Who wants to trade around ex-dividend days?

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Abstract

This paper examines order flows around ex-dividend dates on the Taiwan Stock Exchange. Not only does Taiwan's tax code allow us to separate the tax hypothesis from other explanations, but Taiwan's data also permits us to examine the heterogeneity of investors' behavior around ex-dividend dates. We find that, different types of investors show entirely different patterns of order flows. For both taxable and non-taxable samples, small investors sell before the ex-date and start to buy from the ex-date, which suggests that small investors prefer low-priced stocks. We find weaker evidence consistent with the tax hypothesis: foreigners and large domestic investors who are tax-disadvantaged avoid participating in taxable dividends. We also find strong evidence that tax-neutral institutions play the role of short-term arbitrageurs around ex-dividend dates.

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1. Introduction

This paper examines order flows around ex-dividend dates (ex-dates) on the Taiwan Stock Exchange. Not only does Taiwan's tax code allow us to separate the tax hypothesis from other explanations, but Taiwan's data also permits us to examine the heterogeneity of investors' behavior around ex-dates.

Taiwanese companies pay stock dividends as well as cash dividends. There are two types of stock dividends, which differ for both accounting and tax purposes. For accounting, the source of stock dividends can come from capital surplus or retained earnings. If the source is capital surplus, then the stock dividend is non-taxable; if the source is retained earnings, then the stock dividend will be taxable, just like cash dividends. Given that the accounting method has no real effect, the tax consequence is the only difference between the two types of stock dividends. Therefore, Taiwan's data can offer a good pair of samples to separate the tax hypothesis from the others. If we look at a sample of stock dividends with capital surplus as the source, then tax has no role to play. If we contrast the non-taxable capital surplus sample with the taxable retained earnings sample, then any differences should be due to taxes.

It has been well documented that on ex-dates, stock returns are significantly greater than zero (Campbell & Beranek, 1955; Durand & May, 1960). This ex-dividend day phenomenon occurs in many countries (Kato & Lowenstein, 1995; Frank & Jagannathan, 1998). It also occurs for various distributions; for example, cash dividends, stock dividends, and stock splits (Eades, Hess, & Kim, 1984).

Researchers have offered many explanations for the abnormal return. Given that dividends are taxable, Elton and Gruber (1970) propose a tax clientele effect: investors with high marginal tax rates will sell their stock before the ex-date and buy afterwards, and the price change on the ex-date will reflect the tax rate of the marginal investors.

Aside from taxes, dividends can be a nuisance for some investors. If investors take cash dividends, then they need to cash the check and do something with it; if they take stock dividends, then they might end up with odd lots and a higher transaction cost (Barker, 1958; Grinblatt, Masulis, & Titman, 1984). Because of this, market makers tend to buy before a stock goes ex-dividend and sell on the ex-date. If we calculate returns using transaction prices, then we are likely to observe a positive return (Frank & Jagannathan, 1998).

Another attribute of a stock dividend is that the stock price on the ex-date will drop significantly. Practitioners think that the price drop can attract investors of small means to buy stocks in round lots (Lakonishok & Lev, 1987). Black (1986) conjectured that noise traders might prefer low-priced stocks.

Despite the fact that all these explanations have similar implications on the ex-date returns, they have very different predictions regarding who wants to trade around the ex-date. This paper explores these predictions and tests them using the intraday order data from the Taiwan Stock Exchange.

Taiwan's data allows us to examine the heterogeneity of investors' behavior around ex-dates. Utilizing intraday order data, we can divide investors into four groups: foreigners, institutions, large individual investors, and small individual investors. Different investor groups have drastically different patterns of order submission under alternative hypotheses, even though these hypotheses have similar implications on returns. Therefore, studying the pattern of order submission across investor groups provides a powerful test for alternative hypotheses and improves our understanding of the ex-date phenomenon.[1]

[1] Some of the previous studies analyze trading data. Lakonishok and Vermaelen (1986) examine aggregate trading volume around various distributions. Kryzanowski and Zhang (1996) examine transactions of large and small trade sizes for a stock split sample on the Toronto Stock Exchange. Koski and Scruggs (1998) look at transactions of corporations and securities dealers. The only study using order data, as far as we know, is Jacob and Ma (2003), in which they study the aggregate order

Section 2 of this paper introduces institutional details of stock dividends and stock trading in Taiwan. Section 3 develops testable implications. We will discuss our sample in section 4. Section 5 and 6 report our findings and section 7 concludes.

2. Institutional details

2.1. Dividend payments and taxes

There are two types of stock dividends that Taiwanese companies can distribute. These two types are similar in the way the company distributes them. Both types of distribution are proposed by the board of directors, approved in shareholder meetings, and publicly announced. The number of shares stockholders receive is determined by the dividend amount announced. Because stocks have a par value of NT$10 in Taiwan, shareholders will receive D/10 shares for each share owned, where D is the announced dividend amount in NT$ and D/10 is the distribution rate.

The two types of stock dividends are different, however, in terms of their accounting treatment and tax status. Given a distribution rate of D/10 and N outstanding shares, the amount of D*N will be transferred to the paid-in capital item on the balance sheet. The source of the accounting transfer D*N defines the type of the stock dividend: it can be the capital surplus or the retained earnings item on the balance sheet. If its source is capital surplus, then the stock dividend is legally viewed as a distribution of shares and is non-taxable. If the source is retained earnings, then the stock dividend is viewed as a distribution of earnings and is taxable. In the following, we will call these two types of stock dividends as the 'non-taxable capital surplus sample' and the 'taxable retained earnings sample'.

According to Article 241 of the Company Act, companies in Taiwan can distribute new shares to existing shareholders from capital surplus if the balance of

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imbalance around ex-dividend dates for over 63 trading days for NYSE-listed companies.

the capital surplus is sufficient for the accounting transfer. Capital surplus is a part of equity that comes from items that increase the book value of assets, but not earnings. Based on Article 238, the major sources of capital surplus include: (1) the additional paid-in capital, which is the premium of the issuing price of stock above its par value (NT$10), and (2) the increase in asset values due to revaluations, etc. Given that this type of dividend is viewed as a distribution of shares rather than a distribution of earnings, it is not subject to income tax.

According to Article 232 of the Company Act, companies can distribute earnings when their cumulative retained earnings are positive. To distribute earnings in the form of stock instead of cash requires the approval of a shareholder meeting (Article 240). When the source of the accounting transfer is retained earnings, the stock dividend in Taiwan is taxable. In contrast, a stock dividend is not subject to tax in many countries. Take United States of America as an example, following the Supreme Court decision in 1920 in the case of Eisner vs. Macomber, a stock dividend is not generally taxable in the U.S.[2] Cohen (1974) argues that:

> (It is due to the) basic tax distinction between corporate earnings distributed to shareholders and corporate earnings retained for reinvestment. In general, distributed earnings are taxed at the ordinary income rate applicable to the individual shareholder upon distribution. Retained earnings, with minor exceptions, are never directly attributed or imputed to individual shareholders but are taxed as gain to shareholders on the sale of stock to the extent that the sales price reflects earnings retained.

Capital gains in Taiwan are tax-exempt. Without taxing retained earnings, government tax revenues will be limited. As a result, earnings retained but distributed

[2] Andrews and Wilson (1971) provide a historical account of stock dividend taxation in the U.S. Section 305 of the Tax Reform Act of 1969 delineates the general rule and exceptions to the stock dividend taxation.

with stocks (the second type of stock dividend) are subject to ordinary income tax (Article 14 of the Income Tax Act). Furthermore, Article 76-1 of the Income Tax Act stipulates that companies should keep undistributed earnings of less than half of their paid-in capital; otherwise their shareholders will be taxed as if earnings have been distributed.

Starting in 1998, Taiwan adopted an imputation tax system, which taxes corporate earnings and then rebates this tax to shareholders with a dividend tax credit. Similar systems are also used in countries like Germany, Italy, Singapore, Thailand, Australia, and Canada. The purpose of this system is to eliminate the double taxation of corporate income - once when it is earned and the second time when it is distributed to shareholders.

Here is how the imputation tax system works in Taiwan. Let us say a company has earnings before tax, E, and the corporate tax rate is t_c. Suppose that the company distributes all the earnings after tax, $(1- t_c)$ E, to shareholders as a dividend. The dividend tax credit, which gives shareholders a credit for taxes already paid by the company, given to a shareholder who receives dividend D is $t_c/(1- t_c)$ D. The credit rate $t_c/(1- t_c)$ equals total corporate taxes paid, t_c E, divided by total dividend paid, $(1- t_c)$ E. Currently, the corporate tax rate is 25% in Taiwan, and so the tax credit rate will be 33.33%.[3] In the following, we will denote D as the net dividend, while the sum of the net dividend and the tax credit is the gross dividend.

For shareholders, receiving stock dividends distributed from earnings can be subject to income tax. The tax status depends on whether shareholders are foreigners, domestic individuals, or domestic corporations. For domestic corporations, the net

[3] To mitigate tax evasion caused by retained earnings, Article 66-9 of the Income Tax Act levies a 10% tax on retained earnings. Assume a company retains all the earnings after tax: 0.75E. It thus has to pay, in addition to 0.25E, an extra 0.075E as income tax and shareholders can only receive 0.675E as dividend D in the future. As a result, the credit rate will be 0.325E/0.675E=48.15%.

dividend received is not included in their taxable income, and the dividend tax credit received will be passed onto their shareholders (Article 42 of the Income Tax Act).

If shareholders are domestic individuals, then the gross dividend received will be included in their regular taxable income. The dividend tax credit will be counted as prepaid tax and serves to reduce the tax liability of shareholders (Article 14 of the Income Tax Act). The marginal tax rate applied to regular taxable income can be 6%, 13%, 21%, 30%, or 40%.

When shareholders are foreigners, either individuals or corporations, they cannot use the tax credit accompanying the dividend. As for net dividends, foreigners will be subject to a withholding tax at the time of payment based on the prescribed tax rates. The withholding tax rates range from 5% to 30%.

2.2. Trading mechanism

Given that the tax status is different across investors, we will use detailed order data to test the tax implications. To better understand the order data used, we first introduce the trading mechanism of the exchange.

The Taiwan Stock Exchange (TSE) has no market makers. The exchange is fully computerized and is an order-driven market. All orders are limit orders and the detailed order book is not available to investors.[4] Despite having no market makers, the Exchange is very liquid. In 1999, the turnover rate is 288%, only next to the Korea Stock Exchange and Nasdaq.

During our sample period, trading occurs from 9 a.m. to 12 p.m. Monday to Friday and from 9 a.m. to 11 a.m. every other Saturday. Orders accumulate starting from 8:30 a.m. and unexecuted orders will only remain on the order book until the end of the day, unless cancelled. Trading on the TSE involves two mechanisms: a

[4] The tick size in the TSE is a function of the price level. The tick size can be \$0.01, 0.05, 0.1, 0.5, or 1.0 when the price is respectively less than \$5, between \$5 and \$15, between \$15 and \$50, between \$50 and \$150, and above \$150.

periodic call auction used to open trading and a batch call auction used throughout the day. In either a periodic or a batch auction, orders accumulate and the computer sets a single market-clearing price at which all executed orders are transacted. The priority of the order execution depends first on the price and then on the arrival time of orders. Although structured as batch auctions, trading is almost continuous. For our sample firms in 1999, the median time interval between transactions is 62 seconds.

To illustrate the determining of the market-clearing price, we take Figure 1 as an example. Suppose, at the instant before the matching t, the demand schedule D gives the number of shares investors are willing to buy, while the supply schedule S gives the number of shares investors are willing to sell at different prices. The market-clearing price P_t is the price (it is P_3 in Figure 1) that can maximize the trading volume Q_t subject to demand and supply. After the matching, but before any new orders arrive, the best bid (B_t) is the highest bid price from unfilled buy orders; the best ask (A_t) is the lowest ask price from unfilled sell orders. In Figure 1, all buy orders that are willing to pay P_3 have been filled, and the highest bid price is P_2. The lowest ask price from unfilled sell orders is the same as the market-clearing price P_3. After each transaction, the exchange will disclose to investors the clearing price P_t, the trading volume Q_t, the best bid price B_t, and the best ask price A_t.

In the following empirical work, we will use the best bid price and ask price to classify new orders as aggressive or conservative. Aggressive orders are those that have the highest priority in trading. For orders arriving between transactions t and t+1, aggressive buy orders have limit prices higher than the prevailing best ask price, A_t; aggressive sell orders have prices lower than the prevailing best bid price, B_t. Conservative orders are those that have low priority in matching: The limit price of conservative buy (sell) orders is lower (higher) than the prevailing best bid price B_t (best ask price A_t).

3. Testable hypotheses

Several explanations have been offered for the ex-date phenomena. Most of them also have empirical implications for the pattern of order submission. We discuss these hypotheses in this section.

Nuisance hypothesis

Stock dividends can be a nuisance for some investors. On the Taiwan Stock Exchange, one round lot is one thousand shares. For investors who hold 1000 shares, taking a stock dividend with a 20% distribution rate makes them end up with an odd lot (less than 1000 shares). Trading an odd lot is costly: the exchange requires that an odd lot order can only be submitted after the market closes, and the selling price is discounted 0.5% from the closing price. Therefore, small investors whose holdings will end up with an odd lot after the distribution will have an incentive to sell before the ex-date or buy afterwards.

A higher distribution rate may increase or reduce the incentive to avoid an odd lot. For example, investors receiving a dividend of a 10% distribution rate will have an odd lot if their holdings are not in a multiple of 10 lots. Increasing the distribution rate to 20% will reduce the number of investors trying to avoid an odd lot, which will arise only if their holdings are not in a multiple of five lots. If we increase the distribution rate further to 30%, the number of investors who will have an odd lot (anyone whose holding is not in a multiple of 10 lots) will be higher rather than lower.

Hypothesis 1: For both non-taxable and taxable samples, the order imbalance for small investors will be negative before the ex-date and/or be positive on the ex-date and afterwards.

Price drop hypothesis

One attribute of a stock dividend is that the stock price on the ex-date will drop significantly: a stock dividend with a 20% distribution rate prompts the price to drop 16.7%. Practitioners think that the price drop can attract investors with little means to buy stocks in round lots (Lakonishok & Lev, 1987). Black (1986) speculates that noise traders prefer low-priced stocks. Hence, the prediction from the price effect is that noise traders or investors who are subject to a wealth constraint will sell before and buy on the ex-date or after, and they are more willing to buy when the distribution rate is higher.

Hypothesis 2: For both non-taxable and taxable samples, the order imbalance from noise traders or investors who are subject to a wealth constraint will be negative before the ex-date, and positive on the ex-date and afterwards. The order imbalance will be larger when the distribution rate is higher.

Tax hypothesis

For the retained earnings sample, stock dividends are taxable. As discussed in the previous section, stockholders need to consider both the tax credit and tax liability. The tax credit received is εkD, where D is the announced amount of net stock dividend in the local currency, k is the dividend tax credit rate, and ε is the fraction of dividend tax credit that can be received by an investor. Based on Taiwan's Income Tax Law, ε is 0 for corporations and foreigners and is 1 for domestic individuals. The tax liability faced by an investor is $\tau(1+\varepsilon k)D$, where τ is the tax rate applicable for dividends. For corporations, τ is 0, because net dividends are exempt from tax. For foreigners, τ is the withholding tax rate for net dividends; for individuals, gross dividends are taxed at the personal income tax rate τ.

Combining both tax credit and liability, the net dividend tax credit for an investor is $\varepsilon kD - \tau(1+\varepsilon k)D$. Ignoring transaction costs, if $\varepsilon kD-\tau(1+\varepsilon k)D>0$, then investors will have an incentive to receive the stock dividend, because it will increase their after-tax income. On the other hand, if $\varepsilon kD-\tau(1+\varepsilon k)D<0$, then investors receiving the dividend will have a lower after-tax income.

Whether the disposable income will be higher or lower depends on the magnitude of ε, k, and τ as listed in Table 1. Foreigners will have a lower after-tax income by receiving stock dividends, because $\varepsilon=0$ and $\tau>0$. As for domestic individuals, it depends on their personal tax rates. If the tax credit rate is 33.33% and the tax rate is higher (lower) than 25%, then receiving dividends will reduce (increase) investors' after-tax income. For corporations, receiving stock dividends does not affect their after-tax incomes, because both ε and τ equal 0.

Table 1. Impact on after-tax incomes by receiving stock dividends

Investor type	Parameters	Net tax credit $\varepsilon kD - \tau(D+\varepsilon kD)$	Changes in the after-tax income
Foreigners	$\varepsilon=0$, $\tau>0$	< 0	Decrease
Domestic high tax bracket individuals	$\varepsilon=1$, $\tau > k/(1+k)$	< 0	Decrease
Domestic corporation	$\varepsilon=0$, $\tau=0$	$= 0$	Unchanged
Domestic low tax bracket individuals	$\varepsilon=1$, $\tau < k/(1+k)$	> 0	Increase

When there are transaction costs and a non-zero expected return, investors' response to stock dividends will depend on the specific trading strategy they use. In the following, we will adopt the framework used in Boyd and Jagannathan (1994) and McDonald (2001) to develop specific hypotheses. We assume a proportional transaction cost and discuss four trading strategies: long arbitrage, short arbitrage,

delayed purchase, and delayed sale. Previous discussions suggest that investors with a positive net dividend tax credit may prefer the long arbitrage and delayed sale strategies to receive dividends, while investors with a negative net dividend tax credit may prefer the short arbitrage and delayed purchase strategies to avoid dividends.

A long arbitrageur is someone who purchases shares cum-dividend and sells them ex-dividend. To purchase one share, the total cost is $(1+c)\ P_{-1}$, where P_{-1} is the cum-dividend price on the day before the ex-date and c is the transaction cost of the trading value in percentage terms. The net revenue from selling shares after distribution is $(1-c)\ (1+d)\ E[P_0]$, where $E[P_0]$ is the expected ex-right price on the ex-date and d is the distribution rate of the stock dividend with the dollar amount D $(d=D/10)$[5]. Including cost, revenue, and tax, the after-tax gain for a long arbitrageur is $(1-c)\ (1+d)\ E[P_0] - (1+c)\ P_{-1} + \varepsilon kD - \tau\ (D+\varepsilon kD)$. Therefore, investors will use the long arbitrage strategy if the following conditions hold:

$$\frac{(1+d)E[P_0]-P_{-1}}{P_{-1}} > \frac{2c}{(1-c)} - \frac{1}{(1-c)}\frac{D}{P_{-1}}[ek - t\,(1+ek)]. \qquad (1)$$

The left-hand side of the inequality is the stock return adjusted for the distribution effect. As previously discussed, one direct implication of equation (1) is that the incentive to pursue a long arbitrage strategy increases with the investors' net dividend tax credit $\varepsilon kD - \tau\ (1+\varepsilon k)D$. Given the existence of transaction costs, a long arbitrage will not be profitable unless the rate of return passes the threshold. The threshold is increasing to c in order to cover transaction costs, while the threshold is decreasing to the net dividend tax credit. When the net dividend tax credit is negative,

[5] In reality, new shares distributed as a stock dividend will not be available for sale immediately. We assume that short-selling is costless to derive the expression.

the price increase on the ex-date must be large enough to cover the tax disadvantage. When the net dividend tax credit is positive, a long arbitrage can still be profitable even if the price drops on the ex-date.

A short arbitrageur is someone who sells shares cum-dividend and buys them back ex-dividend. Given that the Exchange prohibits short selling over a five-day period starting from five days before the ex-date, a short arbitrageur must actually own a stock to sell. To sell one share, the net revenue is (1-c) P_{-1}. To buy back the share and its dividend, the total cost is (1+c) (1+d) $E[P_0]$. The after-tax gain for a short arbitrageur is (1-c) P_{-1} - (1+c) (1+d) $E[P_0]$. Therefore, investors will use the short arbitrage strategy if the following condition holds:

$$\frac{(1+d)E[P_0]-P_{-1}}{P_{-1}} < \frac{-2c}{(1+c)}. \qquad (2)$$

Given the existence of transaction costs, a short arbitrage will not be profitable unless the price drop passes the threshold. Interestingly enough, the threshold for a short sale is not related to the net dividend tax credit $\varepsilon kD - \tau(1+\varepsilon k)D$, because by selling shares in advance, investors are not subject to any dividend taxes.

McDonald (2001) suggests a different kind of short arbitrage that combines a stock loan with selling shares. Given that foreigners cannot receive the tax credit, they may be able to lend their shares to others and get them back after ex-dividend. In return, the borrower may pay a fraction of the dividend tax credit. The borrower can then sell the stock to someone who can receive the dividend tax credit. The regulation in Taiwan, however, does not allow this kind of short arbitrage. First, stock lending has to go through financial institutions for foreigners, because their holdings are required to be kept in the Taiwan Securities Central Depository. Second, stock lending

through financial institutions is prohibited during a five-day period: starting from five trading days before the ex-right date. Therefore, there is no way for foreigners to receive the tax credit by lending to someone who can.

The last two strategies can be classified as implicit arbitrage. They are used by anyone who can decide the timing of trading. For either buyers or sellers, they can trade shares cum-dividend or ex-dividend. For a buyer who purchases shares ex-dividend, the cost is (1+c) (1+d) $E[P_0]$; the cost is (1+c) P_0 - εkD + τ (D+εkD) if the purchase occurs at cum-dividend. As a result, investors will delay a purchase if the inequality (3) holds; else they will purchase cum-dividend.

$$\frac{(1+d)E[P_0]-P_{-1}}{P_{-1}} < -\frac{1}{(1+c)}\frac{D}{P_{-1}}[ek-t(1+ek)]. \qquad (3)$$

A seller can choose either to sell shares cum-dividend or sell ex-dividend. To sell ex-dividend, the income is (1-c) (1+d) $E[P_0]$ + εkD - τ (D+εkD); to sell cum-dividend, the income is (1-c) P_{-1}. Therefore, investors will delay selling if

$$\frac{(1+d)E[P_0]-P_{-1}}{P_{-1}} > -\frac{1}{(1-c)}\frac{D}{P_{-1}}[ek-t(1+ek)]. \qquad (4)$$

To sum up these four strategies, we can use Figure 2. In this figure we draw four straight lines representing arbitrage conditions (1) to (4). The horizontal axis is the net dividend tax credit for each dividend in dollar amounts and the vertical axis is the expected stock return on the ex-date.

From Figure 2, we know that the choice of each investor's strategy will depend on the expected return on the ex-date. When the expected return on the ex-date is higher, more investors will find the long arbitrage and sell delay strategies to be

attractive, and fewer investors will find the buy delay strategy worthwhile. As a result, there will be more sell orders and less buy orders on the ex-date, which puts an upper limit on the expected return on the ex-date. The same reasoning suggests that the expected return on the ex-date cannot be too low either. The exact equilibrium price on the ex-date will depend on the distribution of orders along the net dividend tax credit dimension as stated in the following lemma.

Lemma 1. Assuming that more wealth belongs to investors that have higher tax rates (negative net dividend tax credits), the expected return on the ex-date is positive.

Proof: When the expected price change is zero, investors can choose to defer their purchase, defer their sale, or execute a long arbitrage strategy. Given that investors choosing to defer a purchase are those in high tax brackets, they are likely to be the majority in the stock market. Therefore, there will be more buy orders than sell orders on the ex-date if the expected return is zero. To clear the market, the expected price change has to be positive so as to reduce buy orders on the ex-date.

Given a positive expected return, we have the following hypothesis for tax-related trading.

Hypothesis 3: For the taxable sample,

(1) High tax bracket investors will delay their purchase until the ex-date. Hence, their order imbalance is negative before the ex-date and positive on the ex-date or afterwards.

(2) Foreign investors will delay their purchase until the ex-date. Hence, their order imbalance is negative before the ex-date and positive on the ex-date

or afterwards.

(3) **Low tax bracket investors will adopt the long arbitrage strategy or delay their sales until the ex-date. Their order imbalance is positive before the ex-date and negative on the ex-date or afterwards.**

Since investors with wealth constraints tend to be in low tax brackets, the tax hypothesis makes exactly the opposite prediction to the nuisance hypothesis or the price drop hypothesis. Another thing that will affect investors' incentive to trade is the dividend distribution rate. From equation (3), we learn that, given a positive expected return on the ex-date, more investors will delay their purchase when the dividend becomes higher. Therefore, the expected return will change when the distribution rate gets higher, which is described in lemma 2.

Lemma 2. When the dividend distribution rate increases, the expected return on the ex-date will be higher. More high tax bracket investors will follow the delay purchase strategy. For low tax bracket investors, fewer investors will follow the delayed sale strategy, and there is no clear-cut prediction on the number of investors following the long arbitrage strategy.

Proof: See appendix.

Although we do not have clear predictions regarding trading from low tax bracket investors, the implications on trading by high tax bracket investors are clear and listed in the following hypothesis.

Hypothesis 4: For the taxable sample, when the dividend distribution rate is

higher,

(1) More high tax bracket investors will delay their purchases until the ex-date. Hence, their order imbalance is more negative before the ex-date and more positive on the ex-date or afterwards.

(2) More foreign investors will delay their purchase until the ex-date. Hence, their order imbalance is more negative before the ex-date and more positive on the ex-date or afterwards.

Tax-neutral arbitrageurs

For institutions, receiving stock dividends does not affect their earnings and tax liabilities. They are tax-neutral arbitrageurs and trade for profits. For both taxable and non-taxable distributions, if the expected return is greater than 2c/(1-c), then institutions will buy cum-dividend and sell ex-dividend. If institutions are selling for other reasons, then they will delay their sales until the ex-date if the expected return is positive. The difference between taxable and non-taxable distributions is that Lemma 1 predicts a positive expected return for the former, but there is no such prediction for the latter.

Hypothesis 5. For the taxable sample

(1) Institutional investors will delay their sales until the ex-date. Therefore, their order imbalance is positive before the ex-date and negative on the ex-date or afterwards.

(2) When the dividend distribution rate increases, the expected return on the ex-date will be higher; institutional investors' order imbalance will be more positive before the ex-date and more negative on the ex-date or afterwards.

4. Methodology and sample

4.1 Methodology

To test our hypotheses, we construct daily relative order imbalances for different types of investors. The relative daily order imbalance is the difference between buy and sell values divided by the sum of buy and sell values. Using relative instead of absolute order imbalances can mitigate the influence from skewness and extreme values. Orders submitted by investors are divided into aggressive and conservative categories. Aggressive orders are those that have high priority in matching, and conservative orders are those that have low priority. Buy orders are aggressive if their limit prices are higher than the best ask, and are conservative if their prices are lower than the best bid. Sell orders are aggressive if their limit prices are lower than the best bid, and are conservative if their prices are higher than the best ask.

To test for significance, we follow Lakonishok and Vermaelen (1986) to estimate standardized abnormal returns and standardized abnormal relative order imbalances during the event period –2 to +2, where 0 is the ex-date. The estimation period is from day -50 to day –6.

Taking the abnormal order imbalance for example, for each sample stock, we first estimate a market model as in equation (5) using OLS for the estimation period:

$$O_{ijt} = a_{ij} + b_{ij}O_{mjt} + u_{ijt}, \text{ t = -50,…,-6.} \quad (5)$$

Here, O_{ijt} is the relative order imbalance for firm i from the type-j investor on event day t, and O_{mjt} is the market aggregate order imbalance.

To reduce the influence of extreme observations in estimating market models we delete influential observations using the DFFITS statistics as suggested by Belsley, Kuh, and Welsch (1980)[6]. The abnormal order imbalance is then defined as follows:

[6] The DFFITS statistic for the *i*th observation is a scaled measure of the difference between the predicted value using all observations and the predicted value after deleting the *i*th observation.

$$AO_{ijt} = O_{ijt} - \hat{a}_{ij} - \hat{b}_{ij} O_{mjt}, \quad (6)$$

where AO is the abnormal relative order imbalance.

The variable we will analyze is the standardized abnormal order imbalance as in equation (7):

$$SAO_{ijt} = \frac{AO_{ijt}}{s\left(AO_{ijt}\right)}. \quad (7)$$

To test our Hypotheses 1, 2, 3 and 5, we will calculate and test the significance of the average of *SAO*. To test our Hypotheses 4 and 5, we will regress *SAO* against the distribution rate and test the significance of the regression coefficient.

4.2. Sample descriptions

Our sample period is 1999, because we only obtained investors' order data for that year. To ensure a sharp contrast between taxable and non-taxable stock dividends, we only include in our sample those distributions that are either fully taxable or fully non-taxable. Any distributions that contain both taxable and non-taxable dividends are deleted. We also have excluded distributions that are combined with cash dividends or rights issues. The initial sample has 125 stocks. In order to estimate abnormal returns and abnormal order imbalances, we require a minimum of 40 days of data in the estimation period from day –50 to –6: 13 stocks are dropped accordingly. We also delete one stock that has a very large distribution rate of 168% (the 2nd largest distribution rate is 50%). The final sample includes 111 stock dividends: 45 are non-taxable and 66 are taxable.

Table 2 provides basic descriptions of companies included in our sample. The non-taxable capital surplus sample is quite different from the taxable retained earnings sample. Companies that pay out stock dividends from retained earnings are bigger (median market capitalization is NT$9.6 billion versus $6.8 billion; the

exchange rate at the end of 1999 was NT$31.4 = U$1); their stock prices are higher (median closing price on the day before the ex-date is NT$30.4 versus NT$14.4); their distribution rates are larger (median rate is 10% versus 6%). Given that the Company Act requires profitability as a prerequisite for companies to distribute earnings, companies in the retained earnings sample are also more profitable (median ROA is 7.7% versus 1.5%).

The difference between the two samples in firm characteristics should not cause any systematic bias to our results. It is likely that differences in firm characteristics will bring about differences in the composition of investors and differences in their order strategies. It is highly unlikely, however, that differences in firm characteristics will cause differences between the period before the ex-date and the period around the ex-date. Given that we will be testing the significance of an abnormal order imbalance (that is, the difference between the period around the ex-date and the estimation period), rather than the significance of raw data, our results should not be biased.

Our order data is obtained from the Taiwan Stock Exchange (TSE) and the file contains all orders submitted by investors to the TSE during 1999. The detailed information includes the time, investor type, order type (buy or sell), volume, and limit price.[7] Due to availability, we can only examine order data rather than trading data. Nevertheless, using order data has the benefit of being better able to reflect investors' intentions, while trading requires the existence of the other side of the trade.

To test our hypotheses, we divide investors into four groups: foreigners, domestic institutions, large individuals, and small individuals. Individuals who submit a daily total order value greater than NT$200,000 are classified as large investors; otherwise they are small investors. NT$200,000 is approximately half of the annual GNP per capita, and this criterion will cause more than half of all investors to be

[7] The Taiwan Stock Exchanges allows limit orders only.

classified as small.[8] We will also report results based on critical values of 100,000 or 300,000. We use the order value to classify individual investors rather than volume because the former is the dollar amount that needs to be invested, which should be a better indication of the wealth condition of investors.

The small individual investor group can be used to test Hypotheses 1 and 2. Hypothesis 1 makes predictions about small investors who view stock dividends as a nuisance. Hypothesis 2 discusses investors with little means and noise traders who react to the price drop brought on by the ex-date. It seems reasonable to assume that individual investors whose order values are low are the ones who will view stock dividends as a nuisance or who will react to the price drop *per se*. Since we do not know the tax rate applicable to each individual investor, we will also use the small individual investor group as a proxy for the low tax bracket investors as discussed in Hypotheses 3 and 4.

5. Empirical results

5.1. Abnormal returns

Before looking at the order imbalance, we first examine return behavior on the ex-date. Table 3 reports the mean of standardized abnormal returns around the ex-date. The average standardized abnormal return on the ex-date for the non-taxable capital surplus sample is 0.5, significant at a 0.05 level. Given that stock dividends paid out of capital surplus are not taxable, this result is similar to that of Eades, Hess, and Kim (1984) for a stock split sample in the U.S. For the taxable retained earnings sample, the average standardized abnormal return on the ex-date is 0.6, also significant at a 0.05 level. Although the taxable sample has a slightly lower average return than the

[8] In 1999, the median daily total order values submitted by individual investors was NT$114,000, and the GNP per capita was NT$427,097.

non-taxable sample, the difference is too small to be significant. Our results suggest that the tax is neither a necessary condition for the ex-date phenomenon, nor an important factor, if not completely irrelevant, in explaining the ex-date phenomenon. Of course, our results are based on a small sample and future research is warranted.

If we look at the non-standardized return combing both samples: for the 111 ex-dates, 73 (66%) experience a positive abnormal return, where the average abnormal return is 1.21% and the median is 1.23% (both are significantly different from zero at a 0.01 level). There are two explanations why arbitrage cannot eliminate abnormal returns. One is that arbitrage is costly. Arbitrageurs have to pay a 0.3% securities transaction tax when they sell and a two-way commission rate of 0.1425% on the Exchange. After deducting both transaction costs, the average abnormal return shrinks to 0.62% and the median is 0.64%, barely significant at a 0.05 level. The second is that arbitrage around the ex-date is risky. In our sample, 46 out of 111 stocks (41%) experience a negative abnormal return after cost on the ex-date. The risk involved may deter some traders from doing more arbitrage.

Another thing to notice in Table 3 is that returns around ex-dates are positive and sometimes significant. For the non-taxable sample, the average abnormal return on day 1 is significant, whereas for the taxable sample, the average is significantly positive on day -1.

Abnormal returns around the ex-date are not necessarily associated with abnormal order imbalances. Table 4 reports aggregate order imbalances around ex-dates. Despite a significant return, for the non-taxable sample, there is no significant abnormal order imbalance from day –1 to day 1. In contrast, for the taxable sample, buy orders are significantly more than sell orders from day –1 to day 1. To understand the source of order imbalances, we need to examine the order behavior of different investor types.

5.2. Abnormal order imbalances

Our hypotheses make specific predictions about order behaviors from foreign investors, domestic institutions, and large and small individual investors. Table 5 reports the average standardized abnormal order imbalance from day –2 to day 2. Panels A and B give the average order imbalances from aggressive orders for non-taxable and taxable samples; Panels C and D give the average from conservative orders.

For the non-taxable capital surplus sample, our only predictions are for small individual investors: they want to sell before the ex-date and buy afterwards due to the nuisance hypothesis (Hypothesis 1) and the price drop hypothesis (Hypothesis 2). The evidence is consistent with our predictions. For small investors, we find that the imbalances from their aggressive orders on days –2 and –1 are both negative, although neither is significant at a 0.1 level (Column 4 in Panel A of Table 5). Moreover, small investors turn into net buyers on the ex-date: their average order imbalance is a positive 0.48 on day 0, which is significant at a 0.05 level.

Corroborative evidence for the nuisance and the price drop hypotheses comes from the taxable retained earnings sample. Small investors sell more and sell aggressively before the ex-date (Panel B in Table 5): the averages of order imbalances are –0.41 and –0.56 for day –2 and –1, both are significant at a 0.05 level. Then they become net buyers from the ex-date: the averages are all positive from day 0 to day 2, and the average on day 0 is 0.56, which is statistically significant. The evidence from small investors does not support the tax hypothesis. If small investors are in low tax brackets, they should buy before and sell after the ex-date to capture the dividend tax credit. The evidence says otherwise.

It seems that small investors are very determined not to receive the stock dividend. Compared with aggressive orders, the evidence is much weaker for

conservative orders submitted by small investors (Panel C and D in Table 5). The only significant result occurs on the ex-date for the taxable sample; where we find that, similar to aggressive orders, small investors submit a significantly higher number of conservative buy orders. The aggressiveness of small investors does not appear to be rational. The timing of the ex-date and its effect on prices are matters of public knowledge. Rational investors should spread their orders to reduce the price impact rather than concentrate their orders.

Our tax hypothesis (Hypothesis 3) argues that foreigners and large investors (if they are in high-tax brackets) should sell before the ex-date and buy afterwards. Table 5 presents some weak evidence to support the tax hypothesis. Both foreigners and large investors submit significantly more conservative buy orders than sell orders on the ex-date of the taxable sample: the average order imbalances are 0.37 for foreigners and 0.45 for large investors (Columns 1 and 2 in Panel D of Table 5). In contrast to aggressive trading by small investors, large investors and foreigners do not trade aggressively around the ex-date relative to the estimation period.

The lack of significance before the ex-date may be a rational choice by these tax-motivated investors. Sophisticated investors know the exact timing of the ex-date and its tax implications long before day 0 (the time interval between the ex-date and the shareholder meeting that decides the dividend distribution rate ranges from 27 to 209 days, and the median is 59 in our sample). Harris (1998) argues that under such a circumstance, uninformed liquidity traders will submit conservative orders when deadlines are distant. Liquidity traders will also spread orders over the whole period to minimize the price impact. Therefore, we should not be too surprised to find it difficult to detect changes in behavior for tax-motivated investors.

In Table 5, we define small and large investors using a daily order value of NT$200,000 as the cut-off point; $200,000 is approximately one half of the per capita

gross national product in Taiwan in 1999. For median priced stocks (the median cum-dividend prices are $14.4 or $30.4 for two samples), $200,000 amounts to 14 or 7 lots. To examine the robustness of our choice, we also use $100,000 and $300,000 as cut-off points. Table 6 reports order imbalance results for large and small individual investors based on aggressive orders and different cut-off points. When the cut-off point is NT$100,000, none of the order imbalances for small and large investors is significant. The results for a $300,000 cut-off point are very similar to results for the $200,000 cut-off point. Therefore, the evidence for small and large investors is robust with the choice of the cut-off point.

Institutional investors behave very differently from other types of investors. For the taxable sample, institutions buy aggressively before the ex-date (the average order imbalance is 0.4 on day –1) and start to sell aggressively from day 0 (averaged –0.34), and most abnormal order imbalances are significant. This result is consistent with Hypothesis 5 that institutions delay their sale or pursue a long arbitrage strategy, because dividend taxes are irrelevant for them and the expected return is positive. Lending credence to the tax story is the sharp contrast between the negative order imbalances in the taxable sample from day 0 to day 2 and the positive order imbalances in the non-tax sample.

Institutions prefer to submit aggressive orders around the ex-date. Although the sign of order imbalances is the same, numbers from conservative orders are not significant except on day 1. To be aggressive is reasonable if institutions are acting as short-term arbitrageurs. Arbitrage is risky and aggressive orders can reduce the uncertainty of failing to trade.

Our evidence on tax-neutral institutions is consistent with other researchers' findings. Using a sample from NYSE stocks, Koski and Scruggs (1998) find a significant abnormal trading volume by securities dealers. Our sample goes one step

further to show the direction of trading: institutions buy more before the ex-date and sell more afterwards.

6. Further results

We have found that the pattern of the average order imbalance for the four types of investors is consistent with our hypotheses. In this Section, we would like to present more evidence on the order imbalance to better our understandings.

6.1. High versus low distribution rates

In addition to average results, we also would like examine the effect of distribution rates on order imbalances. Hypothesis 5 predicts that, for the taxable retained earnings sample, order imbalances from institutions are more positive before the ex-date and more negative afterwards, as the dividend increases. Table 7 provides evidence broadly consistent with this hypothesis.

Table 7 reports the coefficient on the distribution rate in a simple regression where the dependent variable is the abnormal order imbalance. Column 3 of Panel B in Table 7 shows that the result is consistent with Hypothesis 5: as the distribution rate increases, institutions submit significantly more buy orders before the ex-date and then submit significantly more sell orders from day 0.

Table 7 also examines the behavior of small investors; they behave exactly opposite to institutions. As the distribution rate increases, small investors' order imbalances are more negative before the ex-date and more positive from day 0. This result is more consistent with the price drop hypothesis than with the nuisance hypothesis. The nuisance hypothesis argues that small investors do not like stock dividends because it will generate odd lots, but the probability of getting an odd lot is not a monotonic function of the distribution rate (Hypothesis 1). On the other hand, the percentage of the price drop is a linear function of the distribution rate; therefore,

the magnitude of order imbalances should be increasing to the distribution rate under Hypothesis 2. The evidence in Table 7 supports the price drop hypothesis; investors like low-priced stocks, as Black (1986) suggested.

Regarding the tax hypothesis, similar to the average results in Table 5, supporting evidence is weak. Hypothesis 4 predicts that when the distribution rate gets higher, order imbalances from foreigners and large investors will be more negative before the ex-date and more positive afterwards. There are no significant changes in behavior by foreigners. For large investors in the taxable sample, when the distribution rate increases, they submit more conservative buy orders on days 0 and 1 as predicted. In contrast, however, large investors' aggressive orders on day 0 drop significantly.

6.2. Explicit arbitrage activities

In Table 5 we found that institutions buy more before the ex-date and sell more afterwards, whereas small investors are doing the opposite. These results can arise because investors are choosing the timing of their trade. They can also arise because investors are taking explicit arbitrage opportunities: institutions are doing long arbitrage and small individual investors are conducting short arbitrage. To provide further evidence to differentiate these two possibilities, we directly estimate the extent of arbitrage activities near the ex-date; to which we now turn.

To test for explicit arbitrage activities, we calculate the abnormal relative order imbalances from arbitrage activities. To estimate the extent of long arbitrage, we first locate investors who submit both buy orders on day –1 (or –2) and sell orders on the ex-date 0. We then calculate the total order value from buy orders to measure the extent of long arbitrage. To estimate the extent of short arbitrage, we locate investors who submit both sell orders on day –1 (or –2) and buy orders on the ex-date, then we calculate the total order values from sell orders. The relative order imbalances from

arbitrage activities are the differences between long and short arbitrages divided by the sum of total buy and sell orders for that day.

To calculate the standardized abnormal arbitrage activities during the event period, we use the average and standard deviation of normal arbitrage activities during the estimation period. To estimate the normal relative order imbalances from arbitrageurs, the same procedure is applied over the estimation period –50 to –6. For each day t within the estimation period, we locate investors who submit both buy (sell) orders on day t-1 and sell (buy) orders on day t, and use the total values from buy (sell) orders as the normal long (short) arbitrage volume. Table 8 reports the results for abnormal arbitrage activities.

There is strong evidence of long arbitrage activities around the ex-date for both non-taxable and taxable samples. All types of investors are doing long arbitrage, and the only difference is their aggressiveness. Institutions and individual investors, both large and small, are submitting aggressive orders to do long arbitrage; foreigners only submit conservative orders.

The results on explicit arbitrage from small individual investors are very different from results on total orders (Table 5). When we look at the total order imbalances from small investors, they sell before the ex-date and buy afterwards for both non-taxable and taxable samples. When we only examine the order imbalances from explicit arbitrage activities, they buy before the ex-date and sell afterwards. These results suggest that individual investors are heterogeneous: some will do the long arbitrage to capture the dividend tax credit and a positive expected return as suggested in Hypothesis 3, but most will choose to avoid the dividend. The heterogeneity of small individual investors is unlikely to come from their unobserved marginal tax rates because similar behaviors are observed for both non-taxable and taxable distributions.

The results of explicit arbitrage from large individual investors and foreigners suggest these investors are also heterogeneous. When we examine the order imbalances from explicit arbitrage activities, for both non-taxable and taxable samples, large investors and foreigners will do the long arbitrage: buy before the ex-date and sell afterwards. This behavior suggests that some of the large individual investors and foreigners want to capture the positive expected return on the ex-date. This behavior is not consistent with our tax Hypothesis 3: both foreigners and high-tax bracket investors should avoid receiving the tax-disadvantaged dividends. Although not all foreigners and large investors avoid dividends, enough of them do want to avoid the dividend tax. Therefore, we observe in Table 5 that, for the total order imbalances, large investors and foreigners do not buy until the ex-date.

6.3. Returns and order imbalances

We have seen in Section 5.1 that on the ex-date, the average abnormal return is significantly positive, but the average abnormal aggregate order imbalance is not. Therefore, the aggregate order imbalance cannot explain the return behavior. A natural question is whether we can explain returns using order imbalances from various types of investors.

Table 9 reports regression results using abnormal returns on the ex-date as the dependent variable. Both taxable and non-taxable samples are included in the regression. Independent variables include a dummy variable for the tax status, and order imbalances from four groups of investors. We find that the only significant variable is the order imbalance of large individual investors: when large individuals buy more, the stock price gets higher. Large individual investors not only submit the largest number of shares (Table 2 reports their median percentage is higher than 65%), they are also the marginal trader.

Despite a significant relation between the abnormal return and the order

imbalance of large investors, we still cannot explain the average abnormal return. Without including any order imbalances variables, the intercept is 0.514 (significant at a 0.05 level); the intercept becomes an even bigger 0.580 when order imbalances from all the four groups of investors are included. We should not be too surprised by the result, however, since Table 5 has shown that the order imbalance of large individuals is not significantly different from 0.

7. Conclusion

This paper examines order flows around ex-dividend dates on the Taiwan Stock Exchange. Not only does Taiwan's tax code allow us to separate the tax hypothesis from other explanations, but Taiwan's data also allows us to examine the heterogeneity of investor behavior around ex-dates.

We find strong evidence that small investors sell before the ex-date and start to buy from the ex-date, which suggests that small investors prefer low price. We find weaker evidence consistent with the tax hypothesis: Foreigners and large domestic investors who are tax-disadvantaged avoid participating in dividends. We also find strong evidence that institutions play the role of short-term arbitrageurs around ex-dividend dates: they buy before the ex-date and sell afterwards.

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Figure 1. The determinants of the transaction price.

Line D (S) is the demand (supply) schedule at the instant before a match. After this match, the exchange will disclose the transaction price (P_3), the trading volume (Q_t), the best ask price from unfilled orders after the transaction (P_3), and the best bid price from unfilled orders after the transaction (P_2).

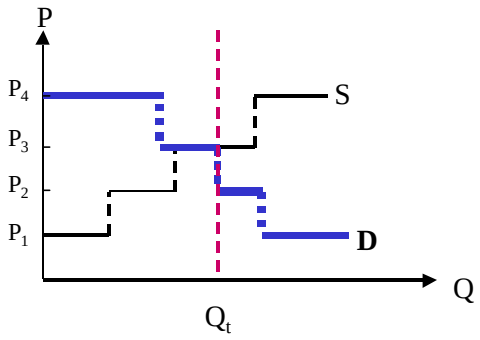


Figure 2. Investor's trading strategy

Investors can use four strategies to trade: Delay selling from the day before the ex-date (–1) until the ex-date (0), delay purchasing from day –1 until day 0, long arbitrage that purchases on day –1 and sells at 0, short arbitrage that sells on day –1 and buys at 0. The willingness to adopt any strategy depends on the expected return on day 0, $\frac{(1+d)E[P_0]-P_{-1}}{P_{-1}}$, and the net dividend tax credit received, $ek-t(1+ek)$, where k is the dividend tax credit rate, ε is the fraction of dividend tax credit that can be received by an investor, and τ is the tax rate applicable for dividends.

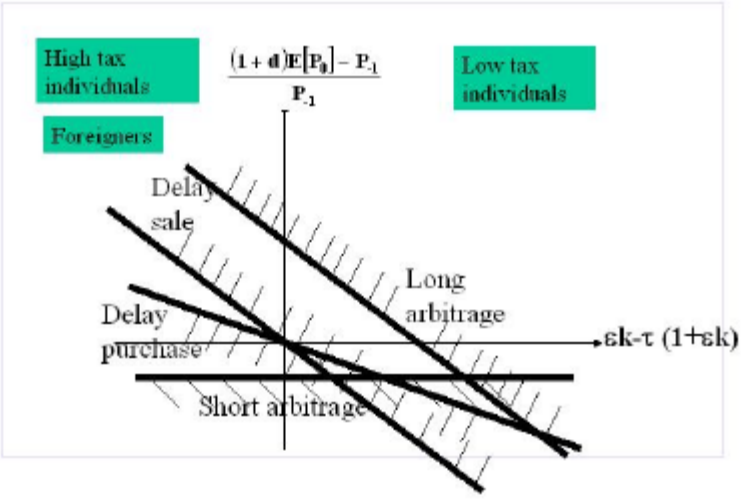


Table 2. Descriptive statistics of the stock dividend sample

These are descriptive statistics of related items for the ex-date sample during 1999. The ex-date sample is divided into two groups according to the sources of stock dividends (there are 45 and 66 ex-dates in the non-taxable capital surplus and taxable retained earnings sample, respectively). The value of market capitalization is measured at the end of 1998. Return on equity, return on assets, daily trading value and daily turnover rate is measure over the year 1998.

Panel A: The non-taxable capital surplus sample

Item	Mean	Standard deviation	Q1	Median	Q3
Distribution rate of dividend (%)	8.06	5.00	5.00	6.00	10.00
Market capitalization (NT$ billion)	13.18	18.46	3.61	6.83	14.27
Return on equity (%)	1.59	6.63	-1.37	1.13	4.10
Return on assets (%)	1.79	3.22	-0.15	1.52	3.40
The closing prices cum-dividend	18.58	12.14	10.60	14.40	24.60
Daily trading value (NT$ million)	152.29	393.02	16.67	36.21	94.06
Daily turnover rate (%)	0.73	0.57	0.35	0.61	1.00
Foreigners % in orders	1.06	1.82	0.00	0.09	1.70
Large individuals % in orders	64.69	10.65	59.48	65.60	72.11
Institutions % in orders	8.16	8.70	3.30	5.99	10.60
Small individuals % in orders	26.09	9.44	20.73	25.83	31.15

Panel B: The taxable retained earnings sample

Distribution rate of dividends (%)	15.82	21.64	5.00	10.00	20.00
Market capitalization (NT$ billion)	30.39	65.43	4.33	9.56	21.91
Return on equity (%)	14.62	12.47	6.57	11.82	17.99
Return on assets (%)	9.52	7.81	4.86	7.71	12.42
The closing prices cum-dividend	73.27	116.19	16.90	30.40	63.50
Daily trading value (NT$ million)	364.08	714.11	19.39	82.54	33.96
Daily turnover rate (%)	1.03	0.97	0.31	0.72	1.64
Foreigners % in orders	2.18	5.79	0.00	0.26	1.59
Large individuals % in orders	68.73	12.89	60.00	72.10	78.68
Institutions % in orders	10.94	7.02	5.84	8.76	16.35
Small individuals % in orders	18.16	11.45	9.11	16.26	26.93

Table 3. Average daily standardized abnormal return around the ex-date

To calculate normal return, we use a market model estimated from day –50 to –6, where day 0 is the ex-date. There are 45 stocks for the capital surplus sample and 66 for the retained earnings sample. ** and * denote significant levels of 5% and 10%, respectively, using a two-tailed t-test.

Day	Non-taxable capital surplus sample	Taxable Retained earnings sample	Difference
-2	-0.031	0.074	0.105
-1	0.284	0.431**	0.147
0	0.514**	0.632**	0.118
1	0.408**	0.108	-0.300
2	0.165	0.124	-0.041

Table 4. Average daily standardized abnormal relative order imbalance around the ex-date

The relative daily order imbalance is the difference between daily buy and sell values divided by the sum of buy and sell values. Orders submitted by investors are divided into aggressive and conservative ones. Buy (sell) orders are aggressive if their limit prices are higher (lower) than the best ask (bid), and are conservative if their prices are lower (higher) than the best bid (ask). To calculate normal order imbalance, we use a market model for order imbalance estimated from day –50 to –6, where day 0 is the ex-date. There are 45 stocks for the capital surplus sample and 66 for the retained earnings sample. ** and * denote significant levels of 5% and 10%, respectively, using a two-tailed t-test.

Panel A. Aggressive orders

Day	Non-taxable capital surplus sample	Taxable retained earnings sample	Difference
-2	-0.050	0.002	0.052
-1	0.214	0.436**	0.222
0	0.200	0.070	-0.131
1	0.037	0.261*	0.223
2	-0.152	0.009	0.161

Panel B. Conservative orders

Day	Non-taxable capital surplus sample	Taxable retained earnings sample	Difference
-2	0.164	0.176	0.012
-1	0.094	0.174	0.080
0	0.054	0.440**	0.386*
1	0.002	0.170	0.168
2	0.323*	0.114	-0.209

Table 5. Average standardized abnormal relative order imbalances across investor types

The relative daily order imbalance is the difference between daily buy and sell values divided by the sum of buy and sell values. Orders submitted by investors are divided into aggressive and conservative ones. Buy (sell) orders are aggressive if their limit prices are higher (lower) than the best ask (bid), and are conservative if their prices are lower (higher) than the best bid (ask). To calculate normal order imbalance, we use a market model for order imbalance estimated from day –50 to –6. Large individuals are individuals whose daily order value is at most NT$200,000. There are 45 stocks for the capital surplus sample and 66 for the retained earnings sample. ** and * denote significance at levels of 5% and 10%, respectively.

Panel A: Aggressive orders for the non-taxable capital surplus sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.173	-0.173	0.067	-0.325
-1	0.090	-0.084	0.059	-0.088
0	0.249	0.081	0.189	0.477**
1	-0.074	0.128	-0.027	0.072
2	-0.139	-0.356**	0.025	-0.210

Panel B: Aggressive orders for the taxable retained earnings sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	-0.117	-0.223	0.235	-0.405**
-1	-0.085	0.093	0.400**	-0.564**
0	0.040	0.038	-0.340*	0.560**
1	-0.226	0.173	-0.018	0.129
2	0.001	0.213	-0.244*	0.077

Panel C: Difference of aggressive orders between taxable and non-taxable samples

	Foreigners	Large individuals	Institutions	Small individuals
-2	-0.290	-0.050	0.168	-0.081
-1	-0.175	0.177	0.341	-0.476*
0	-0.209	-0.043	-0.528*	0.083
1	-0.152	0.045	0.009	0.057
2	0.140	0.569**	-0.269	0.287

Table 5. Average standardized abnormal relative order imbalances across investor types (continued)

Panel D: Conservative orders for the non-taxable capital surplus sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	-0.181	0.057	0.217	0.176
-1	0.159	-0.084	0.420*	0.328
0	-0.153	0.096	0.075	-0.051
1	0.064	-0.015	0.251	-0.112
2	-0.079	0.265	0.253	-0.062

Panel E: Conservative orders for the taxable retained earnings sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.133	-0.239	0.400	0.287
-1	0.175	-0.077	0.149	0.227
0	0.371*	0.446**	-0.095	0.388**
1	0.219	0.206	-0.271*	0.054
2	0.219	0.010	-0.073	0.157

Panel F: Difference of conservative orders between taxable and non-taxable samples

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.314	-0.296	0.183	0.112
-1	0.016	0.008	-0.271	-0.100
0	0.524*	0.351	-0.170	0.439*
1	0.155	0.222	-0.522*	0.165
2	0.298	-0.256	-0.325	0.219

Table 6. Average abnormal relative order imbalances from aggressive orders submitted by large and small individual investors using different cut-off points

The relative daily order imbalance is the difference between daily buy and sell values divided by the sum of buy and sell values. Buy (sell) orders are aggressive if their limit prices are higher (lower) than the best ask (bid). To calculate normal order imbalance, we use a market model for order imbalance estimated from day –50 to –6, where day 0 is the ex-date. Large individuals are individuals whose daily order value is at most NT$100000, 200000, or 300000. There are 45 stocks for the capital surplus sample and 66 for the retained earnings sample. ** and * denote significance at levels of 5% and 10%, respectively.

Panel A: Aggressive orders for the non-taxable capital surplus sample

Day	Cut-off value					
	$100,000		$200,000		$300,000	
	Large individuals	Small individuals	Large individuals	Small individuals	Large individuals	Small individuals
-2	-0.281	-0.115	-0.173	-0.325	-0.156	-0.257
-1	-0.120	0.191	-0.084	-0.088	-0.165	-0.050
0	0.100	-0.023	0.081	0.477**	0.142	0.378**
1	0.074	-0.030	0.128	0.072	0.122	0.150
2	-0.256	-0.214	-0.356**	-0.210	-0.330*	-0.098

Panel B: Aggressive orders for the taxable retained earnings sample

Day	Cut-off value					
	$100,000		$200,000		$300,000	
	Large individuals	Small individuals	Large individuals	Small individuals	Large individuals	Small individuals
-2	-0.213	-0.158	-0.223	-0.405**	-0.180	-0.327**
-1	0.041	-0.079	0.093	-0.564**	0.201	-0.560**
0	0.059	0.255	0.038	0.560**	0.033	0.547**
1	0.167	-0.096	0.173	0.129	0.228*	0.039
2	0.086	-0.017	0.213	0.077	0.297**	-0.047

Table 7. The sensitivity of the distribution rate on the average abnormal relative order imbalance

Number in this table is the coefficient on the log of dividend distribution rate in a simple regression where the dependent variable is the daily abnormal relative order imbalance. The daily relative order imbalance is the difference between daily buy and sell values divided by the sum of buy and sell values. Orders submitted by investors are divided into aggressive and conservative ones. Buy (sell) orders are aggressive if their limit prices are higher (lower) than the best ask (bid), and are conservative if their prices are lower (higher) than the best bid (ask). To calculate normal order imbalance, we use a market model for order imbalance estimated from day –50 to –6. ** and * denote significance at levels of 5% and 10%, respectively.

Panel A: Aggressive orders for the non-taxable capital surplus sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.488	0.138	0.061	0.098
-1	0.220	0.268	0.162	-0.337
0	-0.466	0.265	-0.283	0.493*
1	0.491	0.535*	-0.108	0.231
2	-0.150	0.022	-0.147	0.432

Panel B: Aggressive orders for the taxable retained earnings sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	-0.065	-0.275	0.187	-0.396**
-1	-0.081	-0.084	0.350*	-0.700**
0	0.062	-0.993**	-0.430*	0.454*
1	0.126	0.280*	-0.450**	0.319**
2	0.099	0.101	-0.109	0.132

Panel C: Conservative orders for the non-taxable capital surplus sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	-0.093	-0.136	0.175	-0.200
-1	-0.470	0.236	0.599*	-0.394
0	-0.148	-0.086	-0.225	0.221
1	0.012	0.104	0.010	0.243
2	-0.106	-0.211	0.064	-0.027

Panel D: Conservative orders for the taxable retained earnings sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	-0.135	0.089	0.163	-0.166
-1	-0.006	-0.258	0.354*	0.010
0	0.196	0.578**	0.029	0.473**
1	-0.185	0.334*	-0.201	0.488**
2	0.087	0.070	-0.209	0.020

Table 8. Average abnormal relative order imbalances from explicit arbitrage activities

To estimate the extent of long arbitrage, we first locate investors who submit both buy orders on day –1 (or –2) and sell orders on the ex-date 0. We then calculate the total order value from buy orders to measure the extent of long arbitrage. To estimate the extent of short arbitrage, we locate investors who submit both sell orders on day –1 (or –2) and buy orders on the ex-date, then we calculate the total order values from sell orders. The relative order imbalances from arbitrage activities are the differences between long and short arbitrages divided by the sum of total buy and sell orders on that day. Orders submitted by investors are divided into aggressive and conservative ones. Buy (sell) orders are aggressive if their limit prices are higher (lower) than the best ask (bid), and are conservative if their prices are lower (higher) than the best bid (ask). To calculate normal arbitrage activity, we use a market model estimated from day –50 to –6, where day 0 is the ex-date. Large individuals are individuals whose daily order value is at most NT$200,000. There are 45 stocks for the capital surplus sample and 66 for the retained earnings sample. ** and * denote significance at levels of 5% and 10%, respectively.

Panel A: Aggressive orders for the non-taxable capital surplus sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.320	0.241	0.243	-0.240
-1	0.013	0.649**	0.719**	0.258

Panel B: Aggressive orders for the taxable retained earnings sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.015	0.188	0.088	0.138
-1	0.237	0.928**	0.337**	0.319**

Panel C: Conservative orders for the non-taxable capital surplus sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	0.041	0.250	0.872**	-0.004
-1	1.091**	0.494**	0.828**	0.324

Panel D: Conservative orders for the taxable retained earnings sample

	Foreigners	Large individuals	Institutions	Small individuals
-2	-1.402**	-0.172	1.187**	0.040
-1	0.548**	0.127	0.147	0.144

Table 9. The effect on ex-date abnormal returns of abnormal relative order imbalances

The relative daily order imbalance is the difference between daily buy and sell values divided by the sum of buy and sell values. Orders submitted by investors are divided into aggressive and conservative ones. Buy (sell) orders are aggressive if their limit prices are higher (lower) than the best ask (bid), and are conservative if their prices are lower (higher) than the best bid (ask). To calculate normal order imbalance, we use a market model for order imbalance estimated from day –50 to –6. Large individuals are individuals whose daily order value is at most NT$200,000. There are 45 stocks for the capital surplus sample and 66 for the retained earnings sample. ** and * denote significance at levels of 5% and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.514**	0.522**	0.503**	0.526**	0.545**	0.580**
Taxable Dummy	0.118	0.111	0.124	0.085	0.123	0.072
Foreigners order imbalance		-0.058				-0.090
Large individuals order imbalance			0.143*			0.171**
Institutions order imbalance				-0.064		-0.099
Small individuals order imbalance					-0.064	-0.101

Appendix

If the dividend amount is D^i, then let the associated equilibrium expected return on the ex-date be R^i. The critical after-tax unit dividend income, $\varepsilon k - \tau(1+\varepsilon k)$, is $x^{i,j}$, and that will turn inequalities (1), (3), and (4) into equalities when investors face a dividend D^i, an equilibrium expected return R^i, and adopt the strategy j, where j can be LA (long arbitrage), DP (delayed purchase), or DS (delayed sale) as follows:

$$R^i = \frac{2c}{(1-c)} - \frac{1}{(1-c)}\frac{D^i}{P_{-1}}\mathbf{x}^{\mathbf{i,LA}}, \tag{A1}$$

$$R^i = -\frac{1}{(1+c)}\frac{D^i}{P_{-1}}\mathbf{x}^{\mathbf{i,DP}}, \tag{A3}$$

$$R^i = -\frac{1}{(1-c)}\frac{D^i}{P_{-1}}\mathbf{x}^{\mathbf{i,DS}}. \tag{A4}$$

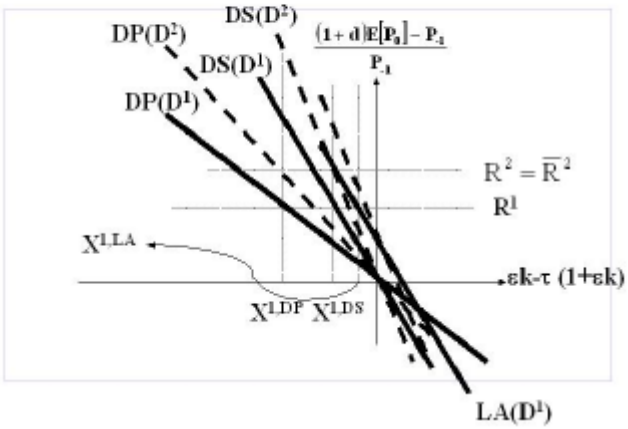
To show that the expected return on the ex-date will increase with the dividend, let us first assume $D^2 > D^1$. If the expected return stays at R^1 when the dividend increases from D^1 to D^2, then more investors will pursue the delay purchase strategy, fewer investors will pursue the delayed sale strategy, and fewer investors will use the long arbitrage strategy.[9] Hence, an order imbalance will be positive on the ex-date if the expected return stays at R^1 and the expected return has to increase to a higher level R^2.

The next thing we want to show is how the order imbalance for different investors will change when the dividend increases to D^2 and the equilibrium expected return becomes R^2. To provide the answer, we need to know how high R^2 can be. Can R^2 be high enough to keep the order imbalance the same from investors following the delay purchase strategy? To keep the order imbalance the same from investors following the delay purchase strategy is to keep the critical x the same (that is, $x^{2,DP} = x^{1,DP}$), Hence, R^2 must satisfy the following equation (see Figure A1):

$$R^2 = \overline{R}^2 = -\frac{1}{(1+c)}\frac{D^2}{P_{-1}}\mathbf{x}^{\mathbf{1,DP}}. \tag{A5}$$

[9] Fewer investors will use the long arbitrage strategy if the expected return is higher than 2c/(1-c), which is approximately 0.59% in Taiwan, because the maximum commission rate is 0.1425% and the security transaction tax is 0.3% and levied on the seller. If the expected return is less than 2c/(1-c), then there will more investors choosing the long arbitrage strategy that will offset the change in the delayed sale strategy.

Figure A1



Since $x^{1,DP}/(1+c) = x^{1,DS}/(1-c)$ from (A1) and (A3), R^2 will also satisfy the following equation and the order imbalance from investors following the delayed sale strategy will stay the same:

$$R^2 = -\frac{1}{(1-c)}\frac{D^2}{P_{-1}}x^{1,DS}. \qquad \text{(A6)}$$

When R^2 satisfies (A5), the order imbalance from investors following the long arbitrage strategy will be larger than the order imbalance at D^1 and R^1, because (A1), (A3), and (A5) will imply the following:

$$R^2 > \frac{2c}{(1-c)} - \frac{1}{(1-c)}\frac{D^2}{P_{-1}}x^{1,LA}. \qquad \text{(A7)}$$

Therefore, when R^2 satisfies (A5), order imbalances on the ex-date will be negative and that will drive the equilibrium expected return R^2 lower. Given that

$$R^2 < \bar{R}^2, \qquad \text{(A8)}$$

the critical value x will be higher ($x^{2,DP} > x^{1,DP}$), more investors will follow the delay purchase strategy, and the order imbalance on the ex-date from these investors will be larger. Fewer investors will follow the delayed sale strategy and there is no clear-cut prediction on the number of investors following the long arbitrage strategy.