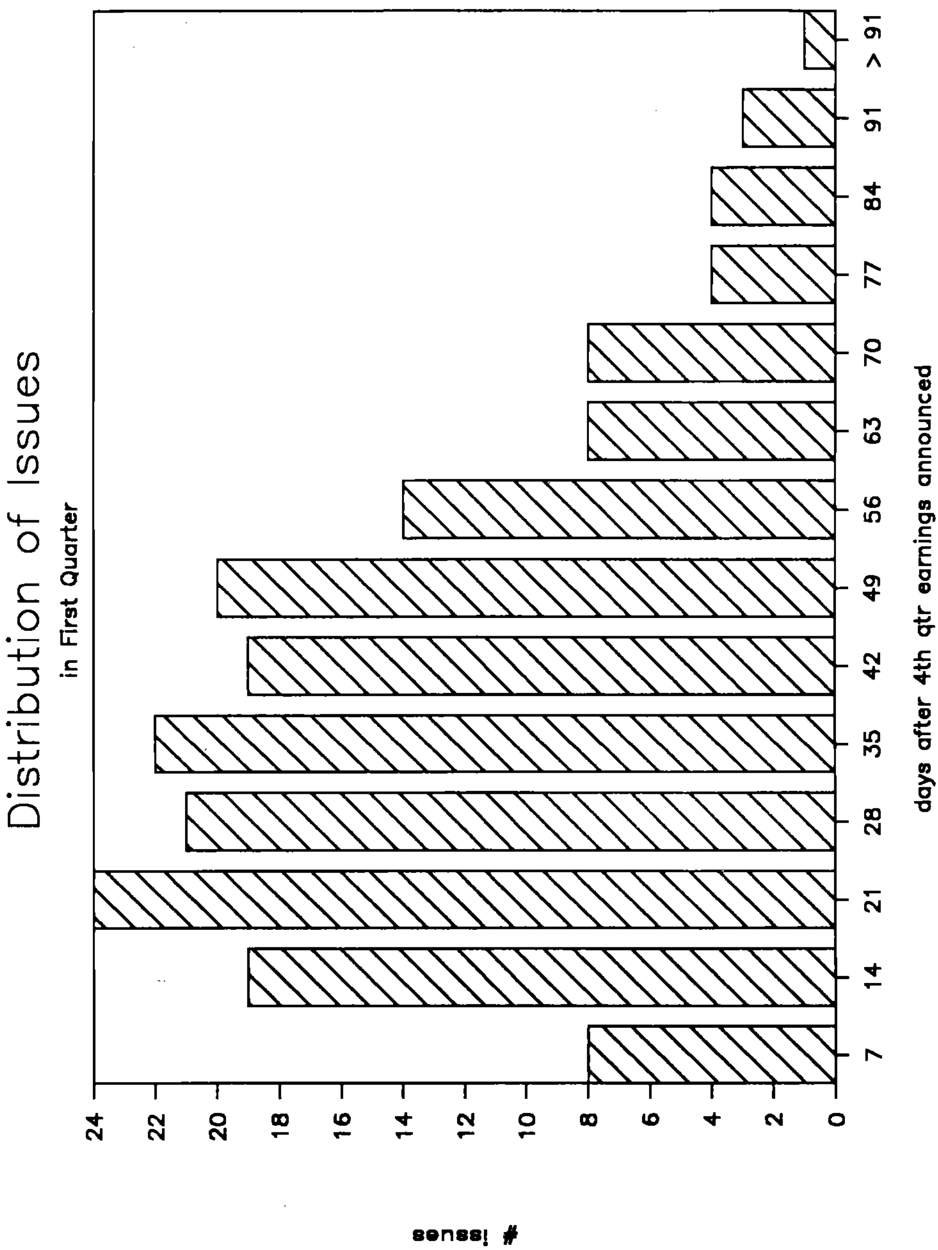
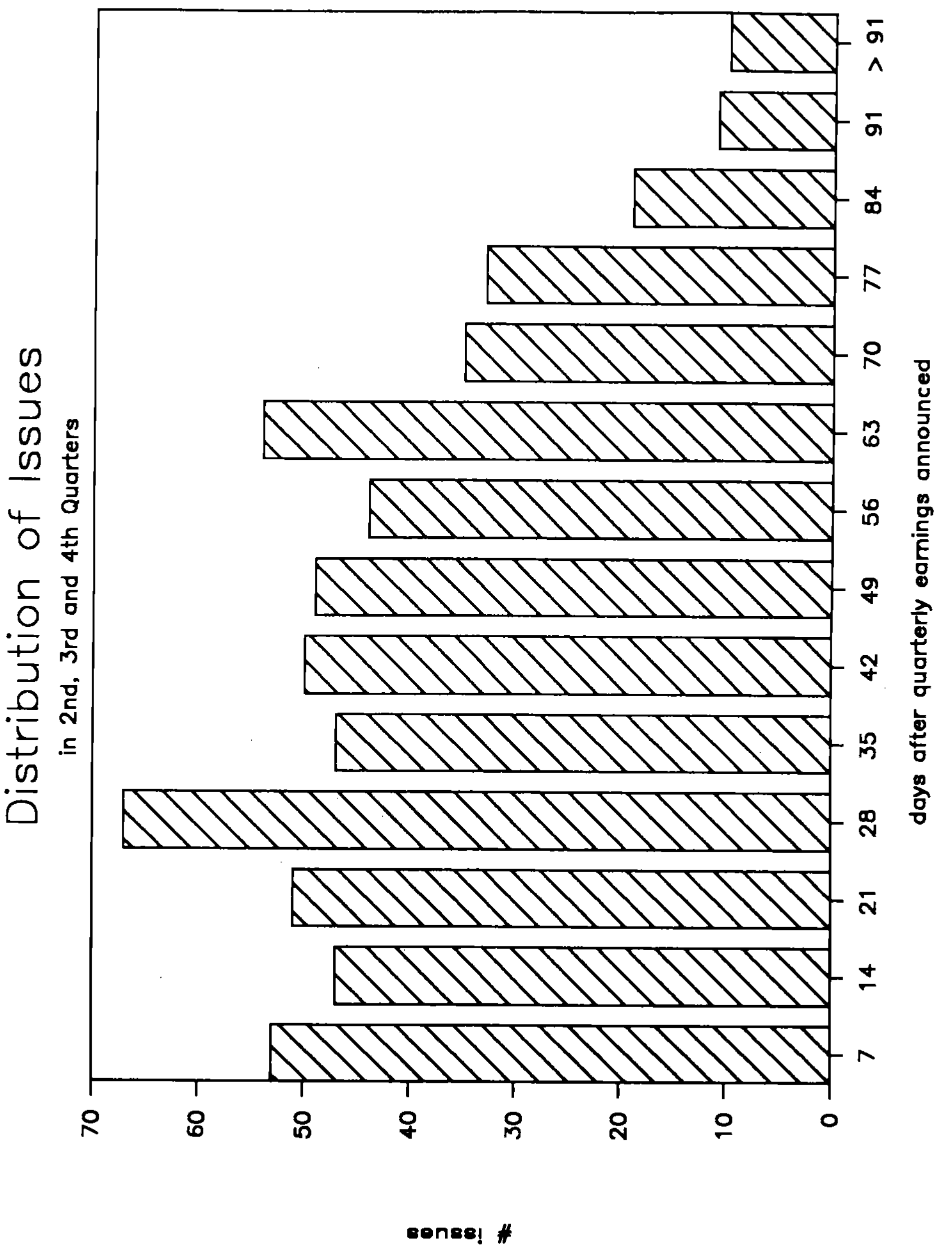
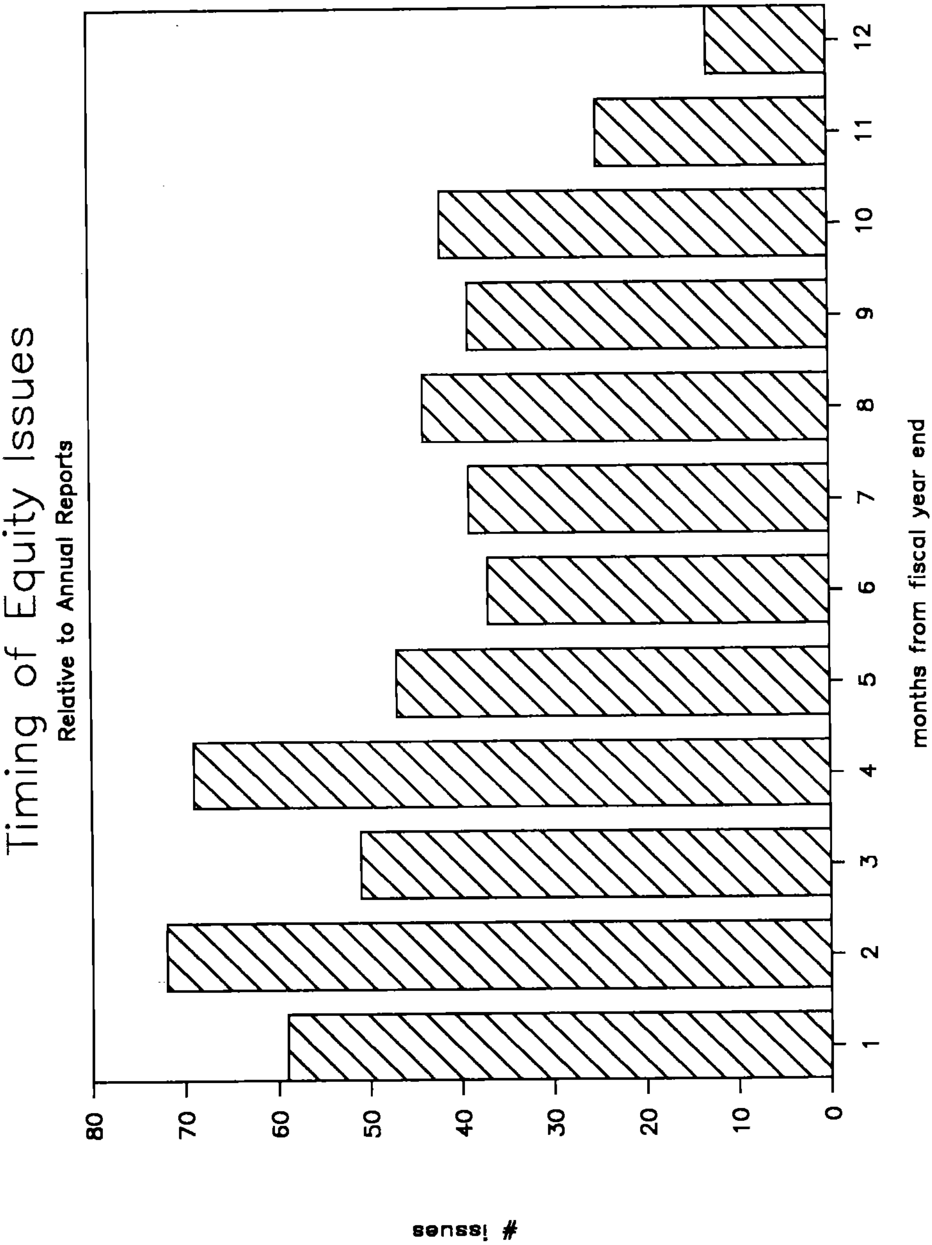

Distribution of Issues
in First Quarter
issues
0 2 4 6 8 10 12 14 16 18 20 22 24
days after 4th qtr earnings announced
7 14 21 28 35 42 49 56 63 70 77 84 91 > 91

FIGURE 4



Distribution of Issues
in 2nd, 3rd and 4th Quarters
issues
0
10
20
30
40
50
60
70
7
14
21
28
35
42
49
56
63
70
77
84
91
> 91
days after quarterly earnings announced

FIGURE 5


Timing of Equity Issues
Relative to Annual Reports
issues
0
10
20
30
40
50
60
70
80
months from fiscal year end
1
2
3
4
5
6
7
8
9
10
11
12

quarter by several weeks [Wilson (1987)]. This waiting period coincides reasonably closely to the period during which the there is a lull in issues. This evidence suggests then that firms avoid issuing equity shortly before an information release, although they do not hurry to issue immediately after an information release.

We also consider the effect of firm size on a firm's propensity to issue around earnings announcements. Since information tends to be scarcer for small firms, it may be that small firms have a greater incentive to issue equity when fresh information is released. To test this idea, we regress D_I (days between announcement and issue) on firm size, as measured by market value of equity. If small firms are more anxious to issue when information is fresh, the correlation should be positive. The results of two simple cross-sectional regressions are reported in Table 5. The regression results support the hypothesis that smaller firms are more likely to issue closer to an information release.

Table 5: The Effect of Firm Size on the Timing of Issues

	α	β	
1) $D_I = \alpha + \beta$ size			
	.4104	.0045	# obs = 362
	(.2708)	(.0032)	R^2 = .0057
2) $D_I = \alpha + \beta \ln(\text{size})$			
	α	β	
	.4302	.0279	# obs = 362
	(.2687)	(.0099)	R^2 = .0215

Hypothesis 2: The Stock Price Reaction to the Timing of Issue Announcements and Issues.

Case 1: Regular Information Release Precedes Announcement of Issue. H_n: The fall in the stock price upon announcement of the equity issue is independent of the timing of the announcement relative to information releases. Also, the price drop at issuance is unrelated to the timing of the issue relative to announcement or information 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 information release. Also, the fall in the stock price on the actual date of issuance is smaller the more closely issuance follows announcement of the issue.

Case 2: Regular Information Release Falls Between Announcement of Issue and Issue Day. H_n: - same as case 1. H_a: The fall in the stock price on the actual date of issuance is smaller the more closely issuance follows the regular information release.

ollowing the results of Sections 2 and 3, we expect to reject H_{n2} in avor of H_{a2} for each case.

We use standard event study methods to estimate the stock price eaction to the announcement and completion of the equity issues. We then se cross-sectional regressions to estimate the relation between the ricing effects and the time between the event and previous information eleases. For the announcement of the equity issue, we define the event ay as the day on which the earliest announcement, related to the issue, ppears 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 a value-weighted market portfolio on that day, R_{mt}, $A_{it} = R_{it} - R_{mt}$. For firms trading on the NYSE or AMEX, R_{mt} is defined as the value-weighted portfolio of NYSE/AMEX stocks. For firms trading Over the Counter, R_{mt} is defined as the value-weighted portfolio of OTC stocks. Abnormal returns computed in this manner are commonly referred to as "market adjusted returns" [see Brown and Warner (1985)]. The average abnormal returns, $\bar{A}_t$, for the twenty-one day period surrounding the announcement day and issue day are listed in Table 6. $\bar{A}_t$ is the abnormal return on an equal-weighted portfolio stocks in the sample. The t-statistics provided in Table 6 are calculated for each day using a cross-sectional estimate of the variance of abnormal returns. 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.[15]

There are negative average abnormal return of -1.936% and -0.277% on the day preceding and the day of the *Wall Street Journal* article, respectively. The associated t-statistics are -19.74 and -2.72. There also appear to be some statistically significant positive abnormal returns both prior to and after the announcement. There are also significant negative average abnormal returns at the actual issue date. The average abnormal returns on the day preceding and the day of the issue are -0.872 and -0.273 with t-statistics of -10.01 and -3.30. There are also significantly negative abnormal returns on days -2, -3, and -4 and some significantly positive returns after the issue date.

Table 6
Abnormal Returns Around Announcement Day
and Issue Day

Day[a] Relative to Event	Announcement Abnormal Return (%)	t-statistic	n[b]	Issue Abnormal Return (%)	t-statistic	n
-10	0.206	2.57	1112	-0.054	-0.64	1163
-9	0.174	2.05	1113	-0.060	-0.68	1166
-8	0.051	0.60	1113	-0.017	-0.22	1165
-7	0.057	0.71	1114	-0.108	-1.33	1169
-6	0.249	3.04	1111	0.074	0.95	1170
-5	0.167	2.10	1113	-0.137	-1.77	1169
-4	0.162	1.87	1112	-0.199	-2.47	1169
-3	-0.052	-0.57	1113	-0.227	-2.85	1169
-2	-0.067	-0.70	1112	-0.388	-4.74	1170
-1	-1.936	-19.74	1109	-0.872	-10.01	1167
0	-0.277	-2.72	1110	-0.273	-3.30	1160
1	0.115	1.18	1114	0.204	2.75	1169
2	0.153	1.83	1112	-0.002	-0.03	1170
3	0.260	3.26	1108	0.164	2.11	1168
4	0.176	2.03	1110	0.129	1.75	1169
5	0.184	2.39	1111	0.184	2.60	1168
6	0.124	1.52	1113	0.233	3.24	1170
7	0.055	0.71	1110	-0.003	-0.05	1169
8	0.039	0.48	1113	0.086	1.15	1168
9	0.164	1.87	1113	0.102	1.38	1170
10	-0.002	-0.03	1113	0.146	1.96	1170

a For the announcement of the issue, day zero is the day on which the earliest appearance, in the *Wall Street Journal*, of news of the issue.

b n is the number of firms with observed returns on that day relative to the event. There are some firms for which we could not locate announcement dates. Therefore, n is less around the announcement day than around the issue day.

The cumulative abnormal returns around the announcement and issue dates, defined by

$$CAR_t = \sum_{\tau=\tau_0}^{t} \bar{A}_\tau \qquad t = \tau_0, \tau_0+1, \ldots, T$$

are plotted in Figures 6 and 7. For the announcement date we plot the CAR from $\tau_0 = -200$ to $T = 100$ while for the issue date we plot the CAR from $\tau_0 =$ -20 to $T = 20$. There is a large increase in the CAR prior to the announcement of the equity issue (36.75% from -200 to day -4), followed by a drop around the announcement day (-2.33% from -4 to 0) and a slight increase in the two weeks after announcement (1.27% from 0 to +10). There is no noticeable trend in the CAR after day +10. The negative abnormal return upon announcement of the equity issue is consistent with past empirical evidence and the hypothesis that equity issues convey unfavorable information about the value of assets in place. In the twenty-one trading days up to and including the actual issue date there is an average abnormal return of -1.92% which is realized mainly in the week prior to the issue. Following the issue, there is an average abnormal return of 1.88% from day 0 to day +20.

Our interest is in relating the timing of both the actual equity issue and announcement to the size of the price drops on the two event days. By Theorem 2, firms which announce an equity issue further from the information release should suffer a larger price drop. Also, from the discussion in Section 3, it is clear that we need to treat separately the case where the information release precedes the announcement and issue, and the case where it is between them. In the former case, the model has

FIGURE 6

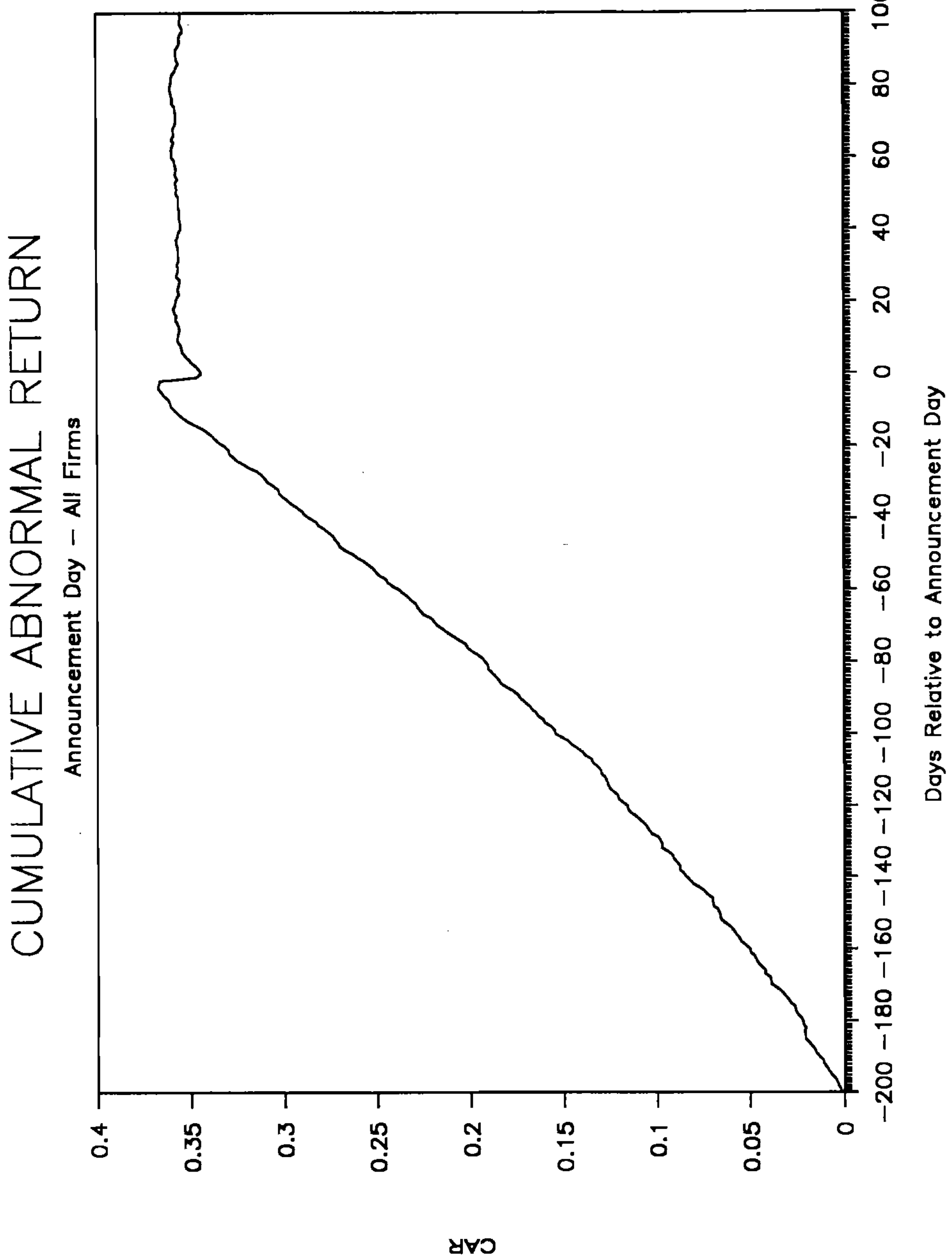
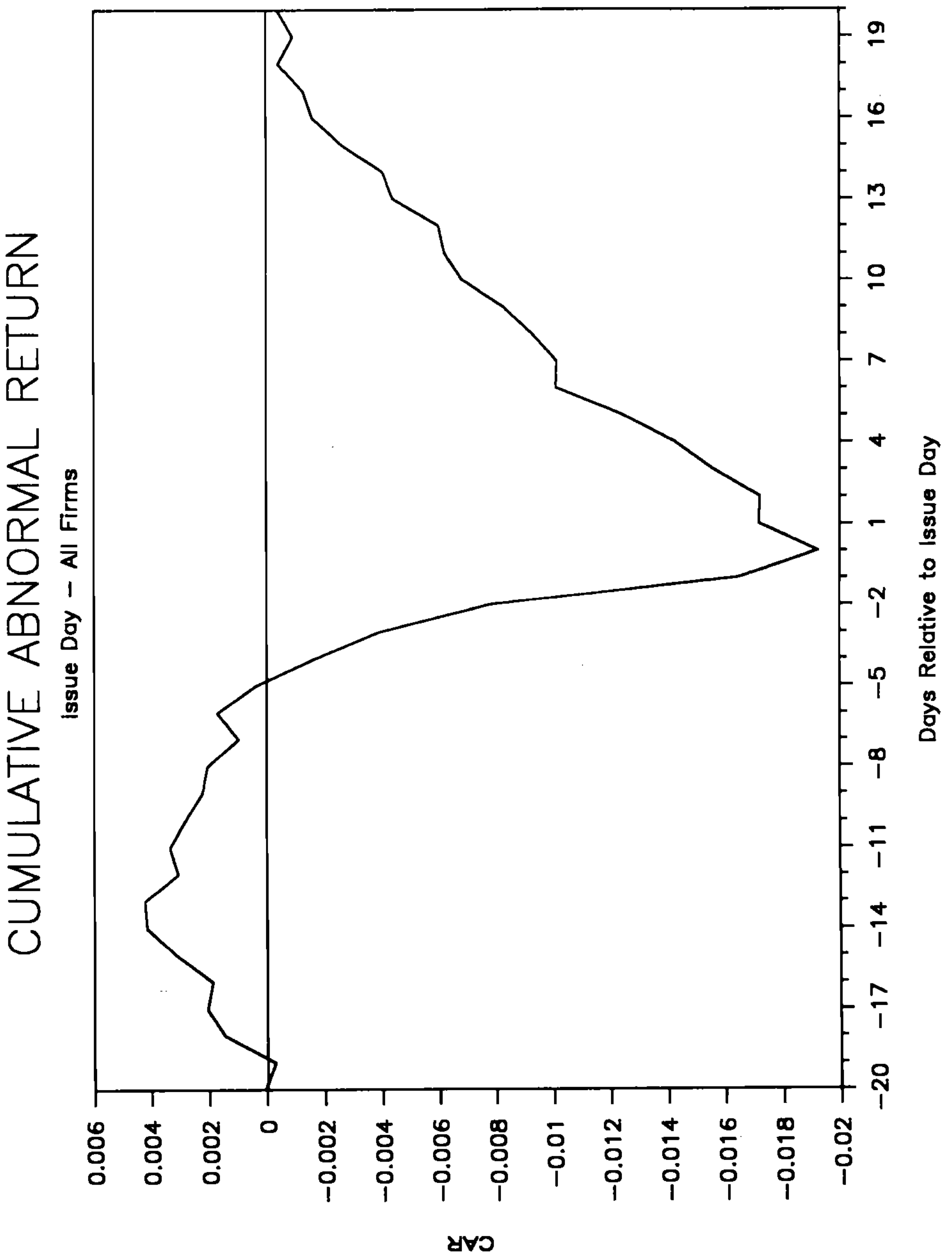

CUMULATIVE ABNORMAL RETURN
Announcement Day - All Firms
CAR
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
20
40
60
80
100
Days Relative to Announcement Day

FIGURE 7


CUMULATIVE ABNORMAL RETURN
Issue Day - All Firms
CAR
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
-0.02
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
Days Relative to Issue Day

two predictions: (a) a negative relation between the price change upon announcement of the issue and the time between the announcement and the last regular information release and (b) a negative relation between the price change at issuance and the time between issue and announcement. In the latter case the model predicts: (a) no correlation between the price change at announcement of the issue and the time between the announcement and the last regular information release and (b) a negative relation between the price change at issuance and the time between issue and announcement.

We test these propositions by regressing measures of abnormal returns around the event day on the relative time between the information release and announcement of the equity issue or on the time between the issue day and announcement of the issue. We estimate the abnormal return due to the event asset i as the sum of the abnormal returns on days -1 and 0, $A(i) = A_{i,-1} + A_{i,0}$.

The regressions we run all have the form

$$(14) \qquad A_j(i) = \phi_0 + \phi_1 T_j(i) + \eta(i) \qquad i = 1, 2, \ldots, n; \; j = a, s$$

where A_a is the abnormal return at announcement of the issue, A_s is the abnormal return at the actual issue day, $T_a(i)$ is the number of days between the last regular information release and announcement, $T_s(i)$ is the number of days between issue and announcement or between issue and information release, depending upon the case, and $\eta(i)$ is an error term. $A_j(i)$ is a noisy measure of the abnormal return due to the event since it is composed of the abnormal returns associated with the event (announcement or issuance) as well as abnormal returns associated with other unrelated events over a two-day window. Since the variability of abnormal returns is likely to vary across different firms, we estimate the regressions using weighted least squares (WLS) where each asset's observations are weighted by the inverse of the standard deviation of the its abnormal return. This standard deviation is estimated from the time-series of abnormal returns from days -200 to -21 and +21 to +100 relative to the announcement of the issue. As a diagnostic check, the squared residuals from ordinary least squares estimates of (14) are regressed on the time-series estimates of the variance. The t-statistics on the variance are on the order of 2.5 to 6. This indicates the presence of heteroscedasticity and justifies the use of WLS. Our estimates of (14) are reported in Table 7.

For Case 1, where the information release precedes announcement of the issue, $T_s(i)$ is the number of days between the announcement and issue. The model implies that $\phi_1 < 0$ for both the regression of A_a on T_a and the regression of A_s on T_s. Our estimates of ϕ_1 are both negative. The announcement day estimate of ϕ_1 is not statistically different from zero (t-statistic = -0.92) while the issue day estimate of ϕ_1 is significantly below zero (t-statistic = -3.50).

For Case 2, where the information release is between announcement and issuance, $T_s(i)$ defined as the number of days between the last regular information release and the issue day. The model implies that $\phi_1 = 0$ for the announcement day regression and that $\phi_1 < 0$ for the issue day regression. We find that our estimates of ϕ_1 are positive for the announcement day and negative for the issue day. Neither is significantly different from zero.[16]

Table 7: Regression estimates of the relation between abnormal returns and the timing of earnings announcements and equity issues.

A. Case 1 - Last Regular Information Release Before Announcement of Issue

$$A_j(i) = \phi_0 + \phi_1 T_j(i) + \eta(i)$$

	Price Change at Announcement[a]	Price Change at Issue[b]
ϕ_0	-2.04	0.02
	(-8.03)	(0.09)
ϕ_1	-0.66	-3.85
	(-0.92)	(-3.50)
R^2	0.02	0.02
n	513	513

B. Case 2 - Announcement of Issue Before Last Regular Information Release

$$A_j(i) = \phi_0 + \phi_1 T_j(i) + \eta(i)$$

	Price Change at Announcement[a]	Price Change at Issue[c]
ϕ_0	-3.44	-0.39
	(-3.20)	(-0.83)
ϕ_1	0.82	-1.03
	(0.53)	(-0.61)
R^2	0.04	-0.01
n	107	163

Note: T-statistics in parentheses. Estimates of ϕ_1 are multiplied by 100. Number of observations = n. Coefficient of determination (R^2) is adjusted for degrees of freedom.

[a] T_j is the time between announcement of issue and last earnings release.

[b] T_j is the time between issue and announcement of issue.

[c] T_j is the time between issue and last earnings release.

Theory predicts that the price drop at announcement should be unrelated to T_a if there is to be a fully revealing information release prior to the actual issue, and this is consistent with the insignificant ϕ_1. (If the information release is not fully revealing there should still be a price drop -- the magnitude of which is unrelated to T_a -- at the issue announcement, and this shows up as the negative intercept.)

Although most of the preceding discussion has focussed on postponing equity issues until after information releases, firms may also speed up or delay information releases to more closely precede equity issues. For instance, firms have a window of 90 days in which they can file an annual report after the fiscal year end. Because of this flexibility, we expect that the variation in the number of days between information releases immediately prior to equity issues will be higher than the average variation in the number of days between information releases. Thus we have:

Hypothesis 3: Timing of Information Releases

H_n: The variance of the days between information releases is not affected by the event of an equity issue in the following quarter. H_a: The variance of days between information releases is greater than average when equity is issued in the following quarter.

We test this hypothesis by comparing the overall variance of the time between consecutive quarterly earnings announcements with the variance in the time between the two announcements immediately prior to an equity issue. Table 8 presents the results. Clearly the null hypothesis cannot be rejected by this simple test.

Table 8: The Number of Days Between Earnings Announcements

	D_{BR} Prior to Issue	D_{BR} Unconditional
Mean	90.11	91.21
Std Dev	15.94	16.44

5. Conclusions

In this paper we explore the implications of information asymmetries for the timing and pricing of equity issues, and find evidence supporting the theory. In particular, we find that

1. Firms tend to issue equity earlier within a quarter rather than later.
2. Firms are least likely to issue equity in their fiscal-year fourth quarter, immediately prior to the annual report.
3. Almost no firms issue equity in the first few weeks after the announcement of the fourth quarter's earnings. This is likely due to the lag of several weeks between that earnings announcement and the release of the annual report.
4. The share price decline at the time of an equity issue is increasing in the time since the announcement of the equity issue.

We have focussed upon earnings announcements as information-revealing events, but firms can release information in other ways. Earnings announcements 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 paper would be to study the effects of voluntary information releases on the timing and pricing of equity issues.

Appendix A

The discussion in Sections 2 and 3 assumed that $\tau < \beta < 2\tau$. In this appendix we consider equilibrium for the other possible values of β.

<u>$\beta > 2\tau$</u> The equilibrium in this case is simpler than that in the text. α_0-τ+β is always the lowest possible equilibrium valuation for firms issuing shares. The highest quality type e firms will issue if $\alpha_0 + \tau$, their value conditional on not issuing is less than the equilibrium valuation, which is at least $\alpha_0 - \tau + \beta > \alpha_0 - \tau + 2\tau$. Thus, the highest quality type e firms always find it optimal to issue equity. The equilibrium valuation is therefore given always by (7). The equilibrium valuation is decreasing over time, since (7) is decreasing over time.

<u>$\beta < \tau$</u> In this case the highest quality type e firms never find it optimal to issue equity. If they did issue equity, the greatest possible equilibrium valuation is given by $\alpha_0 + \beta$. Their value conditional upon not issuing is $\alpha_0 + \tau$. Thus, they will never issue. Equation (8) therefore gives the equilibrium valuation initially. At some point, depending upon parameters, the type e firms with $\alpha = \alpha_0$ may drop out, in which case the equilibrium valuation would simply be $\alpha_0 - \tau + \beta$.

Appendix B

Lemma 1: i) If a firm with assets worth α^* does not issue equity, then no firm of the same type (d or e) with $\alpha > \alpha^*$ will issue equity. ii) If a firm with assets worth α^* does issue equity, then all firms of the same type with lower α will issue equity. iii) For any given α^*, if a type d firm issues equity, then type e firms with the same α will also issue equity.

Proof. (i) and (iii) follow from (5) and (6). (ii) follows for evaporating firms from (5). For durable firms, suppose that a firm with $\alpha = \alpha^*$ issues equity. If a firm with $\alpha^{**} < \alpha^*$ does not issue equity it must violate (6). But if α^* satisfies (6), so must $\alpha^{**} < \alpha^*$. //

Lemma 2:

i. $\alpha_0 - \tau + \beta \leq V_t < \alpha_0 + \beta$, $0 < t < 1$.

ii. type d firms with $\alpha = \alpha_0$ or $\alpha = \alpha_0 + \tau$ never issue equity before time 1.

iii. Type e firms with $\alpha = \alpha_0$ and with $\alpha = \alpha_0 - \tau$ always issue equity.

Proof. (i) If all firms issued equity, then the fair valuation would be $V_t^* = \alpha_0 + \beta$. At $V_t = V_t^*$, (6) is violated for durable firms with $\alpha = \alpha_0 + \tau$, so they will not issue equity. From Lemma 1, it will never be the case that a higher α firm issues equity when a lower α firm does not. Since at least one type does not issue equity, $V_t < V_t^*$. As for the lower bound, the rational value for firms issuing equity can not be lower than the value for the worst type.

(ii) Since $V_t < \alpha_0 + \beta$, (6) is violated for type d firms with $\alpha \geq \alpha_0$, so those firms do not issue equity.

(iii) Follows from (5), the fact that $\beta > \tau$, and from part (i). //

Lemma 3: The average valuation of firms issuing equity at time 1 exceeds $\alpha_0 + \beta$, and the number of firms issuing equity is greater at time 1 than at time t, for $0 < t < 1$.

Proof: By Lemma 1, $V_t < \alpha_0 + \beta$. All type e firms with new projects issue equity at time 1, so the average value for these is $\alpha_0 + \beta$. All type d firms which have received projects between time 0 and time 1, and which have $\alpha \geq \alpha_0$, issue equity at time 1. The lowest quality type d firms have already issued equity when projects arrived, and thus there are fewer of these firms than of high quality type d firms. So for type d firms, the average valuation is greater than $\alpha_0 + \beta$.

There are as many evaporating projects and newly arriving worst quality type d projects at time 1 as at time t. In addition, those type d firms with $\alpha \geq \alpha_0$ which have not issued previously, do so at time 1. Thus, the quantity of issues is greater at time 1 than at any time in the interval between 0 and 1. //

Lemma 4: The equilibrium price path for issuing firms is non-increasing in δ on (0,1).

Proof: At any given t, the only firms issuing equity are type e firms and the lowest quality type d firms. If there is a decrease in the relative quantity of type d firms, the average quality of firms which potentially issue equity rises, and this cannot reduce the equilibrium price at t. //

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Endnotes

1. 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.
2. When all projects evaporate if not financed, the model is similar to that in Myers and Majluf (1984).
3. This is similar to the idea that firms always find it advantageous to disclose all relevant information when it is free to do so [Grossman (1979), Milgrom (1981), Fishman and Hagerty (1987)].
4. For a discussion of alternative managerial decision rules, see Myers and Majluf (1984).
5. The management of an overvalued firm may optimally choose to finance a negative NPV project. Taking into account the existence of negative NPV projects would strengthen our prediction that the equilibrium equity price will be higher after information releases, because firms with negative NPV projects lower the average quality of issuers when the market is uninformed. With an infinity of firms, however, including these firms would reduce the extent to which new issues are clustered after information events, since they could issue equity at any time.
6. It is possible to allow firms to also have financial slack (e.g. cash and marketable securities), as in Myers and Majluf (1984). However, as long as the amount of slack is publicly known, the market evaluates the firm conditional on the quantity of slack, and this adds nothing to the

analysis. Firms with sufficient slack do not issue equity.

7. Firms plan information releases in advance because producing a credible signal is costly, and gathering the necessary information takes time (e.g., accountants work for several months preparing a 10K report). The existence of SEC disclosure rules requiring the periodic release of information also suggests that some information release dates are anticipated by both insiders and outsiders.

8. The assumption that the change in asset value is binomially distributed is made for convenience, but is not essential. Similarly, β could be made stochastic without changing the qualitative results.

9. The assumption that investors learn the truth at time 1 is made for simplicity. If management's information were modelled as a refinement of investor's information at t=0, and if the information at t=1 refines the investors' information, similar results would follow.

10. In this equilibrium, evaporating firms issue equity immediately. Receiving a project and not issuing equity thus reveals a firm to be durable. Is there any advantage to durable firms waiting to reveal their durability, and then issuing equity? The answer is no. If the market ever believed that a firm waiting and then issuing equity could not be the worst type, then the worst type would have an incentive to wait and pretend to be a durable firm with $\alpha \geq \alpha_0$. This belief by the market would guarantee a valuation of at least $\alpha_0 + \beta$, which is better than the worst durables could obtain by pooling with the evaporating firms. But once the worst durable firms wait to issue equity, it is advantageous for the better durable firms to wait until their type is revealed. Thus, in equilibrium the worst durable firms would be revealed as being the worst

by issuing equity. The only Nash equilibrium is for the worst durable firms to pool with the evaporating firms, and for the better durable firms to defer issuing equity until the next information announcement.

11. All type d firms will announce an issue because of the chance that after time 1 they will learn that their asset quality is $\alpha_0 - \tau$, in which case they will proceed with the issue. (If their assets are worth α_0 or $\alpha_0 + \tau$, they will withdraw, which we assume to be costless.) Similarly, type e firms will want to issue, though they may later withdraw if they learn that they have assets worth $\alpha_0 + \tau$.

12. For each test, as many observations were retained as was feasible. Thus sample size varies substantially across tests. The largest source of data loss was gaps in the Compustat data.

13. We required that successive earnings announcements be no less than 40 an no more than 180 days apart. Observations not meeting this criterion were omitted.

14. Because 51% of the firms have December fiscal-year ends, we constructed separate histograms for December fiscal year ends and all other fiscal year ends. There appeared to be no significant difference between the two.

15. We also estimate the t-statistics using a time-series estimate of the variance of average abnormal returns. The results are essentially the same as those reported in the paper.

16. We have included additional regressors in cross-sectional regressions like (14), such as the relative size of the primary and secondary components of the equity issue (% of previously outstanding equity) and the size of the firm. The coefficients on these variables are not

significantly different from zero.