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Risk Clientele and Predisclosure Information Asymmetry Effects of Accounting Earnings Announcements

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ABSTRACT

The theoretical literature shows that predisclosure information asymmetry causes investors to establish differential predisclosure expectations, which induce differential belief revisions when an earnings announcement is made. The differential belief revisions, in turn, lead investors to trade. Changes in the risk of securities after a public announcement can also induce investors to trade in order to realign the risk of their portfolio with their risk preferences. On the other hand, previous studies have documented that trading volume around annual earnings announcements is related to the information content of the announcement and firm size. Under this framework, this paper examines whether abnormal trading volume around the time of an annual earnings announcement is related to the risk clientele effect of portfolio rebalancing and the level of predisclosure information asymmetry, after controlling for firm size and the information effect of the announcement. The empirical results are as follows. First, the magnitude of trading volume reaction is an increasing function of the magnitude of abnormal returns. Second, generally, the risk change and the two proxies for predisclosure information asymmetry are significantly positively related to trading volume reactions, after controlling for the magnitude of the associated price reaction. Third, trading volume around the time of an earnings announcement is an increasing function of the risk level before the announcement. Finally, there still exist a risk clientele effect, information effect, and predisclosure information asymmetry effect even after controlling for firm size.

Key Words: earnings announcement, risk clientele effect, analysts' forecasts, predisclosure information asymmetry level

I. Introduction

Theoretically, price reactions to public disclosures reflect average revision in investors' beliefs whereas trading volume reactions reflect idiosyncratic belief revision.[1] This implies that trading volume reactions depend on idiosyncratic changes in investors' expectations and differential interpretation of the disclosure. Among the related theoretical studies, Kim and Verrecchia (1994) demonstrated that an earnings announcement reveals some investors' superior judgement of the firm's performance and causes more information asymmetry during the announcement period. McNichols and Trueman (1994) showed that an impending disclosure encourages investors to acquire private information prior to the disclosure, and that the absolute price change is an increasing (decreasing) function of the probability and precision of the disclosure prior to (on) the disclosure date. Under the assumption that a costly private signal about the date 2 announcement is acquired by investors, Demski and Feltham (1994) argued that when the amount of information released in an announcement increases, the variance of price change increases or decreases, but the expected trading volume decreases. These theoretical analyses were mostly based on two-date rational expectations models used to explore the effect of the relationship between private information and public disclosures upon changes in price and volume on date 2. This line of research reveals academic interest in the impact of public disclosures upon information asymmetry. This academic interest motivated this paper to empirically investigate the magnitude of security price and trading volume responses to accounting earnings announcements.

Lang *et al.* (1992) assume that investors observe a private signal and conclude that trading volume is affected by the difference between individual and average beliefs, price variation and changes in average belief. Lin *et al.* (1995) assume that individual traders observe a private signal in each period, and that there exists a common and an idiosyncratic noise in each of the two signals. They showed that when the supply of a risky asset remains constant, the period 2 trading volume is affected by differential and average beliefs, in each period. Also, when supply contains random shocks, trading volume is influenced not only by dispersion in beliefs, but also by current and historical prices and average belief. These studies reveal that idiosyncratic noise in private signals leads to information asymmetry, and that trading is induced by differential beliefs in each period.[2] The results of theoretical analyses imply that predisclosure information asymmetry causes investors to establish differential predisclosure expectations, which result in differential belief revisions after a public disclosure. The differential belief revisions, in turn, induce investors to trade. This study, thus, aimed to test empirically whether predisclosure information asymmetry is related to abnormal trading volume around an earnings announcement, after controlling for the information effect of the announcement.

Among the empirical studies, Bamber (1986, 1987) found that the magnitude of trading volume around an earnings announcement is related to the information content of the announcement. Karpoff (1987) also documented a positive relationship between trading volume and price change around the earnings announcement. Kross *et al.* (1994) found that after controlling for the information effect of the announcement, volume reaction to a public announcement is related to changes in the risk of securities. Their results confirm that a public disclosure will change the risk of investors' portfolios, and that when the risk of their portfolios is not consistent with their risk preferences, they will trade to rebalance their portfolios. However, Verrecchia (1981) argued that volume reactions may not occur if there are heterogeneous risk tolerances and if these risk tolerances happen to be constant. The different conclusions drawn in these theoretical discussions make it desirable to empirically test whether differential risk preferences induce trading in the Taiwan stock market as reported by Kross *et al*. (1994). Therefore, this paper also examines whether volume reactions to earnings announcement are related to the risk clientele effect.

Following Atiase and Bamber (1994) and Bamber and Cheon (1995), this study employs analysts' forecasts as the proxy for predisclosure information asymmetry to measure investors' heterogeneous expectations.[3] Since the mid-1980s, analysts' forecasts have replaced statistical forecasts and have become mainstream resources because:[4] (1) It has been found that analysts' forecasts are superior or, at least, not inferior to statistical forecasts. (2) Many firms in the United States provide updates of analysts' earnings and nonearnings forecasts for both long and short term. (3) There is fewer restriction on collecting analysts' forecasts data than on collecting historical earnings data used to make statistical predictions. (4) Analysts' forecasts contain clues about accounting research and help us understand how analysts deal with accounting information and how investors react to forecasts.

In the Taiwan stock market,[5] analysts' earnings forecasts come mainly from: (1) security brokers and investment consulting firms, and (2) periodically published data. Analysts' earnings forecasts provided by security brokers and investment consulting firms are fragmentary and irregular. This is because when the stock market is active, more security brokers and investment consulting firms hire analysts to provide earnings forecasts for their customers. But when the market is dull, this service is reduced. It is, thus, hardly advisable to analyze this source of forecast data. Periodically published earnings forecasts come from four different sources: forecasts in "Fortune Monthly," "Four Seasons Journal," "Economy Daily," and management forecasts. These sources of forecast information are well kept and easily accessible to every investor. In the United States, there are analysts earnings forecast databases provided by professional institutions, such as the Institutional Brokers Estimate System (IBES) and Value Line (VL) Investment Survey. The quantity and quality of forecast information from periodically published data in Taiwan are definitely not comparable to those in the United States. Nevertheless, they provide relatively complete information and, therefore, are better proxies for investors' expectations.[6] This study pioneers the investigation of information asymmetry based on four different sources of analyst forecast data in Taiwan.

On the other hand, Atiase (1985) and Bamber (1987) showed that firm size is related to predisclosure information. Accordingly, this study also considers firm size in the model to examine whether abnormal volume around annual earnings announcements is related to the risk clientele effect of portfolio rebalancing and the level of predisclosure information asymmetry.

The remainder of this paper is organized as follows. Section II introduces the research design, which includes the research hypotheses and research method. Section III details the sample selection criteria, data collection and variable measurements. Section IV explains the empirical results and provides sensitivity analysis. A summary and conclusions are given in Section V.

II. Research Design

1. Research Hypotheses

To achieve the research purpose of this study, the following testable hypotheses were developed.

Hypothesis 1. *Trading volume reactions to an earnings announcement are positively related to the risk clientele effect of portfolio rebalancing and the information effect of the announcement.*

Explanation. Lin *et al.* (1995) showed that their two-period noisy rational expectations model leads to restrictions concerning the relation of trading volume with changes in the dispersion of traders' expectations (divergent bliefs) and in average expectations. Karpoff (1986) suggested that even if investors interpret the information identically, investors with divergent prior expectations will still trade. Ziebart (1990) also supported a positive relationship between the absolute value of unexpected earnings and trading volume. To investigate if volume reactions to an earnings announcement are associated with the information content of the announcement, this paper follows Bamber (1987) and Kross *et al.* (1994) in measuring the information content based on abnormal returns surrounding an announcement. A positive relationship between vol-ume reactions and abnormal returns is expected.

On the other hand, an earnings announcement may cause changes in the risk of securities, and when the risk of investors' portfolios becomes misaligned with investors' respective risk preferences, they will undertake portfolio rebalancing. Hamada (1972) found that financial leverage is positively related to systematic risk, and that if dollar debt levels are not adjusted for changes due to earnings retention, then large earnings changes can result into beta change even if the amount of debt is held constant. In other words, the association between earnings and security price is due to risk shift, and there exists a positive relationship between changes in earnings and risk. Bowman (1979) indicated a direct association between systematic risk and cross-sectional earnings covariability. An earnings announcement will alter investors' perceptions of the covariability of the income stream and change the systematic risk accordingly. Hakansson *et al.* (1982) found that trading in response to public announcements is related to the heterogeneity of investors' beliefs or the desire of investors to alter their risk-sharing arrangements. But Verrecchia (1981) argued that trading volume reaction to information indicates nothing about the homogeneity of risk tolerances among investors.

Because of the lack of consistent conclusions in the theoretical literature, this paper attempts to provide some empirical evidence related to the issue of whether or not differential risk preferences induce higher trading volume. Moreover, in Taiwan, institutional investors are becoming more active, and their investment percentage has been rising.[7] Relative to individual investors, the weight of their trading volume in the market has been increasing. As institutional investors are more concerned about risk management, the risk clientele effect is expected to be significant.

Hypothesis 2. *Trading volume reactions to public announcements are positively related to the level of predisclosure information asymmetry. Predisclosure information asymmetry will lead to heterogeneous expectations of stock prices and risk levels among investors.*

Explanation. Predisclosure information asymmetry leads investors to form heterogeneous expectations, which results in differential belief revisions when a public announcement is made. This implies that volume reactions are related to investors' heterogeneous expectations. Kim and Verrcchia (hereinafter KV) (1991a) showed that predisclosure information asymmetry arises when individual investors acquire private predisclosure information, and when the quality of this private information differs among investors. Also, trading volume reaction to public announcements is an increasing function of the magnitude of the associated price reaction and the level of predisclosure information asymmetry among investors. In other words, the level of predisclosure information asymmetry is positively related to trading volume responses to accounting disclosures, even after controlling for the associated price reactions. Theoretically, the level of predisclosure information asymmetry and heterogeneous expectations arises from the quality and quantity of the private information acquired by each investor. However, it is empirically impossible to collect the required data.[8]

This study uses analysts' earnings forecasts as the proxy for predisclosure information asymmetry. In the United States, there are professional security analysis institutions that provide a large amount of forecast information. In Taiwan, up to now, only four sources of earnings forecasts have been periodically published. As they are widely available and easily accessible to every investor, relative to other sources of earnings forecasts, they are a more adequate proxy for measuring information asymmetry. Some studies have considered analysts' earnings forecasts in their discussions of various issues related to the Taiwan stock market. For example, Fang and Wu (1997) used analysts earnings forecasts that become available just before management makes earnings forecasts as the proxy for market earnings expectations, and suggested that management earnings forecasts convey useful information and bring about reactions of stock price. Lin and Pan (1998) examined whether dividend change announce-ments are associated with revisions in analysts' current earnings forecasts. They found that the magnitude of current earnings forecast revisions is greater for low Tobin's Q firms than for high Tobin's Q firms because asymmetry in information is larger for smaller firms. Thus, this study follows Kross *et al.* (1994) and Atiase and Bamber (1994) in using two empirical proxies (the dispersion and range of analysts forecasts of EPS) for unobservable theoretical predisclosure information asymmetry.[9]

In addition to the above two research hypotheses, this paper also performs sensitivity analysis by controlling for firm size. For large firms, more alternative sources are available to provide information; hence, formal accounting earnings announcements have only a diluted effect. For small firms, such announcements are important sources of information. It follows that firm size can be one factor affecting trading volume reaction. Atiase (1985) showed that average precision of investors' predisclosure private information is an increasing function of firm size. Bamber (1987) stated that firm size is an important factor related to the availability of predisclosure information. As there are more sources providing information regarding large firms, investors have more incentive to collect information about them. Given that relatively more information about large firms is revealed prior to earnings announcements, large firms' formal announcements are less important; therefore, the magnitude of trading volume reaction is smaller and the duration, shorter. Furthermore, Atiase and Bamber (1994) indicated that the dispersion and range of analysts' forecasts do not by themselves distinguish between differential expectations arising from the differential precision versus average precision of investors' predisclosure private information. This paper addresses this issue by including the magnitude of the price reaction and the variable of firm size, both of which impound the average precision of investors' predisclosure private information. In other words, sensitivity analysis is performed to test whether *there still exists a risk clientele effect, an information effect, and a predisclosure information asymmetry effect even after controlling for firm size.*

2. Research Methods

This study employs correlation coefficient analysis, t-test, regression analysis, and sensitivity analysis to empirically test the hypotheses. In the following, we briefly describe each research method.

(1) *Correlation Analysis*: Correlation analysis is performed for each variable to determine whether it is appropriate to proceed with regression analysis.

(2) *t-statistics*: t-statistics are employed to test whether the sample firms' mean abnormal volume ($MNUV_t$) surrounding the earnings announcements is significantly greater than zero. The test statistic is calculated as follows:

$$t = \frac{MNUV_t}{S(MNUV_t)},$$

where $MNUV_t$ the mean abnormal trading volume on date t; $S(MNUV_t)$ the standard error of $MNUV_t$ on date t.

(3) *Regression Analysis*

A. Risk Clientele Effect and Information Effect

This paper uses three measures of abnormal trading volume XUV_i: (1) AUV_i is the market-adjusted abnormal trading volume. (2) MUV_i is the firm-specific median-adjusted abnormal trading volume. (3) $AMUV_i$ is the firm-specific non-announcement period median-adjusted abnormal trading volume.[10] The following regression model is used to investigate whether abnormal trading volume is related to the risk clientele effect and information effect.

Model 1:

$$XUV_i = a_0 + a_1\beta_{b_i} + a_2 DEV\beta_i + a_3 RISK_i + a_4 ACAR_i + \varepsilon_i, \quad \textbf{(1)}$$

where

XUV_i : firm i's abnormal trading volume;

β_{b_i} : firm i's β before an earnings announcement;

β_{a_i} : firm i's β after an earnings announcement;

$DEV\beta_i$: firm i's beta measurement error, calculated as the squared difference between β_{b_i} and its global average (1.0), that is, $(1-\beta_{b_i})^2$;

$RISK_i$: firm i's risk change, measured as the absolute percentage change in risk between the period prior and the period subsequent to the announcement, that is, $|\beta_{b_i} - \beta_{a_i}| / \beta_{b_i}$;

$ACAR_i$: the absolute cumulative abnormal return from the market model, which measures the information content of the announcement.

The above regression model represents six models as there are two kinds of event windows (11 days and 21 days) and three measures of abnormal trading volume.

B. Predisclosure Information Asymmetry Effect

The divergence in analysts' forecasts is used as a basis for the two information asymmetry proxies: (1) the dispersion in analysts EPS forecasts for each sample firm i($DISP_i$), and (2) the range across the most optimistic analyst EPS forecast and the most pessimistic analyst EPS forecast for each sample firm i, scaled by the absolute value of the mean forecast ($RANGE_i$). To test the predisclosure information asymmetry effect, this study develops two regression models described in the following:

i. Using the Standard Deviation of Analysts' Forecasts as the Proxy for Predisclosure Information Asymmetry

Model 2:

$$XUV_i = b_0 + b_1 \boldsymbol{b}_{b_i} + b_2 DEV\boldsymbol{b}_i + b_3 RISK_i + b_4 ACAR_i + b_5 DISP_i + \boldsymbol{e}_i, \quad \textbf{(2)}$$

where, XUV_i, $\boldsymbol{b}_{b_i}$, $DEV\boldsymbol{b}_i$, $RISK_i$ and $ACAR_i$ are all defined in the same way as stated in Model 1, and $DISP_i$, firm i's level of predisclosure information asymmetry, calculated as

$$DISP_i = \frac{Standard\ \ deviation\ \ of\ \ analysts\ '\ forecasts}{|Mean\ \ forecast|}.$$

ii. Using the Range of Analysts' Forecasts as the Proxy for Predisclosure Information Asymmetry

Model 3:

$$XUV_i = b_0 + b_1 \boldsymbol{b}_{b_i} + b_2 DEV\boldsymbol{b}_i + b_3 RISK_i + b_4 ACAR_i + b_5 RANGE_i + \boldsymbol{e}_i, \quad \textbf{(3)}$$

where, XUV_i, $\boldsymbol{b}_{b_i}$, $DEV\boldsymbol{b}_i$, $RISK_i$ and $ACAR_i$ all have the same meaning as stated in Model 1, and $RANGE_i$, firm i's level of predisclosure information asymmetry, calculated as

$$RANGE_i = \frac{Highest\ \ forecast - Lowest\ \ forecast}{|Mean\ \ forecast|}.$$

C. Control for Firm Size

For sensitivity analysis, we control firm size to further examine the risk clientele effect, information effect, and information asymmetry effect. When the standard deviation and range of analysts' forecasts are used to measure the information asymmetry effect, the regression models are as follows:

i. Using the Standard Deviation of Analysts' Forecasts

Model 4:

$$XUV_i = c_0 + c_1 \boldsymbol{b}_{b_i} + c_2 DEV\boldsymbol{b}_i + c_3 RISK_i + c_4 ACAR_i + c_5 DISP_i + c_6 MAVAL_i + \boldsymbol{e}_i, \quad \textbf{(4)}$$

where, XUV_i, $\boldsymbol{b}_{b_i}$, $DEV\boldsymbol{b}_i$, $RISK_i$, $ACAR_i$ and $DISP_i$ all have the same meaning as stated in Model 2, and $MAVAL_i$ is the size of the firm i.

$$MAVAL_i = \ln(MV_i) - md\,(\ln(MV_j));$$

$\ln(MV_i)$ is the natural log of the market value of firm i's common shares outstanding MV_i; $md(\ln(MV_j))$ is the median natural log market value of all sample firms' common shares outstanding.

ii. Using the Range of Analysts' Forecasts

Model 5:

$$XUV_i = c_0 + c_1 \boldsymbol{b}_{b_i} + c_2 DEV\boldsymbol{b}_i + c_3 RISK_i + c_4 ACAR_i + c_5 RANGE_i + c_6 MAVAL_i + \boldsymbol{e}_i, \quad \textbf{(5)}$$

where, XUV_i, $\boldsymbol{b}_{b_i}$, $DEV\boldsymbol{b}_i$, $RISK_i$, $ACAR_i$ and $RANGE_i$ all have the same meaning as stated in Model 3, and $MAVAL_i$ has the same meaning as stated in Model 4.

III. Data

1. Sample Selection

Because Taiwan's stock market began returning to a more rational stage in 1991, this research period was from 1992 to 1996. In calculating the variables, data covered one-year prior to and one-year after the earnings announcement. Therefore, the data were collected between 1991 and 1997. The sample selection criteria are:

(1) The sample firm must be listed on Taiwan's Security Exchange (TSE) because financial analysts only provide earning forecasts for those listed firms.
(2) The firm must not be in financial distress (an unlisted firm or a change-trading-rule firm). These troubled firms have financial problems, and their trading rules are different from those of other listed firms.
(3) A firm must have a December 31 fiscal year-end throughout the research period. Because this study uses cross-sectional setting, different accounting fiscal years would influence data consistency and compatibility, which could affect validity.
(4) The 1st year data of newly listed firms is not included, because during the first listing stage, the firm's stock price may have abnormal returns, which may influence the trading volume.

In addition to these four criteria,[11] this study uses cross-sectional analysts' earnings forecast data to proxy information asymmetry, so we need more than three forecast observations to obtain a more stable estimation; thus a fifth criteria is included.

(5) Four annual earnings forecasts are available for a firm.

The above sample selection criteria yielded 946 earnings announcements.

2. Data Collection and Event Date

A. Data Collection

Investors in Taiwan have very limited analyst forecast information.[12] The three easily accessible and periodic sources of EPS forecasts are "*Fortune Monthly*," "*Four Seasons Journal*,"[13] and "*Economy Daily*."[14] Another source of earnings forecast data is management forecasts. Because this information can influence investors' expectations, it is also included and becomes the fourth source of earnings forecast data. The data sources are:

(1) *Fortune Monthly* and *Four Seasons Journal* earnings forecasts: from TEJ's analyst forecast data file.
(2) *Economy Daily* earnings forecasts: Following this newspaper's earnings forecast method, we sum the most recent four seasons' actual EPS of each sample firm.
(3) Management's earnings forecasts: from TEJ's listed firm earnings forecast data file.
(4) Actual earnings: from TEJ's listed firm financial data file.
(5) Daily stock return and trading volume: from TEJ's listed firm security price and trading volume data file.
(6) Earnings announcement date: from TEJ's listed firm earnings primary estimation file.

B. Confirmation of Event Date

This study investigates the inference of trading volume response to yearly earnings announcements under information asymmetry. In general, the earnings announcement date has multiple bases, including the earlier earnings primary estimate date, the yearly board of directors meeting date, the yearly shareholders meeting date, and the formal financial statements announcement date. This study looks from the efficiency hypothesis and considers the most informative signal, that is, the earliest public announcement information. Because the primary estimate earnings number is roughly equal to the actual yearly earnings number, it is a more powerful tool for testing our hypotheses in comparison with the later released formal financial statement announcement date. Therefore, the first publicly released date of an earnings primary estimate is used as the event date.[15]

Because the first publicly released date (in newspapers) of an earnings primary estimate is viewed as the event study base date, we assume that the base date is date zero (t = 0). Also, $+t$ and $-t$ denote the t-th day after the base date and the t-th day before the base date, respectively. To estimate RISK and b, the estimation period includes: (1) The pre-estimation period (non-announcement period): data from the –210th trading date to the –6th

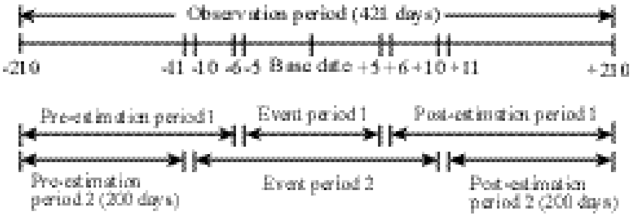

Fig. 1. The time lines of various study periods.

(or–11th) trading date are used to estimate the firm's specific non-announcement period trading volume median, the pre-announcement b, and the other variables. (2) The post-estimation period: data from the +6th (or +11th) to the +210th trading date are used to estimate post-announcement b. In sum, the event observation period is 210 days before and after the base date (t = –210 to t = +210).[16]

Furthermore, to calculate abnormal return and abnormal volume, the two event windows are: (1) Event period 1: from the –5th date to the +5th date, totaling 11 days. (2) Event period 2: from the –10th date to the +10th date, totaling 21 days. Figure 1 presents the above relationships in time lines.

3. Trading Volume Variable

So far, there does not exist a complete model that explains equilibrium trading volume. Beaver (1968) was the first researcher to use the volume market model (which is similar to the price market model) to formulate the expectation of each firm's trading volume. Many scholars have used this idea to develop various measurement methods. This research uses three kinds of expectation models to measure the abnormal trading volume around an earnings announcement.

A. The Market-Adjusted Abnormal Trading Volume

The first measure of trading volume follows Atiase and Bamber (1994). By subtracting the daily percentage of shares traded in the TSE on date t($V_{m,t}$) from each firm's percentage of shares traded ($V_{i,t}$), the market-adjusted abnormal trading volume is obtained. Therefore, firm i's abnormal shares traded on day t($UV_{i,t}$) is

$$UV_{i,t} = V_{i,t} - V_{m,t} \quad \text{for} \quad i = 1, \ldots, N, \qquad \textbf{(6)}$$

$$V_{i,t} = \frac{T_{i,t}}{S_{i,t}}, \quad V_{m,t} = \frac{T_{m,t}}{S_{m,t}},$$

where

$V_{i,t}$: the percentage of firm i's shares traded on date t;

$V_{m,t}$: the percentage of all shares traded in the TSE on date t;

$T_{i,t}$: the number of firm i's shares traded on date t;

$S_{i,t}$: the total number of firm i's shares outstanding on date t;

$T_{m,t}$: the total number of market shares traded on date t;

$S_{m,t}$: the total number of market shares outstanding on date t.

Because trading volume (percentage of shares traded) does not follow the normal distribution, the natural log (ln) of trading volume is taken. In order to prevent the computer from cutting off trading volume values that are too small during data processing, we multiplies the trading volume by 100 and then take the natural log. The calculation is as follows:

$$UV_{i,t} = \ln(100 * V_{i,t}) - \ln(100 * V_{m,t})$$
$$\text{for } i = 1, \ldots, N \quad t = 1, \ldots, T. \qquad \textbf{(7)}$$

The dependent variable of this research is the cumulative abnormal trading volume around the sample firms' announcement period. In order to understand whether there is any insider information leakage before the earnings announcement, this paper uses two event windows to calculate the abnormal trading volume. One event window covers 5 days before and after the announcement date; the other, 10 days before and after. The cumulative abnormal trading volume during these two event windows, totaling 11 and 21 days, respectively, is calculated as follows:

$$AUV_i = \sum_{t=-5}^{5} UV_{i,t} \qquad \textbf{(8)}$$

or

$$AUV_i = \sum_{t=-10}^{10} UV_{i,t}, \qquad \textbf{(9)}$$

where AUV_i in Eqs. (8) and (9) represents the cumulative abnormal trading volume adjusted by the overall market level for the event windows of 11 and 21 days, respectively.

B. The Firm-Specific Median-Adjusted Abnormal Trad-ing Volume

The second measure of trading volume follows Bamber (1986) and Kross *et al.* (1994) by subtracting the firm-specific median of trading volume to get the firm-specific median-adjusted abnormal trading volume. Firm i's abnormal shares traded on day $t(UV_{i,t})$ are calculated as follows:

$$UV_{i,t} = V_{i,t} - V_{i,med} \quad \text{for } i = 1, \ldots, N,$$

where $V_{i,med}$ is the median of firm i's trading volume 60 days before and after the base date. Similarly, because trading volume does not follow a normal distribution and trading volume values that are too small may be cut off by the computer during data processing, we multiply the trading volume by 100 and then take the natural log. That is,

$$UV_{i,t} = \ln(100 * V_{i,t}) - \ln(100 * V_{i,med})$$
$$\text{for } i = 1, \ldots, \text{N} \quad t = 1, \ldots, T, \qquad \textbf{(10)}$$

$$MUV_i = \sum_{t=-5}^{5} UV_{i,t} \qquad \textbf{(11)}$$

or

$$MUV_i = \sum_{t=-10}^{10} UV_{i,t}, \qquad \textbf{(12)}$$

where MUV_i in Eqs. (11) and (12) represents the firm-specific median-adjusted cumulative abnormal trading volume during the event windows of 11 and 21 days, respectively.

C. The Firm-Specific Non-announcement Period Median-Adjusted Abnormal Trading Volume

This paper also uses a firm-specific non-announcement period median-adjusted cumulative abnormal trading volume ($AMUV_i$), similar to Bamber (1986) and Atiase and Bamber (1994).[17] That is,

$$AMUV_i = \left(\sum_{t=-5}^{5} V_{i,t}\right) - md\left(\sum_{k=1}^{11} V_{i,-(k+m+5)}\right)$$
$$m = 0, 11, 22, \ldots, 11[\text{INT}(T/11) - 1], \qquad \textbf{(13)}$$

or

$$AMUV_i = \left(\sum_{t=-10}^{10} V_{i,t}\right) - md\left(\sum_{k=1}^{21} V_{i,-(k+m+10)}\right)$$
$$m = 0, 21, 42, \ldots, 21[\text{INT}(T/21) - 1], \qquad \textbf{(14)}$$

where T is the number of trading days in the pre-estimation period; $md\left(\sum V_{i,-(k+m+d)}\right)$, d = 5, 10, is the median of the percentage of firm i's shares traded, summed over 11 (or 21) continuous day (non-announcement period) intervals during the pre-estimation period.

The steps are as follows. First, we sum each sample firm's trading volume over 11 (21) continuous days prior to the announcement date to obtain the cumulative trading volume $\left(\sum V_{i,-(k+m+d)}\right)$ and then take the median $md\left(\sum V_{i,-(k+m+d)}\right)$. Second, we subtract the firm-specific median non-announcement period volume from the firm's percentage of shares traded during the 11 day (21 day) announcement period. The firm i's specific median-adjusted abnormal trading volume ($AMUV_i$) is thus obtained. Note that, as before, in order to prevent the computer from cutting off trading volume values that are too small during data processing, $V_{i,t}$ and $V_{i,-k-m-d}$ are multiplied by 100 and defactored by a natural log.

4. Other Variables

In addition to trading volume, this study's independent variables and control variables are measured as follows.

A. Systematic Risk (Beta, including b_b and b_a)

This paper uses stock price data in the non-announcement period and employs the market model to estimate each sample firm's systematic risk, including the pre-announcement beta ($\boldsymbol{b}_b$) and post-announcement beta ($\boldsymbol{b}_a$). The market model formula can be written as follows:

$$R_{i,t} = \boldsymbol{a}_i + \boldsymbol{b}_i R_{m,t} + \boldsymbol{e}_{i,t},$$

where $R_{i,t}$ is the return of security i on date t; $R_{m,t}$ is the market return, calculated by taking the natural log of the value-weighted TSE relative index; $\boldsymbol{b}_i$ measures the systematic risk of security i; $\boldsymbol{e}_{i,t}$ is the error term.

The pre-announcement beta, $\boldsymbol{b}_b$, is calculated using the stock price data of the pre-estimation period (9 months to −6 or −11 days prior to the announcement date). The post-announcement beta, $\boldsymbol{b}_a$, is calculated based on the stock prices of the post-estimation period. That is,

$$R_{i,t} = a_i + b_{b_i} R_{m,t} + e_{i,t} \quad t = -210, \ldots, -6\ (-11),$$

$$R_{i,t} = a_i + b_{a_i} R_{m,t} + e_{i,t} \quad t = +6\ (+11), \ldots, +210.$$

B. Risk Change (RISK)

This research, following Kross *et al.* (1994), measures the degree of change in firm risk (RISK) from before an earnings announcement to after the announcement. RISK is calculated as the absolute percentage difference between the pre-announcement and post-announcement betas divided by the systematic risk of the pre-earnings announcement ($\boldsymbol{b}_b$). Hence, firm i's risk change can be expressed as

$$RISK_i = \left|\boldsymbol{b}_{b_i} - \boldsymbol{b}_{a_i}\right| / \boldsymbol{b}_{b_i}.$$

C. Beta Measurement Error (DEVb)

Kross *et al.* (1994) indicated that any abnormal volume around the earnings announcement might be correlated with measurement error in beta.[18] The empirical result obtained by Blume (1971)[19] documents a significant coefficient of the beta measurement error variable (DEV$\boldsymbol{b}$).[20] In order to control for the measurement error from beta estimation, the squared difference between beta and its global average (1.0) is used. 1.0 is used as the benchmark because betas deviating from the theoretical global average (1.0) typically contain more measurement errors. Hence, firm i's beta measurement error in the period prior to the announcement can be expressed as

$$DEV\boldsymbol{b}_i = \left(1 - \boldsymbol{b}_{b_i}\right)^2.$$

D. Absolute Cumulative Abnormal Return (ACAR)

This study uses absolute cumulative abnormal return, ACAR, to control for the information content of the earnings announcement. The measurement steps are as follows:

(1) The market model is employed with the pre-estimation period return data to estimate the pre-earnings announcement beta ($\boldsymbol{b}_{b_i}$) and $\boldsymbol{a}_i$. The estimation is

$$R_{i,t} = a_i + b_{b_i} R_{m,t} + e_{i,t}, \quad t = -210, \ldots, -6\ (-11).$$

(2) Each sample firm's expected return ($ER_{i,t}$) on date t is

$$ER_{i,t} = \boldsymbol{a}_i + \boldsymbol{b}_{b_i} R_{m,t},$$

$$t = -5\ (\text{or} -10), \ldots, +5\ (\text{or} +10).$$

(3) The abnormal daily return ($AR_{i,t}$) is obtained by subtracting the expected return ($ER_{i,t}$) from each sample firm's actual daily return. That is,

$$AR_{i,t} = R_{i,t} - ER_{i,t},$$

$$t = -5\ (\text{or} -10), \ldots, +5\ (\text{or} +10).$$

(4) To calculate the cumulative abnormal return ($CAR_{i,t}$),

we sum the abnormal daily return of each sample firm. This study uses two event windows to measure $CAR_{i,t}$.

(i) Event window 1: from $t = -5$ to $t = +5$, totaling 11 days, that is,

$$CAR_{i,t} = \sum_{t=-5}^{+5} AR_{i,t}.$$

(ii) Event window 2: from $t = -10$ to $t = +10$, totaling 21 days, that is,

$$CAR_{i,t} = \sum_{t=-10}^{+10} AR_{i,t}.$$

(5) The absolute cumulative abnormal return, $ACAR_{i,t}$, is obtained by taking the absolute value of $CAR_{i,t}$.

IV. Empirical Results

1. Descriptive Statistics

The descriptive statistics of the entire group of samples indicate that the standard deviation of RISK is large, with the minimum and maximum values being 0 and 253.847, respectively. This shows that the sample firms' risk change between pre- and post-earnings announcment is large. The means of beta are 0.957 (BETA5) and 0.961 (BETA10), less than the theoretical global mean 1.0. Because the value of the systematic risk (BETA) measurement error (DEVb) is between 0 and 67.026, the measurement error of beta among the sample firms is quite significant. This indicates that including this control variable in the model is appropriate. Furthermore, the minimum and maximum values of the two information asymmetry measurement variables (DISP and RANGE) do not differ significantly. The main reason for this may be that there are only data from four forecasts, which are all open to the public; thus, the forecast results do not differ significantly among different analysts. As for the pre-announcement beta (b_b), BETA5 (BETA10), it is measured based on pre-announcement return data from days $t = -210$ to $t = -6$ (days $t = -210$ to $t = -11$). There is no significant difference between BETA5 and BETA10 in terms of their minimum and maximum values (Table 1).

Table 1. Some Descriptive Statistics of Full Samples

	N	Mean	Std. Dev.	Minimum	Maximum
BETA5	946	0.957	0.222	0.172	1.601
BETA10	946	0.961	0.221	0.180	1.659
DEVb*	946	5.035	8.468	0.000	67.026
RISK*	946	19.786	25.504	0.000	253.847
ACAR*	946	7.167	6.330	0.027	42.485
DISP	939	0.402	0.425	0.000	2.203
RANGE	939	0.685	0.879	0.000	4.000
MAVAL	940	0.134	0.886	2.291	3.767

Note: The above variables: DEVb, RISK, ACAR has been multiplied by 100.

Table 2 shows the correlation analysis results for each variable. The risk change variable (RISK) is negatively correlated with price responses but positively with trading volume responses. Furthermore, BETA5 and BETA10 are significantly positively associated with abnormal trading volume. This implies that large security risk induces investors to trade. The two proxy variables of pre-announcement information asymmetry, DISP and RANGE, are highly correlated (p = 0.997). These two information asymmetry proxies are positively correlated with both price and trading volume response to earnings announcements. It is, therefore, desirable to examine,

Table 2. Pearson Correlation Coefficients

	BETA5	BETA1	DEVb	RISK	ACAR	DISP	RANGE	MAVA	AUV21	AUV11	MUV21	MUV11	AMUV2	AMUV11
BETA5	1.000													
BETA10	0.995	1.000												
DEVb	–0.507*	–0.505*	1.000											
RISK	–0.503*	–0.508*	0.668*	1.000										
ACAR	0.052	0.050	–0.073	–0.125	1.000									
DISP	0.078	0.079	–0.061	–0.026	0.112	1.000								
RANGE	0.080	0.082	–0.057	–0.017	0.109	0.997*	1.000							
MAVAL	–0.055	–0.052	0.010	0.039	0.037	–0.045	–0.069	1.000						
AUV21	0.456*	0.452*	–0.135*	0.170*	0.301*	0.217*	0.261*	–0.169*	1.000					
AUV11	0.457*	0.454*	–0.133*	0.166*	0.293*	0.220*	0.255*	–0.175*	0.988*	1.000				
MUV21	0.150*	0.146*	0.004	0.009	0.120*	0.030	0.023	–0.010	0.170*	0.181*	1.000			
MUV11	0.178*	0.175*	0.005	0.007	0.063	0.133*	0.134*	–0.119*	0.167*	0.218*	0.938*	1.000		
AMUV2	0.277*	0.279*	–0.194*	0.038	0.124*	0.074	0.076	–0.025	0.269*	0.263*	0.600*	0.564*	1.000	
AMUV1	0.286*	0.287*	–0.186*	0.132*	–0.050	0.182*	0.188*	–0.129*	0.268*	0.2958	0.645*	0.673*	0.956*	1.000

* The significance level for the coefficients is $\alpha = 0.01$.

after controlling for price reaction, whether the two information asymmetry proxies are still significantly positively correlated with trading volume response. This is the main issue addressed in the following discussion.

2. Primary Analysis

The variance inflation factor values listed in Table 3 show that there is no multi-collinearity among the independent variables. Table 3 reveals that most of the measures of trading volume response are significantly positively associated with price responses to earnings announcements (ACAR). Only when measured by AMUV11, trading volume response is negatively correlated with ACAR, but this is not significant. It is, therefore, proper to conclude that price reaction explains a significant part of trading volume response to earnings announcements. These results are consistent with the findings commonly given in the financial literature, which show that trading volume reaction is significantly positively correlated with price reaction.

In addition, Modigliani (1982) and Karpoff (1986) suggested that trading volume is correlated with risk preference. Hakansson *et al.* (1982) also argued that trading volume response to public announcements is related to the heterogeneity of investors' beliefs. This research attempts to test whether trading volume response to an earnings announcement is related to investors' perception of risk. Table 3 shows that even after controlling for the abnormal return, i.e., controlling for the information content of announcements, trading volume response to earnings announcements is generally an increasing function of RISK and β_b.[21] That is, trading volume is significantly positively correlated with RISK and β_b. This result roughly coincides with that of Kross *et al.* (1994). In other words, these findings support Hypothesis 1.

Kim and Verrecchia (1991b) suggested that trading volume and price changes reflect change in the average belief of investors. But trading volume also reflects differences among investors' belief revision resulting from information asymmetry. They conclude that trading volume response is related to absolute price change and the level of predisclosure information asymmetry. The following analysis discusses whether trading volume reaction to earnings announcements is also positively related to the level of predisclosure information asymmetry.

In this study, DISP and RANGE are used as proxies for unobservable predisclosure information asymmetry. They are based on actual expectations of real market participants. Atiase and Bamber (1994) suggest that these two variables have two limitations. The first limitation is that these proxies only capture a subset of market participants, that is, security analyst's expectations. The second limitation is that KV's construct (Kim and Verrecchia, 1991a, 1991b) is different information quality (precision) prior to the announcement, but our proxies reflect different expectations. Atiase and Bamber further proved that DISP and RANGE could not by themselves distinguish between

Table 3. The Effects of Risk Clientele and Information Content on Trading Volume

Dependent variable	Model 1: $XUV = a_0 + a_1\beta_b + a_2 DEV\beta + a_3 RISK + a_4 ACAR + \varepsilon$ Independent variable Intercept a_0	β_b a_1	$DEV\beta$ a_2	$RISK$ a_3	$ACAR$ a_4	Adjusted R^2	F value	D-W
AUV11	2.2918 (1.29)*	19.8063 [1.396] (10.73)***	0.0136 [1.651] (0.45)	0.0798 [1.646] (3.02)**	0.1784 [1.016] (3.29)***	0.3824	14.95	1.99
MUV11	–2.2147 (–2.69)**	2.4513 [1.394] (3.32)***	0.0179 [1.651] (0.49)	0.0127 [1.666] (1.10)*	0.0196 [1.016] (1.24)*	0.1911	5.45	1.96
AMUV11	–0.2680 (–0.21)	3.7406 [1.394] (2.44)**	–0.0483 [1.649] (–1.69)*	0.0158 [1.666] (1.15)*	–0.0247 [1.015] (–0.41)	0.1552	5.65	1.98
AUV21	4.3685 (1.86)*	28.8006 [1.365] (12.19)***	0.0018 [1.651] (0.02)	0.1215 [1.667] (3.89)***	0.7248 [1.017] (7.96)***	0.4103	16.87	2.02
MUV21	–2.3485 (–2.01)*	1.9151 [1.394] (1.39)*	0.0257 [1.651] (0.59)	–0.0167 [1.649] (–0.73)	0.2162 [1.016] (5.58)***	0.2060	8.91	2.00
AMUV21	–1.5815 (–0.39)	3.8362 [1.394] (1.12)*	–0.1147 [1.649] (–1.73)*	0.0216 [1.666] (0.78)	0.6025 [1.017] (6.84)***	0.2205	9.30	1.96

Notes: (1) Each cell reports the estimated regression coefficient.
(2) A number in ( ) is the t-statistic. ***p<0.01, **p<0.05, *p<0.1.
(3) A number in [ ] shows the variance inflation factor value.

differential expectations arising from differential levels of precision versus the average precision of investors' private predisclosure information. Hence, this study includes the magnitude of price reaction in the model to control for the second component.[22] Because price reaction may also be affected by other factors in addition to the average precision, including the variable of price reaction in the regression model only controls for part of the average precision of investors' private predisclosure information.

From Table 4, the variance inflation factor values of independent variables show that multicollinearity does not exist. As indicated in Table 4, the relationship between

Table 4. The Effects of Predisclosure Information Asymmetry Level, Risk Clientele, and Information Content on Trading Volume

Panel A: Model 2

$$XUV = b_0 + b_1 \boldsymbol{b}_b + b_2 DEV\boldsymbol{b} + b_3 RISK + b_4 ACAR + b_5 DISP + \boldsymbol{e}$$

Dependent variable	Independent variable								
	intercept b_0	$\boldsymbol{b}_b$ b_1	*DEV***b** b_2	*RISK* b_3	*ACAR* b_4	*DISP* b_5	Adjusted R^2	F value	D-W
AUV11	2.4101	19.9697	0.0362	0.0812	0.1356	2.6818	0.3022	14.21	2.05
	(1.29)*	[1.4009]	[1.6538]	[1.6698]	[1.0290]	[1.0249]			
		(11.64)***	(0.63)	(3.51)***	(2.56)**	(3.41)***			
MUV11	–2.1950	2.8252	0.0106	0.0134	0.1016	0.2656	0.1425	5.01	2.18
	(–2.28)**	[1.3989]	[1.6538]	[1.6698]	[1.0290]	[1.0206]			
		(2.91)**	(0.51)	(1.16)*	(1.26)*	(1.16)*			
AMUV11	–0.1450	3.2817	–0.0821	0.0174	–0.0086	0.4179	0.1441	6.26	1.96
	(–0.20)	[1.3989]	[1.6520]	[1.6698]	[1.0290]	[1.0206]			
		(1.81)*	(–1.07)	(1.18)*	(–0.34)	(1.98)*			
AUV21	4.6059	28.6258	0.0146	0.1288	0.6342	4.2679	0.3126	17.98	1.95
	(1.89)*	[1.4010]	[1.6538]	[1.6698]	[1.0302]	[1.0319]			
		(11.24)***	(0.12)	(3.01)***	(7.48)***	(3.00)**			
MUV21	–2.3557	1.5341	0.0302	–0.0071	0.1698	0.0403	0.1695	9.35	2.09
	(–2.06)*	[1.3989]	[1.6538]	[1.6687]	[1.0290]	[1.0200]			
		(1.52)*	(0.72)	(–0.69)	(5.17)***	(0.06)			
AMUV21	–1.1294	2.9140	–0.1759	0.0202	0.5942	0.3149	0.2046	10.63	2.11
	(–0.41)	[1.3989]	[1.6521]	[1.6698]	[1.0301]	[1.0206]			
		(1.49)*	(–2.04)**	(0.70)	(6.02)***	(0.39)			

Panel B: Model 3

$$XUV = b_0 + b_1 \boldsymbol{b}_b + b_2 DEV\boldsymbol{b} + b_3 RISK + b_4 ACAR + b_5 RANGE + \boldsymbol{e}$$

Dependent variable	Independent variable								
	intercept b_0	$\boldsymbol{b}_b$ b_1	*DEV***b** b_2	*RISK* b_3	*ACAR* b_4	*RANGE* b_5	Adjusted R^2	F value	D-W
AUV11	2.2095	19.5644	0.0292	0.0816	0.1392	1.4031	0.3695	14.01	2.05
	(1.30)*	[1.4567]	[1.6547]	[1.6710]	[1.0286]	[1.0249]			
		(11.58)***	(0.63)	(3.52)***	(2.57)**	(3.44)***			
MUV11	–2.1245	2.8453	0.0111	0.0139	0.1029	0.2134	0.1512	4.98	2.16
	(–2.23)**	[1.3997]	[1.6539]	[1.6707]	[1.0281]	[1.0205]			
		(2.92)**	(0.49)	(1.12)*	(1.30)*	(1.21)*			
AMUV11	–0.1640	3.2758	–0.0729	0.0169	–0.0072	0.3640	0.1244	6.31	1.98
	(–0.19)	[1.4009]	[1.6107]	[1.6707]	[1.0281]	[1.0205]			
		(1.80)*	(–1.08)	(1.17)*	(–0.28)	(1.95)*			
AUV21	4.6796	28.6167	0.0134	0.1233	0.6568	2.4632	0.3961	17.03	1.95
	(1.90)*	[1.4896]	[1.6539]	[1.6756]	[1.0298]	[1.0250]			
		(11.26)***	(0.15)	(3.03)***	(7.56)***	(3.03)**			
MUV21	–2.2485	1.5396	0.0221	–0.0072	0.2000	–0.0070	0.2675	9.32	2.07
	(–1.98)*	[1.3989]	[1.6539]	[1.6609]	[1.0282]	[1.0201]			
		(1.39)*	(0.71)	(–0.70)	(5.20)***	(-0.05)			
AMUV21	–1.1322	2.8586	–0.1746	0.0195	0.5108	0.2913	0.1734	10.65	2.12
	(–0.33)	[1.3997]	[1.6012]	[1.6707]	[1.0291]	[1.0205]			
		(1.41)*	(–2.04)**	(0.70)	(6.05)***	(0.37)			

Notes: (1) Each cell reports the estimated regression coefficient.
(2) A number in ( ) is the t-statistic. ***p<0.01, **p<0.05, *p<0.1.
(3) A number in [ ] shows the variance inflation factor value.

trading volume and ACAR, RISK, DEVb, and b_0 is roughly consistent with the results shown in Table 3. As for the level of information asymmetry (DISP and RANGE), it is significantly positively correlated with AUV11, MUV11, AMUV11 and AUV21. The evidence reveals that, generally, the higher the level of predisclosure information asymmetry, the larger the abnormal trading volume. In other words, the empirical evidence agrees with the results of KV's model and of Atiase and Bamber (1994) and is consistent with Hypothesis 2.

3. Sensitivity Analysis

In the previous section, we pointed out that price reaction can only control for part of the average precision of investors' private predisclosure information. Atiase (1985) showed that the average precision of investors' private predisclosure information is an increasing function of firm size. Therefore, in this section, we include firm size as a control variable. Table 5 shows that multi-collinearity does not exist among the independent variables. From Panel A of Table 5, the relationship of ACAR, DISP, RISK, DEVb, and b_0 to abnormal trading volume is roughly the same as that shown in Tables 3 and 4. As for firm size, it is significantly negatively correlated with most of the abnormal volume measures.[23] This clearly shows that firm size adds explanatory power to our model. In other words, there still exists a risk clientele effect, information effect, and predisclosure information asymmetry effect even after controlling for firm size.

V. Summary and Conclusions

Following the theoretical models of Kim and Verrecchia (1991a, 1994) and Lin *et al.* (1995), this paper uses TSE data to investigate whether investors' trading behavior in Taiwan's capital market is the same as that which the theoretical models predict. This study has provided empirical evidence regarding the effect of annual accounting earnings announcements on trading volume. We have used three expectation models to measure abnormal trading volume: (1) the abnormal trading volume adjusted by the overall market level of trading; (2) the abnormal trading volume adjusted by the firm-specific median; (3) the abnormal trading volume adjusted by the firm's specific non-announcement period median.

The empirical results are as follows. First, for all measures, except one, of abnormal trading volume, the magnitude of trading volume reaction is an increasing function of the magnitude of absolute cumulative abnormal returns. Second, for the three measures of abnormal trading volume in the 11 days event window and for one measure in the 21 days window, trading volume reactions are significantly positively related to risk change and the two proxies for the level of predisclosure information asymmetry, even after controlling for the magnitude of the associated price reaction. Third, abnormal trading volume around the earnings announcements date is an increasing function of risk level before the announcement. The above empirical results still exist even after controlling for firm size.

The evidence shows that in the 21 days event window, the two measures of abnormal trading volume adjusted by the firm-specific median and by the non-announcement period firm-specific median are not significantly associated with the variables of predisclosure information asymmetry and risk change. There are two possible reasons for these results. One is that these two measures are not valid representations of abnormal trading volume. The other is that the 21 days event window is too long, so that some of the announcement effect has dissipated. In future research, the event window can be shortened to determine which is the real reason. In the Taiwan stock market, because obtaining bid and ask prices is difficult, this research has not investigated the change in trading volume due to liquidity. In the future, if bid and ask prices data are easily accessible, researchers can consider liquidity factors in the model to test its relationship with trading volume, and examine whether this additional variable changes the empirical results of this paper. In addition, the marginal information content of accounting earnings announcements may vary across industries. Future research can add the variable of industry differences into the framework to test whether there is an industry effect or not.

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Notes

1 See Beaver (1968).

2 Karpoff (1986) found that investors with divergent prior expectations will trade even if they interpret the announced information identically.

3 Bartov and Bodnar (1996) employed volume as the empirical proxy for information asymmetry to test the validity of the information asymmetry perspective.

4 There are three sources of earnings forecasts: (1) statistical forecasts, (2) management forecasts, and (3) analysts' forecasts. Statistical forecasts have been losing their attraction due to the difficulty of collecting data, the complicated nature of the techniques, and poor forecast precision. Management forecasts are voluntary disclosures, and researchers are more interested in understanding management's incentives for making disclosures. Thus, studies on earnings prediction have focused on analysts' forecasts as a result of their precision as well as the variety of incentives and characteristics involved.

5 There were more than the usual number of analysts' earnings forecasts before the stock market breakdown in 1989. After the breakdown, the number of analysts' forecasts decreased rapidly. It was not until 1999 when trading became considerably active that a lot of earnings forecasts reappeared.

Table 5. The Effects of Predisclosure Information Asymmetry Level, Risk Clientele, and Information Content on Trading Volume while Controlling for Firm Size

Panel A: Model 4

$$XUV = c_0 + c_1\beta_D + c_2 DEV\beta + c_3 RISK + c_4 ACAR + c_5 DISP + c_6 MAVAL + \varepsilon$$

Dependent variable	Independent variable									
	intercept c_0	β_D c_1	*DEVβ* c_2	*RISK* c_3	*ACAR* c_4	*DISP* c_5	*MAVAL* c_6	Adjusted R^2	F value	D-W
	3.0213	19.3896	0.0269	0.0879	0.1512	2.5975	–0.5869	0.3206	13.92	1.96
AUV11	(1.48)*	[1.3974]	[1.6494]	[1.6744]	[1.0328]	[1.0533]	[1.0109]			
		(11.08)***	(0.42)	(4.86)*	(2.59)**	(3.35)***	(–1.57)**			
	–2.1366	2.8467	0.0107	0.0150	0.0032	0.3015	–0.1206	0.1134	4.85	2.10
MUV11	(–2.21)**	[1.3951]	[1.6494]	[1.6744]	[1.0328]	[1.0527]	[1.0109]			
		(3.13)**	(0.38)	(1.14)*	(0.06)	(0.77)*	(–1.12)*			
	–0.1627	3.2401	–0.0574	0.0218	–0.0211	0.7825	–0.3627	0.1319	4.88	1.96
AMUV11	(–0.10)	[1.3951]	[1.6491]	[1.6744]	[1.0328]	[1.0527]	[1.0109]			
		(1.81)*	(–1.64)*	(1.10)*	(–0.39)	(1.16)*	(–1.64)*			
	5.4503	29.8382	–0.0108	0.2248	0.6873	4.3270	–0.7963	0.4032	16.18	2.01
AUV21	(2.03)**	[1.3980]	[1.6494]	[1.6744]	[1.0330]	[1.0233]	[1.0110]			
		(12.93)***	(–0.13)	(4.18)***	(7.96)***	(3.01)**	(–1.35)*			
	–2.6478	1.5598	0.0189	–0.0103	0.2115	0.0286	–0.0378	0.1856	7.71	1.97
MUV21	(–2.02)**	[1.3951]	[1.6494]	[1.6737]	[1.0328]	[1.0527]	[1.0110]			
		(1.46)*	(0.53)	(–0.52)	(5.89)***	(0.11)	(–0.41)			
	–1.0322	2.8384	–0.1860	0.0162	0.6015	0.3892	–0.1674	0.1777	8.17	2.02
AMUV21	(–0.24)	[1.3951]	[1.6488]	[1.6444]	[1.0330]	[1.0527]	[1.0109]			
		(1.10)*	(–1.94)*	(0.71)	(6.87)***	(0.30)	(–0.92)			

Panel B: Model 5

$$XUV = c_0 + c_1\beta_D + c_2 DEV\beta + c_3 RISK + c_4 ACAR + c_5 RANGE + c_6 MAVAL + \boldsymbol{e}$$

Dependent variable	Independent variable									
	intercept c_0	β_D c_1	*DEVβ* c_2	*RISK* c_3	*ACAR* c_4	*RANGE* c_5	*MAVAL* c_6	Adjusted R^2	F value	D-W
	3.0286	19.3647	0.0268	0.0880	0.1513	1.5031	–0.5867	0.3762	13.91	1.97
AUV11	(1.49)*	[1.3966]	[1.6495]	[1.6759]	[1.0320]	[1.0252]	[1.0114]			
		(11.20)***	(0.42)	(4.85)***	(2.60)**	(3.41)***	(–1.56)*			
	–2.1315	2.8520	0.0106	0.0149	0.0019	0.1232	–0.1410	0.1821	4.83	2.08
MUV11	(–2.28)**	[1.3958]	[1.6495]	[1.6756]	[1.0318]	[1.0252]	[1.0112]			
		(3.14)***	(0.37)	(1.15)*	(0.06)	(0.59)*	(–1.13)*			
	–0.1554	3.2371	–0.0761	0.0220	0.0293	0.8256	–0.3565	0.1421	4.87	1.96
AMUV11	(–0.09)	[1.3958]	[1.6489]	[1.6759]	[1.0318]	[1.0252]	[1.0112]			
		(1.80)*	(–1.63)*	(1.10)*	(–0.35)	(1.32)*	(–1.62)*			
	5.5178	29.7925	–0.0107	0.2254	0.7013	2.8602	–0.7958	0.4222	16.21	2.03
AUV21	(2.06)**	[1.3970]	[1.6489]	[1.6759]	[1.0325]	[1.0252]	[1.0114]			
		(12.88)***	(–0.12)	(4.17)***	(7.95)***	(2.83)**	(–1.29)*			
	–2.6534	1.5605	0.0192	–0.0115	0.2201	–0.0101	–0.0357	0.1568	7.71	1.95
MUV21	(–2.09)**	[1.3952]	[1.6495]	[1.6755]	[1.0320]	[1.0250]	[1.0112]			
		(1.45)*	(0.55)	(–0.52)	(5.93)***	(–0.10)	(–0.33)*			
	–1.0434	2.8103	–0.1862	0.0161	0.6018	0.2491	–0.1679	0.2012	8.18	2.01
AMUV21	(–0.25)	[1.3958]	[1.6490]	[1.6759]	[1.0320]	[1.0252]	[1.0112]			
		(1.11)*	(–1.93)*	(0.70)	(6.88)***	(0.29)	(–0.95)			

Notes: (1) Each cell reports the estimated regression coefficient.
(2) A number in ( ) is the t-statistic. ***p<0.01, **p<0.05, *p<0.1.
(3) A number in [ ] shows the variance inflation factor value.

[6] Another measure of information asymmetry is the bid-ask spread, but this data is not available in Taiwan.

[7] The three major institutional investors in Taiwan include foreign investment institutions, local investment institutions, and security dealers.

[8] Following Atiase and Bamber (1994), the measurement of predisclosure information asymmetry is determined by the quality of private information obtained by each investor.

[9] Atiase and Bamber (1994) found that the magnitude of trading volu-me is an increasing function of both the associated price

reaction and the level of predisclosure information asymmetry. Bamber and Cheon (1995) showed that trading volume reaction to earnings announcement is relatively higher than price reaction when an earnings announcement generates more differential belief revisions.

[10] The details of these three measures of abnormal trading volume will be described in Section III.3.

[11] In general, when studying the phenomenon of accounting issue, the most researchers add up the limitations of non-banking and non-insurance firm because these firms have their own special accounting structures. Their accounting systems and related policies usually are required to follow the Department of Finance's instructions. But this effect will not be significant in this study. This research investigates the information asymmetry effect of earnings announcements; if firms meet the previous criteria, they are included in the sample.

[12] In Taiwan, no services are provided by professional security analysis institutions, like IBES and Value Line, which supply a large amount of forecast information.

[13] *Four Seasons Journal* is one of the important publications of *China Times*; their forecast information is included in the *Nightly China Times* stock panel.

[14] The *Economy Daily* EPS forecast number uses the moving average method by taking the sum of the most recent actual four quarterly EPS data.

[15] If the earnings primary estimation date is a non-trading day, this study uses the first trading day after the announcement date.

[16] Following the estimation period given by Kross *et al.* (1994), this study uses 210 pre- and post-trading days around the base date, which roughly equals 9 months. A long observation period has the advantage of not omitting relevant data and the disadvantage of some noise information. Nevertheless, a large sample can mitigate this disadvantage.

[17] The non-announcement period includes pre- and post-estimation periods. Different from Atiase and Bamber (1994), this study uses the pre-estimation period to calculate the firm-specific non-announce-ment period median.

[18] Although the measurement of abnormal trading volume used by Kross *et al.* (1994) is MUV_i, (the second abnormal trading volume measurement used in this paper) without the estimation of b, their empirical results also support this argument.

[19] Blume (1971) showed that beta values tend to regress towards the mean over time.

[20] Kross *et al.* (1994) also used the standard error of beta prior to the earnings announcement as the proxy for measurement error of beta.

[21] Except for MUV21 and AMUV21, all measures of abnormal trading volume are significantly positively associated with RISK. As for b_0, there is significantly positive association between all measures of abnormal trading volume and this variable.

[22] Kim and Verrecchia (1991) believes that price reaction is partly attributable to the average precision of investors' private predisclosure information.

[23] Only when measured by AMUV21, there is no significant association.

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會計盈餘宣告的風險客戶與揭露前資訊不對稱效果

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摘　要

理論文獻證明，宣告前資訊不對稱將造成投資人形成不同的宣告前預期，致使公開宣告後投資人有不同的看法修正，並產生交易量；而公開宣告後的證券風險變動，也易造成投資人按個人風險偏好來重組投資組合。本研究主要係採用證券分析師的盈餘預測來衡量資訊不對稱水準，藉以探討其對盈餘宣告附近交易量的影響。由於以往的實證文獻大多指出每年會計盈餘宣告時的交易量與宣告的資訊內涵有關，故本文在調查資訊不對稱與交易量的關係時，將藉由異常報酬來控制宣告的資訊內涵。除了驗證資訊不對稱水準與交易量對會計揭露的反應外，尚檢驗交易量是否與宣告前的風險以及宣告前後證券的風險變動有關，即是否存在風險客戶效果。同時，本文亦探討在控制公司規模後，是否會影響前述資訊不對稱與風險客戶效果的結論。實證結果發現：(1)異常交易量與異常報酬大致呈顯著正相關。(2)經由累積異常報酬控制了價格反應後，宣告前資訊不對稱水準與盈餘宣告鄰近幾天的交易量反應大致呈顯著正相關。(3)在控制了宣告的資訊內涵後，盈餘宣告日鄰近幾天的交易量與宣告前風險、宣告前後風險變動皆大致呈顯著正相關。(4)在控制公司規模後，仍存在風險客戶效果、資訊內涵效果與宣告前資訊不對稱效果。

關鍵詞彙：盈餘宣告，風險客戶效果，分析師預測，揭露前資訊不對稱水準