The Ex-dividend Day: Action On and Off the Danish Exchange

Umid Akhmedov[a], Keith Jakob[b,*]

[a] –Saxo Bank, Smakkedalen 2, DK-2820, Gentofte, Denmark

[b] – Department of Finance, University of Montana, Missoula, MT 59812, USA

We examine ex-dividend day behavior on the Copenhagen Stock Exchange. We report price-drop ratios of 32% and 18% for close-to-close and close-to-open samples respectively, well below the ratios observed in the U.S. Our findings are generally consistent with limit-order adjustment explanations from recent literature. In Denmark a unique average-price trading opportunity makes it possible for investors to capture dividends without directly altering supply or demand in the regular market, and therefore not necessarily driving the price-drop ratios toward one.

JEL Classification: G14, G15

Keywords: Ex-dividend day, average price trading, dividend arbitrage, dividend capture trade, illiquid markets

*Corresponding author: Tel.: (406)243-6159; Fax: (406)243-2086
E-mail address: keith.jakob@business.umt.edu

We thank Bjarne Florentsen from Copenhagen Business School, Dennis Olson from Aarhus School of Business and Niels Stender from Saxo Bank for their valuable comments. Special thanks to Carsten Tanggaard from Aarhus School of Business for providing the necessary average price trading information. Dr. Jakob also would like to recognize the vital support from the Donald and Carol Jean Byrnes Professorship. We also thank Arnie Cowan (the editor) and the anonymous reviewers for their valuable comments.

1. Introduction

Over the last five decades a large effort has been made to better understand the behavior of stock prices around ex-dividend days. At first glance the ex-dividend date appears to be a fairly trivial event, since dividend distributions are relatively small and the ex-day is pre-announced. However, ex-dividend day stock price behavior is important, since it is potentially applicable to testing the efficiency of the markets, defining the marginal tax rates of investors or measuring the liquidity of the markets. Ex-dividend day studies generally find that stock prices on the ex-dividend day fall by an amount that is on average less than the dividend. This is an anomaly because in a frictionless capital market the stock price should, on average, fall by exactly the amount of the dividend. A variety of explanations have been proposed for observed ex-dividend day behavior, but the rationale for the ex-day anomaly remains contested.

In this paper we examine the ex-dividend day behavior of Danish stocks that trade on the Copenhagen Stock Exchange (CSE). Our goal is to understand whether various market frictions and market mechanisms systematically affect the ex-dividend day anomaly. The unique structure of the Danish market allows for new insights into this popular research topic. With data from the Danish market we can examine the impact of taxes, transactions costs, liquidity, and the ex-day limit order adjustment mechanism. The Danish trading system also includes off-exchange *average price* trading where trades are executed against bank holdings away from the general market. We examine how this off-exchange trading mechanism affects ex-dividend day stock price movements in the main market.

For our cum-day close to ex-day close sample from the CSE we observe a very small ex-dividend day price-drop ratio, defined as the cum-day price minus the ex-day price, quantity divided by the dividend, on average. We find a mean of 0.32, a median of

0.1, and a mode of zero. For the cum-day close to ex-day open sample we report even smaller price-drop ratios with a mean of 0.18 and both median and mode of 0.00. These values are far below the 70-80% price-drop ratios observed in U.S. data. The Danish price-drop ratios are more in line with the price-drop ratios from the Toronto Stock Exchange reported by Jakob and Ma (2005). The findings are inconsistent with the tax clientele hypothesis that predicts a price-drop ratio between 0.57 and 1.26 based on the Danish tax structure. The observed price-drop ratios also conflict with the tax-transactions costs combined models and tick-size constraint models.

Our findings for the CSE are generally consistent with prior limit order adjustment explanations from Dubofsky (1992) and Jakob and Ma (2004, 2005). The low price-drop ratios are consistent with a lack of an automated order adjustment mechanism in a market with relatively low liquidity. The small price-drop ratios are also somewhat surprising since the average dividend yield in Denmark is larger than the current dividend yields observed in the U.S. Large yields should theoretically encourage dividend capture trading which would ultimately increase the price-drop ratio. In regard to this issue we find evidence that the average price trading opportunity helps to facilitate the unusually low ratios. In the Danish environment, short-term arbitrage traders can trade in the regular CSE market or they can use an alternative average price trading mechanism to capture the abnormal returns associated with dividend distributions. Since trades made at average prices do not have a direct supply or demand impact in the regular CSE market, they also do not directly drive the price-drop ratios toward one. Overall, our results suggest that observed Danish ex-day behavior is caused by the lack of a limit order adjustment mechanism, low overall liquidity, and average price trading as an alternative mechanism for dividend capture activity.

2. Literature review

One of the oldest explanations of the ex-dividend day anomaly is the tax-driven clienteles of Elton and Gruber (1970). Their model suggests that investors' preferences for capital gains or dividend income depend on the taxation of the dividends and capital gains. According to their theory, taxation is important because investors are interested in after-tax returns on stocks. Elton and Gruber indicate that the equilibrium price-drop ratio depends on the specific tax clientele that receives the dividend payment. In their story, the equilibrium price-drop ratio occurs when the tax clientele is indifferent between trading on cum-dividend or ex-dividend days. As empirical support for their model they report a positive relation between the price-drop ratio and dividend yield in the United States.

Popular extensions and alternatives to the tax-clientele model are short-term trading models and market microstructure models. Kalay (1982) argues that marginal tax rates are not the only factors that influence the ex-day phenomenon. He suggests that there are forces, caused by short-term traders that reduce any tax-induced effects. In this type of short-term trader or transactions costs model arbitrage traders attempt to eliminate any difference between the price change and the dividend amount that is caused by tax clienteles. According to this model, transactions costs are the final restriction that keeps the price drop from adjusting the same amount as the dividend.

Bali and Hite (1998) propose a market microstructure alternative to the tax clientele and short-term trading models. Their tick-size model implies that the price-drop ratio is caused by non-continuous pricing, imposed by a mandatory tick size that is enforced by the exchange. They suggest that the ex-day price of a stock changes by the price increment equal to or just smaller than the size of the dividend payment. For example, with a minimum bid-ask spread of one eighth ($0.125), a $0.20 dividend would lead to a $0.125 drop in share price, which translates into a price-drop ratio of 0.625. In contradiction to Bali and Hite, Graham, Michaely and Roberts (2003) and Jakob and Ma (2004) analyze the relation between tick sizes and price-drop ratios on the NYSE. They find that price-drop ratios actually decrease after stock market decimalization.

French, Varson, and Moon (2005) present a different possible explanation for the ex-day anomaly. Their analysis relies on the valuation of corporate securities using option-pricing theory where the payment of a cash dividend causes the value of the firm to fall by an amount equal to the dividend. According to their theory, the debt claim absorbs a portion of the decrease, so that the remainder (the fall in value of equity) is less than the dividend.

Dubofsky (1992) and Jakob and Ma (2004) examine another market microstructure explanation for the ex-day anomaly. They suggest that an automated cum- to ex-day limit order adjustment mechanism appears to control ex-dividend day behavior in the United States. In U.S. markets, outstanding limit buy orders are automatically adjusted downward by the dividend amount rounded to the next larger tick size. Limit sell orders are not adjusted. According to their model, this automated limit order adjustment systematically impacts the limit order book and drives the price-drop ratios observed in the United States. Jakob and Ma (2005) examine trading on the Toronto Stock Exchange (TSX) where limit orders are not automatically adjusted from the cum-day to the ex-day. They find much smaller price-drop ratios on the TSX, and conclude that the lack of an automated limit order adjustment, along with relatively low trading volume, leads to incomplete price adjustments on Canadian ex-dividend days.

For Danish financial markets one prior ex-day study exists. Florentsen and Rydqvist (2002) examine the behavior of Danish Treasury obligations on ex-distribution days and find that the cash distributions do not on average exceed the subsequent price drops.

The above explanations for anomalous ex-dividend day price behavior depend on a variety of factors including market liquidity, market trading rules and government imposed regulations. All of these factors can differ substantially from country to country or even from market to market within a country.

3. The Danish taxation system

Over one million investors directly own shares in the Danish market. The majority of shareholders in Denmark hold their shares in their *pension savings* accounts, since pension accounts are taxed at a lower rate than a standard investment account.[1] In standard investment accounts, investors pay capital gains taxes that depend on the holding period and the size of the portfolio. According to Danish Tax Regulations "If a share listed on the stock exchange is sold after being owned for more than 3 years, and it is not part of a total share portfolio of more than DKK 136,600, any profits are tax free."[2] Any dividends are taxable, and are deducted together with capital gains on shares owned less than three years. Capital gains from selling shares held for more than three years from a portfolio worth more than the amount specified are taxed at 28% and 43% based on a progressive scale similar to dividends. Dividends are taxed on a progressive scale.[3] During 1995-2005 the tax structure on income from capital gains and dividends changed slightly, but the changes do not dramatically alter our tax hypotheses. The tax rates for low and high brackets increased proportionally from 25-40% to 28-43%, leaving general rules unchanged.

Danish companies normally pay dividends once a year. There is no rule mandating the portion of the year's profit allocated to dividends, and profits are taxed

[1] Returns on pension investments are taxed at 15% tax rate. Returns on privately bought shares are taxed at 28-43% rate. The larger the earned income the higher is the tax rate. However, no gains are taxed if the shares are not sold during a three year holding period.
[2] A typical exchange rate in the sample period is 6 DKK = 1 USD (2005).
[3] Any dividend amount less than DKK 43,300 is taxed at 28% tax rate, and over that amount at 43% tax rate.

before paying dividends. When dividends are distributed to shareholders the company withholds an additional 28% tax. For the vast majority of shareholders this 28% withholding is the final tax on the dividend distribution.[4] In these cases, the dividends are not filed on a shareholder's tax return.

If shares are sold before they have been held for three years, the net capital gains are taxed at up to a 59% rate progressively in a manner similar to dividends.[5] In the case of a loss from selling shares held less than three years, it can be offset against any profit from sales of shares owned for the same period.

4. Market rules of the Copenhagen Stock Exchange

Private and institutional investors in the Danish market can place sell and buy orders electronically through an exchange trading system.[6] This system is provided by the CSE, and three main order submission strategies are possible. Orders can be submitted for immediate execution (market orders), placed into the order book of the trading system (limit orders), or submitted for execution with an average price trading method.

The immediate trade option allows an investor to submit market orders that trade at the quoted price, or within the spread in the exchange's electronic limit order book. Placing orders into the trading system, also called on-exchange trading or automatic order routing, allows investors to place limit orders. There are two types of limit orders. Regular limit orders are stored in the limit order book until the end of each trading day. At the end of the day unfilled orders are cancelled,

---

[4] The majority of shareholders in Denmark do not receive dividends of more than DKK 43,300.

[5] Capital gains on shares held for less than three years are taxed at the corporate tax rate.

[6] Trading in shares, bonds, premium bonds, convertibles and fixed interest securities on the CSE is conducted in a computerized trading system called SAXESS, developed by OMX. With SAXESS, trading no longer takes place on the floor of the exchange. Instead, traders operate from their own offices via PCs connected to the SAXESS computer at the exchange. SAXESS is an order-driven trading system. Bids and offers are automatically matched to make transactions when price, volume and other order conditions are met. For very large trading lots, transactions may be made via telephone, and then have to be entered manually into the system.

and traders have the option to deliver revised orders for the morning of the next trading day. However, there are also Good Till Cancelled (G.T.C.) orders, which are kept in the electronic limit order book for a maximum of 8 days. These orders are cancelled only if they are not executed during the investor specified period. The G.T.C. orders are not adjusted by the exchange for stock splits or dividend distributions. Traders must manually adjust their G.T.C. orders for any stock splits or dividend payments at the start of a trading day.

The most unusual tool for trading stocks in Denmark is the average price order submission mechanism, where an investor can submit an order to buy or sell shares at an average price that is announced by the exchange at the end of the trading day. An average price is a turnover-weighted average of all execution prices for trades made during the day. There are two kinds of average price trades. Individual or private investors generally use type 42 trades and institutional investors generally use type 46 trades. Type 42 trades are Standard Average Price Trades that are filled at the average price of all regular CSE trades during the day. Standard Average Price trades are not routed through the regular CSE quotation system at the time of submission. Investors who use the average price order submission mechanism must have an investment account at a participating Danish bank. Average price transactions are executed against portfolio holdings of the bank. A standard average price trade is executed in a similar manner to a mutual fund transaction in the United States, where the trade is filled at the end of the day after the NAV of the fund is calculated. For standard average price trades an investor submits an order and when the average price is announced by the exchange at the end of the trading day the bank fills the order at the announced price. At the beginning of each trading day, banks report all off-exchange transactions from the prior day to the CSE. With this order fulfillment process the execution of a standard average price transaction is not expected to influence quoted prices in the regular trading environment. We note that these trades can indirectly affect the regular market on the day a trade is submitted if banks make market transactions to adjust their positions for standard average price trades. However, the relatively small amount of average price trading suggests that member banks can match buy and sell orders and fulfill any remaining average price orders with shares from their portfolios.

Type 46 trades are also called Volume Weighted Average Price Trades. A Volume Weighted Average Price (VWAP) calculation is used by banks to gauge their trading effectiveness in filling these orders. The VWAP for this kind of transaction is calculated by dividing the total DKK volume of the trades by the total share volume for the trades:

$$VWAP = \frac{\sum(\text{Price} * \text{Volume})}{\sum(\text{Volume})} \tag{1}$$

VWAP trades are typically used by institutional investors. If an institutional investor does not feel that they possess the knowledge or skill to effectively execute a large order, they can use a VWAP trade and let the bank do the strategic order submission for them. For example, a bank can receive an order from an institutional investor to buy a certain amount of shares at some premium or discount to a pre-arranged price such as the closing price for the day. When a VWAP order is received the bank can fill the order from its holdings, or trade in the regular market to fill the order. At the close of the trading day the bank consolidates the trades made for each VWAP order.

For example, suppose a bank gets a Type 46 order to buy 10,000 shares. The bank and the investor agree on a price of 1% lower than the day's closing price for the security. Assume that the bank trades to fill the order and the bank's transactions are:

5,000 shares @ DKK 100.

3,000 shares @ DKK 101.

2,000 shares @ DKK 102.

According to the formula above the bank's VWAP is DKK 100.7. Assume that the stock's closing price was DKK 102. Based on the bank's and the investor's agreement, the bank transfers the shares to the investor for DKK 100.98 (1% less than the closing price). In this example the bank did a good job of filling the order, since they bought the shares for less than the pre-arranged price. In this case the bank keeps the extra profit from the superior execution of the order. The VWAP average price trades are also not routed to the exchange for execution. However, these trades have clearer indirect market impacts due to the typical same-day fulfillment and the relatively larger size of institutional orders.

The CSE also has a unique round lot provision. To trigger an update of the prices quoted by the CSE, the size of a submitted limit order must be at least one round lot. Unlike other stock exchanges, a round lot is measured not solely by the number of shares traded. On the CSE the size of a round lot is contingent on the current share value of the security. For 20 issues that constitute the exchange's index, the round lot is equal to approximately DKK 20,000 and for other listed shares it is DKK 10,000. The round lot is rounded to the nearest 1, 5, 10, 25, 50, 100, 200, 500, 1,000, 1,500, 2,000 or 5,000 shares that are closest to the DKK 10,000 amount. Investors can trade in odd lots, but in this case, such orders have a lower priority in the trading system than round lot orders. It is not possible to trade fractions of a share.

The commission structure associated with equity trading on the CSE varies from bank to bank, and currently the lowest commission available in the market is 0.1% of the trading amount but not less than DKK 19 for market and limit orders.[7] These trades also have additional costs associated with the bid-ask spread. On the other hand, private investors trading with the average price method forego bid-ask spread costs, but pay a larger commission of 0.25% of the traded amount.[8]

Finally, the tick size on the CSE is not fixed across the exchange, and like the round lot system it also depends on the value of the traded security. As the share price increases the minimum price difference between the best bid price and the best offer price for a given security in the trading system also increases. A similar *variable* tick size system is also used in Japan. Kato and Lowenstein (1995) examine ex-day behavior in Japan where there is a one yen tick size for securities priced less than 1,000 yen. For securities with a price more than 1,000 yen the tick size jumps up to 10 yen. The Danish tick size system has a wide spectrum of available tick sizes: the tick size varies from 0.01 to 100 DKK (see Table 1).

5. Methods

Danish investors receive an after tax dividend payment of $Div(1-t_d)$, where Div is the pre-tax dividend amount and t_d is the dividend taxation rate equal to 28%. This is different from the United States where the pre-tax dividend is distributed and shareholders separately pay taxes on the dividend based on their own tax rate. For capital gains an investor would receive $(P_{cum} – P_{ex})*(1-t_c)$ where t_c is a tax rate on capital gains which is either 28% or 43% depending on the amount of the capital gain.

[7] This is the lowest commission available and is offered by the Saxo Bank A/S. Clients with an account value above DKK 500,000 are exempt from minimum commissions.
[8] These rates are offered by Nordea Bank.

According to Elton and Gruber (1970) the price-drop ratio should have the following equilibrium:

$$\frac{P_{cum} - P_{ex}}{Div} = \frac{1 - t_d}{1 - t_c} \tag{2}$$

In the case where both dividends and capital gains are taxed at the same rate of 28% the price-drop ratio should be equal to 1.0, exactly as if there were no taxes. However there are several other possible equilibrium outcomes resulting from combinations of different prevailing tax rates. Table 2 presents these outcomes.

Based on the values in Table 2, the occurrence of average price-drop ratios in the range of 0.57 to 1.26 would be consistent with the tax structure in Denmark and the tax clientele hypothesis. If the tax clientele hypothesis holds, the number of traders from the various tax clienteles should determine the equilibrium price-drop ratio.
This leads to our first hypothesis for the Danish stock market:

Hypothesis 1: According to the tax clientele hypothesis the price-drop ratio should fall within the range 0.57 to 1.26.

Short-term trading models suggest that arbitrage traders push an incomplete price-drop ratio caused by the tax effect toward one. In these models transactions costs are the limiting factor that keep the average price-drop ratio from equaling one. In the Danish case the tax clientele hypothesis predicts equilibrium price-drop ratios both above and below one. According to the short-term trading models, for the cases where the tax based equilibrium ratio is not exactly equal to one, this should lead to increased short-term trading that drives the ratio toward one. Therefore, based on short-term trading models and the tax rates in Denmark we should continue to find the price-drop ratio within the 0.57 to 1.26 range. The boundaries for the ratio should narrow toward one based on the transactions costs model, and they should not be wider than the specified range if the tax clientele hypothesis and the transactions costs models are combined. This leads to our next hypothesis:

Hypothesis 2: According to the short-term trading hypothesis the price-drop ratio should still fall within the range of 0.57 to 1.26, and there should be excess trading volume around the ex-dividend day.

According to Bali and Hite (1998) unequal price drop and dividend amounts are caused by tick-size constraints. Their model states that the stock price on the ex-dividend day should fall to the nearest tick amount equal to or below the dividend. In the Danish market where tick size changes with the stock price we must determine the expectation of the Bali and Hite model for each dividend with respect to the stock price at the time of the dividend distribution. To examine the tick size hypothesis we calculate the expected price-drop ratio for all dividends in the sample, and we compare these predictions with our empirical findings. The expected price-drop ratio based on the Bali and Hite model is

$$\text{PredictedRatio} = \frac{\left[Int(Dividend \div Tick)\right] \times \left(Tick\right)}{Dividend} \tag{3}$$

where;

Dividend = Dividend Amount

Tick = Tick size

Int(X) = Round value X downward to nearest whole number

This leads to our next hypothesis:

Hypothesis 3: According to the tick-size model the stock price on the ex-dividend day should fall to the nearest tick amount equal to or below the dividend. Therefore the price-drop ratio should be described by equation 3.

There is no automated limit order adjustment mechanism on the CSE, so all existing G.T.C. limit orders on the cum-day are not adjusted at the beginning of the ex-dividend day. With no new order submissions and no manual investor order adjustments this mechanism leads to a predicted price-drop ratio of zero. Dubofsky (1992) and Jakob and Ma (2004, 2005) suggest that these predictions from the general limit order adjustment model must be modified with increased stock liquidity. In the case of increased liquidity, investors are more likely to manually adjust their outstanding orders and submit new orders overnight and on the ex-dividend day. In a similar fashion to the transactions costs model, these actions drive the observed price-drop ratios toward one.

Table 3 presents statistics of trading on the CSE, the TSX and the NYSE. The average liquidity on the CSE is slightly greater than on the TSX and much lower than on the NYSE. On the CSE the average number of trades per day for a listed company in 2004 is 64, while the average number of trades for a listed company on the TSX and NYSE are 47 and 1,615 respectively. Since the Copenhagen Stock Exchange has no limit order adjustment mechanism and relatively low typical trading volume (low liquidity), the limit order adjustment model predicts that the price-drop ratio should be relatively small. This is consistent with Jakob and Ma's (2005) findings for the Toronto Stock Exchange. They report an average close-to-close price-drop ratio of 53.9%, and an average ratio measured from cum-day close to ex-day open of 48.0%.

Hypothesis 4: Without an automated limit order adjustment mechanism, the unmodified limit order adjustment model predicts a price-drop ratio of zero. Due to the low liquidity environment on the CSE the price-drop ratio should remain relatively small.

6. Data

The initial sample is comprised of dividend distributions for B shares of 130 cash dividend paying companies listed on the CSE at any time from 1995 to 2005.[9] The close-to-close prices on cum-, and ex-dates, dividend amounts, yields and trading volumes come from the DataStream database. The daily average price trading information is from the CSE's high frequency database. We also extract the market data for the value-weighted OMXC20 (formerly called KFX) index.[10] The initial sample contains 1388 observations. We exclude any observations with missing trading volume. All one-time dividends and stock splits are also excluded. The traded value is defined as the sum of all trades multiplied by the corresponding price of each trade; expressed in DKK. In order to decrease noise we trim the data. Trimming removes 2.5 percent of the observations from the top and bottom most extreme price-drop ratios. This trimming method is common in the ex-day literature. The final sample contains 721 observations.

We examine cum- and ex-day prices for the various price-drop ratios. For trading volume analysis we compare the average trading volume around the ex-day to average trading volume on normal trading days. To determine which of the days surrounding distributions contribute to the total traded value, we examine the proportion of both ex-day and cum-day trading volume divided by average trading volume on normal trading days. Our measure of the average trading volume around the ex-day includes trades

[9] A-shares have voting rights and B-shares do not; however B-shares are generally more liquid with higher trading volume.

[10] The daily returns for the OMXC and the OMXC20 are similar. We use the OMXC20 to adjust our sample since it is available for the entire sample period.

from the three days before and the three days after the ex-dividend day. The available data within 30 days before and 30 days after the ex-dividend day are used to calculate normal average trading volume.

As an extension to the regular on exchange market data, we consider average price trading data, which to our knowledge were never before examined in relation to ex-dividend day effects. Our sample for average price trades involves the data for 130 CSE listed companies. We extract average prices and average price trading volume for ex-dividend days and match these observations with the regular price trades and prices reported in the initial data.[11] This process leaves us with average price data for 36 companies. The average price data set is rather small because this information is relatively new and it reports only average price trades executed between 2002 and 2005. From the second half of 2005 the type 42 and type 46 trades are no longer separately reported so our analysis includes data only through the first half of 2005.

In addition to the DataStream and average price samples we also extract closing prices on the cum-days and opening prices on the ex-days from the CSE High Frequency Database for the years 2001-2005. Since there are minor discrepancies between DataStream and the High Frequency Database we keep all of the samples separate in order to be more persistent and clear with our final results. The close-to-open sample from the CSE's High Frequency Database allows us to look at the overnight price drops on ex-dividend days, since opening prices were not available from Datastream.

[11] The measure for average price trading data is identical to the initial dataset. i.e. trading volume around the ex-day includes the ex-day and the three days before and the three days after the ex-dividend day. The available data within 30 days before and 30 days after the ex-dividend day are used to calculate normal average trading volume.

7. Results

Table 4, Panel A presents descriptive statistics for all variables based on the main dataset with close-to-close price changes. The table shows low price-drop ratios and large positive abnormal returns. The table also presents three trading volume measures that all indicate significant abnormal trading volume on and around the ex-dividend day. For our close-to-close sample the mean price-drop ratio is equal to 0.32 with a median value of 0.1, and a mode of zero. In Table 4, Panel B we present the descriptive statistics for the close-to-open price sample. For the close-to-open sample the mean price-drop ratio is equal to 0.18, with median and mode of zero. Although the two samples are not exactly alike the relatively larger value for the close-to-close price-drop ratio suggests that some of the price-drop anomaly is eliminated via trading activity on the ex-dividend day. In Table 5 we report the twenty most frequent price-drop ratios from our data set. The price-drop ratio is zero for about 30% of the observations in both the close-to-close and close-to-open samples. The Danish unadjusted price-drop ratios in our sample are much smaller than U.S. ratios and even lower than for Canadian data, where price-drop ratios are also relatively small. The results indicate that the price drop in Denmark is generally only a small fraction of the dividend. The standard unadjusted price-drop ratio is:

$$R = \frac{P_{cum} - P_{ex}}{Div} \tag{4}$$

Jakob and Ma (2005) report a market adjusted ratio for the Canadian stock market. This approach is also applicable for the Danish sample. We calculate the adjusted by market ratio (AMR) as follows:

$$AMR = \frac{P_{cum} \times (1 + market \cdot return) - P_{ex}}{Div} \tag{5}$$

For our data the market adjusted ratio is equal to 0.33 for the close-to-close sample and 0.23 for the close-to-open sample. Thus, after adjusting for market movements the price-drop ratios on the CSE remain very small. After the market adjustment we still report a relatively larger value for the close-to-close ratio which again suggests that some of the price drop anomaly is eliminated via trading activity on the ex-dividend day. The findings regarding the market adjusted price-drop ratio for Denmark differ dramatically from similar U.S. studies and the reported price-drop ratios are also smaller than the values seen on the Toronto Stock Exchange. Both the unadjusted and the market adjusted ratios fall well out of the range of 0.57-1.26 specified by the tax clientele hypothesis and the tax-transactions costs models. The findings are therefore inconsistent with the tax-transactions costs hypotheses, but they support the limit order adjustment model originally derived by Dubofsky (1992).

To examine whether the tick-size model effectively describes ex-day behavior for the dividends on the CSE we must first calculate the expected price-drop ratio for each dividend. For the 721 observations in the sample the expected price-drop ratios are calculated from equation 3. The most common tick sizes seen in our sample are 0.25, 0.5 and 1.0 (See Table 1). For the vast majority of the dividends in our sample (643 cases) the tick-size model predicts a complete price drop with a corresponding price-drop ratio of 1.0. Based on equation 3 the average expected price-drop ratio for the sample is 0.994 with a minimum value of 0.833. The expected price-drop ratios predicted by Bali and Hite's (1998) tick size model are inconsistent with the empirical results for the sample, regardless if we compare them to the unadjusted or adjusted price-drop ratio measure. Similar results for Finnish data are reported by Liljeblom, Loefland and Hedvall (2001). They also report that price-drop ratios were far below the predicted ratios from the tick size model. Our findings strongly conflict with the tick-size model.

Table 6 reports regressions to examine the relation between the dividend yield and the price-drop ratio. Regardless of the price drop measure, we do not find a significant positive relation between yield and the price-drop ratio. We test for this relation in both the regular price and average price samples. In some cases we find negative and significant relations between the two variables. These cases suggest that larger yields have less complete price adjustments on the ex-dividend day in Denmark. These findings are consistent with Jakob and Ma (2005). They do not find a positive relation between yield and the price-drop ratio on the TSX. Our results are consistent with the low liquidity of the CSE and Hypothesis 4.

In Table 7 we divide the sample into yield quintiles as an additional method to examine how yield and the price-drop ratio interact. There is no clear pattern in the results. However, the mean price-drop ratio in each quintile is notably less than the lower bound of the tax based range or the expected ratio of the tick model, so these hypotheses are again rejected for each subsample.

Many prior studies also examine abnormal return as an alternative to the price-drop ratio. When the mean price-drop ratio is less than one, we should generally observe positive abnormal returns on the ex-day. The abnormal return is calculated as:

$$AR = \frac{P_{ex} - P_{cum} + Div}{P_{cum}} - E(r) \qquad (6)$$

In our case we use the return on the OMXC20 index return for *E(r)*. Here we assume that the abnormal return is the amount by which the return on the individual stock exceeds the return of the market. The abnormal returns in the sample are large and positive. The mean indicators are equal to 6.0% for the close-to-close and 3% for the close-to-open samples when we use the regular market data (see Table 4). The large abnormal returns are consistent with the observed small price-drop ratios and the large dividend yields. These abnormal returns are large compared to U.S. findings. In the United States ex-day abnormal returns are relatively small, since average dividend yields are much lower and ex-day price drops are more complete.

The high ex-day abnormal returns on the CSE appear to justify dividend capturing activity, especially since they are higher than the associated bid-ask spread transaction costs plus the necessary trading commissions. Typical bid-ask spreads for the more liquid stocks on the CSE are between 0.25%-1.00%. In our sample the highest abnormal returns are among the large cap stocks which are generally the more liquid securities. This suggests that dividend capture trade is economically significant considering the abnormal returns and the full costs associated with the necessary round-trip transactions. Koski (1996) analyzes the bid-ask spread as a component of transactions costs related to dividend capture trading and the ex-day anomaly. Koski observes that "*although use of the entire spread may overstate actual transaction costs, this analysis ignores additional short-term trading costs such as commissions*". In this sense we have a rather conservative measure of potential excess returns since the amount of the ex-day abnormal return is larger than the full bid-ask spread and the total roundtrip trading commissions.

High abnormal returns and low price-drop ratios suggest that short-term traders do not strongly influence prices around the ex-dividend day. Table 7 reports the trading volume around the ex-dividend day divided by typical volume for each yield quintile. In all quintiles the average trading volume around the ex-day exceeds the volume on a normal trading day. For example, E_REG measures the activity on ex-days divided by the number of trades on normal trading days, and it is higher than 100% in all five quintiles. The additional trading volume around the ex-day does not appear to push the ratios dramatically toward one. In fact, the price-drop ratios in all quintiles remain surprisingly low.

Table 8 presents regressions to examine the relation between normal trading volume and the price-drop ratio. The results show that the normal trading volume of a security has a positive and significant impact on the price-drop ratio. However, in the CSE's low liquidity environment, this relation does little to increase the mean price-drop ratio.

To better understand how the existing orders in the limit order book affect stock prices we examine the available DKK amount of the buy and sell orders in the cum-day close and ex-day opening order book for each observation in our sample. The average ex-day open measures are 1,640,095.66 DKK and 2,648,975.41 DKK respectively. On the cum-day close these amounts are 2,243,613.51 DKK and 1,927,583.34 DKK respectively. The quantity of shares in the opening order book suggests that some orders likely remain in the limit order book from cum- to ex-day. To examine whether potentially stale limit orders in the opening order book affect ex-day pricing we compare total ex-day trading volume to the aggregate DKK volume of the buy and sell orders in the opening order book. We calculate a ratio of the average of the buy and sell orders in the limit order book at opening over the total DKK ex-day trading volume. We find a ratio of 1.68, which indicates that the depth in the opening limit order book is large relative to the amount of total ex-day trading volume. This suggests that any unadjusted orders in the order book affect ex-day price behavior.

Table 9 offers an additional empirical explanation for why increased trading on ex-days does not heavily influence the price-drop ratio. The table presents evidence that abnormal trading volume appears to be increasing more dramatically around ex-days via average price transactions. This is consistent with dividend capture activity using average price trading. This dividend capture activity again seems economically viable, since average price trading eliminates bid-ask spread costs with only a small increase in the roundtrip trading commissions.

Finally, we report the price-drop ratios for our average price sample. We note that the sample sizes for the average price data are quite low. Consistent with our prior results we find that the price-drop ratios are again relatively small within the average price data. The unadjusted ratio for standard average price trades is 0.57 and the market adjusted ratio equals 0.51, and for VWAP trades the ratios are 0.41 and 0.47 respectively. We also observe positive abnormal returns using the average price data (Table 10). The possibility to trade at average prices creates a unique dividend capturing opportunity for short-term traders, and our ratio and volume data suggest that there are some investors using these trading tools to their benefit. However, this unusual trading opportunity does not appear to be widely used. With few investors trading at average prices many participating banks do not separately report the trading methods' volumes and prices. This creates some difficulty in assessing the true portion of average price trades that occur on ex-dividend days. Panel A and Panel B of Tables 9 present the average price trades on cum- and ex-dividend days divided by normal trading days. For example, in Table 9, Panel B we observe a mean value of 1.198 for E_42. This indicates that the DKK volume of type 42 trades on ex-days was on average 1.198 times as large as DKK volume of type 42 trades on normal trading days.

Banks must report the total volume of all executed trades (including average price trades) to the CSE on a daily basis. For the overall trading volume measure that we report the CSE does not distinguish between average prices and regular trades. The total trading volume therefore includes average price volume. To better understand the perceived level of average price trading we conduct a survey of member banks. Survey respondents report that average price trading volume typically does not exceed 1% of total trading volume. In Panel C and Panel D of Table 9 we additionally report the proportion of average price trades in the overall trading volume for our sample. In our empirical analysis we find somewhat more average price trading than indicated in the survey results. For normal trading days we report VWAP and standard average price trading of nearly ten percent and two percent respectively. We also find that the overall share of average price trades increases on ex-dividend days for both trade types. The increase is more explicit with VWAP trades, but the standard average price trades also demonstrate higher trading volume on ex-days.

While average price trading increases on a relative basis around ex-days, the overall trading volume remains relatively low. This suggests that short-term traders are not heavily trading in the regular market or using this alternative trading mechanism to capture the somewhat large abnormal returns associated with the Danish ex-dividend day. Our findings suggest that an arbitrage opportunity using average price trading may still be available for a keen Danish investor, and Danish banks should perhaps reconsider whether or not average price trading should be available on ex-dividend days.

8. Conclusion

In the unique Danish trading environment, we find that the price-drop ratios on ex-dividend days are very small. We find that the price-drop ratios on the CSE are inconsistent with tax clientele effects, tick-size constraints, and short-term trading behavior combined with the tax clientele hypothesis. Our results suggest that the small price-drop ratios in Denmark are caused by relatively illiquid markets combined with a lack of an automated limit order adjustment mechanism. Our findings for the CSE are consistent with the limit order explanations from Dubofsky (1992) and Jakob and Ma

(2004, 2005). We also find evidence that average price trading facilitates the extremely low price-drop ratios found on the CSE.

References

Bali, R., Hite, G., 1998. Ex Dividend Day Stock Price Behavior: Discreteness Or Tax-Induced Clienteles? *Journal of Financial Economics* 47, 127-159.

Dubofsky, D., 1992. A Market Microstructure Explanation of Ex-Dividend Abnormal Returns, *Financial Management* 21, 32-43.

Elton, E., Gruber, M., 1970. Marginal Stockholder Tax Rates and the Clientele Effect, *Review of Economics and Statistics* 52, 68-74.

Florentsen, B., Rydqvist, K., 2002. Ex-Day Behavior When Investors and Professional Traders Assume Reverse Roles: The Case of Danish Lottery Bonds, *Journal of Financial Intermediation* 11, 152-175.

French, D., Varson, P., Moon, K., 2005. Capital Structure and the Ex-Dividend Day Return. *The Financial Review* 40, 361-379. http://www3.interscience.wiley.com/journal/118656158/abstract

Graham, J., Michaely, R., and Roberts, M., 2003. Do Price Discreteness and Transaction Costs Affect Stock Returns? Comparing Ex-Dividend Pricing Before and After Decimalization, *Journal of Finance* 58, 2611-2636

Jakob, K., Ma, T., 2004. Tick size, NYSE Rule 118, and Ex-Dividend Day Stock Price Behavior, *Journal of Financial Economics* 72, 605-625.

Jakob, K., Ma, T., 2005. Limit Order Adjustment Mechanism and Ex-Dividend Day Stock Price Behavior, *Financial Management* 34, 89 – 101.

Kalay, A., 1982. The Ex-dividend Day Behavior of Stock Prices: A Re-examination of the Clientele Effect, *Journal of Finance* 37, 1059-1070.

Kato, K., Loewenstein, U., 1995. The Ex-Dividend Day Behavior of Stock Prices: The Case of Japan, *Review of Financial Studies* 8, 817-848.

Koski, J., 1996. A microstructure Analysis of Ex-Dividend Stock Price behavior Before and After the 1984 and 1986 Tax Reform Acts, *Journal of Business* 69, 3 313-338.

Liljeblom, E., Loeflund, A., Hedvall, K., 2001. Foreign and Domestic Investors and Tax-Induced Ex-Dividend Trading, *Journal of Banking and Finance* 25, 1687-1716.

Table 1

Tick sizes on the Copenhagen Stock Exchange, 1995–2005

The sample contains dividend distributions for B shares of 130 cash dividend paying companies for which we have trading volume; after excluding observations with extreme price changes around the ex dividend date, the sample size is 721. As the share price increases, the minimum price difference between the best bid price and the best offer price for a given security in the trading system also increases. The tick size varies from 0.01 to 100 DKK.

Price of a share	Tick size	Number of observations	Percentage of the sample
0.00 – 4.99	0.01	3	0.42%
5.00 – 9.95	0.05	0	0.00%
10.00 – 49.90	0.10	38	5.27%
50.00 – 249.75	0.25	358	49.65%
250.00 – 499.50	0.50	205	28.43%
500.00 – 4,999.00	1.00	103	14.29%
5,000.00 – 19,990.00	10.00	5	0.69%
20,000.00 –	100.00	9	1.25%

Table 2

Possible equilibrium price-drop ratios based on Danish tax rates

The price-drop ratio is defined as the cum-day price minus the ex-day price, quantity divided by the dividend. Case (a) considers the tax rate when selling shares within three years of purchase regardless of the portfolio amount. Case (b) considers the tax rates for long term capital gains from selling the shares held for more than 3 years providing that total portfolio amount is not higher than DKK136.600, otherwise the profits are taxed as dividend income. X – The marginal tax rate; D_i- Dividend income; C_g – Capital gain

	D_i > DKK X, C_g < DKK X		
Type and source of income	**Tax rate**	**Combination**	**Expected price-drop ratio**
Dividend income	43%		
Capital gain, holding period less than 3 years	28%	Case (a)	**0.79**
Capital gain, holding period more than 3 years	0%	Case (b)	**0.57**
	D_i < DKK X, C_g > DKK X		
Dividend income	28%		
Capital gain, holding period less than 3 years	43%	Case (a)	**1.26**
Capital gain, holding period more than 3 years	0%	Case (b)	**0.79**
	D_i < DKK X, C_g < DKK X		
Dividend income	28%		
Capital gain, holding period less than 3 years	28%	Case (a)	**1.0**
Capital gain, holding period more than 3 years	0%	Case (b)	**0.79**
	D_i > DKK X, C_g > DKK X		
Dividend income	43%		
Capital gain, holding period less than 3 years	43%	Case (a)	**1.0**
Capital gain, holding period more than 3 years	0%	Case (b)	**0.57**

Table 3

Trading statistics of North American and Danish stock exchanges

Number of trades from the New York Stock Exchange (NYSE), the Toronto Stock Exchange (TSX) and the Copenhagen Stock Exchange (CSE). Source: The World Federation of Exchanges.

	NYSE			TSX			CSE		
	2004	2003	2002	2004	2003	2002	2004	2003	2002
Number of trades per year (in millions)	933.11	722.75	545.56	43.14	32.98	27.85	2.94	2.22	1.81
Number of trading days	252	252	252	252.5	251.5	251.5	253	249	249
Number of listed companies	2,293	2,308	2,366	3,604	3,599	3,791	183	194	201
Average number of trades per listed company per day	1,615	1,243	915	47	36	29	64	46	36

Table 4

Cum- and ex-day descriptive statistics for the Copenhagen Stock Exchange

We use the z-test to find if there is a difference between a sample mean and a hypothetical population mean of either one or zero. The hypothetical population mean is zero for Market return, Abnormal return (AR) and Dividend yield (Yield). The hypothetical population mean is one for Price drop ratio (R), Adjusted by market ratio (AMR), Total daily trading volume on cum-days divided by normal daily trading volume (C_REG); Total daily trading volume on ex-days divided by normal daily trading volume (E_REG) and Total daily trading volume around ex-days divided by normal daily trading volume (A_REG).

	Minimum	Maximum	Mean	Std. error	Std. deviation
Panel A: Descriptive statistics for close-to-close data (721 observations)					
R	-1.25	2.12	0.32***	0.02	0.56
AMR	-5.27	4.50	0.33***	0.03	0.77
Market return	-0.05	0.03	0.00***	0.00	0.01
AR	-0.07	3.43	0.06***	0.01	0.10
Yield	0.00	0.72	0.07***	0.00	0.10
C_REG	0.00	44.32	1.34***	0.11	3.08
E_REG	0.00	25.23	1.23***	0.08	2.27
A_REG	0.01	21.22	1.29***	0.06	1.56
Panel B: Descriptive statistics for close-to-open data (250 observations)					
R	-1.74	2.31	0.18***	0.04	0.58
AMR	-2.52	4.02	0.23***	0.06	0.88
Market return	-0.03	0.05	0.00***	0.00	0.01
AR	-0.05	0.44	0.03***	0.00	0.04
Yield	0.00	0.42	0.03***	0.00	0.04

*** - significant at the 1% level.

Table 5

Distribution of price-drop ratios on the Copenhagen Stock Exchange

The table presents the 20 most frequently observed price-drop ratios for the cum-day close to ex-day close and the cum-day close to ex-day open samples.

	Close-to-close			*Close-to-open*		
#	Price-drop ratio	Number of observations	Percentage of the sample	Price-drop ratio	Number of observations	Percentage of the sample
1	0.00	229	30.9%	0.00	74	29.6%
2	1.00	28	3.8%	1.00	6	2.4%
3	0.50	19	2.6%	-0.03	5	2.0%
4	0.83	12	1.6%	0.33	5	2.0%
5	0.75	11	1.5%	0.13	5	2.0%
6	0.67	10	1.4%	0.67	4	1.6%
7	0.25	10	1.4%	0.50	4	1.6%
8	1.25	9	1.2%	0.21	4	1.6%
9	-0.50	9	1.2%	0.14	4	1.6%
10	0.10	8	1.0%	-0.22	4	1.6%
11	0.60	8	1.0%	-0.11	4	1.6%
12	0.20	7	0.9%	-1.00	3	1.2%
13	0.40	7	0.9%	-0.42	3	1.2%
14	0.71	6	0.8%	-0.25	3	1.2%
15	0.33	5	0.7%	-0.08	3	1.2%
16	-1.25	5	0.7%	0.04	3	1.2%
17	0.80	5	0.7%	0.19	3	1.2%
18	2.00	4	0.6%	0.20	3	1.2%
19	-0.83	4	0.6%	0.25	3	1.2%
20	1.50	4	0.6%	0.75	2	0.8%

Table 6

Regressions of price-drop ratio on dividend yield

We test for relations in both the regular price and average price samples. Each regression has dividend yield as the independent variable with a different specified price-drop ratio metric as the dependent variable.

Model	Coefficient	Unstandardized coefficients		Standardized coefficients	t	P-value	R square	Adj. R square	Std. Error
		B	Std. error	Beta					
		Regression of unadjusted price-drop ratio on dividend yield (Dependent variable: Price-drop ratio)							
1	(Constant)	0.385	0.026		14.880	0.000	0.158	0.025	0.55
	Yield	-0.915	0.213	-0.157	-4.296	0.000			
		Regression of adjusted price-drop ratio on dividend yield (Dependent variable: Adjusted by market price-drop ratio)							
2	(Constant)	0.411	0.036		11.387	0.000	0.017	0.015	0.76
	Yield	-1.036	0.297	-0.125	-3.486	0.001			
		Regression of unadjusted average price-drop ratio on dividend yield (Dependent variable: VWAP price-drop ratio)							
3	(Constant)	1.20	0.34		3.57	0.00	0.139	0.121	1.22
	Yield	-32.56	11.80	-0.37	-2.76	0.01			
		Regression of adjusted average price-drop ratio on dividend yield (Dependent variable: Market adjusted VWAP price-drop ratio)							
4	(Constant)	1.47	0.38		3.87	0.00	0.166	0.149	1.37
	Yield	-40.60	13.26	-0.41	-3.06	0.00			
		Regression of unadjusted average price-drop ratio on dividend yield (Dependent variable: Standard average price-drop ratio)							
5	(Constant)	0.63	0.72		0.88	0.40	0.001	-0.071	1.54
	Yield	-2.31	21.34	-0.03	-0.11	0.92			
		Regression of adjusted average price-drop ratio on dividend yield (Dependent variable: Market adjusted standard average price-drop ratio)							
6	(Constant)	0.459	0.662		0.694	0.499	0.000	-0.071	1.40
	Yield	1.585	19.511	0.022	0.081	0.936			

Table 7

Yield quintiles and the price-drop ratio

We divide our sample into dividend yield quintiles to examine the relations between yield, trading volume, the price-drop ratio and abnormal returns. Normal volume – Average number of daily trades executed during 30 days before and 30 days after the ex-dividend day; C_REG – Total daily trading volume on the cum-day divided by normal daily DKK trading volume; E_REG – Total daily trading volume on the ex-day divided by normal daily DKK trading volume; A_REG – Total daily trading volume around the ex-day divided by normal daily DKK trading volume; R – The unadjusted price-drop ratio; AR – Abnormal return

Dividend yield group	Statistics	Dividend yield	Stock price	Normal volume	C_REG	E_REG	A_REG	R	AR
	Mean	0.013	1726.126	86.368	130%	117%	126%	0.448***	0.007***
1	Standard error	0.000	561.233	20.407	0.204	0.194	0.131	0.062	0.001
	Observations	144							
	Mean	0.024	625.897	30.028	164%	111%	130%	-0.016***	0.022***
2	Standard error	0.000	201.941	8.113	0.277	0.143	0.107	0.352	0.008
	Observations	144							
	Mean	0.037	522.408	58.056	100%	135%	134%	0.354***	0.025***
3	Standard error	0.000	211.700	19.974	0.111	0.208	0.120	0.046	0.002
	Observations	144							
	Mean	0.065	572.285	84.387	111%	123%	124%	0.366***	0.041***
4	Standard error	0.001	180.740	21.026	0.115	0.223	0.153	0.040	0.003
	Observations	144							
	Mean	0.230	107.755	69.827	169%	131%	132%	0.099***	0.205***
5	Standard error	0.010	8.570	14.656	0.429	0.147	0.126	0.022	0.010
	Observations	145							

*** Significant at the 1% confidence level

Table 8

Regression analysis of normal trading volume and the price-drop ratio

The independent variable is normal trading volume, and the dependent variable is the unadjusted price-drop ratio. Normal volume – The average number of daily trades executed during 30 days before and 30 days after the ex-dividend day.

Dependent variable: Price-drop ratio										
Model	Coefficient	Unstandardized coefficients		Standardized coefficients	t	P-value	R square	Adj. R square	Std. error
		B	Std. Error	Beta					
1	(Constant)	0.296	0.022		13.765	0.000	0.014	0.013	0.551
	Normal Volume	0.0003	0.000	0.118	3.186	0.002			

Table 9

The intensity of average price trading on the Copenhagen Stock Exchange

The table presents the market share of average price trades on cum-, ex- and normal trading days. VWAP trades – Volume weighted average price trades initiated by institutional investors; Standard average price trades – Average price trades initiated by private investors; E_46 - The ratio of VWAP trades on ex-dividend days to VWAP trades on normal trading days; C_46 - The ratio of VWAP trades on cum-dividend days to VWAP trades on normal trading days; E_42 - The ratio of standard average price trades on ex-dividend days to standard average price trades on normal trading days; C_42 - The ratio of standard average price trades on cum-dividend days to standard average price trades on normal trading days; NN_46 –Proportion of VWAP trades in normal day overall trading volume; EE_46 –Proportion of VWAP trades in ex-day overall trading volume; CC_46 –Proportion of VWAP trades in cum-day overall trading volume; NN_42 –Proportion of standard average price trades in normal day overall trading volume; EE_42 –Proportion of standard average price trades in ex-day overall trading volume; CC_42 –Proportion of standard average price trades in cum-day overall trading volume

	Minimum	Maximum	Mean	Std. error	Std. deviation
Panel A: VWAP trades on the cum and ex- day (65 observations)					
E_46	0.010	7.060	1.134	0.205	1.432
C_46	0.000	3.960	0.883	0.139	0.972
Panel B: Standard average price trades on the cum and ex-day (65 observations)					
E_42	0.034	5.251	1.198	0.333	1.333
C_42	0.032	30.707	2.579	1.881	7.525
Panel C: The proportion of VWAP trades in the total trading volume (65 observations)					
NN_46	0.010	0.910	0.097	0.020	0.140
EE_46	0.000	8.240	0.264	0.168	1.175
CC_46	0.000	4.500	0.174	0.093	0.648
Panel D: The proportion of standard average price trades in the total trading volume (65 observations)					
NN_42	0.001	0.079	0.020	0.007	0.027
EE_42	0.000	0.174	0.030	0.013	0.053
CC_42	0.000	0.098	0.020	0.008	0.030

Table 10

Descriptive statistics of average-price trading variables

The table presents the price-drop ratio, the adjusted-to-market price-drop ratio and the abnormal return for standard average price and VWAP trades. R – Price-drop ratio; AMR – Adjusted by market price-drop ratio; AR – Abnormal return

Panel A: Standard average price trade group (65 observations)					
	Minimum	Maximum	Mean	Std. error	Std. deviation
R	-1.99	5.10	0.568***	0.371	1.483
AMR	-1.02	4.81	0.505***	0.339	1.356
AR	-0.03	0.05	0.012***	0.005	0.190
Panel B: VWAP trade group (65 observations)					
R	-1.75	5.71	0.407***	0.185	1.297
AMR	-1.47	6.25	0.471***	0.211	1.480
AR	-0.04	0.07	0.021***	0.004	0.025

*** - significant at the 1% confidence level