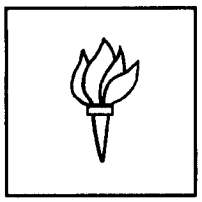

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Option Listing, Information Production and the Stock Price Response to Earnings Announcements

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1. Introduction

This paper addresses the issue of whether investors produce more information on firms that have listed stock options than on similar firms that do not have options and, if so, whether this additional information translates into a smaller stock-price reaction to releases of public information such as earnings announcements. After correcting for factors previously found to explain changes in two indicators of investor interest, analyst attention and institutional ownership, we find that firms with listed options exhibit significantly higher average levels of each of these variables than firms without listed options. Prior results regarding this issue are limited and contradictory. We also find, contrary to previous research, that this additional information production does not lead to a smaller price reaction to earnings announcements. The remainder of the introduction discusses prior research as well as the motivation for this study.

Previous research (e.g., Black [1975], Manaster and Rendleman [1982], and Cox and Rubinstein [1985]) motivates a link between option listing and information production. The argument is as follows. Several factors, including the availability of greater (and less expensive) leverage, lower transactions costs, and a lack of short sales restrictions, cause options to be preferred to stocks for many information traders. In addition to allowing investors who possess positive (negative) information regarding a firm to benefit from, say, buying a call (put), the introduction of option trading allows informed investors to benefit from more types of specialized information such as predictions of volatility changes. Further, for option firms, investors have a greater range of strategies to choose from by combining puts, calls, and positions in the underlying stocks. These advantages make trading in the option market profitable when it would not be profitable to trade in the stock market. This perceived increase in the opportunity for

profitable trading induces more investors to produce more information about firms with traded options than would be produced otherwise.

The last consideration, the ability to trade a stock and an option on that stock (nearly) simultaneously, should ensure that additional information produced about a firm (because of its options) will be reflected quickly in its stock price. Since an option's price is a function of the stock price plus a few observable or estimable variables, any information reflected in the option price should be impounded rapidly into the stock price in order to preclude arbitrage opportunities.

Other research documents a negative relation between variables believed to be related to the level of information production and the magnitude of a firm's stock-price reaction to earnings announcements. These variables include exchange listing and financial press coverage (Grant [1980]), firm size (Atiase [1985], Freeman [1987], and Collins, Kothari, and Rayburn [1987]), and analyst attention (Dempsey [1989], Lobo and Mahmoud [1989], and Shores [1990]). Consider the case of two otherwise identical firms where investors produce more information about one firm than the other. At any point in time, the stock price of the firm for which more information is produced should reflect this greater intelligence level. Its stock-price reaction to an earnings announcement should be smaller than that of the other firm since more of the potential information contained in earnings is preempted (see Atiase[1980]).

Taken together, the studies suggesting a positive relation between option listing and information production and those linking information production with the magnitude of the stock-price reaction to earnings provide motivation to study the relation between option listing and the stock-price response to earnings. In other words, the former studies strongly suggest that given

two operationally identical firms, the stock price of a firm with listed options should reflect more information than the stock price of one without. The latter studies then suggest that the preannouncement stock price of the option firm will reflect some incremental information that would have otherwise been revealed with the announcement of earnings. The option firm should exhibit a smaller price response to earnings announcements than the non-option firm.

Skinner (1990) attempts to test the hypothesis that option listing leads to a smaller response to earnings by examining firms before and after option listing. After listing, stocks exhibit both a smaller absolute price reaction to earnings announcements than before and a smaller earnings response coefficient (the slope coefficient from a regression of abnormal returns on a measure of earnings surprise) than before. Skinner points out, however, that these firms are undergoing multiple changes around the time of the options listing and warns:

> "... optioned firms change in systematic ways between pre- and post-listing periods. It is possible that these systematic changes are related to the options exchanges' decision to list the firm *and* to the observed change in the information content of these firms earnings releases. In other words, options listing is endogenous, which makes it difficult to conclude that options listing *causes* changes in the information content of these firms' earnings releases." (p.192, emphasis in the original)

Indeed, these firms change dramatically along several dimensions around the time of listing. For example, in the 60 months prior to option listing, the firms outperform the CRSP Value-Weighted index on a risk-adjusted basis by almost 13% per year. In the 60 months following listing they underperform the index by about 3% per year. Not surprisingly, listing firms grow significantly faster than the average firm during the test interval. In the pre-listing period, they tend to announce earnings that exceed analysts' estimates, while in the post- listing period their earnings tend to fall short. Two years before option listing, 10.14 analysts, on

average, report annual earnings forecasts to I/B/E/S, while two years after listing 16.70 report forecasts. While a longitudinal study may control for several factors, it is likely to be inappropriate in this situation since these firms are changing so rapidly along so many dimensions. As Skinner points out above, it is impossible to conclude that option listing actually causes the observed decrease in the price response to these firms' earnings releases.

Ho (1993) cites this problem as motivation for performing a cross-sectional investigation of the hypothesis that option firms' stocks exhibit a smaller price reaction to earnings announcements than non-option firms' stocks. Ho's stock-price reaction results generally support those of Skinner (1990). When using a measure of return volatility at the time of earnings announcements and controlling for other variables related to information production, she finds a smaller price reaction for option firms than for non-option firms. The distinction between the Ho (1993) and Skinner (1990) hypotheses is subtle but important. Skinner, by examining earnings response characteristics before and after option listing, is looking for the total effect of option listing. For example, when Skinner notes that the number of analysts following his sample firms increases around the time of options listing, rather than try to control for this factor in his earnings response tests, he cites it as confirmatory evidence regarding his hypothesis that more information is produced for option firms than for non-option firms.

Ho (1993), on the other hand, attempts to control for the number of analysts following a firm, as well as several other variables believed to be related to predisclosure information, when she tests for a difference in return variability across firms. She is testing the hypothesis that option listing has additional explanatory power regarding the stock-price response to earnings beyond that captured by other observable variables. While Skinner is testing for the *total* effect

of option listing on the response to earnings, Ho is testing for the *incremental* effect of option listing.

In testing her hypothesis, Ho does not use analysts' forecasts or any other earnings prediction model. She, therefore, performs no tests using earnings response coefficients; she focuses exclusively on return variance tests. Perhaps more important, without an earnings prediction model, her return variability tests fail to control for possible differences in the average magnitude of earnings surprise across the option and non-option subsamples. An alternative explanation for her results is that the non-option firms in her sample may have exhibited greater earnings surprises than the option firms.

Both Skinner and Ho explicitly state their motivation for the hypothesis that the response to earnings announcements for option firms should be smaller than that for non-option firms, in ways consistent with the discussion above. The existence of option trading leads to a greater motivation for some investors to collect information. These traders use this information in their portfolio revision decisions causing the stocks of option firms to reflect higher information levels. Even if these investors engage only in option trading, option prices will reflect this greater intelligence and arbitragers will quickly cause the same information level to be impounded in stock prices.

If this logic is correct and option listing leads to greater predisclosure information, it may still be premature to extrapolate the argument to imply a smaller response to earnings announcements. This is made evident by some recent additions to the post-earnings-announcement drift or SUE (standardized unexpected earnings) literature. Many previous studies (e.g., Rendleman, Jones, and Latané [1982], Foster, Olsen, and Shevlin [1984], and Bernard and

Thomas[1989]) document a post-earnings-announcement drift in abnormal returns in the direction of the earnings surprise that continues for several weeks or even months following the earnings announcement. Bernard and Thomas (1990) provide convincing evidence that the stock-price reaction to the earnings release is not nearly complete on the day that the announcement occurs *and* that the incomplete reaction is attributable to uninformed investors. The Bernard and Thomas (1990) results may be interpreted as follows. Uninformed (or unsophisticated) investors do not fully understand the times-series properties of earnings and, in fact, hold views that cause them to tend to underweight the information in earnings announcements. The influence of these investors tends to bias stock prices and gives rise to the post-earnings-announcement drift.

Bhushan (1994) goes farther by hypothesizing that, if Bernard and Thomas are correct, informed investors, who understand the times-series process of earnings, will drive stock prices to within transactions costs of their "true" value at the time of the earnings announcement. Bhushan supports his contention by obtaining results suggesting that the magnitude of the post-earnings-announcement drift is positively related to the costs of trading securities. Fedenia and Grammatikos (1992) show that, on average, the bid-ask spreads of NYSE stocks fall by around 20% following option listing[1]. If informed investors drive stock prices to within transactions costs of the "true" price at the time of the earnings announcement, and if option trading reduces transactions costs, then option firms should exhibit a more nearly complete immediate response

[1] Interestingly, Fedenia and Grammatikos (1992) find that the bid-ask spreads for OTC firms increase after option listing. Due to data restrictions, the vast majority of the firms we study are listed on the NYSE.

to earnings announcements.[2] Consistent with these arguments, evidence in Botosan and Skinner (1993) and Ho (1993) suggests that the post-earnings-announcement drift may be smaller for option firms than for non-option firms.

There are, therefore, two potentially offsetting factors influencing the effect of option listing on the stock-price response to earnings. On the one hand, the hypothesized additional information production may lead to a greater preempting of the potential information in the earnings announcement. On the other hand, reduced transactions costs may induce a more nearly complete response to the information contained in the announcement. Because of this and the limitations of previous empirical research in the area, we choose to reexamine the issue.

2. Hypotheses

We perform separate tests for the direct effects of option listing on information production and on stock-price reaction. We begin with hypotheses related to the direct effects on information production. To start we must identify observable variables related to the level of information produced about a firm. Several papers (e.g., Dempsey [1989], Lobo and Mahmoud [1989], and Shores [1990]) hypothesize a positive link between the number of analysts reporting earnings forecasts for a firm and the total amount of information available about that firm. This seems quite plausible -- the more analysts producing information, the greater the total amount of information produced.

O'Brien and Bhushan (1990) discuss an information link between analyst following and

[2] Logic similar to this appears in Botosan and Skinner (1993). But, while they apply it to post-earnings-announcement drift, they are silent on its potential implications for the announcement response.

institutional holding. Since institutions (such as investment companies, banks, insurance companies, and college endowments) are subject to a "prudent person" standard of fiduciary responsibility, they tend to follow only firms for which sufficient information is available. For example, in the event of poor investment performance, managers of institutions may be called upon to show that they exercised due diligence in making their investment choices. They are reluctant, therefore, to invest in stocks for which they cannot provide reasonable evidence of close scrutiny into the prospects of the firm. There should, therefore, be a positive relation between the number of institutions that choose to hold shares in a stock and the amount of information produced on the issuing firm.

For these reasons we use both analyst following and institutional holding as indicators of investor interest or information production. If investors have greater motivation to produce information on option firms, then we should observe higher levels of "investor-interest" variables, such as analyst following and institutional ownership, after controlling for non-investor-interest variables such as firm size and risk.[3] O'Brien and Bhushan (1990) find evidence suggesting that the degree of analyst attention is linked to stock-price volatility (negatively) and to industry factors. They also find a positive association between institutional ownership and both firm size and market risk. We use their analysis to motivate our choice of control variables when testing for the affects of option listing on analyst attention and institutional ownership.

Skinner (1990) finds an increase in analyst following around the time of option listing. In Ho's (1993) cross-sectional study, however, she does not detect a significant difference in

[3]Clearly, investors may choose to produce or not to produce information on a firm because of factors such as size or risk, but the term "investor-interest variable" here applies to direct evidence of investor following that could be readily altered by a factor such as option listing.

analyst attention between option and non-option firms once she controls for the market value of equity. Similarly, she does not find a significant difference in the number of institutions holding stock.[4] In short, direct evidence of a relation between option listing and investor-interest variables is scant.

This leads to the first two hypotheses:

H_{01}: There is no difference between the number of analysts who follow option and non-option firms after controlling for non-investor-interest variables previously found to be related to measures of investor interest.

H_{02}: There is no difference between the number of institutions that hold the stock of an option firm and the number that hold the stock of a non-option firm after controlling for non-investor-interest variables previously found to be related to measures of investor interest.

The above two hypotheses address the issue of whether option listing is related to directly observable measures of information production, while the third hypothesis addresses the issue of the incremental effect of option listing on the stock-price response to earnings announcements of option and non-option firms. This is the issue addressed by Ho (1993). By attempting to control for variables such as analyst attention and institutional holdings, she is (implicitly) testing the hypothesis that option listing is associated with higher levels of information production than can be inferred from other observable variables. The stated logic (in both Skinner and Ho) for testing for a difference in the price response to earnings announcements, is based solely on differential levels of information production. Presumably, under this logic, if researchers could adequately control for information production, the stock-price responses to earnings announcements would be the same for option and non-option firms. As discussed above,

[4]Ho (1993) does not treat these as major issues. These results appear only in her footnote 5.

however, option listing may have other relevant effects such as reducing the transactions costs of the underlying stocks. Consistent with prior research, we test the following hypothesis while recognizing that interpretation of the results is somewhat subjective.

H_{03}: There is no difference between the stock-price reaction to earnings announcements for option and non-option firms after controlling for variables believed to be related to information production.

If we reject H_{03} and find a negative relation between option listing and the magnitude of the stock-price response to earnings announcements, we will have evidence, consistent with Ho, that option listing is associated with a reduction in stock-price earnings response beyond that predicted by other previously documented relevant variables. If we fail to reject H_{03} (or find a positive relation) the question arises as to what the *total* effect of listing is on the magnitude of the earnings response. That is, when we control for all variables believed to be related to the magnitude of the earnings response and test for a relation between option listing and earnings response, we are testing for the *partial* derivative between the two variables conditional on other known relevant factors.

The other question is that posed by Skinner (1990), what is the *total* derivative of the magnitude of stock-price earnings response with respect to option listing? In other words, what is the difference in earnings response between two operationally identical firms, one with listed options and the other without. For tests of this hypothesis, we wish to control for variables believed to be related to earnings response but *not* to option listing. That is, if we reject H_{01}, then we have evidence suggesting that the act of option listing increases the number of analysts producing information on a firm and we might expect this to affect the firm's response to earnings. Tests of H_{03} attempt to control for this factor, while tests of the final hypothesis, H_{04}

do not. H_{04} is as follows.[5]

H_{04}: There is no difference between the stock-price reaction to earnings announcements for option and non-option firms after controlling for variables believed to be related to information production but believed not to be related to option listing.

3. Empirical Procedures

3.1 DATA

Sources for data used in the various tests of this paper are as follows.

1. Actual quarterly earnings per share (EPS) and earnings announcement dates are taken from *Compustat.*
2. Stock-return, stock-price, and number of shares outstanding are taken from *CRSP.*
3. Analysts forecasts of quarterly EPS and a proxy for the number of analysts following a firm are taken from the I/B/E/S summary tape. The forecast used is the most recent available dated prior to the earnings announcement.
4. Data on option listing dates for all U.S. exchanges are provided by the Chicago Board Options Exchange (CBOE).
5. The number of investment institutions holding shares is hand collected from *Standard and Poor's Stock Guide.*

[5] When testing H_{04}, we cannot be sure that differences in the earnings-response-relevant variables, that we intentionally choose not to control for, are entirely due to options listing (although some diagnostics can be performed). It is important to realize that tests of H_{04} become important only if we fail to reject H_{03}. If we fail to reject H_{03}, tests of H_{04} intentionally entail weaker controls to allow for the possibility of a total effect of option listing (e.g., through the omitted variables) on the magnitude of a firm's earnings response.

3.2 DEFINITIONS OF SELECTED VARIABLES

3.2.1 Abnormal Returns Abnormal returns are defined as the compounded stock return over the holding period minus the compounded return of an equal-weighted index of all firms listed on either the New York Stock Exchange (NYSE) or American Stock Exchange (AMEX) that fall into the same size-decile (based on market value of equity) at the beginning of the calendar year.

$$CAR(t_1, t_2) = \prod_{t=t_1}^{t_2} (1+r_{i,t}) - \prod_{t=t_1}^{t_2} (1+r_{D,t}), \qquad (1)$$

where,

$CAR(t_1,t_2)$ ≡ the cumulative abnormal return between days t_1 and t_2,

$r_{i,t}$ ≡ the raw stock-return of firm i on day t,

$r_{D,t}$ ≡ the raw return of the equal-weighted portfolio consisting of all NYSE-AMEX firms in the same size decile of firm i.

3.2.2 Analyst Forecast Error Analyst forecast error (AFE) is used as a measure of earnings surprise and is defined as actual earnings per share (EPS) minus forecasted EPS divided by the stock price two-weeks (ten trading days) prior to the earnings announcement date.

$$AFE_{i,q} = \frac{E_{i,q} - FE_{i,q}}{P_{i,q}}$$

Where,

$AFE_{i,q}$ ≡ the analysts' forecast error for firm i for quarter q,

$E_{i,q}$ ≡ the actual EPS for firm i for quarter q,

$FE_{i,q}$ ≡ the most recent forecasted EPS for firm i for quarter q,

$P_{i,q}$ ≡ the price of firm i ten trading days prior to firm i's announcement of EPS for quarter q.

Freeman and Tse (1990) provide empirical results indicating that there are non-linearities in the earnings-return relation. They show that an arctangent transformation of earnings forecast errors leads to a better fit of the association. We find that the transformation of forecast errors to coded decile scores, as used in Bernard and Thomas (1989 and 1990), gives a very similar degree of fit, while providing some advantages. First, the coded-decile method requires estimation of only one parameter while the arctangent transformation requires estimating two. In addition, the two parameter estimates of the arctangent transformation complicate interpretation of the earnings response coefficient, where the coded decile scheme enhances interpretation.

For these reasons, in tests of earnings response coefficients or tests requiring control for earnings surprise, we use a coded score reflecting the decile of the earnings forecast error of the firm-quarter observation within the sample. Specifically, we rank every observation by earnings forecast error and divide them into deciles. Each observation in the top decile is coded as +0.5 while each observation in the lowest decile is coded as -0.5 and others are equally spaced between. We designate these coded scores as $AFEDEC_{i,q}$. This coding scheme allows interpretation of the coefficient on the earnings forecast error (when used as the independent variable to explain abnormal returns) as the average difference in abnormal returns between observations in the top and bottom deciles. The intercept can be interpreted as the expected abnormal return of a hypothetical observation with the median forecast error; it should, therefore, be close to zero.

3.2.3 Relative Return Variance Following Ho (1993), the relative return variance is

used as one measure of a firm's stock-price response to earnings announcements. It is defined as follows (see Patell [1976] or Ho [1993]).

$$RRV_j = \sum_{t=-1}^{1} \frac{\dfrac{\mu_{j,t}^2}{(c_{j,t})(s_j^2)}}{\sqrt{3}} \bullet [(T_j - 4)/(T_j - 2]$$

where,

$\mu_{j,t}$ ≡ the abnormal return of firm j on day t as determined by a market model regression of the firm's return on the *CRSP* Value-Weighted NYSE-AMEX index for days -209 to -10 relative to the earnings announcement date,

s_j^2 ≡ the residual variance from the market model regression described above to estimate μ;

T_j ≡ the number of days used to estimate the market model regression described above to estimate μ;

$c_{j,t}$ ≡ a factor to adjust variance estimate for prediction outside the estimation period,

$$c_{j,t} = 1 + \frac{1}{T_j} + \frac{(R_{m,t} - \overline{R_m})^2}{\sum_{t_e=1}^{T_j} (R_{m,t_e} - \overline{R_m})^2}$$

where,

$R_{m,t}$ ≡ the return of the value-weighted NYSE-AMEX index for day t of the test period;

$\overline{R}_m$ ≡ the average daily return of the value-weighted NYSE-AMEX index over the estimation period;

$R_{m,te}$ ≡ the return of the value-weighted NYSE-AMEX index for day et of the estimation period.

The other measure of the stock price reaction to earnings announcements is the earnings response coefficient. The earnings response coefficient is the slope coefficient of a regression of the abnormal returns at the time of the earnings announcement on the analysts' forecast error. As described ins section *3.2.2*, in place of the raw forecast error we use a coded decile score of the analyst forecast error (AFEDEC).

4. Empirical Tests and Results

4.1 ANALYST FOLLOWING AND INSTITUTIONAL HOLDINGS

We begin by testing H_{01} and H_{02}. Recall

H_{01}: There is no difference between the number of analysts that follow option and non-option firms after controlling for non-investor-interest variables previously found to be related to measures of investor interest.

H_{02}: There is no difference between the number of institutions that hold the stock of an option firm and the number that hold the stock of a non-option firm after controlling for non-investor-interest variables previously found to be related to measures of investor interest.

We address both hypotheses using two tests. First we regress the number of analysts reporting to I/B/E/S (H_{01}) and the number of institutions holding shares (H_{02}) against variables found to be important in explaining *either* analyst attention or institutional holdings by O'Brien and Bhushan (1990) and a binary variable (OPTIND) taking on the value of one for option firms and the value of zero for non-option firms.

O'Brien and Bhushan (1990) perform an analysis on changes in analyst following and changes in institutional holding. They find that "analyst following increases more in firms with

smaller prior analyst following and in firms whose return volatility has declined, and that analyst following increases more in industries with regulated disclosure and with increasing number of firms. Institutional ownership increases with firm size and with increased market risk." Since they test for *changes* and they hypothesize that recent stock-price performance may be valuable in its own right, they break the change in firm size (market value of equity) into changes in the number of shares and recent abnormal return performance. For reasons discussed in section 1 above, we test for differences in levels (as opposed to changes) in analyst following and in institutional holding. Our resulting regression equation becomes:

$$NUM_{j,q} = \alpha_0 + \alpha_1 OPTIND_{j,q} + \alpha_2 REGIND_{j,q} + \alpha_3 PRECAR + \alpha_4 LNSHARES_{j,q} + \alpha_5 BETA_{j,q} + \alpha_6 RESIDSE_{j,q} + \Sigma_{i=1,25} \beta_i I_{i,j,q} + \Sigma_{y=84,91} \gamma_y Y_{y,j,q} + \Sigma_{cq=1,3} \delta_{cq} Q_{cq,j,q},$$

where,

$NUM_{j,q}$ ≡ number of analysts reporting quarterly forecasts to I/B/E/S (QNUM), annual forecasts (ANUM), or number of institutions holding shares (INUM),

$OPTIND_{j,q}$ ≡ 1 if the firm j has listed options trading at the time of earnings announcement q and 0 otherwise,

$REGIND_{j,q}$ ≡ 1 if firm j is a member of an industry with regulated disclosure (SICs 421, 483, 493, 612, 621, 633, 805, or 809) and 0 otherwise,[6]

[6]O'Brien and Bhushan (1990) hypothesize that analysts prefer to follow industries with regulated disclosure since firms in these industries are required to provide information exceeding that required by Generally Accepted Accounting Principles. Their prediction (for which they find empirical support) is consistent with analysts' compensation schemes that are linked either explicitly or implicitly to the accuracy of their forecasts or recommendations. The regulated

$PRECAR_{j,q}$ ≡ compounded return for firm j over days -209 through -10 relative to the earnings announcement date for firm j for quarter q minus the compounded return of an equal-weighted index consisting of all NYSE-AMEX firms of the same size decile,

$LNSHARES_{j,q}$ ≡ the natural log of firm j's shares outstanding ten days before the announcement of quarter q's earnings,

$BETA_{j,q}$ ≡ the Scholes-Williams (1977) beta as estimated from a market model regression of firm j's returns on the *CRSP* Value-Weighted index over days -209 to -10 relative to the announcement of quarter q earnings,

$RESIDSE_{j,q}$ ≡ the residual standard error (times 100) from the market model regression described above to estimate BETA,

$I_{i,j,q}$ ≡ 1 if firm j is a member of industry i at the time of announcement of quarter q earnings,

$Y_{i,j,q}$ ≡ 1 if the calendar year of firm j's announcement of quarter q's earnings is y and 0 otherwise, and

$Q_{cq,j,q}$ ≡ 1 if the calendar quarter of firms j's announcement of quarter q's earnings is cq and 0 otherwise.

The $I_{i,j,q}$ variables are intended to control for industry effects not captured by $REGIND_{j,q}$. There is an I variable for each of the 25 most populous industries as indicated by 2-digit SIC

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industries are Trucking, Broadcasting, Utility Services, Savings Institutions, Securities Brokers, Insurance, Nursing and Personal Care, and Health.

code. These industries account for about 80% of the entire sample. $Y_{y,j,q}$ and $Q_{cq,j,q}$ are intended to control for time specific effects such as the general increase in shares outstanding over time and possible fluctuations in analyst following and institutional holding. The results of three regressions, performed with dependent variables indicated above, appear in Table 1. (The industry, year, and quarter binary variables are suppressed for ease of exposition.)[7]

(Insert Table 1 About Here)

First notice that despite the differences between our tests and those of O'Brien and Bhushan (1990), our results are remarkably similar. For each variable that they find significant we obtain significance of the same sign. More important for this paper, the coefficient of OPTIND is highly significant for all three regressions with t-statistics ranging from 36.98 to 53.87. The results strongly suggest that, after controlling for variables documented to be relevant in previous research, option firms are associated with higher levels of analyst following and institutional holding than are non-option firms.

The results suggest that option firms have about 1.96 more analysts reporting quarterly earnings forecasts than do non-options firms. For reference, the sample mean and median of the entire sample are 5.21 and 4.00, respectively. The difference for annual forecasts is 4.21 where the sample mean (median) is 12.37 (10.00). Finally, the number of additional institutions holding options firms' stock is estimated to be 81.24 where the sample mean (median) is 158.12 (91.00). these results suggest that, after controlling for non-investor-interest variables previously shown

[7] Since we are still in the process of collecting institutional holdings data, the number of observations for the tests of analyst following differs from that for the tests of institutional holdings. The current draft uses institutional holdings data through 1988; future drafts will use data continuing through 1992.

to be related to analyst following and institutional holding, option listing has additional explanatory power.

To address the issue further, we form a sample of matched pairs of option and non-option firms, in the following way. For each calendar year, each option firm, in an industry with non-regulated (regulated) disclosure, is compared to each non-option firm from an industry with non-regulated (regulated) disclosure. The firms are compared along the dimensions of market value of equity (SIZE), PRECAR, BETA, and RESIDSE. Option firms are considered a potential match with an non-option firm if their SIZE, BETA, and RESIDSE are within 20% of the non-option firm's values and their PRECAR is within 3.2% (approximately 1% per calendar quarter). The option firm that is closest in SIZE to the non-option firm is considered its matched counterpart. The process is repeated for all option firms without replacement of either the option or non-option firm. Table 2 provides statistics on the control variables of the two matched pair subsamples. Notice that the distributions of all four variables are very similar across the option and non-option subsamples.

(Insert Table 2 about Here)

Table 3 presents statistics for the investor-interest variables, which are the object of H_{01} and H_{02}.

(Insert Table 3 About Here)

Notice that t-statistics for the test of differences in the means of QNUM (the number of analysts

reporting quarterly forecasts), ANUM (the number of analysts reporting annual forecasts), and INUM (the number of institutions holding the firm's shares) across the option and non-option subsamples are 10.90, 10.51, and 7.90, respectively. Each of these indicates a high level of significance.

Table 3 indicates that the mean (median) option firm has 0.98 (1.00) more analysts reporting quarterly forecasts and 1.92 (2.00) analysts reporting annual forecasts than the mean (median) non-option firm. These figures are approximately one-half as large as the regression estimates. One possibility is that the regression estimates are biased upward because of the failure to use the (unobservable) correct functional form relating the dependent and independent variables. Nonetheless, the conclusion of both tests is that, after controlling for previously recognized relevant variables, option firms are followed by more analysts and their shares are held by more institutions than non-option firms.

4.2 STOCK-PRICE REACTION TO EARNINGS ANNOUNCEMENTS

In this section we begin by addressing H_{03}. Recall

H_{03}: There is no difference between the stock-price reaction to earnings announcements for option and non-option firms after controlling for variables believed to be related to information production.

We assess the stock-price reaction to earnings announcements using both the relative return variability (RRV, discussed in section *3.2.3*) at the time of the announcement and the earnings response coefficient. Tests of this hypothesis require controlling for variables, other than options listing, that we believe to be related to the magnitude of the stock-price reaction to earnings announcements. These factors include exchange listing (Grant [1980] and Atiase

[1987]), firm size (Atiase [1985 and 1987], Freeman [1987], and Collins, Kothari and Rayburn [1987]), analyst attention (Dempsey [1989]), and beta (Easton and Zmijewski [1989]).

To her tests, Ho (1993) adds the natural log of recent monthly trading volume and the natural log of the number of institutions holding the firm's shares.[8] As she points out, several of these potential explanatory variables are highly correlated. For our sample, the pairwise correlations between the log of firm size, the number of analysts reporting quarterly (or annual) forecasts, the log of the number of institutions holding shares, and the log of the monthly share volume (all variables used by Ho) range from 0.665 to 0.908. We feel that any attempt to draw inferences from a regression containing several independent variables *all* with correlations this high would be futile. For this reason we address H_{03} using solely a matched pair sample.

The matched pair sample was constructed in a manner very similar to that of the sample constructed for tests of H_{01} and H_{02}. Market value of equity (SIZE), average monthly trading volume in shares for the three months prior to the earnings announcement (MVOL), and beta (BETA) for the option firm are required to be within 20% of the non-option firm values. The number of analysts reporting quarterly forecasts (QNUM) is allowed to differ by one in either direction, while both observations must be in the same analyst forecast error decile (AFEDEC). Finally, if one twin is traded on the NYSE then the other must be as well. Table 4 provides summary statistics on the control variables for the matched pair sample for H_{03}[9].

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[8] Ho (1993) uses one additional variable, the number of news releases reported by the *Wall Street Journal Index* over her four- year test period, in her tests. We believe the effects of this variable are captured by the combined effect of the other variables we use.

[9] Future drafts will use a matched pair sample that controls for the number of institutions holding the firm's stock (INUM). See footnote 7.

(Insert Table 4 About Here)

Notice that again the distributions are very similar across subsamples for each variable.

Analysis of H_{03} consists of comparing the distributions of the relative return variance (RRV) and testing for a difference in earnings response coefficients across subsamples. Statistics from the distributions of RRV for the two subsamples are shown below.

	MAX	75%	50%	25%	MIN	MEAN
OPTION	323.630	3.445	1.547	0.630	0.005	3.571
NON-OPTION	244.295	3.365	1.505	0.653	0.000	3.323

The mean and median option firm have greater abnormal return variability around earnings announcements than the mean and median non-option firms. The t-statistic for the difference in the mean, however, is only an insignificant 0.90. In addition, the fraction of times that the option firm's variability is greater than that of the non-option firm is only 50.5%. This suggests a very similar level of abnormal stock-price volatility around earnings announcements for both option and non-option firms after controlling for other relevant variables.

The test for a difference in earnings response coefficients uses the following regression.

$$CAR_{j,q}\,(t_1,t_2) = \alpha_0 + \alpha_1\, AFEDEC_{j,q} + \alpha_2\,(OPTIND_{j,q} * AFEDEC_{j,q}) + e_{j,q}\,.$$

As discussed above, $CAR(t_1,t_2)$ is the abnormal return from t_1 to t_2, AFEDEC is the coded score of the analysts' forecast error, and OPTIND is a binary variable that takes on a value of 1 for option firms and 0 for non-options firms. In the regression test of H_{03} we use three return cumulation intervals: trading days -63 to -2; days -1 and 0; and days +1 to +63. These three

intervals represent (approximately) the abnormal return since the previous earnings announcement, the contemporaneous reaction to the earnings announcement, and the abnormal return until the next earnings announcement, respectively. The results are presented in Table 5.

(Insert Table 5 About Here)

First notice that, as expected, the coefficient on AFEDEC is positive and significant for all three cumulation periods. The variable of interest for this paper, however, is OPTIND*AFEDEC, which indicates the difference in abnormal returns over the cumulation period between option and non-option firms. The results for this variable vary remarkably from what might be expected given the results of prior research. The short-window earnings response coefficient representing the contemporaneous reaction to the earnings announcement [dependent variable CAR(-1,0)] is significantly *larger* for the option firms than for the non-option firms. This is contrary to one interpretation of the findings of Skinner's (1990) longitudinal study. It suggests that it is not option listing that causes his sample firms' earnings response coefficients to fall, but rather one or more of the other variables that changes around the time of option listing. In addition, the two long windows [CAR(-63,-2) and CAR(+1,+63)] show very little evidence of greater anticipation of earnings news (as suggested by Ho's [1993] analysis) or a weakening of the post-earnings announcement drift as suggested by both Ho and Botosan and Skinner (1993).

As stated above, use of the coded score for analyst forecast error enhances the interpretation of the regression coefficients. The coefficient of 0.0271 for AFEDEC for the -1

to 0 window indicates an average difference in abnormal return of 2.71% between non-option observations in the top and bottom forecast-error deciles. The coefficient of 0.0081 on (OPTIND*AFEDEC), in the same regression, indicates that the average difference in abnormal returns between *option* firms in the top and bottom forecast error deciles is 3.52% (2.71%+0.81%). Other coefficients in the table can be interpreted similarly.

Finally we test H_{04}. Recall

H_{04}: There is no difference between the stock-price reaction to earnings announcements for option and non-option firms after controlling for variables believed to be related to information production but believed not related to option listing.

Tests of H_{04} are identical to those of H_{03}, but are performed on a new matched pair sample that does not control for variables believed to be related to option listing. That is, we wish to control for variables so that the firms are operationally similar, but we do not wish to control for variables that may be altered by the act of option listing, such as analyst following. Here we control for firm size, exchange, analyst forecast error decile, status of regulatory disclosure, and beta. The procedure used to construct the matched pair sample is the same as that used for the sample of the tests of H_{03}. Table 6 presents statistics from the distributions of two control variables, SIZE and BETA (statistics of other control variables, e.g., exchange and analyst forecast error decile are not necessary since the variables are required to be the same for each of the matched pairs), and the test variable RRV.

(Insert Table 6 About Here)

Notice that option firms in this matched pairs sample tend to be somewhat larger and have

somewhat higher betas than non-option firms, but the differences are not significant based on traditional t-tests. The biases, regarding their implications for RRV, are in the same direction. The greater size should tend to bias option firms toward having a smaller RRV (e.g., Atiase [1985]) as should the larger beta (see Easton and Zmijewski [1989]). Once again, however, the mean and median RRV for the option subsample are larger than for the non-option subsample and once again the difference is not significant. This suggests that the total effect of option listing on a firm's stock-price response to earnings announcements is minimal.

Results of a regression tests analogous to those of H_{03} are presented in Table 7.

(Insert Table 7 About Here)

Here the immediate response to earnings is no longer significantly different between subsamples, but there appears to be some evidence of greater anticipation of earnings news by the option firms. This finding is preliminary and will investigate it further in future drafts.

4. Summary and Conclusions

This paper addresses the issue of whether investors produce more information on firms that have listed stock options than on those that do not have options and, if so, whether this additional information translates into a smaller price reaction to releases of public information such as earnings announcements. We have some evidence that investors do produce more information on option firms than on non-option firms, but, contrary to previous research, option trading does not seem to lead to a smaller response to earnings once we control for other factors.

In fact, we provide some weak evidence that the opposite occurs. At this point we stress that our findings are preliminary.

Table 1

Results of OLS Regressions of Analyst Following and Institutional Investor Ownership on Firm Characteristics, 1984-1992.

	QNUM[1]	ANUM[2]	INUM[3]
Intercept	-11.73	-36.36	-692.34
	(-62.79)	(-104.76)	(-74.93)
OPTIND	1.96	4.21	81.24
	(46.66)	(53.87)	(36.98)
REGIND	1.29	2.67	14.91
	(5.25)	(5.86)	(1.28)
CAR(-209,-10)	0.39	1.22	40.79
	(7.82)	(13.18)	(14.87)
LNSHARES	1.73	4.65	91.11
	(101.21)	(146.76)	(102.63)
BETA	0.97	1.14	9.81
	(27.33)	(17.37)	(5.11)
RESIDSE	-1.07	-2.55	-56.29
	(-38.99)	(-49.77)	(-39.85)

Regression Summary Statistics

Observations	34839	34839	18438
Adjusted R^2	58.25%	70.08%	68.81%

[1] Number of analysts providing quarterly forecasts to I/B/E/S.

[2] Number of analysts providing annual forecasts to I/B/E/S.

[3] Number of institutions holding shares in the companies stock.

Table 2

Comparison of Control Variables across Matched Pairs Sample of Option and Non-Option Firms for Tests of H_{01} and H_{02}: Differential Levels of Analyst Attention (H_{01}) and Institutional Holding (H_{02}),1984-1992.

	SIZE[1]		CAR(-209,-10) in %[2]		BETA[3]		RESIDSE in %[4]	
	option	non-option	option	non-option	option	non-option	option	non-option
N	3424	3424	3424	3424	3424	3424	3424	3424
MAX	20280928	20446768	136.04	139.09	3.057	2.786	0.329	0.403
75%	2131059	2155771	9.09	8.84	1.306	1.329	0.143	0.145
50%	1198189	1225934	-3.22	-3.15	1.074	1.089	0.116	0.117
25%	668899	661845	-15.36	-15.38	0.854	.864	0.095	0.096
MIN	37982	35024	-66.21	-66.73	0.124	.121	0.037	0.039
MEAN	1638575	1635168	-2.70	-2.71	1.099	1.112	0.122	0.124
ΔMEANS	3407		0.01			0.013		0.002
(T-Stat.)	(0.09)		(0.01)			(1.54)		(1.69)
%Greater	52.6%	47.0%	48.7%	51.3%	48.2%	51.8%	48.7%	51.3%

[1] Market value of equity in thousands of dollars.

[2] Cumulative abnormal return for trading days -209 through -10 relative to the earnings announcement date.

[3] Beta as estimated using the Scholes-Williams (1977) technique over the period -209 through -10 trading days relative to the earnings announcement date.

[4] Standard error of the residuals of a market model regression estimated over trading days -209 through -10 relative to the earnings announcement date.

Table 3

Comparison of Variables Related to Investor Interest across Matched Pairs Sample of Option and Non-Option Firms for Tests of H_{01} and H_{02}: Differential Levels of Analyst Attention (H_{01}) and Institutional Holding (H_{02}),1984-1992.

	QNUM[1]		ANUM[2]		INUM[3]	
	option	non-option	option	non-option	option	non-option
N	3424	3424	3424	3424	1611	1611
MAX	23	24	45	43	731	593
75%	10	9	23	21	274	238
50%	7	6	17	15	195	168
25%	4	4	11	9	135	108
MIN	1	1	1	1	9	1
MEAN	7.35	6.37	17.09	15.17	211.37	182.79
ΔMEANS	0.98		1.92		28.58	
(T-Stat.)	(10.90)		(10.51)		(7.90)	
%Greater	52.2%	35.8%	56.5%	37.6%	65.3%	33.6%

[1] Number of analysts providing quarterly earnings forecasts to I/B/E/S.

[2] Number of analysts providing annual earnings forecasts to I/B/E/S.

[3] Number of institutions holding shares in the firm's stock.

Table 4

Comparison of Control Variables across Matched Pairs Sample of Options and Non-options Firms for Test of H_{03}: Differential Price Reaction at the Time of Earnings Announcements, 1984-1992.

	SIZE[1]		QNUM[2]		MVOL[3]		BETA[4]	
	option	non-option	option	non-option	option	non-option	option	non-option
N	2393	2393	2393	2393	2393	2393	2393	2393
MAX	18542736	1652470	18	18	21297664	19448000	2.604	2.669
75%	2021318	2033535	8	8	3247366	3247366	1.300	1.308
50%	1121309	1128288	6	6	2040866	2055766	1.063	1.085
25%	587570	590493	4	4	1304200	1306066	0.848	0.863
MIN	35037	33276	1	1	249433	264567	0.238	0.219
MEAN	1549676	1561091	6.32	6.26	2673636	2699361	1.087	1.099
ΔMEANS		11419	0.06			26050		0.012
(T-Stat.)		(0.26)	(0.64)			(0.40)		(1.23)
%Greater	48.0%	51.8%	36.5%	30.7%	49.2%	50.8%	46.7%	53.3%

[1] Market value of equity in thousands of dollars.

[2] Number of analysts providing quarterly earnings forecasts to I/B/E/S.

[3] Average monthly trading volume for most recent three months before earnings announcement.

[4] Beta as estimated using the Scholes-Williams (1977) technique over the period -209 through -10 trading days relative to the earnings announcement date.

Table 5

Results of OLS Regressions of Abnormal Returns on Analyst Forecast Error Decile Coded Scores and a Binary Slope Variable for Option Firms. Test is Performed on a Matched Pairs Sample, 1984-1992.

$$CAR_{j,q}\ (t_1,t_2) = \alpha_0 + \alpha_1\ AFEDEC_{j,q} + \alpha_2\ (OPTIND_{j,q} * AFEDEC_{j,q}) + e_{j,q}$$ [1]

	Intercept	AFEDEC[1]	OPTIND[2]* AFEDEC	Adj-R^2
CAR(-63,-2)[3]	0.0010	0.0963	0.0002	4.36%
(t-stat.)	(0.55)	(10.49)	(0.02)	
CAR(-1,0)	-0.0006	0.0271	0.0081	5.61%
(t-stat.)	(-1.05)	(10.32)	(2.19)	
CAR(+1,+63)	-0.0024	0.0546	-0.0048	1.25%
(t-stat.)	(-1.26)	(5.85)	(-0.37)	

[1] AFEDEC is the decile of analyst forecast error coded as -0.5 for the decile comprising the smallest (most negative) forecast errors and +0.5 for the decile comprising the largest (most positive) forecast errors.

[2] OPTIND is a binary variable taking on a value of 1 for option firms and a value of 0 for non-option firms.

[3] $CAR(t_1,t_2)$ is the abnormal return from trading day t_1 through day t_2 relative to the earnings announcement date.

Table 6

Comparison of Control Variables and Test Variable (RRV) across Matched Pairs Sample of Options and Non-options Firms for Test of H_{04}: Differential Price Reaction at the Time of Earnings Announcements, 1984-1992.

	SIZE[1]		BETA[2]		RRV[3]	
	option	non-option	option	non-option	option	non-option
N	5760	5760	5760	5760	5760	5760
MAX	21429952	20446768	3.230	3.470	238.450	244.295
75%	2018066	1992077	1.356	1.350	3.444	3.351
50%	1116423	1094348	1.064	1.055	1.532	1.472
25%	591958	588976	0.796	0.785	0.633	0.631
MIN	35037	32051	0.017	0.019	0.005	0.001
MEAN	1568673	1563070	1.097	1.091	3.418	3.304
ΔMEANS	5603		0.006		0.114	
(T-Stat.)	(0.19)		(0.80)		(0.75)	
%Greater	53.5%	46.2%	55.4%	44.6%	50.2%	49.7%

[1] Market value of equity in thousands of dollars.

[2] Beta as estimated using the Scholes-Williams (1977) technique over the period -209 through -10 trading days relative to the earnings announcement date.

[3] RRV (relative return variation) is a measure of the return variability around the time of the earnings announcement standardized by a measure of return variability during the 200-day estimation period mentioned in the previous footnote.

Table 7

Results of OLS Regressions of Abnormal Returns on Analyst Forecast Error Decile Coded Scores and a Binary Slope Variable for Option Firms. Test is Performed on a Matched Pairs Sample, 1984-1992.

$$CAR_{j,q}\ (t_1,t_2) = \alpha_0 + \alpha_1\ AFEDEC_{j,q} + \alpha_2\ (OPTIND_{j,q} * AFEDEC_{j,q}) + e_{j,q}$$ [1]

	Intercept	AFEDEC[1]	OPTIND[2]* AFEDEC	Adj-R^2
CAR(-63,-2)[3]	-0.0008	0.0969	0.0237	5.47%
(t-stat.)	(-0.66)	(16.20)	(2.80)	
CAR(-1,0)	-0.0002	0.0268	0.0036	4.57%
(t-stat.)	(-0.51)	(15.57)	(1.48)	
CAR(+1,+63)	-0.0004	0.0378	0.0056	0.76%
(t-stat.)	(-0.30)	(6.22)	(0.66)	

N=11,520

[1] AFEDEC is a the decile of analyst forecast error coded as -0.5 for the decile comprising the smallest (most negative) forecast errors and +0.5 for the decile comprising the largest (most positive) forecast errors.

[2] OPTIND is a binary variable taking on a value of 1 for option firms and a value of 0 for non-option firms.

[3] $CAR(t_1,t_2)$ is the abnormal return from trading day t_1 through day t_2 relative to the earnings announcement date.

References

Atiase, R. "Predisclosure Informational Asymmetries, Firm Capitalization, Financial Reports, and Security Price Behavior." Ph.D. dissertation, University of California, Berkeley, 1980.

____. "Predisclosure Information, Firm, Capitalization, and Security Price Behavior Around Earnings Announcements." *Journal of Accounting Research* 23 (1985): 21-36.

____."Market Implication of Predisclosure Information: Size and Exchange Effects." *Journal of Accounting Research* 25 (1987):168-76.

Bernard, V., and J. Thomas. "Post-Earnings-Announcement Drift: Delayed Price Response or Risk Premium?" *Journal of Accounting Research* 27 (Suppl. 1989): 1-36;

Bernard, V., and J. Thomas. "Evidence that Stock Prices Do Not Fully Reflect the Implications of Current Earnings for Future Earnings." *Journal of Accounting and Economics* (December 1990): 305-340.

Bhushan, R. "An Informational Efficiency Perspective on the Post-Earnings Announcement Drift." *Journal of Accounting and Economics* 18 (1994): 46-65.

Black, F. "Fact and Fantasy about the Use of Options." *Financial Analysts Journal* 31 (July/August 1975):36-41 and 61-72.

Botosan, C. and D. Skinner. "The Relation Between Post-Earnings-Announcement Drift and Option Listing." Working paper, University of Michigan (May 1993).

Collins, D., S. Kothari, and J. Rayburn. "Firm Size and the Information Content of Prices with Respect to Earnings." *Journal of Accounting and Economics* 9 (1987): 111-38.

Cox, J., and M. Rubinstein. *Options Markets.* Englewood cliffs, NJ: Prentice Hall.

Dempsey, S. "Predisclosure Information Search Incentives, Analyst Following, and Earnings Announcement Price Response. *The Accounting Review* 64 (October 1989):748-57.

Easton, P. and M. Zmijewski. "Cross-Sectional Variation in the Stock Market Response To Accounting Earnings Announcements." *Journal of Accounting and Economics* 11 (1989):117-41.

Fedenia, M., and T. Grammatikos. "Option Trading and the Bid-Ask Spread of the Underlying Stocks." *The Journal of Business* 65 (1992): 335-351.

Foster, G., C. Olsen, and T. Shevlin. "Earnings Releases and the Behavior of Security Returns." *The Accounting Review* 59 (October 1984):574-603.

Freeman, R. "The Association Between Accounting Earnings and Security Returns for Large and Small Firms." *Journal of Accounting and Economics* 9 (1987):195-228.

Freeman, R. and S. Tse. "A Non-Linear Model of Security Price Responses to Earnings Announcements." *Journal of Accounting Research* 30 (Autumn 1992):185-209.

Grant, E. "Market Implications of Differential Amounts of Interim Information." *Journal of Accounting Research* 18 (1980):255-68.

Ho, L. "Option Trading and the Relation Between Price and Earnings: A Cross-Sectional Analysis." *The Accounting Review* 68 (April 1993); 368-84.

Lobo, G., and A. Mahmoud. "Relationship Between Differential Amounts of Prior Information and Security Return Variability." *Journal of Accounting Research* 27 (Spring 1989): 116-134.

Manaster, S., and R. Rendleman. "Option Prices as Predictors of Equilibrium Stock Prices." *Journal of Finance* 37 (September 1982): 1043-58.

O'Brien, P., and R. Bhushan. "Analyst Following and Institutional Ownership." *Journal of Accounting Research* 28 (Autumn 1990): 55-76.

Patell, J. "Corporate Forecasts of Earnings per Share and Stock Price Behavior: Empirical Tests." *Journal of Accounting Research* 14 (Autumn 1976): 55-76.

Rendleman, R., C. Jones, and H. Latané. "Empirical Anomalies Based on Unexpected Earnings and the Importance of risk Adjustment." *Journal of Financial Economics* 10 (1982): 269-287.

Scholes M., and J. Williams. "Estimating Betas from Non-Synchronous Data." *Journal of Financial Economics* 5 (1977): 307-327.

Shores, D. "The Association Between Interim Information and Security Returns Surrounding Earnings Announcements." *Journal of Accounting Research* 28 (1990):164-81.

Skinner, D. "Options Markets and Stock Return Volatility." *Journal of Financial Economics* 23 (June 1989): 61-78.

_____. "Options Markets and the Information Content of Accounting Earnings Releases." *Journal of Accounting and Economics* 13 (October 1990):191-211.