University of Alberta

THREE ESSAYS ON FINANCIAL ACCOUNTING - EMPIRICAL STUDIES

by

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To my loving wife and son.

Abstract

This dissertation consists of three essays that empirically examine three separate issues in the area of financial accounting. The first study, "Effect of Market Inefficiency on the Value-relevance of Earnings", focuses on how different levels of market efficiency affect the value-relevance of accounting information. I find that the level of market inefficiency is negatively associated with the amount of future earnings information imbedded in current returns. I also find that the level of market inefficiency is negatively associated with the amount of current earnings information imbedded in current returns. The second paper, "Effect of Option Listing on Price Adjustments around Earnings Announcements", examines how exchange-listed options can enhance the informational efficiency of stock market. We find that the existence of listed options is: i) positively associated with the magnitude of pre-earnings announcement drift, ii) positively associated with the magnitude of price response immediately after earnings releases, and iii) negatively associated with the magnitude of post-earnings announcement drift. Our findings indicate that the existence of options results in more complete and faster stock price adjustment and, thus improve the informational efficiency in the market. The third paper, "Voluntary Disclosure of Financial Statement Information in Quarterly Earnings Announcements and Its Impact on Trading Activities of Investors and Information Asymmetry", investigates the capital market effects of voluntary disclosure of balance sheet and cash flow statement information in the press release on the trading activities of investors and information asymmetry among them. We find that investors are *incrementally* informed by the voluntary disclosure of balance sheet and cash flow statement information. We also find that the main beneficiaries of this voluntary practice are large investors. Finally, we find that a firm's decision to provide or not to provide the additional information does not have any systematic effect on the changes in information asymmetry during the period of earnings announcements.

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CHAPTER 1

INTRODUCTION

This dissertation consists of three essays that empirically examine three separate issues in the area of financial accounting. The first study, "Effect of Market Inefficiency on the Value-relevance of Earnings", focuses on how different levels of market efficiency affect the value-relevance of accounting information; the second paper, "Effect of Option Listing on Price Adjustments around Earnings Announcements", examines how exchange-listed options can enhance the informational efficiency of stock market; and the third paper, "Voluntary Disclosure of Financial Statement Information in Quarterly Earnings Announcements and Its Impact on Trading Activities of Investors and Information Asymmetry", investigates the capital market effects of voluntary disclosure of balance sheet and cash flow statement information in the press release on the trading activities of investors and information asymmetry among them.

In Chapter 2, I examine the effect of market inefficiency on the value-relevance of earnings. I measure the degree of market inefficiency by the speed at which a stock's price responds to market-wide information. By using this measure, I investigate the impact of market inefficiency both on the estimated coefficient on current earnings (ERC) and on the estimated coefficient on future earnings (FERC) of return/earnings regression. I hypothesize that market inefficiency will negatively affect the informativeness of firms' future and current earnings.

As hypothesized, I find that the level of market inefficiency is negatively associated with the amount of future earnings information imbedded in current returns. I also find that the level of market inefficiency is negatively associated with the amount of current earnings information imbedded in current returns. These results clearly show that current and future earnings of firms with low levels of market efficiency are less informative – or less value-relevant – than firms with high levels of market efficiency. These results hold after controlling for many other factors such as size, growth opportunities, risk, and persistence; separating loss firms from profit firms; decomposing earnings into operating cash flow; potential cross-sectional correlations; and difference in liquidity.

By showing the magnitude as well as the direction of the impact of market inefficiency, this study demonstrates that market inefficiency is an important factor that should be considered and investigated more in value-relevance study.

Chapter 3 investigates the effect of option listing on stock price adjustments to earnings news. Consistent with prior research, we assert that exchange-listed options are preferred trading vehicles for informed traders because of greater leverage and lower transaction cost. These advantages of options, in turn, give stronger incentives for these traders to acquire private information and to engage in trading activities to exploit their information advantages. The increases in information production and arbitrage activities will lead to more efficient equity markets.

We extend prior research by examining more recent data and by considering the price movements in the pre-announcement and post-announcement periods as well as the earnings announcement period. After controlling for a wide range of firm characteristics, we find that the existence of listed options is: i) positively associated with the magnitude of pre-earnings announcement drift, ii) positively associated with the magnitude of price response immediately after earnings releases, and iii) negatively associated with the magnitude of post-earnings announcement drift. We interpret the first result as evidence that option listing provides investors with increased incentives to engage in information production activities and to exploit their information advantages prior to earnings announcements. Our second result suggests that the availability of exchange-traded options leads stock prices to reflect the content of newly announced earnings information more quickly and more completely. Our third result, together with the first two, implies that option listing alleviates the post-earnings announcement drift caused by a delayed price response. Our findings indicate that the existence of options results in more complete and faster stock price adjustment and, thus improve the informational efficiency in the market. Our results are also consistent with the view that transaction costs cause a delayed price response to earnings news in the post-earnings announcement period and the existence of exchange-traded options reduces the magnitude of post-earnings announcement drift.

Finally, Chapter 4 examines the capital market effects of a voluntary disclosure

practice. In their press releases, some firms include only limited earnings numbers, but others provide disclosures beyond earnings figures, such as balance sheet and/or cash flow statement. While this form of voluntary disclosure has been widely used by firms, prior studies on this issue have focused on either management incentives to provide the supplementary information or its pricing effect. Unlike these studies, we examine the impact of this voluntary disclosure on trading volume reactions of different investor classes and information asymmetry among market participants. Specifically, we examine whether investors are *incrementally* informed by the voluntary balance sheet and/or cash flow information disclosure. We also investigate whether the informedness of investors by this voluntary disclosure practice is different across heterogeneous types of investors. We categorize investors into two groups – large investors and small investors – and examine which group is the main beneficiary of this voluntary disclosure. Finally, we test whether this voluntary disclosure practice reduces information asymmetry among investors.

We find that investors' abnormal trading activities around earnings announcement periods are greater for firms which voluntarily disclose balance sheet and/or cash flow information than for firms which do not disclose this information. This result suggests that investors are *incrementally* informed by the voluntary disclosure of balance sheet and cash flow statement information. By comparing parameter estimates using Seemingly Unrelated Regressions, we also find that large investors' trading response to this voluntary disclosure is significantly larger than small investors', indicating that the main beneficiaries of this voluntary practice are large investors. Finally, we find that a firm's decision to provide or not to provide the additional information does not have any systematic effect on the changes in information asymmetry during the period of earnings announcements.

Our study contributes to current literature in several ways. First, this study extends our understanding of the consequences of voluntary disclosure. To the best of our knowledge, this paper provides the first empirical evidence on the trading responses to this voluntary disclosure practice. Second, our study contributes to the literature regarding the relation between investor sophistication and accounting information. We compare small and large investor group's trading response to the voluntary disclosure and find that large investors are better informed than small investors during earnings announcements and that the voluntary disclosure increases the informedness of large investors more than that of small

investors. Finally, the decomposition of the bid-ask spread and the use of the adverse selection component of the spread as a proxy for information asymmetry mitigate a potential measurement error problem associated with using the quoted bid-ask spread.

CHAPTER 2

EFFECT OF THE MARKET INEFFICIENCY ON THE VALUE-RELEVANCE OF EARNINGS

I. INTRODUCTION

This study examines the effect of market inefficiency on the value relevance of earnings. In most value-relevance studies, regressions of stock prices or returns on accounting earnings are used to get inferences about the informativeness of earnings. Although market efficiency is an important implicit assumption of this regression, most value-relevance studies are silent on the market efficiency issue and seem to make inferences based on the assumption that the stock market is efficient in the semi-strong form. However, there is substantial evidence to suggest that the market may not be completely efficient in the processing of public information. Researchers have studied various forms (and sources) of market inefficiency, such as incomplete information, asymmetric information, transaction costs, short-sale constraints, taxes, liquidity, noise trader, and investor irrationality.[1] How important are these features of market inefficiency for understanding and interpreting the results from the value-relevant studies? This study seeks to address this question.

I define market efficiency in terms of the speed at which prices react to new information. In an efficient capital market, a security's price reaction to information is expected to be immediate and instantaneous. For example, Fama (1965, p.76) states that "In an efficient market, on the average, competition will cause the full effects of new information on intrinsic values to be reflected 'instantaneously' in actual prices". Accordingly, the empirical proxy for the degree of market efficiency in this study is the average speed with which a stock's price responds to common information. The link between the speed of price reaction to information and the market efficiency is consistent with views that the process of information incorporation could be delayed by some factors

[1] Accounting researchers have tested market efficiency using various themes and methodologies such as post-earnings-announcement drift (Bernard and Thomas, 1989; Bartov, 1992; and Bhushan, 1994; Mendenhall, 2002; and Ke and Ramalingegowda, 2005), accounting method difference and change (Hand, 1993; and Dhaliwal *et al.*, 1999), and cross-sectional return predictability (Collins and Hribar, 2000; and Hirshleifer *et al.*, 2004).

such as an incomplete market, transaction costs, neglected firms, among others. For example, Diamond and Verrecchia (1987) present a model in which short-sale constraints reduce the speed of price adjustment to news, especially to bad news. Merton (1987) develops a model of incomplete information. Hong and Stein (1999) develop a model in which private information slowly diffuses across the population. Peng (2005) shows that investors process information gradually because of their information capacity constraints (i.e., investors have limited time and attention to process information). The measure of speed of price reaction used in this paper aims to capture the effect of the aforementioned characteristics of market inefficiency on the price discovery process of a stock.

The main focus of this study is whether market friction has any impact on the informativeness of earnings. Specifically, this study investigates the impact of market friction on the estimated coefficient on both current earnings (i.e., earning response coefficient: ERC) and future earnings (i.e., future ERC: FERC) of return/earnings regression.[2] If a firm faces a significant amount of friction, that market friction will hinder the information in future earnings, as well as current earnings, from being incorporated into current returns. Therefore, I hypothesize that market inefficiency will negatively affect the informativeness of firms' future earnings and current earnings.

To test the hypotheses, I use the regression of annual returns on current and future earnings. Following Collins *et al.* (1994), lagged earnings and future returns are included in the regression to mitigate the error-in-variables problem. The final sample consists of 22,579 firm-year observations during the period 1988 to 2006.

The results of the main regression analysis support the hypotheses. Specifically, I find a significantly negative association between firms' market inefficiency levels, as measured by the speed of stock price adjustment to market-wide information, and the amount of future earnings information reflected in the current annual returns. I also find a significantly negative association between firms' market inefficiency levels and the amount of current earnings information reflected in the current annual returns. These results hold after controlling for many other factors such as size, growth opportunities, risk, and persistence; separating loss firms from profit firms; decomposing earnings into operating

[2] Recently, the value relevance of future earnings drew the attention of many researchers. Studies of this nature include future earnings into the return/earnings regression and test whether the future earnings have any significant explanatory power to current returns (Collins *et al.* 1994; Ayers and Freeman, 2000 & 2003; Lundholm and Myers, 2002; Jiambalvo *et al.*, 2002; and Tucker and Zarowin, 2006). Tucker and Zarowin (2006) use the term 'FERC' for this association.

cash flow; potential cross-sectional correlations; and difference in liquidity. Results of this study clearly show that current and future earnings of firms with lower levels of market efficiency are less informative – or less value-relevant – than firms with high levels of market efficiency.

To my knowledge, this is one of the first studies in the accounting literature that addresses the impact of market inefficiency on the magnitude of coefficients in the value-relevance studies. By showing the magnitude as well as the direction of the impact of market inefficiency, this study demonstrates that market inefficiency is an important factor that should be considered when we make any inferences from the value-relevance studies. As Aboody *et al.* (2002) mentioned, accounting research evolves toward more detailed investigations on not only the sign but also the magnitude of the value relevance coefficient. In this course of trend, I believe that researchers should try to understand more about the role and impact of market inefficiency on the value relevance research.

The results of this study have an important implication for the value relevance studies with an international setting. Previous research shows that cross-country differences in institutional environments – such as corporate governance, legal and financial systems, and ownership structure – cause cross-sectional differences in the value relevance of accounting information (Alford *et al.*, 1993; Joos and Lang, 1994; Ali and Hwang, 2000; Ball *et al.*, 2000; Hung, 2000; Fan and Wong, 2002; and DeFond *et al.*, 2007). These international value relevance studies implicitly assume that stock markets in different countries are reasonably efficient. Further, and more importantly, they assume that the levels of efficiency of each country's stock market are comparably similar. However, prior studies show that differences in market structures result in different levels of market efficiency (Masulis and Shivakumar, 2002). This indicates that the informational efficiency of each country could be significantly different. If this is the case, the differences in the value relevance of accounting numbers across countries could be attributable to the differences in market efficiency across countries. For example, DeFond *et al.* (2007) find weak stock market reaction to earnings announcements in countries with weak investor protection mechanisms and conclude that earnings are less value relevant in those countries. However, if countries with weak investor protection institutions have informationally inefficient stock markets, a possible alternative explanation for their findings is that stock market

inefficiency, not investor protection mechanism, is the factor explaining the association they find. This study's finding – association between market efficiency levels and the value relevance of accounting numbers – makes the alternative explanation very plausible. The results of this study clearly show that value relevance studies, especially studies with an international setting, should consider the potential correlated omitted variable problem related to the differences in informational efficiency.

The remainder of the paper is organized as follows. Section II introduces prior literature. Section III describes the market inefficiency measure, hypotheses development, and the methodology. Section IV describes data. Section V presents empirical results. Section VI presents robustness tests. Section VII summarizes the paper.

II. RELATION TO PRIOR LITERATURE

As discussed above, market efficiency is a critical assumption of the value-relevance study. If the market is not as efficient as we have assumed, then we would have to be careful in interpreting the results from value-relevance studies.[3] However, researchers have not paid enough attention to the validity of the market efficiency assumption and its impact on the value-relevance research.

One notable exception is Aboody, Hughes, and Liu (2002) who investigate the impact of market inefficiency on value-relevance studies. They define market inefficiency as the extent to which a stock price reflects its intrinsic value, i.e., the present value of expected future dividends conditional on all available information, with a measurement error. Assuming all market inefficiencies resolve over time, they adjust current stock prices for predictable future price changes that may be driven by a measurement error. Aboody *et al.* (2002, p. 965) argue that this procedure "adjusts contemporaneous stock prices for future risk adjusted price changes, and yields value relevance coefficient estimates that capture both contemporaneous and delayed market reactions". They apply this adjustment procedure to three types of value-relevance tests of: 1) earnings and book values, 2) residual income, and 3) accruals and cash flows. Their empirical findings generally show

[3] For example, Holthausen and Watt (2001, p. 18) state: "... it is necessary for all the studies to assume at least that capital markets are reasonably efficient. Otherwise the variables reflected in stock prices would not be good estimates of variables of interest and ...." In addition, Tucker and Zarowin (2006, p. 268) discuss the importance of the efficient market assumption for their empirical results: "the interpretation of our results critically relies on the assumption of *market efficiency*. In the presence of mispricing, our results are subject to reinterpretation..."

that the adjustment procedure reduces the bias of estimated coefficients in a conventional value relevance regression, proving that market inefficiency indeed makes an impact on the value relevance of accounting information. This paper is intended to augment the findings of Aboody *et al.* (2002) by using a different definition of market inefficiency and a different methodology. While they define market inefficiency by using the degree of stock prices' deviances from their intrinsic values, I define market inefficiency by using the speed of price adjustment to common information. While Aboody *et al.* (2002) use an adjustment procedure to change the dependent variable, I directly investigate the impact of market inefficiency by observing the estimated coefficients of both contemporaneous and future earnings.

This paper's methodological approach closely follows on the works of Collins, Kothari, Shanken, and Sloan (1994) and Lundholm and Myers (2002). Based on the fact that accounting earnings lag prices, Collins *et al.* (1994) include future years' returns into the regression of current annual returns on current annual earnings and find that this inclusion significantly increases the explanatory power of the regression. They conclude that earnings' lack of timeliness, not value-irrelevant noise, is the main cause of the weak contemporaneous return-earnings association. Lundholm and Myers (2002) use Collins *et al.* (1994)'s approach to explain how a firm's disclosure activity affects the relation between current annual stock returns, contemporaneous annual earnings and future earnings. Using AIMR (The Association for Investment Management and Research) ratings of corporate disclosures, they find a significant positive association between a firm's disclosure level and the amount of future earnings reflected in the current returns. They argue that firms with more informative disclosures "bring the future forward". Following Collins *et al.* (1994) and Lundholm and Myers (2002), I add future earnings, future returns, and interaction terms between the measure of market inefficiency and earnings variables to investigate the effect of market inefficiency on the value relevance of current earnings and future earnings.[4]

Several prior empirical studies have examined various issues about the speed of price adjustment. Jennings and Starks (1985) document a positive correlation between the speed of price reaction to earnings announcements and the size of the earnings price reaction.

[4] The details of the methodology are discussed in the Section III. Hypotheses and Methodology.

Defeo (1986) finds that the duration of market reaction to earnings announcements is positively associated with the firm size and the type of report. Masulis and Shivakumar (2005) find that price adjustments to seasoned equity offering announcements are quicker for NASDAQ firms than NYSE/AMEX firms and conclude that this result is due to differences in market structures. Most previous empirical studies on this issue relate the speed of price adjustment with the efficiency of the information incorporation process of a stock or a market. To my knowledge, this paper is the first attempt to use the speed of price adjustment to investigate the impact of market inefficiency on the value-relevance of accounting numbers.

III. HYPOTHESES AND METHODOLOGY

3.1 The Measure of Market Inefficiency (Price Delay Measure)

For the construction of the measure of market inefficiency, I mainly follow the methodology of Hou and Moskowitz (2005). For each calendar year, I run two regressions. First, I regress each firm's weekly returns on the same week's market return and four lagged market returns.[5] Second, I regress each firm's weekly returns on only the same week's market return.[6] Those two regression equations are the following:

$$r_{i,t} = \alpha_i + \beta_i R_{m,t} + \sum_{n=1}^{4} \lambda_i^{(-n)} R_{m,t-n} + \varepsilon_{i,t} \quad \text{and} \tag{1}$$

$$r_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \tag{2}$$

where $r_{i,t}$ is the return on firm i in week t, $R_{m,t}$ is the return on the CRSP value-weighted market index for NYSE/AMEX firms in week t, and $R_{m,t-n}$ is the same market index return in week t-n (i.e., lagged market index return). The speed of a stock's reaction to market-wide information can be captured by the magnitude of the estimated coefficients from the above two equations. For example, for a stock with a high speed of reaction to

[5] Weekly returns are defined to be the compounded daily returns from Wednesday to the following Wednesday, following Hou and Moskowitz (2005) and Chordia and Swaminathan (2000). These studies document high autocorrelations using Friday to Friday prices and low autocorrelations using Monday to Monday prices. As Hou and Moskowitz (2005) discussed, Wednesday seems like a suitable alternative.

[6] Weekly returns, as opposed to monthly or daily, are used in this study based on the discussion of Hou and Moskowitz (2005) that monthly returns produce little dispersion of the price delay measure and daily returns are vulnerable to more confounding microstructure influences. For more detailed discussion, please consult Hou and Mostkowitz (2005) p. 984. I regenerate results using monthly returns as a robustness check (not tabulated) and find no qualitative differences in results.

market-wide information, the contemporaneous coefficient (β_i) should be significantly different from zero, but the lagged coefficients ($\lambda_i^{(-1)}$, $\lambda_i^{(-2)}$, $\lambda_i^{(-3)}$, and $\lambda_i^{(-4)}$) should be close to zero. For a stock with a lower speed of reaction to market-wide information, the magnitude of the contemporaneous coefficient (β_i) should be smaller (and could be insignificant) and one and/or some of the lagged coefficients ($\lambda_i^{(-1)}$, $\lambda_i^{(-2)}$, $\lambda_i^{(-3)}$, and $\lambda_i^{(-4)}$) should be significantly different from zero.

For each year, the measure of price delay for each firm is computed using both equation (1) and (2). The price delay measure is the difference of the explained portion of each firm's return variation between the full model [i.e., equation (1)] and the restricted model [i.e., equation (2)]. That is, the measure is simply one *minus* the fraction of the R^2 from the restricted regression [i.e., equation (2)] over the R^2 from the full regression [i.e., equation (1)]:

$$D = 1 - \frac{R^2(restricted)}{R^2(full)} \tag{3}$$

If a stock's price responds slowly to market-wide information, then D for the stock will be larger because a larger portion (smaller portion) of return variation of the stock will be captured by lagged market returns (by the contemporaneous market return). If a stock price responds immediately to market news, then D for the stock will be smaller because of a smaller portion (larger portion) of return variation of the stock will be captured by lagged market returns (by the contemporaneous market return).

3.2 Development of Hypotheses and Methodology

I start from the conventional framework of return-earnings relation that has its theoretical foundation on the discounted cash flows valuation model. By assuming that investors' revisions in dividend expectations are correlated with revisions in earnings expectation (e.g., Kormendi and Lipe, 1987), Collins *et al.* (1994) model the return-earnings relations as:

$$R_t = \beta_0 + \beta_1 UX_t + \sum_{k=1}^{\infty} \beta_{k+1} \Delta E_t(X_{t+k}) + \varepsilon_t \tag{4}$$

where

R_t = the annual stock return for year t,
X_t = the earnings for year t,
UX_t = the unexpected earnings for year t, defined as $X_t - E_{t-1}(X_t)$, and
$\Delta E_t(X_{t+k})$ = the change in expectations between year t-1 and t for year $t + k$ earnings.

This framework implies that the current period return is determined by unexpected current earnings, cumulated changes in investors' expectation for future earnings, and a noise term[7]. Since the market's earnings expectations are unobservable, researchers use realized earnings to proxy those unobservable variables in equation (4). Then equation (4) can be restated as:

$$R_t = b_0 + b_1 X_t + \sum_{k=1}^{\infty} b_{k+1} X_{t+k} + \varepsilon_t \tag{5}$$

However, equation (5) is subject to an errors-in-variables problem that biases the regression's explanatory power downward. Collins *et al.* (1994) explain this errors-in-variables problem issue by rewriting equation (5) like the following:

$$R_t = b_0 + b_1[UX_t + E_{t-1}(X_t)] + \sum_{k=1}^{\infty} b_{k+1}[\Delta E_t(X_{t+k}) + UX_{t+k} + E_{t-1}(X_{t+k})] + \varepsilon_t \tag{6}$$

where

UX_t = the unexpected earnings for year t ($= X_t - E_{t-1}(X_t)$),
$E_{t-1}(X_t)$ = the market's expectation at year t-1 for year t earnings,
$\Delta E_t(X_{t+k})$ = the change of market's expectations between year t-1 and t for year $t + k$ earnings, and
UX_{t+k} = the unexpected (at t) earnings for year $t + k$ ($= X_{t+k} - E_t(X_{t+k})$).

In Equation (6), $E_{t-1}(X_t)$, $E_{t-1}(X_{t+k})$, and UX_{t+k} are measurement errors that are

[7] Collins *et al.* (1994) express this relationship using the 'growth rate' of earnings as the independent variables (see equation (3) of Collins *et al.* (1994)). However, as Kothari (2001) clarifies, the intuition from the analysis using the 'growth rate' of earnings is qualitatively the same as that from the analysis using earnings or earnings change, deflated by price, as the independent variables in the regressions

unrelated to R_t. $E_{t-1}(X_t)$, the expected portion of X_t, acts as a measurement error because it is 'stale' information that has been incorporated in past returns, and it is irrelevant to explain current returns. Therefore, the estimated earnings response coefficient is biased and it reduces the model's explanatory power. Similarly, $E_{t-1}(X_{t+k})$, the expected portion of X_{t+k}, is unrelated to R_t and acts as a measurement error in X_{t+k} because it is 'stale' information. UX_{t+k}, the unexpected (at *t*) portion of X_{t+k}, acts as an measurement error because it is caused by shocks (or new information) in future periods that affect X_{t+k}, but were not expected at the end of period *t*. Therefore it cannot explain current return, R_t.

Following Collins *et al.* (1994), many studies include measurement error proxies in the return-earnings regression in order to mitigate this error-in-variables problem. The rationale behind this approach is that the higher the correlation between measurement errors and their proxies, the greater the mitigation of the error-in-variables problem. Collins *et al.* (1994) use the realized earnings for year *t* -1, X_{t-1}, as the proxy for the market's expectation (at year *t* -1) of both current and future earnings [i.e., proxy for both $E_{t-1}(X_t)$ and $E_{t-1}(X_{t+k})$]. To mitigate the errors-in-variables problem related to UX_{t+k}, they also include the future return, R_{t+k}, in the regression. This inclusion of R_{t+k} is based on the idea that an unexpected shock (or new information) to future earnings should also affect future returns. To the extent that the unexpected portions in future earnings are correlated to future returns, the inclusion of future returns into the regression will control for the unexpected portion of future earnings (i.e., control for the measurement error), leaving only the expected portion of future earnings.[8]

While Collins *et al.* (1994) use earnings changes as the explanatory variables, Lundholm and Myers (2002) and Tucker and Zarowin (2006) use the level of earnings as the explanatory variable to allow for a more general form of earnings expectations model.[9] I also use the levels of past, current, and future earnings. Specifically, I implement Collins *et al.* (1994)'s approach by using the following regression:

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[8] This process can be explained by a two-stage procedure. For details, see the appendix of Kothari and Shanken (1992).

[9] Lundholm and Myers (2002) state that "using the level of current and future years is equivalent to using the change in current and future earnings; the regression has the same information in either case"

$$R_t = b_0 + b_1 X_{t-1} + b_2 X_t + \sum_{k=1}^{3} (b_{3k} X_{t+k} + b_{4k} R_{t+k}) + \varepsilon_t \quad (7)$$

As mentioned before, b_2 is the estimated coefficient of current earning (ERC) and b_{3k} s are the estimated coefficients of future earnings (FERCs). I use three years of future earnings and returns because it has been shown that including more than three years adds little explanatory power (Collins *et al.*, 1994). In the interest of brevity, as well as to be consistent with the previous research, I combine the three future year's earnings into one variable - X_{t3} and the three future years' return into one variable - R_{t3}. [10] Therefore, the condensed version of Collins *et al.* (1994)'s benchmark regression model will have the following form:

$$R_t = b_0 + b_1 X_{t-1} + b_2 X_t + b_3 X_{t3} + b_4 R_{t3} + \varepsilon_t \quad (8)$$

where

R_t = the annual stock return for year t,

X_t = the earnings per share (basic EPS excluding extraordinary item: Compustat Data #58) for year t, adjusted for stock splits and stock dividend, deflated by the stock price at the beginning of Year t,

R_{t3} = the aggregate stock return in Year t+1 to t+3 with annual compounding, and

X_{t3} = the sum of earnings for Year t+1 to t+3.

Equation (8) is the basic equation upon which the impact of market efficiency on the relation between current returns and future earnings, as well as current earnings, will be tested.

I hypothesize that the informativeness of firms' future earnings is negatively affected by the degree of market inefficiency for the firms. If a firm faces a significant amount of friction in terms of informational efficiency, that market friction will hinder the information in the future earnings from being incorporated into current returns. This prediction is consistent with previous empirical findings. Jiambalvo *et al.* (2002) show the extent to which stock prices lead earnings is positively related to the percentage of institutional

[10] Combining three future variables into one variable doesn't make any qualitative differences in test results. Therefore, I only tabulate the test results using the condensed version of regression.

ownership. Ayers and Freeman (2003) find that prices of firms followed by sell-side analysts incorporate future earnings earlier than those of other firms. They both argue that market professionals (sell-side and buy-side) are more sophisticated investors who more accurately predict future earnings using current earnings, compared with other investors. If these sophisticated and non-sophisticated investors arguments can be extended to any underlying theories of market inefficiency, such as bounded rationality (Hong and Stein, 1999) and information capacity constraints (Peng, 2005), their empirical findings could be interpreted as evidence that market inefficiency affects the return/earnings relation. Therefore, I conjecture that returns of firms with lower levels of market inefficiency reflect more information in future earnings than firms with higher levels of market inefficiency (i.e., prices incorporate more future earnings as market efficiency increases). This leads to the first hypothesis.

H1: The magnitude of information in future earnings, reflected in current stock returns, is negatively related to the level of market inefficiency.

I test this hypothesis using the following regression:

$$R_t = b_0 + b_1 X_{t-1} + b_2 X_t + b_3 X_{t3} + b_4 R_{t3} + b_5 D_t + b_6 D_t * X_{t-1} + b_7 D_t * X_t + b_8 D_t * X_{t3} + b_9 D_t * R_{t3} + \varepsilon_t \quad (9)$$

where

R_t = the annual stock return for year t,

X_t = the earnings per share (basic EPS excluding extraordinary item: Compustat Data #58) for year t, adjusted for stock splits and stock dividend, deflated by the stock price at the beginning of Year t,

R_{t3} = the aggregate stock return in Year t+1 to t+3 with annual compounding,

X_{t3} = the sum of earnings for Year t+1 to t+3, and

D_t = the market inefficiency measure (the price delay measure) in year t.

I estimate regression (9) on pooled cross-sectional, time-series data. If the market friction negatively affects the informativeness of future earnings incorporated in current returns, then the coefficients on $D_t * X_{t3}$ should be negative (i.e., $b_8 < 0$). If the market

friction has no effect on the informativeness of future earnings, the coefficients on $D_t * X_{t3}$ should be close to zero. Consistent to prior research, the coefficient on X_{t-1} is predicted to be negative and the coefficient on X_t to be positive, reflecting the negative serial correlation pattern of annual earnings (Lundholm and Myers, 2002). Also, the coefficient on X_{t3} is expected to be positive and the coefficient on R_{t3} is expected to be negative.

The second hypothesis focuses on how market inefficiency can affect the informativeness of current earnings news. If market inefficiency plays the same role as it does to future earnings, then I will find less relevant current earnings. If market inefficiency has an effect on the relation between the current return and future earnings but doesn't have the same effect for the current earnings, the increase in the severity of market friction causes returns to depend more heavily on current earnings, and current earnings news might become more relevant.[11] Therefore, I use the null form of the hypothesis for the second hypothesis instead of an alternative form.

H2: The magnitude of information in current earnings, reflected in current stock returns, is not related to the level of market inefficiency.

I test this hypothesis with the coefficient of the interaction term $D_t * X_t$ in equation (9). If the market friction is negatively related to the informativeness of current earnings incorporated in current returns, then the coefficient on $D_t * X_t$ should be negative (i.e., $b_7 < 0$). If the market friction has no impact on the degree of information in future earnings, which is reflected in current returns, the coefficient on $D_t * X_t$ should be close to zero.

IV. DATA

I obtain stock returns from the CRSP (Center for Research in Security Prices) database. Returns for firms *i* at time *t* are the buy-and-hold returns for year *t*. Annual earnings data are collected from COMPUSTAT. Earnings for year *t* are defined as earnings per share

[11] It is also possible that market friction has an impact on current earnings but no has no impact on future earnings. I discuss this possibility at the result section.

before extraordinary items available to common (Compustat annual data #58). All earnings figures are deflated by the stock price at the end of year $t - 1$ for the cross-sectional comparison.

I choose the sample period of 1988 to 2006. The period begins with 1988 because I want to match the starting period with the most recent relevant research (Tucker and Zarowin, 2006) and it is the first year when cash flows statement is required. I delete all firm-year observations if missing data is found for the past, current, and future 3 years of earnings, operating cash flows, accruals, and the future 3 years of returns. Following the convention of accounting research, I also exclude firms in the financial and regulated industries because of their different nature of accounting[12]. To mitigate the effect of outliers, I windsorize all variables at the bottom one percent and top one percent. Finally, the sample is restricted to December-year-end firms to make sure that there is no influence by the difference in fiscal year-end. These procedures generate a final sample of 22,579 firm-year observations.

Insert Table 1

Table 1 presents summary statistics for the final sample. The median annual stock return (R_t) is 0.027 and the median current earnings (X_t) value is 0.034. The median delay measure (the market inefficiency measure) is 0.536, ranging from 0 to 1. Generally, the final sample statistics are similar to previous research (Lundholm and Myers, 2002; and Tucker and Zarowin, 2006).

Insert Table 2

Table 2 presents Pearson (above the diagonal) and Spearman (below the diagonal) correlations for the variables. As expected, the correlation between lag earnings (X_{t-1}) and

[12] Those industries have an SIC of 4000-4999 and 6000-6999.

current earnings (X_t) and between current earnings and future earnings (X_{t3}) are significantly positive. The future returns (R_{t3}) are significantly correlated with future earnings (X_{t3}), consistent with Collins *et al.* (1994), assuring that future returns would do their role as a proxy for the measurement error in future earnings. The correlation results are generally consistent with those of Tucker and Zarowin (2006).

V. EMPIRICAL RESULTS

Table 3 reports the main results. First, in panel A, I replicate the results of the Collins *et al.* model [i.e., equation (8)]. Consistent with previous research, both the ERC and FERC are significantly positive (b_2= 0.873, p-value <0.0001 and b_3=0.109, p-value <0.0001). The significantly positive FERC is consistent with the well-known lead-lag relationship between returns and contemporaneous earnings. It indicates that future earnings are informative in explaining the variation of current returns. As predicted, the coefficients on past earnings and future returns are negative. The negative coefficient on future returns is consistent with previous research (Lundholm and Myers, 2002; and Tucker and Zarowin, 2006). The negative coefficient on future returns demonstrates that realized future earnings contain measurement error and that the inclusion of future returns effectively mitigates the error-in-variable problem.

Insert Table 3

Panel B reports the results of the main model [i.e., equation (9)]. The coefficient on X_{t3} is significantly positive (b_3 = 0.210 and p-value <0.0001) and the coefficient on D_t*X_{t3} is significantly negative (b_8 = -0.145 and p-value <0.0001), indicating that current returns are positively associated with future earnings, but this association weakens as the market inefficiency measure increases. This result supports the first hypothesis that the informativeness of future earnings decreases as the level of market inefficiency increases. The economic interpretation of the result is that a one unit increase in future earnings results in a 0.210 increase in stock return for the firm with the highest level of market

efficiency (i.e., a firm with D of 0), and 0.064 (= 0.210 – 0.145) for the firm with the lowest level of market efficiency (i.e., a firm with D of 1). It is a decrease of roughly 70 percent. Clearly, the level of firms' informational market efficiency plays an important role in the relation between current returns and future earnings. Further, panel B reports the F-statistics for the F-tests of the joint significance of $D_t * X_{t3}$ and $D_t * R_{t3}$. Because $D_t * X_{t3}$ and $D_t * R_{t3}$ together proxy for the expectation of future earnings, a more appropriate test of significance of future earnings is to examine the joint significance of these two variables. The partial F-test of the joint significance of $D_t * X_{t3}$ and $D_t * R_{t3}$ has F-statistics of 24.86 (<0.0001). This result is consistent with the first hypothesis.

The degree of market inefficiency is also associated with the informativeness of current earnings. The coefficient on X_t is significantly positive (b_2 = 1.139 and p-value <0.0001) and $D_t * X_t$ is significantly negative (b_7 = -0.418 and p-value <0.0001). Thus, while the current returns are positively associated with current earnings, this association weakens as the market inefficiency increases.

This result can be interpreted as evidence that the informativeness of current earnings also decreases as the level of market inefficiency increases, rejecting the null form of the second hypothesis that the magnitude of information in current earnings, reflected in current stock returns, is not related to the level of market inefficiency. The economic interpretation of the result is that a one unit increase in current earnings is associated with a 1.139 increase of stock return for the firm with the highest level of market efficiency (i.e., a firm with D of 0), while it results in a 0.720 (= 1.139 – 0.418) increase in stock return for the firm with the lowest level of market efficiency (i.e., a firm with D of 1). It is a decrease of roughly 63 percent. Clearly, the level of a firm's informational efficiency plays an important role in the relation between current returns and contemporaneous earnings.

Thus, the results in Panel A and B of Table 3 support the prediction that the level of market inefficiency is negatively associated with the informativeness of both current earnings and future earnings.

VI. ROBUSTNESS CHECKS

6.1 Potential Correlated Omitted Variables

Prior research has investigated various determinants of ERC. It is possible that the results from the previous section might be due to correlated omitted variables. To address this concern, I control for factors which are known to affect the relation between returns and earnings. Specifically, I control for persistence, growth opportunities, risk, and firm size.

Persistence is included because the more persistent earnings, the easier to predict future earnings. This, in turn, results in greater impact on the market's expectations of future earnings, and therefore the larger the price change or the ERCs (Kormendi and Lipe, 1987; Collins and Kothari, 1989; and Kothari, 2001). Because of the lack of time-series data, I adopted the method of Lundholm and Myers (2002) for the persistence calculation. For each decile of market inefficiency measure, member firm-year observations are used for the regression of X_t on X_{t-1}, with the resulting coefficient assigned as the persistence measure for each firm in the decile.

Growth, measured by the book-to-market ratio, is included because the firms' economic growth opportunities have a positive effect on the earnings response coefficient (Collins and Kothari,1989). Higher economic growth opportunities mean higher future earnings expectation. To the extent current earnings are informative about future growth opportunities – or future earnings expectation, the price change is expected to be larger for firms with higher growth opportunities.[13]

The level of risk, measured by beta using daily returns from CRSP over year *t*, is known to be negatively related to the earnings response coefficient. The greater the risk, the larger the discount rate, and therefore, it reduces the discounted present value of the changes of the market's expectation on future earnings (Easton and Zmijewski, 1989).

Firm size is included to proxy for the information environment and other missing factors that affect the return/earnings relation (Collins and Kothari, 1989). The information environment has been believed to affect the extent to which price changes anticipate earnings change. Collins and Kothari (1989) empirically demonstrate that the returns/earnings relation varies with firm size, where size is a rough proxy for information environment difference.

Control variables are added into the regression model one at a time, referred to as

[13] Please notice that I use the Book-to-Market ratio, which is the inverse measure of the future growth opportunities.

$Control_t$ in equation (10). Following the conventional way, I include $Control_t$ and its interactions with earnings variables in the regression because of the case where $Control_t$ directly affects returns. The regression with control variables has the following form:

$$\begin{aligned} R_t = {} & b_0 + b_1 X_{t-1} + b_2 X_t + b_3 X_{t3} + b_4 R_{t3} \\ & + b_5 D_t + b_6 D_t * X_{t-1} + b_7 D_t * X_t + b_8 D_t * X_{t3} + b_9 D_t * R_{t3} \\ & + b_{10} Control_t + b_{11} Control_t * X_t + b_{12} Control_t * X_{t3} + b_{13} Control_t * R_{t3} + \varepsilon_t \end{aligned} \quad (10)$$

Insert Table 4

Table 4 provides descriptive statistics of four control variables for each decile of the market inefficiency measure. The market inefficiency measure exhibits monotonic relationships with firm size, growth opportunity, and risk. Specifically, bigger firms, firms with more growth opportunities, and more risky firms have greater market efficiency than smaller firms, firms with less growth opportunities, and less risky firms. However, there appears to be no specific relation between the market inefficiency measure and persistence.

Insert Table 5

Panel A of Table 5 reports the regression results with control variables. The second column of Panel A reports the estimated coefficients when the firm size ($Size_t$) is used as a control variable. The third, fourth, and fifth columns are the results when including the book-to-market ratio (BM_t), Risk (β_t), and Persistence ($Persist_t$) as a control variable, respectively. The estimated coefficients on $D_t * X_{t3}$ remain significantly negative regardless of individual models, supporting the first hypothesis that the level of market inefficiency is negatively related to the informativeness of future earnings. The partial F-tests of the joint significance of $D_t * X_{t3}$ and $D_t * R_{t3}$ have F-statistics of 15.50, 17.66, 23.79, and 18.94 for each model. These results suggest that future earnings are significantly

informative for explaining current returns. The estimated coefficient on $D_t * X_t$ is significantly negative under all regression specifications, proving that the level of market inefficiency is an important factor in explaining the current returns after controlling for each control variable.

Panel B of Table 5 reports regression results with all four control variables. The inclusion of all four control variables does not alter previous findings in a meaningful way. The estimated coefficient on $D_t * X_{t3}$ remains significantly negative (b_8 = -0.197 and p-value < 0.0001). The estimated coefficient on $D_t * X_t$ is also significantly negative (b_7 = -0.340 and p-value = 0.0022).

6.2 Profit vs. Loss Firms

I also control for firms with negative earnings, given the evidence in Hayn (1995) and Basu (1995) that profits are more value-relevant than losses. Of the final sample of 22,579 firm-year observations, 7,153 firm-year observations (31.7 percent) reported current year losses. The loss firms are significantly smaller than profit firms. The median market value of equity of loss firms is $ 78.97 million, compared to that of $ 255.49 million for profit firms.[14] The last column of Panel A of Table 5 shows the results after controlling for the incidence of loss. The estimated coefficients on $D_t * X_{t3}$ and $D_t * X_t$ remain significantly negative after controlling for the loss incidence. The partial F-tests of the joint significance of $D_t * X_{t3}$ and $D_t * R_{t3}$ remain significant, indicating that the level of market inefficiency is an important factor in explaining the current returns even after controlling for the incidence of loss. Consistent to the previous research, the coefficient on $Loss_t * X_t$ is significantly negative, indicating that the ERC for loss firms is lower than that for profit firms.

6.3 Decomposing Earnings into Cash Flows and Accruals

Following Tucker and Zarowin (2006), I extend the model to examine whether the market inefficiency impacts operating cash flows and accruals in a different manner. In

[14] These statistics are not tabulated.

doing so, I decompose earnings into operating cash flows (CFO) and accruals (ACC)[15]. The decomposed regression equation will have the following form:

$$\begin{aligned} R_t = {} & b_0 + b_1 CFO_{t-1} + b_2 CFO_t + b_3 CFO_{t3} + b_4 ACC_{t-1} + b_5 ACC_t + b_6 ACC_{t3} + b_7 R_{t3} \\ & + b_8 D_t + b_9 D_t * CFO_{t-1} + b_{10} D_t * CFO_t + b_{11} D_t * CFO_{t3} \\ & + b_{12} D_t * ACC_{t-1} + b_{13} D_t * ACC_t + b_{14} D_t * ACC_{t3} + b_{15} D_t * R_{t3} + \varepsilon_t \end{aligned} \quad (11)$$

The primary focus is on the four interaction terms with the delay measure (i.e., $D_t * CFO_{t3}$, $D_t * CFO_t$, $D_t * ACC_{t3}$, and $D_t * ACC_t$). If the degree of market inefficiency is negatively related to the informativeness of future cash flows incorporated in current return, then the coefficients on $D_t * CFO_{t3}$ should be negative. If the market friction has no effect on the informativeness of future cash flows, the coefficients on $D_t * CFO_{t3}$ should be close to zero. The same logic can be applied to the coefficients on the other three interaction terms with the delay measure.

Panel C of Table 3 reports the results of equation (11). The coefficient on CFO_{t3} is significantly positive (b_3 = 0.228 and p-value <0.0001), while that on $D_t * CFO_{t3}$ is significantly negative (b_{11} = -0.177 and p-value <0.0001). These results show that future cash flows are informative to explain the variability of current returns and the informativeness of future cash flows decreases as the level of market inefficiency increases. However, the coefficients on ACC_{t3} and $D_t * ACC_{t3}$ are insignificant (b_6 = -0.010, p-value =0.673 and b_{14} = -0.029, p-value =0.409). These results imply that future accruals are not informative to explain the variability of current return and the level of market inefficiency does not have any significant role for the association between current returns and future accruals.

On the other hand, the degree of market inefficiency is associated with the informativeness of both current cash flows and current accruals. The coefficient on CFO_t is significantly positive (b_2 = 1.234 and p-value <0.0001), while that on $D_t * CFO_t$ is

[15] For the decomposition, I follow Tucker and Zarowin (2006). That is: CFO is the operating cash flows for Fiscal Year *t* (Compustat Data308), deflated by the market value of equity at the beginning of Fiscal Year *t*. ACC is the total accrual {= net income before extraordinary items and discontinued operations (Compustat Data 18) *minus* operating cash flows (Compustat Data 308)} for Fiscal Year *t*, deflated by the market value of equity at the beginning of Fiscal Year *t*.

significantly negative (b_{10} = -0.340 and p-value <0.0001). In addition, the coefficient on ACC_t is significantly positive (b_5 = 0.988 and p-value <0.0001) and that on $D_t * ACC_t$ is significantly negative (b_{13} = -0.420 and p-value <0.0001). These results are consistent with the notion that current cash flows and accruals are informative to explain the variability of current return and that the informativeness of current cash flows and accruals decreases as the level of market inefficiency increases.

6.4 Fama-MacBeth Regressions

As another robustness check, I use the Fama-MacBeth (1973) regression to ensure that the results reported earlier are not driven by the potential positive cross-sectional correlations of the residuals. Specifically, I run 14 different cross-sectional regressions, one for each year.[16] Then the estimated coefficients are averaged over the sample period.

Insert Table 6

Panel A of Table 6 reports the results obtained using the primary model [i.e., equation (9)] and panel B of Table 6 reports those from the extended model [i.e., equation (11)]. The mean coefficients on $D_t * X_t$ and $D_t * X_{t3}$ are all significant with predicted signs (b_7 = -0.431, p-value =0.006 and b_8 = -0.185, p-value <0.001). In addition, the mean coefficients on $D_t * CFO_t$ and $D_t * CFO_{t3}$ are also significant with the expected signs (b_{10} = -0.431, p-value =0.056 and b_{11} = -0.249, p-value =0.002). Finally, the mean coefficients on $D_t * ACC_t$ and $D_t * ACC_{t3}$ are -0.583 (p-value =0.024) and -0.147 (p-value =0.09) respectively. Overall, these results from the Fama-MacBeth regression are consistent with the results from the primary analysis.

6.5 Other Robustness Tests

I also investigate whether the main results discussed above are sensitive to the levels

[16] Although the sample period is from 1988 to 2006, the first year and the last 4 years are used to calculate some of variables in the regression.

of liquidity of firms. Kim and Verrecchia (1991) show that trading volume will be an increasing function of available information in the market. Bhusan (1994) argues that trading volume is the inverse measure of indirect trading costs, such as the adverse price impact of the trade and the delay in processing the transaction. Therefore, it is possible to expect that future and current earnings information of highly liquid firms might be more easily incorporated into prices because of more information and less transaction cost. To ensure that this study's main results are not driven by the difference in liquidity of firms, I incorporate three different liquidity measures: (1) average daily trading volume, (2) average daily dollar trading volume, and (3) average daily share turnover (= trading volume / number of shares outstanding) over the fiscal year into the analysis. After including each of these measures into equation (10), I find that the inclusion doesn't affect the primary results qualitatively, i.e., the estimated coefficients on $D_t * X_t$ and $D_t * X_{t3}$ are consistently significant and negative after controlling for liquidity.[17] Finally, I took an approach where the sample is partitioned into portfolios according to the magnitude of each individual control variable. I've partitioned the whole sample into 5 quintiles based on the magnitude of each control variable and run the regression (9) within each quintile. The results are generally similar to those of the main result but not statistically significant.[18]

In summary, the results from the robustness tests confirm those from the main test, that the informativeness of future earnings, as well as current earning, decreases as the level of market inefficiency increases.

VII. CONCLUSION

This study examines the effect of market inefficiency on the value-relevance of earnings. I measure the degree of market inefficiency by the speed at which a stock's price responds to information. By using this measure, I investigate the impact of market inefficiency both on the estimated coefficient on current earnings (ERC) and on the estimated coefficient on future earnings (FERC) of return/earnings regression. I hypothesize that market inefficiency negatively affects the informativeness of firms' future

[17] These results are not tabulated.
[18] These results are not tabulated.

earnings and current earnings.

As hypothesized, I find that the level of market inefficiency is negatively associated with the amount of future earnings information imbedded in current returns. I also find that the level of market inefficiency is negatively associated with the amount of current earnings information imbedded in current returns. These results clearly show that current and future earnings of firms with low levels of market efficiency are less informative – or less value-relevant – than firms with high levels of market efficiency. These findings hold after controlling for many other factors such as size, growth opportunities, risk, and persistence; separating loss firms from profit firms; decomposing earnings into operating cash flow; and potential cross-sectional correlations.

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TABLE 2-1
Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Q1	Median	Q3	Maximum
X_{t-1}	-0.025	0.236	-1.520	-0.026	0.036	0.070	0.253
X_t	-0.006	0.184	-1.040	-0.031	0.034	0.073	0.378
X_{t3}	0.020	0.515	-2.660	-0.103	0.087	0.216	1.634
R_t	0.156	0.720	-0.849	-0.272	0.027	0.368	3.680
R_{t3}	0.610	1.604	-0.945	-0.324	0.205	0.921	9.167
CFO_t	0.091	0.195	-0.464	0.002	0.073	0.154	0.968
ACC_t	-0.094	0.218	-1.254	-0.127	-0.042	-0.002	0.400
D_t	0.544	0.306	0.000	0.272	0.536	0.835	1.000

The table presents descriptive statistics for the entire sample (22,579 firm-year observations), during the sample period of 1988 to 2006. The followings are the Definitions of variables:

X_{t-1} = the earnings per share (Compustat Data 58) for Fiscal Year t-1, deflated by the stock price at the beginning Fiscal Year t

X_t = the earnings per share for Fiscal Year t, deflated by the stock price at the beginning of Fiscal Year t

X_{t3} = the sum of the earnings per share for Fiscal Year t+1 through t+3, deflated by the stock price at the beginning of Fiscal Year t

R_t = the buy and hold return for Fiscal Year t;

R_{t3} = the annually compounded stock return for Fiscal Year t+1 through t+3;

D_t = the price delay measure (the market inefficiency measure) measured over the firm's Fiscal Year t ;

CFO_t = the operating cash flows (Compustat Data 308) for Fiscal Year t, deflated by the market value of equity at the beginning of Fiscal Year t;

ACC_t = the total accrual {= net income before extraordinary items and discontinued operations (Compustat Data 18) – operating cash flows (Compustat Data 308)} for Fiscal Year t, deflated by the market value at the beginning of Fiscal Year t

TABLE 2-2
Pearson and Spearman Correlations

	X_{t-1}	X_t	X_{t3}	R_t	R_{t3}	CFO_t	ACC_t	D_t
X_{t-1}		0.4849	0.2676	-0.0685	-0.0759	0.1115	0.3007	-0.1203
		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
X_t	0.5592		0.4011	0.1629	-0.0632	0.3093	0.4930	-0.0735
	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
X_{t3}	0.3879	0.5218		0.0742	0.2640	0.2782	0.0769	-0.0565
	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
R_t	0.1179	0.3729	0.2570		-0.1213	0.1645	-0.0093	0.0259
	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	0.1609	(<0.001)
R_{t3}	0.0860	0.0860	0.4577	-0.1079		0.0829	-0.1227	0.0531
	(<0.001)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(0.165)
CFO_t	0.3772	0.5055	0.4312	0.2565	0.1847		-0.5950	0.0092
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)
ACC_t	0.0653	0.1972	-0.0409	0.0188	-0.1449	-0.5942		-0.0694
	(<0.001)	(<0.001)	(<0.001)	(0.005)	(<0.001)	(<0.001)		(<0.001)
D_t	-0.1017	-0.0397	-0.0351	-0.0026	0.0076	-0.0258	-0.0388	
	(<0.001)	(<0.001)	(<0.001)	(0.692)	(0.252)	(<0.001)	(<0.001)	

This table presents Pearson and Spearman correlations among various variables. Pearson correlations a re above the diagonal and Spearman correlations are below the diagonal. The sample consists of 22,579 firm-year observations during the period 1988-2006. The followings are the Definitions of variables:

X_{t-1} = the earnings per share (Compustat Data 58) for Fiscal Year t-1, deflated by the stock price at the beginning Fiscal Year t

X_t = the earnings per share for Fiscal Year t, deflated by the stock price at the beginning of Fiscal Year t

X_{t3} = the sum of the earnings per share for Fiscal Year t+1 through t+3, deflated by the stock price at the beginning of Fiscal Year t

R_t = the buy and hold return for Fiscal Year t;

R_{t3} = the annually compounded stock return for Fiscal Year t+1 through t+3;

D_t = the price delay measure (the market inefficiency measure) measured over the firm's Fiscal Year t ;

CFO_t = the operating cash flows (Compustat Data 308) for Fiscal Year t, deflated by the market value of equity at the beginning of Fiscal Year t;

ACC_t = the total accrual {= net income before extraordinary items and discontinued operations (Compustat Data 18) – operating cash flows (Compustat Data 308)} for Fiscal Year t, deflated by the market value at the beginning of Fiscal Year t

TABLE 2-3 Main Results

Panel A: Benchmark Collins *et al.* (1994) Model (equation 8) (# of Observations: 22,579)

$$R_t = b_0 + b_1X_{t-1} + b_2X_t + b_3X_{t3} + b_4R_{t3} + \varepsilon_t$$

	b_0	b_1X_{t-1}	b_2X_t	b_3X_{t3}	b_4R_{t3}	Adj R^2
	0.182	-0.637	0.873	0.109	-0.064	0.073
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	

Panel B: Primary Model (equation 9) (# of Observations: 22,579)

$$R_t = b_0 + b_1X_{t-1} + b_2X_t + b_3X_{t3} + b_4R_{t3} + b_5D_t + b_6D_t*X_{t-1} + b_7D_t*X_t + b_8D_t*X_{t3} + b_9D_t*R_{t3} + \varepsilon_t$$

	b_0	b_1X_{t-1}	b_2X_t	b_3X_{t3}	b_4R_{t3}	b_5D_t	$b_6D_t*X_{t-1}$	$b_7D_t*X_t$	$b_8D_t*X_{t3}$	$b_9D_t*R_{t3}$	Adj R^2
	0.140	-0.639	1.139	0.210	-0.067	0.072	0.018	-0.418	-0.145	0.004	0.076
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.8242)	(0.0001)	(<.0001)	(0.6669)	

The F-statistics for the partial F-tests of the joint significance of D_t*X_{t3} and D_t*R_{t3}: 24.86 (<0.0001)

Panel C: Extended Model – Earnings Decompositions (equation 11) (# of Observations: 22,579)

$$R_t = b_0 + b_1CFO_{t-1} + b_2CFO_t + b_3CFO_{t3} + b_4ACC_{t-1} + b_5ACC_t + b_6ACC_{t3} + b_7R_{t3} + b_8D_t + b_9D_t*CFO_{t-1} + b_{10}D_t*CFO_t + b_{11}D_t*CFO_{t3} + b_{12}D_t*ACC_{t-1} + b_{13}D_t*ACC_t + b_{14}D_t*ACC_{t3} + b_{15}D_t*R_{t3} + \varepsilon_t$$

	b_0	b_1CFO_{t-1}	b_2CFO_t	b_3CFO_{t3}	b_4ACC_{t-1}	b_5ACC_t	b_6ACC_{t3}	b_7R_{t3}
	0.078	-0.775	1.234	0.228	-0.512	0.988	-0.010	-0.077
	(<.000	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.6725)	(<.0001)

	b_8D_t	$b_9D_t*CFO_{t-1}$	$b_{10}D_t*CFO_t$	$b_{11}D_t*CFO_{t3}$
	0.080	0.148	-0.340	-0.177
	(<.0001)	(0.2216)	(0.0112)	(<.0001)

	$b_{12}D_t*ACC_{t-1}$	$b_{13}D_t*ACC_t$	$b_{14}D_t*ACC_{t3}$	$b_{15}D_t*R_{t3}$	ε_t	Adj R^2
	0.003	-0.420	-0.029	0.013		0.091
	(0.9682)	(<.0001)	(0.4068)	(0.1957)		

Variable Definitions:

R_t = the buy and hold return for Fiscal Year *t*;

X_{t-1} = the earnings per share (Compustat Data 58) for Fiscal Year *t*-1, deflated by the stock price at the beginning Fiscal Year *t*

X_t = the earnings per share for Fiscal Year *t*, deflated by the stock price at the beginning of Fiscal Year *t*

X_{t3} = the sum of the earnings per share for Fiscal Year *t*+1 through *t*+3, deflated by the stock price at the beginning of Fiscal Year *t*

R_{t3} = the annually compounded stock return for Fiscal Year *t*+1 through *t*+3;

D_t = the price delay measure (the market inefficiency measure) measured over the firm's Fiscal Year *t* ;

CFO_{t-1} = the operating cash flows (Compustat Data 308) for Fiscal Year *t*-1, deflated by the market value of equity at the beginning Fiscal Year *t*;

CFO_t = the operating cash flows for Fiscal Year *t*, deflated by the market value of equity at the beginning of Fiscal Year *t*;

CFO_{t3} = the operating cash flows for Fiscal Year *t*+1 through *t*+3, deflated by the market value of equity at the beginning of Fiscal Year *t*;

ACC_{t-1} = the total accr ual {= net income before extraordinary items and discontinued operations (Compustat Data 18) –operating cash flows (Compustat Data 308)} for Fiscal Year *t*-1, deflated by the market value of equity at the beginning of Fiscal Year *t*;

ACC_t = the total accrual for Fiscal Year *t*, deflated by the market value at the beginning of Fiscal Year *t*; and

ACC_{t3} = the total accrual for Fiscal Year *t*+1 through *t*+3, deflated by the market value at the beginning of Fiscal Year *t*;

TABLE 2-4

Descriptive Statistics for Control Variables by the Market Inefficiency Measure Decile

Decile		1	2	3	4	5	6	7	8	9	10
Number of observations		2,258	2,258	2,258	2,258	2,258	2,258	2,258	2,258	2,258	2,258
Mean	D_t	0.074	0.174	0.272	0.371	0.480	0.595	0.717	0.833	0.930	0.989
	$Size_t$	4,818.1	3,236.2	2,378.5	1,756.9	1,361.5	1,334.9	1,062.8	861.9	734.7	511.6
	BM_t	0.461	0.514	0.570	0.575	0.637	0.637	0.689	0.711	0.734	0.773
	β_t	1.060	0.969	0.860	0.786	0.753	0.705	0.620	0.575	0.533	0.486
	$Persist_t$	0.520	0.447	0.418	0.412	0.499	0.568	0.479	0.435	0.450	0.425
Median	D_t	0.078	0.174	0.272	0.371	0.480	0.594	0.717	0.835	0.932	0.991
	$Size_t$	1,201.3	610.4	372.1	253.1	177.7	129.9	96.1	76.1	58.4	44.4
	BM_t	0.358	0.397	0.430	0.439	0.475	0.478	0.518	0.527	0.551	0.558
	β_t	0.971	0.879	0.786	0.701	0.666	0.612	0.541	0.502	0.447	0.399
	$Persist_t$	0.520	0.447	0.418	0.412	0.499	0.568	0.479	0.435	0.450	0.425

This table report descriptive statistics for control variables by the market inefficiency measure decile. The followings are Variables Definitions:

D_t = the price delay measure (the market inefficiency measure) measured over the firm's Fiscal Year t ;

$Size_t$ = the log of market value of equity at the beginning of Fiscal Year t (in $ millions);

BM_t = the book-to-market ratio (Compustat Data60/(Data199*Data25)) at the beginning of Fiscal Year t;

β_t = the beta calculated using daily returns from CRSP over Fiscal Year t;

$Persist_t$ = earnings persistence is calculated using an approach similar to Lundholm and Myers (2002). For each decile of market inefficiency measure, I regress the member firm-years X_t on X_{t-1}, with the resulting coefficient assigned as the persistence measure for each firm in the decile.

TABLE 2-5
Robustness Tests
Controlling for Potential Omitted Correlated Variables

Panel A: Adding a Single New Control Variable (equation 10) (# of Observations: 22,579)

$$R_t = b_0 + b_1 X_{t-1} + b_2 X_t + b_3 X_{t3} + b_4 R_{t3} + b_5 D_t + b_6 D_t * X_{t-1} + b_7 D_t * X_t + b_8 D_t * X_{t3} + b_9 D_t * R_{t3} + b_{10} Control_t + b_{11} Control_t * X_t + b_{12} Control_t X_{t3} + b_{13} Control_t * R_{t3} + \varepsilon_t$$

Included Control variable =	Size	BM	Beta	Persistence	Loss
Intercept	0.163 (<0.0001)	0.058 (<0.0001)	0.052 (<0.0001)	0.148 (0.0035)	0.022 (0.0542)
X_{t-1}	-0.620 (<0.0001)	-0.597 (<0.0001)	-0.643 (<0.0001)	-0.637 (<0.0001)	-0.482 (<0.0001)
X_t	1.085 (<0.0001)	1.442 (<0.0001)	0.985 (<0.0001)	0.793 (0.0109)	3.371 (<0.0001)
X_{t3}	0.212 (<0.0001)	0.107 (0.0003)	0.274 (<0.0001)	0.450 (<0.0001)	0.285 (<0.0001)
R_{t3}	-0.071 (<0.0001)	-0.071 (<0.0001)	-0.070 (<0.0001)	-0.092 (0.0047)	-0.079 (<0.0001)
D_t	0.050 (0.0027)	0.027 (0.0953)	0.120 (<0.0001)	0.072 (<0.0001)	0.019 (0.2215)
$D_t * X_{t-1}$	-0.001 (0.9855)	0.049 (0.5449)	0.023 (0.7793)	0.015 (0.8489)	0.026 (0.7341)
$D_t * X_t$	-0.358 (0.001)	-0.460 (<0.0001)	-0.334 (0.0023)	-0.390 (0.0004)	-0.301 (0.0037)
$D_t * X_{t3}$	-0.149 (<0.0001)	-0.151 (<0.0001)	-0.183 (<0.0001)	-0.167 (<0.0001)	-0.085 (0.0189)
$D_t * R_{t3}$	0.007 (0.5004)	0.003 (0.8079)	0.007 (0.5033)	0.006 (0.5379)	0.004 (0.7153)
$Control$	0.000 (<0.0001)	0.178 (<0.0001)	0.085 (<0.0001)	-0.017 (0.8737)	-0.086 (<0.0001)
$Control * X_t$	0.000 (0.0003)	-0.141 (<0.0001)	0.181 (<0.0001)	0.715 (0.2536)	-3.066 (<0.0001)
$Control * X_{t3}$	0.000 (0.0304)	0.074 (<0.0001)	-0.063 (<0.0001)	-0.490 (0.0365)	-0.297 (<0.0001)
$Control * R_{t3}$	0.000 (0.8073)	-0.003 (0.4913)	0.002 (0.6295)	0.050 (0.4499)	0.015 (0.0102)
Adjusted R-square:	0.079	0.097	0.083	0.077	0.147
# of observations:	22,579	22,579	22,579	22,579	22,579
F statistics on combined $D_t * X_{t3}$ and $D_t * R_{t3}$: p-values:	15.50 (<0.0001)	17.66 (<0.0001)	23.79 (<0.0001)	18.94 (<0.0001)	5.58 (0.018)

Panel B: Full model (# of Observations :22,579)

R_t =	b_0	+ $b_1 X_{t-1}$	+ $b_2 X_t$	+ $b_3 X_{t3}$	+ $b_4 R_{t3}$	
	-0.078	-0.582	1.163	0.343	-0.096	
	(0.1266)	(<.0001)	(0.0002)	(0.0034)	(0.0030)	
+	$b_5 D_t$	+ $b_6 D_t * X_{t-1}$	+ $b_7 D_t * X_t$	+ $b_8 D_t * X_{t3}$	+ $b_9 D_t * R_{t3}$	
	0.079	0.046	-0.340	-0.197	0.009	
	(<.0001)	(0.5609)	(0.0022)	(<.0001)	(0.3796)	
+	$b_{10} Size_t$	+ $b_{11} Size_t * X_t$	+ $b_{12} Size_t * X_{t3}$	+ $b_{13} Size_t * R_{t3}$		
	-0.000	0.000	0.000	-0.000		
	(<.0001)	(0.0003)	(0.0014)	(0.4701)		
+	$b_{14} BM_t$	+ $b_{15} BM_t * X_t$	+ $b_{16} BM_{t3} * X_{t3}$	+ $b_{17} BM_t * R_{t3}$		
	0.212	-0.112	0.061	-0.003		
	(<.0001)	(<.0001)	(<.0001)	(0.4885)		
+	$b_{18} \beta_t$	+ $b_{19} \beta_t * X_t$	+ $b_{20} \beta_t * X_{t3}$	+ $b_{21} \beta_t * R_{t3}$		
	0.135	0.183	-0.062	0.004		
	(<.0001)	(<.0001)	(<.0001)	(0.4292)		
+	$b_{22} Persist_t$	+ $b_{23} Persist_t * X_t$	+ $b_{24} Persist_t * X_{t3}$	+ $b_{25} Persist_t * R_{t3}$	+ ε_t	Adj R^2
	-0.013	0.146	-0.331	0.039		0.111
	(0.8982)	(0.8128)	(0.1511)	(0.5364)		

Variable Definitions:

R_t = the buy and hold return for Fiscal Year t;

X_{t-1} = the earnings per share (Compustat Data 58) for Fiscal Year t-1, deflated by the stock price at the beginning Fiscal Year t

X_t = the earnings per share for Fiscal Year t, deflated by the stock price at the beginning of Fiscal Year t

X_{t3} = the sum of the earnings per share for Fiscal Year t+1 through t+3, deflated by the stock price at the beginning of Fiscal Year t

R_{t3} = the annually compounded stock return for Fiscal Year t+1 through t+3;

D_t = the price delay measure (the speed of price adjustment) measured over the firm's Fiscal Year t ;

CFO_{t-1} = the operating cash flows (Compustat Data 308) for Fiscal Year t-1, deflated by the market value of equity at the beginning Fiscal Year t;

CFO_t = the operating cash flows for Fiscal Year t, deflated by the market value of equity at the beginning of Fiscal Year t;

CFO_{t3} = the operating cash flows for Fiscal Year t+1 through t+3, deflated by the market value of equity at the beginning of Fiscal Year t;

ACC_{t-1} = the total accrual {= net income before extraordinary items and discontinued operations (Compustat Data 18) –operating cash flows (Compustat Data 308)} for Fiscal Year t-1, deflated by the market value of equity at the beginning of Fiscal Year t;

ACC_t = the total accrual for Fiscal Year t, deflated by the market value at the beginning of Fiscal Year t; and

ACC_{t3} = the total accrual for Fiscal Year t+1 through t+3, deflated by the market value at the beginning of Fiscal Year t;

$Size_t$ = the log of market value of equity at the beginning of Fiscal Year t (in $ millions);

BM_t = the book-to-market ratio (Compustat Data60/(Data199*Data25)) at the beginning of Fiscal Year t;

β_t = the beta calculated using daily returns from CRSP over Fiscal Year t;

$Persist_t$ = earnings persistence is calculated using an approach similar to Lundholm and Myers (2002). For each decile of market inefficiency measure, I regress the member firm-years X_t on X_{t-1}, with the resulting coefficient assigned as the persistence measure for each firm in the decile.

TABLE 2-6
Robustness Tests
Fama-MacBeth Regressions

Primary Model (equation 9):

$$R_t = b_0 + b_1 X_{t-1} + b_2 X_t + b_3 X_{t3} + b_4 R_{t3} + b_5 D_t + b_6 D_t * X_{t-1} + b_7 D_t * X_t + b_8 D_t * X_{t3} + b_9 D_t * R_{t3} + \varepsilon_t$$

Extended Model (equation 11):

$$R_t = b_0 + b_1 CFO_{t-1} + b_2 CFO_t + b_3 CFO_{t3} + b_4 ACC_{t-1} + b_5 ACC_t + b_6 ACC_{t3} + b_7 R_{t3} + b_8 D_t + b_9 D_t * CFO_{t-1} + b_{10} D_t * CFO_t + b_{11} D_t * CFO_{t3} + b_{12} D_t * ACC_{t-1} + b_{13} D_t * ACC_t + b_{14} D_t * ACC_{t3} + b_{15} D_t * R_{t3} + \varepsilon_t$$

Panel A: Primary Model (# of observations: 22,579)

	X_t	$D_t * X_t$	$D_t * X_{t3}$
Mean	1.2122	-0.431	-0.185
# of predicted sign	14/14	11/14	12/14
P-value of Fama-MacBeth t-statistic	<.0001	0.0065	0.0009

Panel B: Extended Model (# of observations: 22,579)

	CFO_t	$D_t * CFO_t$	$D_t * CFO_{t3}$	ACC_t	$D_t * ACC_t$	$D_t * ACC_{t3}$
Mean	1.3105	-0.431	-0.249	1.1815	-0.583	-0.147
# of predicted sign	14/14	9/14	10/14	14/14	11/14	11/14
P-value of Fama-MacBeth t-statistic[a]	<.0001	0.0560	0.002	<.0001	0.024	0.090

Please see the table 5 for the variable definition

[a] t-statistic: mean of the coefficients/standard error of the coefficients over the sample periods

CHAPTER 3

EFFECT OF OPTION LISTING ON PRICE ADJUSTMENTS AROUND EARNINGS ANNOUNCEMENTS

I. INTRODUCTION

This study investigates the effect of options listings on the magnitude of stock price adjustments to earnings news. Traditionally, accounting literature related to option listing addresses two research questions: (1) Do options listings provide a lower-cost alternative for traders with private information? and (2) If so, do options listings improve the informational efficiency of the stock market? Consistent with prior research, we assert that exchange-listed options are preferred trading vehicles for informed traders because of less risk and lower transaction cost. These advantages of options, in turn, give stronger incentives for these traders to acquire private information and to engage in trading activities to exploit their information advantages. The increases in information production and arbitrage activities will lead to more efficient equity markets.

There have been several studies that investigate the relation between option listing and informational efficiency in equity markets (Skinner 1990; Ho 1993; Mendenhall and Fehr 1999).[19] The main focus of these studies is to examine the impact of options listings on price reactions immediately following earnings announcements. Unlike these studies, we examine the effect of options listings using three separate windows: the pre-earnings announcement period, the announcement period, and the post-earnings announcement period. This three-window approach enables us to examine the whole picture of the impact of options listings on the stock price adjustments to earnings news. In addition, this approach allows us to investigate whether transaction costs explain a delayed price response in the post-earnings announcement period, suggested by Bernard and Thomas (1989).

We show that the existence of the exchange-traded options is: (i) positively related to the magnitude of the pre-earnings announcement drift, (ii) positively related to the magnitude of price response during the announcement period, and (iii) negatively related to

[19] Unlike these studies, Amin and Lee (1997) examine the role of option trading in price discovery using option trading data.

the magnitude of the post-earnings announcement drift. We interpret our first two results as evidence that the existence of exchange-traded options improves the speed of price discovery in equity markets and allows investors to better appreciate the implications of earnings information. Our third result, together with the first two, suggests that the post-earnings announcement drift represents a delayed price response to new information and option trading can lessen the magnitude of the drift. Overall, our results indicate that option listing improves the informational efficiency in equity markets in general and surrounding earnings announcements in particular.

The rest of the paper is organized as follows. Section II shows the motivation of this paper and discusses three hypotheses. It also includes literature reviews. Section III discusses the description of variables and research methodology. Section IV describes the sample and its descriptive statistics. Section V presents and discusses our empirical results. Section VI concludes the paper.

II. MOTIVATION AND HYPOTHESIS DEVELOPMENT

The existence of exchange-traded options should improve the informational efficiency in equity markets for the following reasons. First, prior studies suggest that option trading is a cost-efficient alternative to trading the underlying stock for informed traders (Black 1975; Cox and Rubinstein 1985). For example, suppose that an investor knows that a stock is undervalued and considers two alternatives: (i) to buy the stock and (ii) to take a long position in call options. It takes $\frac{1}{\Delta}$ options to create an equivalent position to a share of the underlying stock where Δ, known as the option's delta, measures the change in the option price with respect to a change in the stock price. While $\frac{1}{\Delta}$ options provide the same return (in dollars) as a share, the cost of this stock equivalent position is much lower than that of the share due to the financial leverage implicit in options.[20] When an investor believes a stock is overpriced, trading options may also represent a more attractive alternative to short selling the underlying stock. In addition to a fee paid, a short seller

[20] Lee and Yi (2001) show that the cost of $\frac{1}{\Delta}$ options is less than 10 percent of the underlying stock price.

faces various other constraints. As described in Lamont (2004), these constraints include financial costs (e.g., a fee paid to the lender), recall risk, and legal and institutional restrictions.[21] The absence of these constraints in the options market, together with greater leverage, implies that option trading provides investors with greater opportunities for profitable trading and induces them to acquire more information about firms with traded options. As shown by Black and Scholes (1973), the price of an option depends on the underlying stock price. This and inter-market linkage between the options and stock markets suggest that any incremental information produced for options should be impounded in the underlying stock price.[22] Thus, one may argue that option listing should enhance the informational efficiency in the stock market.

Second, option trading can mitigate or even eliminate the risk faced by arbitrageurs. Standard finance theory assumes that any mispricing of stock is quickly adjusted to the fundamental value by rational arbitrageurs. In theory, arbitrage requires no capital and entails no risk. However, in reality, arbitrage requires taking a large undiversified position in the misvalued stock. Thus, in the absence of perfect or close substitutes, arbitrageurs face significant risk that may discourage from exploiting profitable opportunities. Wurgler and Zhuravskaya (2002), for example, show that an arbitrageur's demand for a stock is inversely related to the stock's arbitrage risk. With traded options, arbitrageurs can construct a synthesized position that replicates the payoff pattern of the underlying stock. This availability of perfect substitutes significantly lessens the arbitrage risk and allows arbitrageurs to exploit profitable opportunities more aggressively. The increase in arbitrageurs' activities, in turn, improves the price efficiency of equity markets.

Given the above arguments, we investigate whether or not the availability of traded options indeed increases the informational efficiency in equity markets. Specifically, we use the effect of traded options on the pre-announcement drift, the price reactions to quarterly earnings announcements, and the post-announcement drift.

Prior studies (e.g., Foster *et al.* 1984; Nichols and Wahlen 2004) document that a large proportion of price adjustment occurs before earnings are actually announced by firms. This phenomenon, known as the pre-announcement drift, implies that market participants,

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[21] See Lamont (2004) for detailed discussions on various short sale constraints.

[22] Many studies have examined the interrelation of stock and options markets. Easley *et al.* (1998), for example, show that option volumes lead stock price changes.

on average, correctly predict and react to the sign and magnitude of earnings surprise. Because these announcements convey price-relevant information and their timing is highly predictable, investors have enormous incentives to acquire and predict the content of earnings information in advance of actual announcements. The presence of traded options will provide even greater profitable opportunities for informed investors because of lower transaction costs and greater financial leverage implicit in options. This leads to our first hypothesis.

H1: The magnitude of the pre-earnings announcement drift is larger for firms with traded options than those without options.

If earnings announcements resolve the divergence of opinions among traders instantaneously, the existence of options will have no effect on the price reactions surrounding the earnings announcement. However, extant literature suggests that this is not the case. Kim and Verrecchia (1994), for example, argue that some market participants (e.g., financial analysts, large shareholders, etc.) process public information such as earnings announcements into private information. Krinsky and Lee (1996) show that information asymmetry among traders increases immediately following earnings announcements. Thus, the findings in these studies imply that some investors have informational advantages surrounding the releases of earnings information. In addition, options will allow them to exploit their information advantages at reduced costs and/or lower risk. This, in turn, improves price discovery processes in equity markets since the options and stock markets are interlinked. The conjecture that the existence of traded options increases the informational efficiency in equity markets has led many studies to examine the effect of option listing on the price reactions to earnings announcements. This line of research compares the ERCs (Earnings Response Coefficients) between two groups – option sample and non-option sample – and examines whether there is any difference in terms of the sign and the magnitude of the ERC between the two groups. The evidence on whether traded options increase or decrease the price reactions in equity markets, however, is mixed. For example, Skinner (1990) shows that the size of the price reaction to earnings releases is smaller after options are listed on exchanges, and concludes that the

information content of firms' accounting earnings releases is lower, on average, after option listing. In similar vein, Ho (1993) compares the information content of the quarterly earnings announcement for option firms and non-option firms and finds that price reactions surrounding quarterly earnings announcement are significantly greater for non-option firms than for option firms. On the other hand, Mendenhall and Fehrs (1999) report evidence that option listing actually increases the magnitude of price reactions to earnings announcements. Using more recent data, they find that option listing actually increases the absolute value of the price reactions to earnings releases. Therefore, it appears that there has been a lack of definitive empirical result regarding the effect of the option listing on the magnitude of ERC in accounting literature. In this study, we reexamine this issue using a more recent and more complete dataset. Similar to Mendenhall and Fehrs (1999), we expect that the existence of options is associated with improved incorporation of new information in stock prices. This leads to our second hypothesis.

H2: Price responses to earnings news are greater for option firms than they are for non-option firms.

Finally, we examine the effect of option listing on the post-announcement drift. We expect a negative association between options listings and the post-earnings announcement drift. If traded options improve price discovery processes during the pre-announcement and announcement windows, much of the content of earnings news will impounded in prices and there will not be much adjustment left during the post-announcement period.[23] This leads to our third hypothesis.

H3: The magnitude of the post-earnings announcement drift is smaller for option firms than that for non-option firms.

[23] Recently, Ng *et al.* (2006) argue that high transaction costs create limits to arbitrage during the post-announcement period. They thereby attribute the post-announcement drift to transaction costs.

III. DESCRIPTION OF VARIABLES AND METHODOLOGY

3.1 Earnings Surprise and Cumulative Abnormal Return

Similar to prior studies (e.g., Mendenhall 2004), we measure earnings surprise by the standardized unexpected earnings (SUE). It is defined as

$$SUE_{i,q} = \frac{E_{i,q} - \overline{\hat{E}}_{i,q}}{SD(\hat{E}_{i,q})} \tag{1}$$

where $E_{i,q}$ is the actual EPS for firm i in quarter q, $\overline{\hat{E}}_{i,q}$ the average of analysts' EPS forecasts, and $SD(\hat{E}_{i,q})$ is the cross-sectional standard deviation of the analysts' forecasts. Both $\overline{\hat{E}}_{i,q}$ and $SD(\hat{E}_{i,q})$ are obtained from the I/B/E/S summary file in the month just prior to the earnings announcement, given that there are at least two forecasts available. Then, we classify SUEs into deciles based on their rank each quarter. Finally, following Mendenhall, we scale SUE deciles such that the scaled variable ranges from –0.5 to 0.5.

For each observation, we calculate the cumulative abnormal return (CAR). The daily abnormal return for firm i on day t ($AR_{i,t}$) is computed as the difference between the daily return of firm i on day t ($R_{i,t}$) and the equally-weighted return on day t for NYSE/AMEX firms ($R_{p,t}$) in the same size-decile as firm i where the size-decile of each firm is determined on the basis of the market value at the end of the previous year. Then, the cumulative abnormal return ($CAR_{i,(a,b)}$) for firm i during the interval of (a, b) is the sum of daily abnormal returns:

$$CAR_{i,(a,b)} = \sum_{t=a}^{b} AR_{i,t} = \sum_{t=a}^{b} (R_{i,t} - R_{p,t}) \tag{2}$$

In this study, we use three sub-periods surrounding quarterly earnings announcements. The pre-announcement period is defined as day –11 to day –2, the announcement period is day –1 to day +1, and the post-announcement period is day +2 to day +50, where day 0 is the earnings announcement date.

3.2 Methodology

To test our hypotheses, we use two approaches: (i) univariate analysis and (ii) multiple regression analysis. In the first approach, we divide the sample into two groups: option firms and non-option firms. For each quarter during the sample period, a firm is classified as an option firm if the firm has options listed and traded in any of option exchanges. Otherwise, the firm is classified as a non-option firm. Then, we compare the cumulative abnormal returns between these two groups for each SUE decile for three sub-periods surrounding earnings announcements. In the second approach, we examine the earnings response coefficients (ERCs) from three regressions of cumulative abnormal returns on earnings surprise and a set of control variables. Our ERCs are estimated from the following model:

$$\begin{aligned} CAR &= b_0 + b_1 SUE + b_2 SUE * OPTION + b_3 SUE * EVAR + b_4 SUE * MVAR \\ &\quad + b_5 SUE * APRICE + b_6 SUE * APVOL + b_7 SUE * FINST + b_8 SUE * NANAL \\ &\quad + b_9 OPTION + \varepsilon \end{aligned} \tag{3}$$

where:

CAR =size-adjusted cumulative abnormal return;

SUE =standardized unexpected earnings;

OPTION =dummy variable that equals 1 if the firm has traded options in a given quarter;

EVAR =unexplained variance from a market model, estimated over 48 months prior to earnings announcement;

MVAR =explained variance from the market model;

APRICE =closing stock price, averaged over 20 trading days immediately prior to the pre-announcement period

APVOL =daily dollar volume, averaged over 250 trading days prior to the pre-announcement period;

FINST =fraction of ownership held by institutions; and

NANAL =number of analysts following.

The above regression model is separately estimated for the pre-announcement period (day –11 to day –2), the announcement period (day –1 to day +1), and the post-

announcement period (day +2 to day +50) where day 0 the quarterly earnings announcement date. The key variable in our regression model is the option dummy, *OPTION*. If the presence of traded options indeed improves informational efficiency in equity markets, the coefficient on $SUE*OPTION$ will be positive in both the pre-announcement and announcement periods (i.e., $b_2 > 0$) while it will be negative in the post-announcement period (i.e., $b_2 < 0$).

In addition to the option dummy, the regression model includes six control variables, similar to Mendenhall (2004). The first variable, $EVAR$, is the firm-specific return volatility and may have two opposing effects on stock price responses. On the one hand, it is a proxy for arbitrage risk. As suggested by Wurgler and Zhuravskaya (2002), if arbitrageurs are highly specialized and hold undiversified portfolios, they cannot avoid the idiosyncratic component of a stock's volatility. Then, a high level of firm-specific volatility may prevent them from fully exploiting their superior information. On the other hand, Durnev *et al.* (2003) find that firm-specific return variability is associated with more informative stock prices. Thus, a higher level of firm-specific variation suggests that private information is more efficiently impounded in stock prices. Given these two opposing effects, the sign of the coefficient on $SUE*EVAR$ depends which of these two effects dominates. $MVAR$ measures systematic return volatility that can be, at least in theory, hedged. However, Shleifer and Vishny (1997) argue that, to specialized arbitrageurs, both idiosyncratic and systematic volatility deters arbitrage activity. Thus, the explained variation by a market model is also included into regression to control the effect of the systematic variation.[24]

In our regression analysis, we also include the average of daily closing prices ($APRICE$) and the average of daily dollar volume ($AVOL$). Prior studies indicate that transactions costs are an important determinant of the efficiency of equity markets. Bhushan (1994), for example, use the stock price as a proxy for the inverse of the direct trading costs and dollar trading volume as a proxy for the inverse of the in-direct trading costs. He finds that the magnitude of the post-earnings announcement drift is negatively associated with these two proxies, suggesting that transaction costs affect the informational

[24] Alternatively, one may include firm-specific return variation as a fraction of total variation instead of idiosyncratic and systematic volatility. We have repeated our regression analysis using this alternative specification. This, however, yields qualitatively similar results to what are reported in the paper.

efficiency in equity markets. Stoll (2000) also finds that the bid-ask spread is inversely related to the stock price and dollar trading volume. Thus, *APRICE* and *AVOL* are used as proxies for transaction costs in the regression model.

As a proxy for investor sophistication, we include the fraction of ownership held by institutions (*FINST*) in the regression model. Previous research suggests that institutions are different from individual investors. Lev (1988) argues that they have a lower marginal cost of gathering information and are generally better informed than individual investors. Kim and Verrecchia (1994) propose that institutions also possess superior information processing ability. Empirical evidence in prior literature also indicates that they are more sophisticated than individual investors. Bartov *et al.* (2000), for example, show that the magnitude of the post-earnings announcement drift is negatively correlated with institutional ownership. Given these studies, we use the fraction of shares held by institutions as a proxy for investor sophistication.

It is well known that the amount of information publicly available about a firm is positively associated with the number of financial analysts following the firm (Bhushan 1994). In addition, Ayers and Freeman (2003) provide evidence that the stock prices of firms with heavy analyst following incorporate future earnings earlier than neglected firms. Thus, we include the number of analysts following (*NANAL*) to capture the effect of information environment on the price responses surrounding earnings announcements.

To be consistent with prior research (e.g., Mendenhall 2004; Bartov *et al.* 2000), we transform all of the six control variables. We first obtain within-quarter decile rank for each variable. Then, the decile ranks are transformed to range between –0.5 and 0.5. This transformation is made to allow time trends in variables and to alleviate the potential problems associated with nonlinearities and/or outliers.

IV. DATA

Our sample period spans the first quarter of 1985 through the third quarter of 2003. For all NYSE/AMEX firms, the date of option listing is hand-collected from the Dow Jones newswire. When a firm's options are listed in more than one exchange such that there is

more than one announcement, we use the earliest announcement.[25] For each quarter during the sample period, a firm is defined as an option firm if its options are listed on any of option exchanges (NYSE, AMEX, CBOE, and PHLX).

For each firm, we obtain the daily and monthly returns, trading volume, closing prices, and number of shares outstanding from the CRSP database. Quarterly earnings announcement dates are retrieved from the COMPUSTAT industrial file. Information on the actual EPS, mean and standard deviation of analysts' EPS forecasts, number of analysts following is obtained from the I/B/E/S Summary file. Specifically, we use the measures reported in the most recent month prior to each quarterly earnings announcement. Finally, we use the CDA Spectrum database to obtain institutional holding data.

Insert Table 1 about here

Our final sample comprises of 52,400 firm-quarters that have all the data required to construct the variables described in Section III. Table 1 shows the distribution of our sample over time. It can be seen that the number of new listings has increased substantially since mid 1990's. As a result, the proportion of option firm-quarters in our sample has also increased each year. In fact, the number of firm-quarters for option firms has exceeded that for non-option firms since 2001. Given this increase in the number of firms with listed options, it has become more important for researchers, practitioners, and policy makers to understand how the existence of traded options affects the informational efficiency in equity markets.

Insert Table 2 about here

Panel A of Table 2 presents descriptive statistics for the entire sample while Panel B of the Table compares characteristics of option firms with those of non-option firms. It can be seen that these two groups of firms clearly display different characteristics. In particular, option firms are larger in firm size (*MV*), have greater dollar trading volume (*APVOL*) than non-option firms. They also have significantly greater firm-specific and

[25] Multiple listings have been allowed for all options since 1990.

systematic variances (*EVAR* and *MVAR*), suggesting that option firms have more volatile stock returns than non-option firms. As discussed in Mayhew and Mihov (2004), in selecting stocks for option listing, exchanges consider various factors such as trading volume, volatility, and market capitalization.[26] Thus, the observed differences in these variables are somewhat expected.

Insert Table 3 about here

In Table 3, we report Pearson and Spearman correlations among various variables. Several variables are significantly correlated. For example, the Pearson (Spearman) correlation between the firm size (*MV*) and average dollar trading volume (*APVOL*) is 0.801 (0.895) and it is statistically significant at the 1% level. In addition, the firm size (*MV*) is highly correlated with the number of analysts following, suggesting that larger firms receive more analysts' coverage. These significant correlations among variables could result in a multicollinearity problem. Therefore, we perform a Variance Inflation Factor (VIF) test to measure the extent of multicollineartiy and examine whether or not the multicollinearity may influence our empirical results. Even though not reported in the paper, the VIF test using the full set of interaction variables with SUE deciles in our main regression model indicates that the VIF for the interaction term of *MV* with *SUE* is very high (26.81). Therefore, we do not include the firm size variable (*MV*) in our multivariate regression model.

V. EMPIRICAL FINDINGS

5.1 Patterns of Price Movements around Earnings Announcements

Figure 1 shows the price movements surrounding earnings releases for option firms and non-option firms while Table 4 presents the cumulative abnormal returns for the most positive and most negative SUE deciles. Each line in the Figure represents the cumulative abnormal return for each SUE decile. The lines left to the earnings announcement date show the cumulative abnormal returns for the pre-announcement and earnings

[26] Unlike the stock market, where firms apply to be listed, option listing decisions are made by exchanges.

announcement periods combined (i.e., day −11 to day +1 relative to the earnings announcement date) while the lines right to the announcement date plot the patterns of the post-earnings announcement drift (i.e., from day +2 to day +50). The Figure reveals that, for the periods before and during earnings announcements, the patterns of price movements are similar to those in Foster *et al.* (1984). It appears that stock prices predict the content of earnings news. However, during these two sub-periods, the magnitude of the pre-announcement drift and/or stock price response to earnings news tends to be greater for option firms than non-option firms. In particular, for observations with extremely good news (i.e., SUE decile 10), the total price adjustment in the pre-announcement and the announcement periods is almost one percentage point higher for option firms than for non-option firms. Similarly, for observations with extremely bad news (i.e., SUE decile 1), the magnitude of the total price adjustment by day +1 is almost one percentage point higher for option firms. The results shown in Panel A and B of Table 4 also suggest that the magnitudes of pre-announcement drift and price response to earnings news are greater for option firms than for non-option firms. Panel A (B) of Table 4 reports mean cumulative abnormal returns of two extreme deciles for both non-option firms and option firms and their differences for the pre-announcement period (announcement period). Consistent to our hypothesis, mean cumulative abnormal returns for option firms are greater than those for non-option firms for both periods. Our findings imply that option listing may result in more intensified price adjustment before and immediately following the announcement of earnings news.

Insert Figure 1 and Table 4 here

Figure 1 also shows that, for non-option firms, the patterns of price movements resemble those in Foster *et al.* (1984). However, it appears that option firms do not exhibit the well-known post-earnings announcement drift. This result is more pronounced for firms with bad news. In fact, only one SUE decile portfolio yields a negative cumulative abnormal return after 50 trading days following earnings announcements. Further, the results in Panel C of Table 4 show that the mean cumulative abnormal return for extreme bad new firms (SUE decile 1) is positive. Thus, the results in both Figure 1

and Panel C of Table 4 imply that the price adjustment after the earnings announcement is smaller for option firms than non-option firms.

Insert Table 5 about here

In Table 5, we show the proportion of the total price adjustment to earnings news made in each period (pre-announcement, announcement, and post-announcement). This proportion is defined as the cumulative abnormal return over the period divided by the total price adjustment over the three periods. Thus, this proportion allows us to compare the relative speed of price adjustment between option firms and non-option firm. If the existence of options traded in exchange induces investors to acquire and process information prior to or during the release of earnings news, one may expect this proportion in the pre-announcement and announcement periods to be greater for option firms than non-option firms. In addition, if exchange-traded options enhance the speed of price discovery in equity markets, one may also expect this proportion in the post-announcement period to be smaller for option firms as well.

The results in Table 5 indicates that option and non-option firms exhibit a similar magnitude of total price adjustment accumulated over all three periods, 6.17% versus 6.11%, for SUE decile 10 (good news) and these firms have the same magnitude of –4.36% for SUE decile 1 (bad news). However, the proportions of total price adjustment made in both the pre-announcement period and announcement periods are larger for option firms than non-option firms while the converse is true in the post-announcement period. This observation is true for both SUE delcile 10 and SUE decile 1. For example, for firms with good news (bad news), 21.77 (46.51) percent of the total price adjustment is made before the announcement for option firms, whereas 18.47 (29.16) percent of the price adjustment is made for non-option firms. In addition, the proportions of total price adjustment made during the announcement are higher for option firms than non-option firms (49.41% versus 40.54% for SUE decile 10 and 59.48% versus 50.21% for SUE decile 1). These results imply that earnings news is impounded in prices earlier for option firms than non-option firms. On the other hand, for the post-announcement period, option firms have smaller proportions of price adjustments than non-option firms (28.82% versus 40.99% for SUE

decile 10 and –5.99% versus 20.63% for SUE decile 1). Thus, the price adjustment after the earnings announcement is smaller for option firms than non-option firms.

Overall, the patterns of price movements shown in Figure 1 and the results presented in Tables 4 and 5 suggest that the information content of earnings news is impounded in prices earlier for option firms than non-option firms, consistent with our expectations. Thus, option listing appears to improve price discovery processes and the informational efficiency in equity markets.

5.2 Multivariate Regression Results

Although the patterns of price movements around earnings news are generally consistent with our expectations, one major limitation of the analysis is that we did not control for the differences in various firm characteristics between option firms and non-option firms. We address this issue by using multivariate regressions. The regression model includes a dummy variable capturing the effect of option trading on price responses to earnings releases and various control variables used in Mendenhall (2004). The control variables are idiosyncratic and systematic variances of stock returns (*EVAR* and *MVAR*), daily stock price (*APRICE*), dollar trading volume (*APVOL*), the fraction of ownership held by institutions (*FINST*), and the number of analysts following (*NANAL*). Following Mendenhall (2004), we code SUE deciles and the control variables from -0.5 to +0.5. With this transformation, the estimated coefficient on SUE can be interpreted as the average difference in cumulative abnormal returns between observations in the highest- and lowest-SUE deciles.[27] We run regressions for the pre-announcement period, the announcement period, and the post-announcement period separately.

Insert Table 6 about here

The first two columns of Table 6 present the regression results for the pre-announcement period after controlling the differences in firm characteristics between option firms and non-option firms. As expected, the estimated coefficient on SUE is

[27] Similarly, the estimated coefficient on each control variable represents the additional spread in cumulative abnormal returns, between the two extreme SUE deciles, for observations in decile 10 versus decile 1 of the control variable.

positive (2.048) and significant (t-statistic = 16.77). In addition, the estimated coefficient on the interaction of OPTION with SUE is positive (0.604) and significant (t-statistic = 2.72). These estimated coefficients suggest that, after controlling for other firm characteristics, the spread between cumulative abnormal returns for the highest and lowest SUE decile observations is 2.048 percentage points for non-option firms while the spread is 0.604 percentage points higher for option firms. This result is consistent with our first hypothesis that option firms have a greater pre-announcement drift than non-option firms. We interpret this as evidence that the existence of traded options increases investors' incentives to acquire earnings information in advance of actual announcements. The next two columns of Table 6 present the empirical test of our second hypothesis, which predicts that the price response is greater for option firms than non-option firms during the announcement period. The estimated coefficient on the interaction of OPTION with SUE is 0.774 with the t-statistic of 4.10. This result implies that, consistent with our hypothesis, option firms are characterized by more intensive price responses to earnings announcements than non-option firms, after controlling for other firm characteristics. In the last two columns of Table 6, we report the regression results for the post-announcement period. The coefficient estimate for SUE*OPTION is negative (-1.256) and significant (t-statistic = -2.69). This result implies that, after controlling for other firm characteristics, the post-earnings announcement drift is smaller for option firms than non-option firms, consistent with our third hypothesis.

Overall, the results presented in Table 6 support our three hypotheses. Specifically, option firms exhibit a larger pre-announcement drift, a more intensive price response to earnings news, and a smaller post-earnings announcement drift than non-option firms. We interpret this as evidence that option listing makes stock price adjustments to earnings news faster and more completely. As a result, it improves the informational efficiency in equity markets.

5.3 Robustness Tests

We conduct several sensitivity tests to ensure that our results are robust. Results from these tests are not fundamentally different from those from our main tests. Therefore, we just discuss these results without tabulating them.

5.3.1 Dependent variable

To examine whether our results are sensitive to how abnormal returns are measured, we use the abnormal buy-and-hold return instead of the cumulative abnormal return. The abnormal buy-and-hold return fore each interval (*a, b*) is calculated as:

$$Abnormal\ Buy-and-hold\ return_{i,(a,b)} = \prod_{t=a}^{b}(1+R_{i,t}) - \prod_{t=a}^{b}(1+R_{p,t})$$

where $R_{i,t}$ is the daily return of firm i on day t and $R_{p,t}$ is the return on day t for NYSE/AMEX firms in the same size-decile as firm i where the size-decile of each firm is determined on the basis of the market value at the end of the previous year. The use of abnormal buy-and-hold return instead of cumulative abnormal return yields results similar to those reported in the paper.

5.3.2 Independent variables

In estimating standardized unexpected earnings (SUE), we deflated analysts' forecast error by the average total assets instead of the cross-sectional standard deviation of the analysts' forecasts. In addition, we repeated empirical analyses by estimating the market's expectation on the basis of the seasonal random walk with drift. However, the use of alternative denominators and/or numerators yields similar results to those reported in the paper.

Our findings are robust to how control variables are constructed. For example, we re-estimated the multivariate regression model of equation (3) where the coded-decile scores of the control variables are replaced with their raw values. Also, results are essentially unchanged when different trimming schemes are used. As stated previously, the results presented do not include observations whose market values fall into the extreme 1% tails. Inferences are robust to trimming at the 0.5% level and at the 5% level.

5.3.3 Different lengths of windows and other issues

Our empirical results are also robust to using alternative lengths of windows over which abnormal returns are accumulated. For example, the use of day –16 or day –21 instead of day –11 as the beginning of the pre-announcement period yields similar results to

those reported in the paper. Further, extending or reducing the lengths of the post-announcement period, i.e., from 50 days to 30, 40, or 60 days, do not alter our results in a meaningful way. Finally, we re-estimated the multivariate regression model of equation (3) by including a time trend variable. This variable can serve as a proxy for changes in return pattern over time. However, the inclusion of this variable does not alter our inferences.[28]

VI. CONCLUSION

This study investigates the effect of option listing on stock price adjustments to earnings news. Because of greater financial leverage implicit in options and lower transactions costs, some informed traders may prefer trading options rather than stocks. These advantages of listed options provide investors with greater opportunities to exploit their information advantages and hence give them more incentives to be informed. It should be noted that the option price is a function of the underlying stock price. Thus, the options and stock markets are interlinked to prevent excessive arbitrage opportunities. This intermarket linkage implies that the existence of exchange-traded options also leads to more efficient dissemination of new information in equity markets.

We extend prior research by examining more recent data and by considering the price movements in the pre-announcement and post-announcement periods as well as the earnings announcement period. After controlling for a wide range of firm characteristics, we find that the existence of listed options is: i) positively associated with the magnitude of pre-earnings announcement drift, ii) positively associated with the magnitude of price response immediately after earnings releases, and iii) negatively associated with the magnitude of post-earnings announcement drift. We interpret the first result as evidence that option listing provides investors with increased incentives to engage in information production activities and to exploit their information advantages prior to earnings announcements. Our second result suggests that the availability of exchange-traded options leads stock prices to reflect the content of newly announced earnings information more quickly and more completely. Our third result, together with the first two, implies

[28] We recalculated the t-statistics of regression coefficients using the heteroscedasticity consistent matrix (White 1980). But the use of this adjustment does not alter our conclusions.

that option listing alleviates the post-earnings announcement drift caused by a delayed price response.

In summary, our findings reinforce the notion that the existence of options results in more complete and faster stock price adjustment and, thus improves the informational efficiency in the market. Our results are also consistent with the view that transaction costs cause a delayed price response to earnings news in the post-earnings announcement period and the existence of exchange-traded options reduces the magnitude of post-earnings announcement drift.

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TABLE 3-1
Sample Distribution

Our sample period spans the first quarter of 1985 to the third quarter of 2003. The first column of the table shows the number of new option listings each year. Columns 2 through 4 present the number of firm-quarters for both option firms and non-option firms. For each quarter of the sample period, a firm is classified as an option firm if it has options traded in any of option exchanges.

		Number of firm-quarters		
Year	Number of new listings	Non-option firms	Option firms	Total
Before 1985	172			
1985	6	1,706	408	2,114
1986	7	1,696	400	2,096
1987	19	1,457	428	1,885
1988	17	1,436	441	1,877
1989	11	1,571	472	2,043
1990	13	1,650	493	2,143
1991	19	1,693	525	2,218
1992	16	1,829	547	2,376
1993	27	2,021	582	2,603
1994	42	2,130	637	2,767
1995	45	2,145	698	2,843
1996	40	2,327	746	3,073
1997	60	2,423	845	3,268
1998	48	2,447	977	3,424
1999	70	2,356	1,199	3,555
2000	62	2,025	1,443	3,468
2001	154	1,539	1,957	3,496
2002	93	1,311	2,523	3,834
2003		1,126	2,191	3,317
Total	921	34,888	17,512	52,400

TABLE 3-2
Descriptive Statistics

The table presents descriptive statistics for the entire sample period (1985-2003). SUE is the standardized unexpected earnings, measured by the actual EPS minus the mean analysts' EPS divided by the cross-sectional standard deviation of the forecasts. EVAR is the residual variance from a market model regression, estimated over 48 months prior to earnings announcement. MVAR is the return variance explained by the market model regression. APRICE is the average of daily closing price over 20 trading days prior to the pre-announcement period (day –11 to day –1 relative to the earnings announcement date). APVOL is the daily dollar trading volume, averaged over 250 trading days prior to the pre-announcement period. FINST is the fraction of the firm's shares held by institutions. NANAL is the number of analysts following. MV is the market value of firms on the quarterly earnings announcement date.

Panel A: Entire Sample

	Entire Sample (n=52,400)				
	Mean	Std. Dev.	Quartile 1	Median	Quartile 3
SUE	-0.160	7.627	-1.000	0.000	1.000
EVAR	0.010	0.011	0.004	0.007	0.011
MVAR	0.002	0.003	0.001	0.002	0.003
APRICE	36.483	426.013	18.550	28.875	42.500
APVOL ($MM's)	15.705	38.002	1.191	4.063	13.486
FINST	0.551	0.191	0.423	0.565	0.687
NANAL	7.960	5.397	4.000	7.000	11.000
MV ($MM's)	4,283.968	9,809.824	480.460	1,315.425	3,723.191

Panel B: Option Firms versus Non-option Firms

	Option Firms (n=17,512)		Non-option Firms (n=34,888)		Wilcoxon Test
	Mean	Median	Mean	Median	z-value
SUE	0.171	0.143	-0.326	0.000	17.94***
EVAR	0.012	0.008	0.009	0.006	32.29***
MVAR	0.003	0.002	0.002	0.002	23.06***
APRICE	37.367	33.000	36.040	27.125	29.92***
APVOL ($MM's)	30.084	10.977	8.487	2.246	100.92***
FINST	0.619	0.632	0.516	0.527	58.08***
NANAL	10.486	9.000	6.693	5.000	78.91***
MV ($MM's)	7,285.432	2,651.194	2,777.386	887.085	78.35***

TABLE 3-3
Pearson and Spearman Correlations

This table presents Pearson and Spearman correlations among various control variables. Pearson correlations are above the diagonal and Spearman correlations are below the diagonal. The sample consists of 52,400 firm-quarter observations during the period 1985-2003. SUE is the standardized unexpected earnings, measured by the actual EPS minus the mean analysts' EPS divided by the cross-sectional standard deviation of the forecasts. EVAR is the residual variance from a market model regression, estimated over 48 months prior to earnings announcement. MVAR is the return variance explained by the market model regression. APRICE is the average of daily closing price over 20 trading days prior to the pre-announcement period (day –11 to day –1 relative to the earnings announcement date). APVOL is the daily dollar trading volume, averaged over 250 trading days prior to the pre-announcement period. FINST is the fraction of the firm's shares held by institutions. NANAL is the number of analysts following. MV is the market value of firms on the quarterly earnings. Values in parentheses represent p-values.

	MV	EVAR	MVAR	APRICE	APVOL	FINST	NANAL
MV	1.000	-0.104	-0.042	0.088	0.801	0.094	0.496
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
EVAR	-0.369	1.000	0.310	-0.018	0.029	0.052	-0.050
	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0,00)
MVAR	-0.059	0.292	1.000	-0.010	0.064	0.088	0.101
	(0.00)	(0.00)		(0.02)	(0.00)	(0.00)	(0,00)
APRICE	0.655	-0.504	-0.116	1.000	0.013	-0.002	0.007
	(0.00)	(0.00)	(0.00)		(0.01)	(0.99)	(0.03)
APVOL	0.895	-0.102	0.060	0.516	1.000	0.169	0.516
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)
FINST	0.272	0.139	0.093	0.236	0.410	1.000	0.283
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)
NANAL	0.710	-0.114	0.135	0.386	0.747	0.308	1.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

TABLE 3-4
Differences in Cumulative Abnormal Returns

This table reports the differences in cumulative abnormal returns during the sample period 1985-2003. Decile 10 (decile 1) includes firm-quarter observations with extremely good (bad) news measured by SUEs. *CAR(a,b)* represents the size-adjusted abnormal return, accumulated over day *a* through day *b* relative to the quarterly earnings announcement date. For each quarter during the sample period, a firm is classified as an option firm if it has exchange-traded options. Values in parentheses represent t-statistic. ***, **, and * denote 1%, 5%, and 10% significant levels, respectively.

Panel A: Pre-announcement Period: CAR(-11,-2)

		Non-option Firms	Option Firms	Difference in Means
SUE Decile 10	Mean	1.14%	1.33%	-0.19%
(Extreme good news)	Std. Dev.	6.67%	7.54%	(-0.89)
	n	3,561	1,661	
SUE Decile 1	Mean	-1.27%	-2.03%	0.76%
(Extreme bad news)	Std. Dev.	8.10%	8.61%	(2.91)***
	n	3,755	1,476	
Difference in Means		2.41%	3.36%	
		(13.91)***	(11.56)***	

Panel B: Announcement Period: CAR(-1,1)

		Non-option Firms	Option Firms	Difference in Means
SUE Decile 10	Mean	2.50%	3.02%	-0.52%
(Extreme good news)	Std. Dev.	5.86%	7.16%	(-2.60)***
	n	3,561	1,661	
SUE Decile 1	Mean	-2.19%	-2.59%	0.41%
(Extreme bad news)	Std. Dev.	7.91%	8.61%	(1.56)
	n	3,755	1,476	
Difference in Means		4.68%	5.61%	
		(28.86)***	(19.64)***	

Panel C: Post-Announcement Period: CAR(2,50)

		Non-option Firms	Option Firms	Difference in Means
SUE Decile 10	Mean	2.53%	1.76%	0.76%
(Extreme good news)	Std. Dev.	18.89%	15.63%	(1.71)
	n	3,561	1,661	
SUE Decile 1	Mean	-0.90%	0.26%	-1.16%
(Extreme bad news)	Std. Dev.	16.64%	13.70%	(-2.06)**
	n	3,755	1,476	
Difference in Means		3.42%	1.50%	
		(9.62)***	(2.40)***	

TABLE 3-5
Speed of Price Adjustment to Earnings News

This table reports the proportions of total price adjustment to earnings news made over each event interval for two extreme SUE deciles during the sample period 1985-2003. The total price adjustment is measured as the total cumulative abnormal returns over all 3 periods (pre-announcement, announcement, and post- announcement periods). Decile 10 (decile 1) includes firm-quarter observations with extremely good (bad) news. *CAR(a, b)* represents the size-adjusted abnormal return, accumulated over day *a* through day *b* relative to the quarterly earnings announcement date. For each quarter during the sample period, a firm is classified as an option firm if it has exchange-traded options.

		Total Price Adjustment CAR(-11, 50)		Pre-announcement Period CAR(-11, -2)		Announcement Period CAR(-1, 1)		Post-announcement Period CAR(2, 50)	
SUE Decile		Non-option Firms	Option Firms	Non-option firms	Option Firms	Non-option firms	Option Firms	Non-option firms	Option Firms
Decile 10	Mean[a]	6.17%	6.11%	1.14%	1.33%	2.50%	3.02%	2.53%	1.76%
(Good news)	Proportion[b]	100.00%	100.00%	18.47%	21.77%	40.54%	49.41%	40.99%	28.82%
Decile 1	Mean[a]	-4.36%	-4.36%	-1.27%	-2.03%	-2.19%	-2.59%	-0.90%	0.26%
(Bad news)	Proportion[b]	100.00%	100.00%	29.16%	46.51%	50.21%	59.48%	20.63%	-5.99%
Number of observations		3,755	1,476						
Difference between Non-option and Option Firms:									
Decile 10	Mean[a]	0.06%		-0.19%		-0.52%		0.76%	
(Good news)	Proportion[b]			-3.30%		-8.87%		12.17%	
Decile 1	Mean[a]	0.00%		0.76%		0.41%		-1.16%	
(Bad news)	Proportion[b]			-17.35%		9.26%		-26.62%	

a. The mean of cumulative abnormal returns for each decile of each sample category (non-option firms and option firms)

b. The proportion of total price adjustment to earnings news made ('total drift') over each period. The total price adjustment is measured as the total cumulative abnormal return over the three periods.

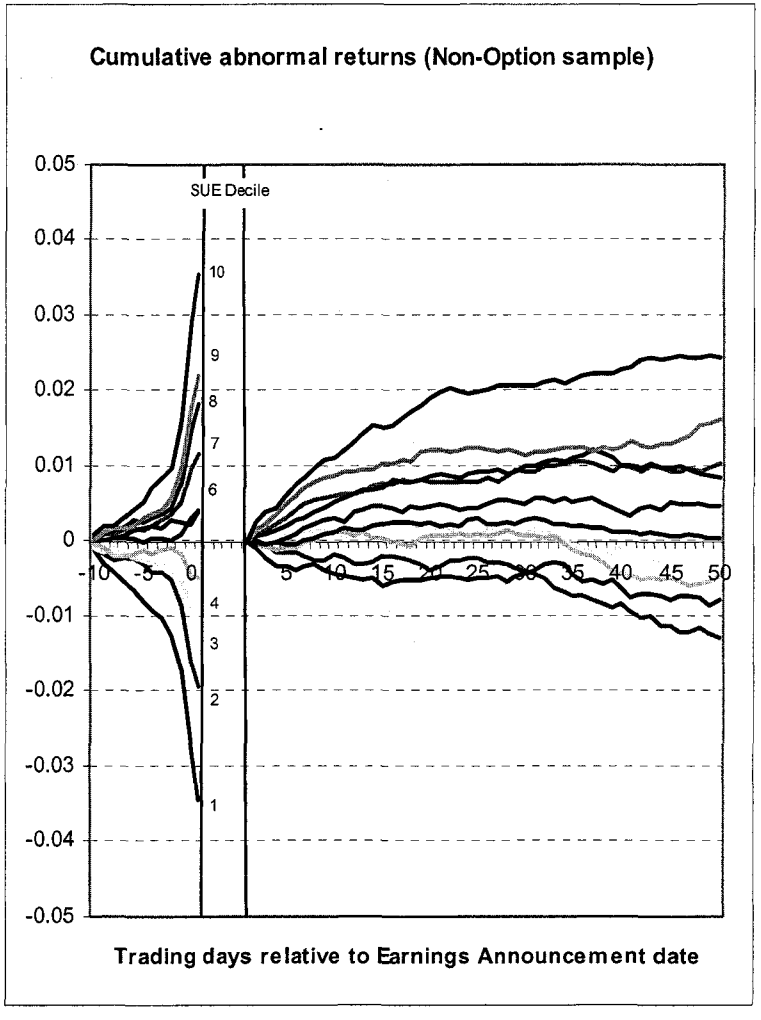
TABLE 3-6
Multivariate Regression Results

This table presents multivariate regression results using 52,400 firm-quarter observations during the sample period 1985-2003. The dependent variable, *CAR(a,b),* is the size-adjusted abnormal return, accumulated over day *a* through day *b* relative to the quarterly earnings announcement date. OPTION is a dummy variable which has a value of 1 if the firm has traded options for the given quarter. Otherwise, it is zero. EVAR is the residual variance from a market model regression, estimated over 48 months ending 1 month prior to the announcement. MVAR is the return variance explained by the market model regression. APRICE is the average of daily closing price over 20 trading days prior to the pre-announcement period, which includes day –11 through day –1 relative to the earnings announcement date. APVOL is the daily dollar trading volume, averaged over 250 trading days prior to the pre-announcement period. FINST is the fraction of the firm's shares held by institutions. NANAL is the number of analysts following. All regression coefficients are multiplied by 100. ***, **, and * denote 1%, 5%, and 10% significant levels, respectively.

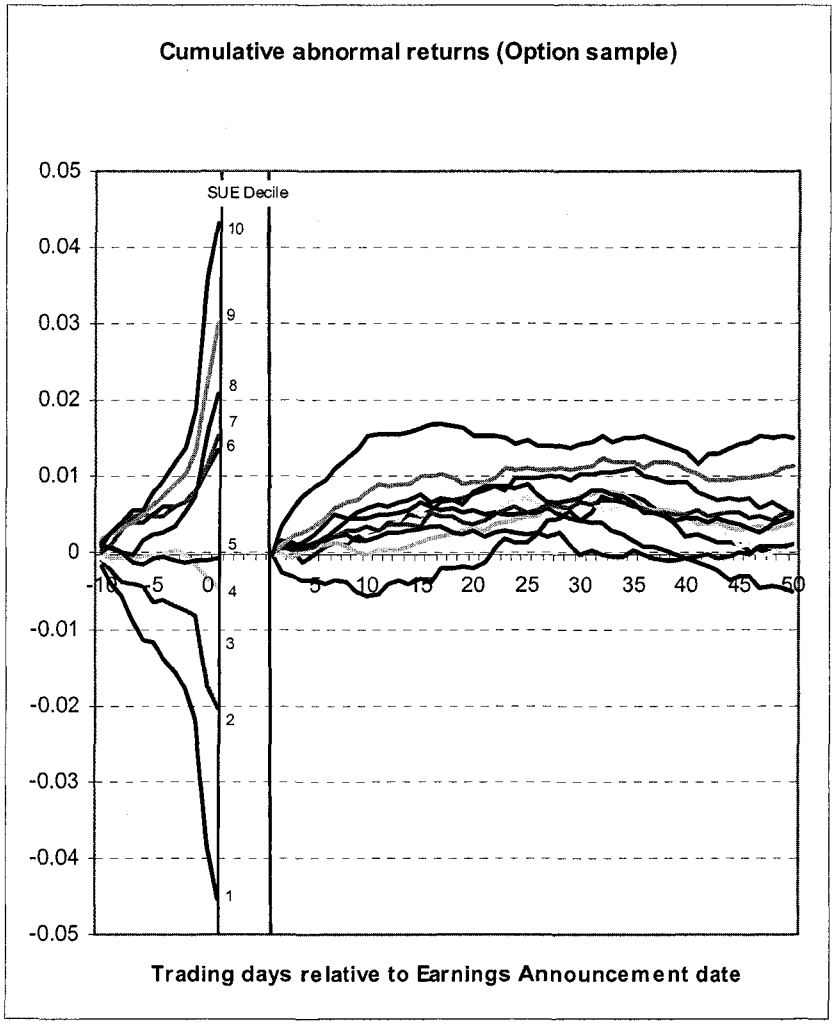
Dependent Variable	Pre-announcement Period CAR(-11,-2)		Announcement Period CAR(-1,1)		Post-announcement Period CAR(2,50)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	0.086	2.30**	0.251	7.86***	0.561	7.08***
SUE	2.048	16.77***	4.121	39.65***	2.969	11.53***
SUE*OPTION	0.604	2.72***	0.774	4.10***	-1.256	-2.69***
SUE*EVAR	3.482	9.15***	2.799	8.64***	1.468	1.83**
SUE*MVAR	-0.494	-1.49	0.253	0.90	-1.844	-2.64***
SUE*APRICE	-0.640	-1.53	-0.782	-2.20**	1.722	1.95*
SUE*APVOL	-0.310	-0.60	-1.855	-4.24***	-4.189	-3.86***
SUE*FINST	0.581	1.78*	0.868	3.13***	-1.176	-1.71*
SUE*NANAL	1.124	2.53**	1.056	2.79***	0.789	0.84
OPTION	0.048	0.75	0.110	2.00**	0.106	0.78
Adjusted R^2	0.014		0.058		0.005	

FIGURE 3-1 Cumulative Abnormal Returns for both Option Firms and Non-option Firms

A: Non-Option Firms



B: Option Firms



CHAPTER 4

VOLUNTARY DISCLOSURE OF FINANCIAL STATEMENT INFORMATION IN QUARTERLY EARNINGS ANNOUNCEMENTS AND ITS IMPACT ON TRADING ACTIVITIES OF INVESTORS AND INFORMATION ASYMMETRY

I. INTRODUCTION

In their press releases, some firms include only limited earnings numbers, but others provide disclosures beyond earnings figures, such as balance sheet and/or cash flow (hereafter BS/CF). This voluntary disclosure practice is becoming more common and pervasive. Prior studies on this voluntary disclosure practice primarily focus on managers' incentives to include supplementary financial statements in their press releases. These studies provide evidence that firms voluntarily include BS/CF information along with their earnings announcements to facilitate investors' demand for additional value-relevant information over simple earnings numbers (Chen *et al.,* 2002; and Levi, 2008). However, the capital market effects of this voluntary disclosure practice have not been investigated thoroughly. This paper is motivated to examine the consequences of this voluntary disclosure practice. Specifically, we examine whether investors are *incrementally* informed by the voluntary BS/CF disclosure. We also investigate whether the informedness of investors by this voluntary disclosure practice is different across heterogeneous types of investors. We categorize investors into two groups – large investors and small investors – and examine which group is the main beneficiary of this voluntary disclosure. Finally, we test whether this voluntary disclosure practice reduces information asymmetry among investors.

We find that investors' abnormal trading activities around earnings announcement periods are greater for firms which voluntarily disclose BS/CF information (hereafter Disclosers) than for firms which do not disclose BS/CF information (hereafter Non-disclosers). This result suggests that investors are *incrementally* informed by the voluntary disclosure of balance sheet and cash flow statement information. By comparing

parameter estimates using Seemingly Unrelated Regressions (Zellner, 1962), we also find that large investors' trading response to this voluntary disclosure is significantly larger than small investors', indicating that the main beneficiaries of this voluntary practice are large investors. Finally, we find that Disclosers have significantly higher levels of information asymmetry than Non-disclosers prior to earnings announcements and they still do so around earnings announcements. However, a firm's decision to provide or not to provide the additional information does not have any systematic effect on the changes in information asymmetry during the period of earnings announcements.

Our study contributes to current literature in several ways. First, this study extends our understanding of the consequences of voluntary disclosure by examining the market effects of the voluntary inclusion of BS/CF information in earnings press releases. Prior research mainly concentrated on managers' motivation for this voluntary disclosure practice (Chen *et al.*, 2002; and Levi, 2008) and its effects on the pricing of accrual (Baber *et al.*, 2006; Louis *et al.*, 2007; and Levi, 2008). To the best of our knowledge, this paper provides the first empirical evidence on the trading responses to voluntary disclosure of BS/CF information in the press release. Second, our study also contributes to the literature regarding the relation between investor sophistication and accounting information. Prior studies show that sophisticated investors have superior ability to acquire and process information about firms (Dontoh and Ronen, 1993; and Kim and Verrecchia, 1994). Balsam *et al.* (2002) show that sophisticated investors recognize the information content of the SEC filing prior to the release of Form 10-Q because they have access to other, more timely sources of information. We extend this view by examining each investor group's trading response to the voluntary disclosure of BS/CF information in earnings press releases. Our results are consistent with the view that large investors are better informed than small investors during earnings announcements and that the voluntary disclosure of BS/CF information increase the informedness of large investors more than that of small investors. Third, the decomposition of the bid-ask spread and the use of the adverse selection component of the spread as a proxy for information asymmetry mitigates a potential measurement error problem associated with using the quoted bid-ask spread. Many prior studies use the bid-ask spread as a proxy for information asymmetry. However, the quoted bid-ask spread is a nosy proxy for information asymmetry because it

contains information-irrelevant components such as inventory holding costs and order processing costs (Callahan *et al.*, 1997; and Krinsky and Lee, 1996). By focusing on the adverse selection component, this study employs a sharper measure of information asymmetry than prior studies.

The reminder of the paper is organized as follows: Section II outlines the motivation and prior studies. Section III presents the development of the hypotheses. Section IV describes our research design and variable definitions. Section V discusses empirical results, and Section VI concludes.

II. MOTIVATION AND PRIOR STUDIES

Firms typically make their earnings announcements through press releases first and then they file the full financial reports to the SEC a few weeks later. In their press releases, some firms provide only basic earnings information, while others include balance sheet and/or cash flow statement as complementary information.[29] This voluntary disclosure practice is becoming more common and pervasive. For example, Chen *et al.* (2002) report that 52% of their sample firms include a balance sheet in at least one quarterly earnings announcement during their sample period of the fourth quarter of 1992 to the third quarter of 1995 and the proportion of earnings announcements, which contain balance sheets, grows from 31% to 46% over their sample period. Thus, it appears that a large number of firms voluntarily disclose financial statements along with their earnings announcements.

Given that the inclusion of balance sheet and/or cash flow statement information in earnings announcements has been a widely used form of voluntary disclosure, it is surprising that only a few attempts have been made to investigate the consequences of this disclosure practice. Notable exceptions are Baber *et al.* (2006), Louis *et al.* (2007), and Levi (2008). Baber *et al.* (2006) investigates whether a firm's decision to disclose or not to disclose BS/CF information yields systematically different price reactions to its earnings announcement. Specifically, they find that investors discount evidence of earnings management at the disclosure date only when the firm voluntarily discloses this supplementary information. This result implies that with the voluntary disclosure,

[29] Appendix exhibits an example of balance sheet and cash flow information disclosure by TVX Gold Inc. in its earnings announcement.

investors can make more informed interpretations of quarterly earnings. Louis *et al.* (2007) investigate how the voluntary disclosure of balance sheet and cash flow information affects the abnormal accruals anomaly – a post-disclosure returns drift that is correlated with discretionary accruals. They find that providing this supplementary information allows the market to differentiate the discretionary and non-discretionary components of earnings surprise such that investors can assess the firm value in a more timely way. Finally, Levi (2008) provides evidence that the accrual information is better impounded into stock prices and, hence, mispricing associated with accruals is mitigated when firms provide supplementary information in their earnings announcements.

While the aforementioned studies focus on the price responses to the voluntary disclosure of BS/CF information, we investigate its effect on the short-term trading response and information asymmetry among market participants. Prior studies have suggested that it is important to utilize not only the price-based analysis but also the trading-based analysis when one examines investors' informedness. For example, Cready and Hurtt (2002) argue that supplementing price-based measures with trading-based measures increases the power of tests designed to detect investors' responses. In addition, the use of intraday transaction and quote data allows us to examine how this voluntary disclosure affects trading responses and information asymmetry across different types of investors who are differentially endowed and have differential abilities to acquire and process information. While prior research has found that heterogeneous classes of investors behave differently around public releases of information (Dontoh and Ronen, 1993; and Kim and Verrecchia, 1994), how the voluntary inclusion of BS/CF information in earnings announcements affects these groups of investors remains under-explored in accounting research.

III. HYPOTHESES DEVELOPMENT

In the current study, we empirically examine the following three questions: (1) Does voluntary inclusion of BS/CF in earnings announcements give additional information over providing only several earnings numbers? (2) Is the informedness of investors by this voluntary disclosure practice different across different types of investors? and (3) Does this voluntary disclosure practice affect information asymmetry among market participants?

For the first question, we investigate whether the voluntary disclosure of BS/CF information gives *incremental* information to the market by examining the abnormal trading response of investors. Prior studies show that balance sheets provide value-relevant information that compliments earnings information (Ou and Penman, 1989; Barth *et al.*, 1998; Berger *et al.*, 1996; and Collins *et al.*, 1999). Other studies also document the incremental information content of operating cash flow over earnings (Livnat and Zarowin, 1990; Ali, 1994; and Pfeiffer *et al.*, 1998). Given the findings of these studies, one may expect that the disclosure of BS/CF information will enhance the informedness of investors such that they can better assess the firm value. As suggested by Holthausen and Verrecchia (1990), greater informedness is associated with greater trading volume during an information release. Thus, if the voluntary disclosure of BS/CF provides incremental information over basic earnings numbers, we may expect that the abnormal trading activity is greater for Disclosers than Non-disclosers. This leads to our first hypothesis which is stated in the alternative form:

H1: Abnormal trading response on earnings announcement dates is greater for firms that voluntarily disclose the BS/CF information than for non-disclosing firms.

Prior studies document different trading behaviours by different types of investors around the time of public announcements. For example, Lee (1992) finds that during a short window of earnings announcement, large traders respond to good (bad) news by intensive buying (selling) while small traders exhibit a puzzling propensity of buying regardless of news type. Bartov *et al.* (2000) report that the magnitude of post-announcement drift is negatively correlated with the fraction of ownership held by institutional investors. In addition, Balsam *et al.* (2002) provide evidence that the reaction of sophisticated investors to 10-Q filings precedes that of unsophisticated investors. While these studies suggest that large (and presumably sophisticated) investors have superior abilities to acquire and process earnings news than small (and presumably unsophisticated) investors, whether the voluntary disclosure of BS/CF information in earnings announcements mitigates or intensifies information advantages of large traders at the time of earnings announcements is not clear. If large traders are aware of, at least

partly, the content of supplementary information, then their responses to the voluntary disclosure will not be as intensive as small investors. On the other hand, when both small and large traders did not have any prior knowledge of the information, then large traders' superior abilities to process and interpret new information will amplify their information advantages. In such a case, one may expect their responses to the voluntary disclosure to be more intensive than small traders'. Therefore, we state the next hypothesis in the alternative form:

H2: Sophisticated and unsophisticated traders exhibit systematically different responses to the voluntary inclusion of BS/CF information in earnings announcements.

Chen *et al.* (2002) document that managers are more likely to voluntarily disclose additional information as part of earnings announcements when they: 1) are in high technology industries; 2) report losses; 3) have larger forecast errors; 4) execute mergers or acquisitions; 5) are younger; and 6) have volatile stock returns. In these settings, investors face a great deal of uncertainty about current and future performance of firms and they are also likely to be subject to a high level of information asymmetry. Thus, the voluntary disclosure of additional information can be viewed as an attempt by management to mitigate uncertainty and information asymmetry. In addition, one may expect information asymmetry to decrease around earnings announcements if providing this supplementary information yields the consequences desired by management. Thus, we have the following hypothesis (in alternative form):

H3: The voluntary disclosure of BS/CF information reduces the level of information asymmetry among market participants around earnings announcements.

IV. RESEARCH DESIGN AND VARIABLE DEFINITIONS

4.1. Data

Our sample period spans the first quarter of 2001 through the fourth quarter of 2003

(12 fiscal quarters).[30] From the COMPUSTAT database, we obtain all quarterly earnings announcements for firms that are listed on the New York Stock Exchange (NYSE) and have December 31 fiscal year-ends. Then, using keywords, we search the Business Wire and PR Newswire services of the Factiva database to obtain 12,061 quarterly earnings announcements. To facilitate our empirical analyses, we require all firm-quarter observations to satisfy the following criteria:

1. Daily stock prices, daily stock returns, and number of shares outstanding are available from the Center for Research in Security Prices (CRSP) database.
2. Transaction data, such as trading prices and bid-ask quotes, are available from the New York Stock Exchange's Trade and Quote (TAQ) database.[31]

These sampling procedures result in 10,275 quarterly earnings announcements made by 1,116 distinct firms during our sample period of 2001 through 2003 (i.e., 12 fiscal quarters).

We categorize 10,275 firm-quarter observations into two groups: 1) Disclosers and 2) Non-disclosers. A firm-quarter observation is coded as a Discloser if its announcement contains sufficient balance sheet and/or cash flow statement information while it is coded as a Non-discloser if its announcement does not contain this supplementary information. Following Louis *et al.* (2007), we restrict a Discloser to be an observation whose balance sheet and/or cash flow information is sufficient enough, at least, for accrual estimation. Some announcements contain only highly aggregated balance sheet line items, such as total assets, total liabilities, and total equity. Although our analyses do not require accrual estimation, we code these observations as Non-disclosers to be consistent with the most recent studies such as Louis *et al.* (2007) and Levi (2008). Therefore, as Louis *et al.* (2007) described, many firms that are considered as Disclosers in Chen *et al.* (2002) are classified as Non-disclosers in our study.

[30] Our sample period starts after Regulation FD which took effect in October 2000. This ensures that information is not selectively disclosed to a subset of investors.

[31] TAQ database contains intraday transactions data (trades and quotes) for all securities listed on the New York Stock Exchange (NYSE) and American Stock Exchange (AMEX), as well as NASDAQ National Market System. For each trade, TAQ provides the time of the transaction to the nearest second, price, volume, and a trade condition code.

Insert Table 1 about here

As reported in Table 1, 60.8% of our sample firms (i.e., 679 out of 1,116 distinct firms) made at least one voluntary disclosure of BS/CF information during the sample period. In addition, 51.8% of quarterly earnings announcements in our sample contained this supplementary information.[32] Thus, our sample distribution is similar to that in Chen *et al.* (2002).

4.2. Proxy for Investor Sophistication

Prior research shows that, on average, more sophisticated and wealthier investors (e.g., institutional investors) are likely to engage in larger trades, while less sophisticated and less wealthy investors (e.g., individual investors) are more likely to make smaller trades (Easley and O'Hara, 1987; and Chan and Lakonishok, 1993). Therefore, several prior studies use trade size to categorize investors either into wealthy, sophisticated investors or less wealthy, unsophisticated investors. It is unlikely for sophisticated institutional investors to engage in small trades since it may reduce their potential trading profits for the following reasons. First, breaking a large order into several smaller trades would require more time to transact the desired number of shares, allowing arbitrageurs and informed traders to exploit the trading opportunities, therefore eroding potential trading profits. Second, a flurry of small orders from one trader could prompt a specialist to believe that the orders are submitted by informed traders, thereby increasing the spread. Finally, transacting a series of small trades instead of one large trade significantly increases direct transaction costs (Bhattacharya *et al.*, 2007). Consequently, large trades are likely to capture primarily sophisticated, institutional investors' trading activities, while small trades are likely to capture primarily unsophisticated, individual investors' trading activities. Prior studies provide evidence supporting this conjecture. For example, Chakravarty (2001) and Alexander and Peterson (2007) find that trades by institutional investors typically involve more than 500 shares, while the majority of individual trades do not exceed 500 shares. Given the aforementioned studies, we assume that large (small) trades are made by

[32] Our initial sample of 12,061 quarterly earnings announcements exhibits a similar distribution to the one reported in Table 1.

sophisticated, institutional (unsophisticated, individual) investors.[33]

4.3. Measures of Abnormal Trading Response

We estimate investors' trading responses around earnings announcements by the abnormal trading volume. In doing so, we first classify transactions into two groups on the basis of trade size.[34] A small trade involves 500 shares or fewer while a large trade involves more than 500 shares. For each size group (i.e., small or large), we accumulate all transactions to obtain the daily number of shares traded. We divide this daily measure by the number of shares outstanding to obtain the daily trading volume (or turnover) for each size group. Then, for each quarterly earnings announcement in our sample, we calculate the daily average values over the control period where the control period includes day –10 to day –6 relative to the earnings announcement day. Then, the abnormal measure is the average value during the event period (day 0 and day +1) minus the average from the control period. Specifically, the abnormal trading volume for firm *i* is defined as:

$$AVOLUME_i^k = VOLUME_{i,Event}^k - VOLUME_{i,Control}^k \quad (1)$$

where $VOLUME_{i,Event}^k$ ($VOLUME_{i,Control}^k$) is the daily turnover for the event (control) period, averaged over day 0 and day 1 (day –10 to day –6), and the superscript k denotes the trade size group (alternatively: *Small or Large*).

4.4. Bid-Ask Spread and the Adverse Selection Component

We use the adverse selection component of the bid-ask spread as a proxy for information asymmetry. Market microstructure literature (Amihud and Mendelson, 1980;

[33] We also use 1,000 shares as an alternative cutoff and find out that results are qualitatively similar. Bhattacharya (2001) and Asthana *et al.* (2004) use an additional medium-sized trade category between small and large trades, arguing that excluding a "buffer-zone" of medium-sized trades increases the power of the statistical tests to separate the trading activities of small and large investors. However, many prior studies (Chakravarty, 2001 and Alexander and Peterson, 2007) show that the vast majority of medium-sized trades are disguised large trades. Therefore, we include medium-sized trades as part of large trades.

[34] Alternative possible proxy is the dollar value of trades (Bhattacharya 2001; Asthana *et al.*, 2004; and Bhattacharya *et al.*, 2007). Most of prior studies claim that switching between the number of trades and the dollar value of trades doesn't make any significant difference in their empirical results.

Copeland and Galai, 1983; Glosten and Harris, 1988; and Stoll, 1989) shows that the quoted bid-ask spread consists of three components: order processing costs, inventory holding costs, and adverse selection costs. The order processing costs are the dealers' costs of arranging trades and clearings transactions. The inventory holding costs compensate market makers for holding for less than fully diversified portfolio, while the adverse selection component is the cost of dealer for taking on the risk of dealing with traders who may have superior information. Therefore, only the adverse selection component of the bid-ask spread reflects the degree of information asymmetry risk perceived by liquidity providers. To measure the level of information asymmetry, we want to isolate the adverse selection component from the quoted bid-ask spread because the other two components are not related to information asymmetry (Callahan *et al.*, 1997; and Lee and Yi, 2001).

Using the method of Huang and Stoll (1996), we decompose the bid-ask spread into two components: i) the realized spread, which covers both order processing costs and inventory holding costs and ii) the adverse selection component. For all time-stamped trades available from NYSE's Trade and Quote (TAQ) data files, we match the quotes prevailing immediately before each trade.[35] Then, we calculate the effective spread which is defined as:

$$Effective\ Spread = \frac{2\left|Trade_t - Quote_t\right|}{Quote_t} \tag{2}$$

where $Trade_t$ is the trade price at the time of t and $Quote_t$ is the existing quote midpoint at the time of t (i.e., $\frac{1}{2}\left(Bid_t + Ask_t\right)$).[36] Using the Lee and Ready (1991) algorithm, we classify each trade as a buyer- or seller- initiated trade. Then, we calculate the realized spread for time horizon τ, which is:

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[35] In obtaining the prevailing quote for each trade, we follow Lee and Ready (1991) and use the most recent prior quote that is time-stamped at least five seconds earlier than the trade. This five-second rule is used because of the speedier reporting of quotes than of trades.

[36] When all transactions take place at the bid and ask price, the quoted spread - difference between ask and bid price - could be used. However, transactions do not necessarily take place at quoted bid and ask prices. Then, the effective spread will be a better measure of transaction costs (Huang and Stoll, 1996). The quoted spread will be the same as the effective spread only if all transactions take place at the prevailing bid and ask quotes. However, if transactions can occur inside the spread, the effective spread will be smaller than the quoted spread.

$$Realized\ Spread = \frac{2\left(Trade_{t+\tau} - Quote_t\right)}{Quote_t} \tag{3}$$

for a seller-initiated stock trade, and

$$Realized\ Spread = \frac{-2\left(Trade_{t+\tau} - Quote_t\right)}{Quote_t} \tag{4}$$

for a buyer-initiated stock trade. Then the adverse selection component is given by the effective spread *minus* the realized spread. Following prior studies (Huang and Stoll, 1996; and Lee and Yi, 2001), we use a five-minute time horizon for τ.[37] The time horizon τ is supposed to be long enough so that the subsequent price reflects a reversal but should be not too long so that unnecessary variability enters into the measure of the realized half-spread (Huang and Stoll, 1996). An increase in adverse selection costs indicates a higher level of information asymmetry between informed traders and liquidity providers, and thus more information-motivated trading.

4.5. Sample Characteristics

Table 2 presents a summary of sample characteristics. Firms that voluntarily disclose BS/CF information along with their earnings announcements tend to be smaller. For example, the mean market value of equity for Disclosers is $3,554 million, compared to $6,655 million for Non-Disclosers. This difference in market capitalization is significant at the one percent level. In addition, while Disclosers have a smaller number of trades and a smaller number of shares traded around earnings announcements, their trading volume (or turnover) is significantly higher than that of Non-disclosers.[38] This result is not surprising because Disclosers have much lower market capitalization than Non-disclosers. Table 2 also shows that Disclosers have higher transaction costs (i.e., higher spread). Overall, the results in the Table indicate that these two types of firms have systematically different firm characteristics.

[37] This means that we measure the realized spread using the first trade occurring at least five minutes after the initial trade. If no subsequent trade occurs on the same day, no realized spread will be calculated.

[38] Although not reported in the paper, we find that Disclosers also have higher trading volume than Non-disclosers during the control period.

Insert Table 2 about here

V. EMPIRICAL RESULTS

5.1. Comparisons of Abnormal Trading Activities between Disclosers and Non-disclosers

In Table 3, we present trading volume reactions to quarterly earnings announcements for Disclosers and Non-disclosers. Each value in the Table represents the percentage of shares traded relative to the number of shares outstanding. We winsorize all values at 2% and 98% to ensure that our results are not driven by outliers.[39] The results in the Table indicate that Disclosers have significantly greater trading volume in the control period (i.e., day –10 through day –6 relative to the earnings announcement date) than Non-disclosers for both small and large trades. For example, as per small (large) trades, the trading volume for Disclosers is 0.1298 (0.4161) while it is 0.1028 (0.3571) for Non-disclosers. This difference in means between these two groups is significant at the one percent level. Table 3 shows that during the period of earnings announcement, Disclosers still have greater trading volume than Non-disclosers. In addition, the differences in trading volume between these two groups increase in the event period. This observation holds for both small and large trades. For example, the abnormal trading volume by small trades (large trades) is 0.0341 (0.2418) for Disclosers while it is 0.0277 (0.2069) for Non-disclosers. The differences in abnormal trading volume are significant at the one percent level.

Insert Table 3 about here

Overall, the results in Table 3 suggest trading volume increases more for Disclosers than Non-disclosers around earnings announcements across all trade size groups. This finding implies that the voluntary disclosure of balance sheet and cash flow information as

[39] Winsorization using other alternative percentiles – 1 and 5 percentile–generates similar results.

part of earnings announcements increases the informedness of investors in general. Consequently, it results in more intensive trading volume reactions by both small and large investors, consistent with our first hypothesis.

5.2. Multivariate Analysis of Trading Volume Responses to Earnings Announcements

In this section, we investigate 1) whether Disclosers and Non-disclosers have systematically different volume reactions around earnings announcements, after controlling for other factors that may affect volume reactions and 2) whether the effect of voluntarily disclosing BS/CF information on volume reactions is systematically different between small and large traders. In doing so, we use the following regression models:

$$AVOLUME_i^{Small} = \alpha_0 + \alpha_1 VDISC_i + \alpha_2 D_P * RETURN_i + \alpha_3 D_N * RETURN_i + \alpha_4 MKTVOL_i + \alpha_5 LN(MV) + \varepsilon_i \quad (5)$$

for small trades, and

$$AVOLUME_i^{Large} = \beta_0 + \beta_1 VDISC_i + \beta_2 D_P * RETURN_i + \beta_3 D_N * RETURN_i + \beta_4 MKTVOL_i + \beta_5 LN(MV) + \omega_i \quad (6)$$

for large trades where

VDISC	=	dummy variable that takes a value of 1 if the announcement contains the voluntary disclosure of BS/CF information; 0 otherwise,
RETURN	=	absolute value of the stock return over the event period,
D_P	=	dummy variable that takes a value of 1 if the return during the event period is positive; 0 otherwise,
D_N	=	dummy variable that takes a value of 1 if the return during the event period is not positive; 0 otherwise,
MKTVOL	=	market-wide (NYSE/AMEX) trading volume during the event period, and
LN(MV)	=	natural log of the market value of equity.

In regression models of (5) and (6), we include the absolute value of firm-specific return as a proxy for the new information or 'surprise' revealed through earnings announcements. Prior studies (Karpoff, 1987; and Bhattacharya, 2001) show that trading

volume is, on average, higher when prices go up than when prices go down. Thus, we also include two dummy variables – one for positive return (D_P) and the other for negative return (D_N). *MKTVOL* is included in the regression models to control for market-wide trading activities (Bamber *et al.*, 1997; and Bhattacharya, 2001) while *LN(MV)* is a proxy for information environment.

Insert Table 4 about here

In Table 4, we present our multivariate regression results. For both small and large trades, the coefficient of *VDISC* is positive and significant (t-values are 5.98 and 5.09, respectively). This implies that even after controlling for other confounding factors, Disclosers have higher trading volume reactions to earnings announcements by both small and large traders than Non-disclosers, consistent with our first hypothesis and our univariate results in Table 3. We interpret this as evidence that the voluntary disclosure of balance sheet and cash flow information along with earnings announcements does provide value relevant information to investors and intensifies trading activities in general. To examine whether this voluntary disclosure has systematically different effects on the two types of traders, we compare the regression coefficient of *VDISC* in Equation (5) with that in Equation (6) using the SUR method of Zellner (1962). We find that β_1 is significantly greater than α_1 (F-statistic = 20.51). This result suggests that the voluntary disclosure of BS/CF information increases large, sophisticated investors' trading activities more than that of small, unsophisticated investors' trading activities during earnings announcements, consistent with our second hypothesis. Overall, the results in Table 4 indicate that large traders are more responsive to earnings announcements than small traders and that the inclusion of BS/CF information along with the announcements amplifies their abnormal trading activities.

5.3. Comparisons of Information Asymmetry between Disclosers and Non-disclosers

In this section, we examine whether Disclosers have different levels of information

asymmetry from Non-disclosers in general and around earnings announcements in particular. In doing so, we estimate the adverse selection component of the bid-ask spread and use it as a proxy for information asymmetry.

Insert Table 5 about here

Table 5 presents the levels of adverse selection costs for Disclosers and Non-disclosers before and during earnings announcements. We find that during the control period (i.e., day –10 through day –6 relative to earnings announcements), Disclosers have significantly higher adverse selection costs than Non-disclosers for both small and large trades. As Chen *et al.* (2002) argue, Disclosers generally operate in the environment where uncertainty about current and future performance is high. In this environment, investors with superior abilities to acquire and process information may find the benefit of being informed to be greater than the cost of being informed.[40] Then, large proportions of both small and large traders choose to be informed. This will lead to higher informed trading which, in turn, increases information asymmetry among traders.

In Table 5, we also report the levels and changes in adverse selection costs around earnings announcements. Consistent with prior studies, adverse selection costs increase during the event period (day 0 and day 1) for both small and large trades. The changes in adverse selection costs are significant at the one percent level. The results in Table 5 also indicate that adverse selection costs are still significantly higher for Disclosers than for Non-disclosers during earnings announcements. In addition, the increase in adverse selection costs is generally larger for Disclosers than for Non-disclosers although the difference in these increases is significant at the five percent level for small trades only.

To ensure that our results in Table 5 are not driven by other confounding factors that may affect information asymmetry around earnings announcements, we augment our analysis with the following regression models:

[40] Grossman and Stiglitz (1980) argue that, when the expected benefit of being informed exceeds the cost, some investors switch from being uninformed to being informed.

$$AADV_i^{Small} = \alpha_0 + \alpha_1 VDISC_i + \alpha_2 VOLUME_i + \alpha_3 LN(MV) + \varepsilon_i \quad (7)$$

for small trades, and

$$AADV_i^{Large} = \beta_0 + \beta_1 VDISC_i + \beta_2 VOLUME_i + \beta_3 LN(MV) + \omega_i \quad (8)$$

for large trades where

VDISC	=	dummy variable that takes a value of 1 if the announcement contains the voluntary disclosure of BS/CF information; 0 otherwise,
VOLUME	=	trading volume during the event period, and
LN(MV)	=	natural log of the market value of equity.

The dependent variables in Equations (7) and (8) are the increases in adverse selection costs for small and large trades, respectively. We also include *VOLUME* in the regression models to control for liquidity while *LN(MV)* is a proxy for information environment.

Insert Table 6 about here

In Table 6, we report our multivariate regression results. We find that the coefficient of *VDISC* is not significant in either regression model. This finding implies that the voluntary inclusion of balance sheet and cash flow information does not have any systematic effect on the changes in adverse selection costs around earnings announcements. Chen *et al.* (2002) suggest that managers have an incentive to voluntarily disclose supplementary information along with their earnings announcements when investors' demand for value relevant information is high. If this form of voluntary disclosure mitigates investors' uncertainty and information asymmetry, we would expect Disclosers to

experience a smaller increase in adverse selection costs during the event period than Non-disclosers. However, our results in Tables 5 and 6 suggest that it generally fails to produce the consequences intended by managers at least during the 2-day window of earnings announcements.

VI. CONCLUSION

It has been well known that some managers voluntarily provide investors with balance sheet and/or cash flow (BS/CF) information along with their earnings announcements. While this form of voluntary disclosure has been widely used by firms, prior studies on this issue have focused on either management incentives to provide the supplementary information or its pricing effect. (Chen *et al.*, 2002; Baber *et al.*, 2006; Louis *et al.*, 2007; and Levi, 2008). Unlike these studies, we examine the impact of this voluntary disclosure on trading volume reactions of different investor classes and information asymmetry among market participants.

We find that Disclosers (i.e., firms that voluntarily disclose BS/CF information in their earnings announcements) exhibit much stronger volume reactions to earnings announcements than Non-disclosers (i.e., firms that do not provide this additional information). This finding implies that the voluntary disclosure practice conveys value relevant information to investors. In addition, we document that large traders' trading response to this disclosure is more intensive than small traders, even after controlling for potential confounding factors. Thus, we provide evidence that the additional information provided through this voluntary disclosure does not necessarily have the same value to heterogeneous investor types.

Prior studies argue that firms voluntarily disclose supplementary information along with their earnings announcements when uncertainty about their performance is high and when investors demand additional value relevant information. Consistent with this, we find that Disclosers display higher levels of information asymmetry prior to earnings announcements than Non-disclosers. However, while earnings announcements increase information asymmetry for both types of firms, we do not find any evidence that the increases in information asymmetry are systematically different between these two types. This observation holds for both small and large trades. If managers indeed use this

voluntary disclosure to mitigate investors' uncertainty and information asymmetry, our results cast serious doubt on the effectiveness of this practice.

APPENDIX

A.1. Balance sheet statement disclosure from TVX Gold, Inc., May 10, 2001.

TVX Gold, Inc.
Consolidated Balance Sheets (US$ thousands; unaudited)

	March 31, 2001	December 31, 2000
Assets		
Current assets		
Cash and cash equivalents	$116,306	$93,635
Short-term investments	1,680	31,492
Accounts receivable	28,374	29,596
Inventories	33,961	32,986
	180,321	187,709
Mining property, plant and equipment	491,084	494,105
Export prepayment contracts	42,562	43,695
Deferred charges	9,967	7,384
Deferred income taxes	9,562	9,112
Other assets	23,358	21,002
	$756,854	$763,007
Liabilities		
Current liabilities		
Accounts payable and accrued liabilities	$26,069	$28,407
Current portion of long-term debt	18,343	18,585
Debenture payable	26,855	26,855
Deferred revenue	5,430	4,984
	76,697	78,831
Long-term debt	64,372	69,780
Other liabilities	25,270	24,648
Deferred income taxes	27,571	28,411
	193,910	201,670
Minority interests and participation rights	162,674	164,788
	356,584	366,458
Shareholders' Equity		
Capital stock	382,900	382,900
Contributed surplus	1,526	1,526
Gold-linked convertible notes	237,096	233,960
Deficit	(221,252)	(221,837)
	400,270	396,549
	$756,854	$763,007

A.2. Cash flows statement disclosure from TVX Gold, Inc., May 10, 2001.

TVX Gold, Inc.
Consolidated Statements of Cash Flows (US$ thousands; unaudited)

	Three months ended March 31, 2001	2000
Operating Activities		
Net earnings	$3,721	$4,005
Non-cash items:		
Depletion and depreciation	9,302	9,238
Deferred income taxes	(1,574)	213
Minority interests and participation rights	(175)	718
Other	(2,199)	(137)
Deferred revenue	(1,337)	(2,836)
	7,738	11,201
Change in working capital	(1,470)	3,328
Cash provided by operating activities	6,268	14,529
Investing Activities		
Mining property, plant and equipment	(6,101)	(15,422)
Other assets and short-term investments	30,945	(10,669)
Other	(100)	1,184
Cash provided by (used for) investing activities	24,744	(24,907)
Financing Activities		
Gold-linked convertible notes	(5,866)	(5,637)
Minority interest dividend	(1,940)	(5,078)
Net long-term debt (repayment) borrowings	(535)	(6,125)
Cash used for financing activities	(8,341)	(16,840)
Increase (decrease) in cash and cash equivalents	22,671	(27,218)
Cash and cash equivalents, beginning of period	93,635	147,176
Cash and cash equivalents, end of period	$116,306	$119,958

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TABLE 4-1
Distribution of Earnings Announcements and the Proportion of Disclosing Firms

Quarterly earnings announcements are categorized into two groups: 1) Disclosers and 2) Non-disclosers. Disclosers are defined as the ones that provide balance sheet and/or cash flow information in their earnings announcements while Non-disclosers do not provide the supplementary information. Values in parentheses represent the percentage of each group.

Year	Quarter	Disclosers		Non-disclosers		Total
2001	Qtr 1	371	(47.4%)	401	(52.6%)	782
	Qtr 2	417	(50.5%)	409	(49.5%)	826
	Qtr 3	413	(49.9%)	415	(50.1%)	828
	Qtr 4	416	(51.6%)	390	(48.4%)	806
2002	Qtr 1	459	(52.4%)	417	(47.6%)	876
	Qtr 2	468	(53.2%)	412	(46.8%)	880
	Qtr 3	453	(53.0%)	402	(47.0%)	855
	Qtr 4	374	(45.8%)	443	(54.2%)	817
2003	Qtr 1	454	(52.0%)	419	(48.0%)	873
	Qtr 2	449	(51.0%)	432	(49.0%)	881
	Qtr 3	516	(56.2%)	402	(43.8%)	918
	Qtr 4	532	(57.0%))	401	(43.0%)	933
Entire Sample		5,322	(51.8%)	4,953	(48.2%)	10,275

Number of distinct firms with at least one earnings announcements	1,116
Number of firms with at least one announcement with voluntary disclosure	679
Proportion of firms with at least one announcement with voluntary disclosure	(60.8%)

TABLE 4-2
Descriptive Statistics on the Firm Characteristics for Disclosing firms and Non-disclosing Firms

Quarterly earnings announcements are categorized into two groups: 1) Disclosers and 2) Non-disclosers. Disclosers are defined as the ones that provide balance sheet and/or cash flow information in their earnings announcements while Non-disclosers do not provide the supplementary information. All values are the daily values on earnings announcement dates averaged across the sample period of 2001 through 2003 (i.e., 12 quarters). MV is the market value of equity (in million dollars). TRADE is the average daily number of trades. NSHR is the daily number of trades. VOLUME is the daily total number of shares traded, divided by the number of shares outstanding. PRICE is the average of bid-ask mid-points (in $). QSPRD is the average daily value of quoted bid-ask spread (in dollar). RQSPRD is the percentage value of the quoted spread relative to the bid-ask mid-point. *, **, and *** indicate that the mean (median) of Disclosers is significantly different from the mean (median) of Non-disclosers at the 10%, 5%, and 1%, respectively.

	Disclosers (N = 5,322)		Non-disclosers (N = 4,953)	
	Mean	Median	Mean	Median
MV ($MM)	3,554	1,211	6,655***	2,057***
TRADE	856	488	1,055***	613***
NSHR	948,970	328,100	1,265,882***	462,600***
PRICE ($)	25.52	23.30	29.59***	27.21***
VOLUME (×100)	0.8279	0.6077	0.6987***	0.5137***
QSPRD ($)	0.0638	0.0563	0.0634	0.0539***
RQSPRD	0.4067	0.2477	0.3392***	0.2056***

TABLE 4-3

Comparison of Trading Volume Responses between Disclosers and Non-disclosers

Quarterly earnings announcements are categorized into two groups: 1) Disclosers and 2) Non-disclosers. Disclosers are defined as the ones that provide balance sheet and/or cash flow information in their earnings announcements while Non-disclosers do not provide the supplementary information. The event period (Event) includes days 0 to +1 relative to the quarterly earnings announcement date as reported by COMPUSTAT. The control period (Control) includes days –10 to –6 relative to the earnings announcement date. Each period's value is the average value during that period. Trading volume is measured as the number of shares traded for each trade size group divided by the number of shares outstanding. Then, each volume measure is multiplied by 100 to obtain the percentage value. A small (large) trade involves 500 shares or fewer (more than 500 shares). *, **, and *** indicate the significance at the 10%, 5%, and 1%, respectively.

		Disclosers (N = 5,322)		Non-disclosers (N = 4,953)		Disclosers – Non-disclosers	
	Period	Mean	(t-value)	Mean	(t-value)	Difference	(t-value)
Small Trades	Control	0.1298		0.1028		0.0270	(12.02)***
	Event	0.1638		0.1305		0.0333	(13.69)***
	Event – Control	0.0341	(27.07)***	0.0277	(30.65)***	0.0064	(4.09)***
Large Trades	Control	0.4161		0.3571		0.0590	(6.38)***
	Event	0.6579		0.5640		0.0939	(8.88)***
	Event – Control	0.2418	(33.46)***	0.2069	(33.46)***	0.0349	(3.64)***

TABLE 4-4

Multivariate Analysis of Trading Volume Responses around Quarterly Earnings Announcements

Quarterly earnings announcements are categorized into two groups: 1) Disclosers and 2) Non-disclosers. Disclosers are defined as the ones that provide balance sheet and/or cash flow information in their earnings announcements while Non-disclosers do not provide the supplementary information. The event period (Event) includes days 0 to +1 relative to the quarterly earnings announcement date as reported by COMPUSTAT. The control period (Control) includes days –10 to –6 relative to the earnings announcement date. Each period's value is the average value during that period. Trading volume is measured as the number of shares traded for each trade size group divided by the number of shares outstanding. The abnormal trading volume (*AVOLUME*) is given by the trading volume during the event period minus the trading volume during the control period. We then use the following regression models:

$$AVOLUME_i^{Small} = \alpha_0 + \alpha_1 VDISC_i + \alpha_2 D_P * RETURN_i + \alpha_3 D_N * RETURN_i + \alpha_4 MKTVOL_i + \alpha_5 LN(MV) + \varepsilon_i$$

for small trades, and

$$AVOLUME_i^{Large} = \beta_0 + \beta_1 VDISC_i + \beta_2 D_P * RETURN_i + \beta_3 D_N * RETURN_i + \beta_4 MKTVOL_i + \beta_5 LN(MV) + \omega_i$$

for large trades where

VDISC	=	dummy variable that takes a value of 1 if the announcement contains the voluntary disclosure of BS/CF information; 0 otherwise,
RETURN	=	absolute value of the stock return over the event period,
D_P	=	dummy variable that takes a value of 1 if the return during the event period is positive; 0 otherwise,
D_N	=	dummy variable that takes a value of 1 if the return during the event period is not positive; 0 otherwise,
MKTVOL	=	market-wide trading volume during the event period, and
LN(MV)	=	natural log of the market value of equity.

A small (large) trade involves 500 shares or fewer (more than 500 shares). Values in parentheses are t-statistics *, **, and *** indicate the significance at the 10%, 5%, and 1%, respectively.

	Intercept	*VDISC*	D_P*RETURN	D_N*RETURN	*MKTVOL*	*LN(MV)*	N	*Adj.*R^2
Small Trades	0.0170 (3.26)***	0.0059 (5.98)***	0.2836 (24.22)***	0.3590 (28.23)***	5.3962 (10.42)***	-0.0022 (-7.13)***	10,275	0.1244
Large Trades	-0.3516 (-10.45)***	0.0324 (5.09)***	2.5293 (33.60)***	3.5396 (43.28)***	18.0024 (5.41)***	0.0230 (11.37)***	10,275	0.1999
		Test of $\alpha_1 \neq \beta_1$:			F-statistic = 20.51***			

TABLE 4-5

Comparison of Adverse Selection Costs between Disclosers and Non-disclosers around Quarterly Earnings Announcements

Quarterly earnings announcements are categorized into two groups: 1) Disclosers and 2) Non-disclosers. Disclosers are defined as the ones that provide balance sheet and/or cash flow information in their earnings announcements while Non-disclosers do not provide the supplementary information. The event period (Event) includes days 0 to +1 relative to the quarterly earnings announcement date as reported by COMPUSTAT. The control period (Control) includes days –10 to –6 relative to the earnings announcement date. Each period's value is the average value during that period. A small (large) trade involves 500 shares or fewer (more than 500 shares). *, **, and *** indicate the significance at the 10%, 5%, and 1%, respectively.

		Disclosers (N = 5,322)		Non-disclosers (N = 4,953)		Disclosers – Non-disclosers	
	Period	Mean	(t-value)	Mean	(t-value)	Difference	(t-value)
Small Trades	Control	0.2077		0.1780		0.0297	(6.63)***
	Event	0.2343		0.1982		0.0361	(8.02)***
	Event – Control	0.0264	(10.89)***	0.0202	(30.65)***	0.0064	(1.98)**
Large Trades	Control	0.2788		0.2434		0.0354	(6.01)***
	Event	0.3107		0.2719		0.0388	(6.53)***
	Event – Control	0.0318	(10.08)***	0.0285	(33.46)***	0.0033	(0.75)

TABLE 4-6

Multivariate Analysis of Adverse Selection Costs around Quarterly Earnings Announcements

Quarterly earnings announcements are categorized into two groups: 1) Disclosers and 2) Non-disclosers. Disclosers are defined as the ones that provide balance sheet and/or cash flow information in their earnings announcements while Non-disclosers do not provide the supplementary information. The event period (Event) includes days 0 to +1 relative to the quarterly earnings announcement date as reported by COMPUSTAT. The control period (Control) includes days –10 to –6 relative to the earnings announcement date. Each period's value is the average value during that period. The abnormal adverse selection costs (*AADV*) is given by the adverse selection costs during the event period minus the adverse selection costs during the control period. We then use the following regression model:

$$AADV_i^{Small} = \alpha_0 + \alpha_1 VDISC_i + \alpha_2 VOLUME_i + \alpha_3 LN(MV) + \varepsilon_i$$

for small trades, and

$$AADV_i^{Large} = \beta_0 + \beta_1 VDISC_i + \beta_2 VOLUME_i + \beta_3 LN(MV) + \varpi_i$$

for large trades where

VDISC = dummy variable that takes a value of 1 if the announcement contains the voluntary disclosure of BS/CF information; 0 otherwise,
VOLUME = trading volume during the event period,, and
LN(MV) = natural log of the market value of equity.

A small (large) trade involves 500 shares or fewer (more than 500 shares). Values in parentheses are t-statistics *, **, and *** indicate the significance at the 10%, 5%, and 1%, respectively.

	Intercept	*VDISC*	*VOLUME*	*LN(MV)*	N	*Adj.*R^2
Small Trades	0.0963 (7.49)***	0.0022 (0.85)	0.0122 (5.86)***	-0.0058 (-6.65)***	10,275	0.0075
Large Trades	0.0899 (5.02)***	-0.0002 (-0.05)	0.0198 (6.80)***	-0.0052 (-4.28)***	10,275	0.0058
Test of $\alpha_1 \neq \beta_1$:		F-statistic = 0.51				

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CONCLUSION

This dissertation contains three empirical studies in the area of financial accounting research. The first paper investigates the effect of market inefficiency on the value-relevance (informativeness) of earnings. I measure the degree of market inefficiency by the speed at which a stock's price responds to market-wide information. By using this measure, I investigate the effect of market inefficiency on the relation between current annual stock returns and contemporaneous annual earnings, as well as future earnings. I find that there are positive relations between the level of market efficiency and the informativeness of future earnings as well as current earnings. These results suggest that both contemporaneous and future earnings of firms are more informative as the level of market efficiency increases.

The second study examines the effect of option listing on the stock-price adjustments to quarterly earnings news. We find that option trading reduces the magnitude of the pre-earnings announcement drift. We also present evidence that firms with options exhibit more intensive price reactions to earnings news than firms without options. In addition, we show that the magnitude of the post-earnings announcement drift is smaller for option firms than non-option firms. These results suggest that the existence of traded options increases the speed of stock price adjustment. Overall, our results prove the idea that option listing improves the informational efficiency in equity markets.

The third paper examines the impact of a voluntary disclosure practice – including balance sheet and/or cash flow information in the press release – on trading volume reactions of different investor classes and information asymmetry among market participants. We find that firms that voluntarily disclose balance sheet and/or cash flow information in their earnings announcements exhibit much stronger volume reactions of investors to earnings announcements than firms that do not provide this additional information. This finding implies that the voluntary disclosure conveys incremental information to investors. In addition, we document that large traders' trading response to this disclosure is more intensive than small traders, indicating that the additional

information provided through this voluntary disclosure have different value to different investor types. Finally, we find no evidence of decrease in information asymmetry by this voluntary disclosure. If managers use this voluntary disclosure to mitigate investors' uncertainty and information asymmetry, our results cast doubt on the effectiveness of this practice to resolve investors' uncertainty and information asymmetry.