MARKET ANOMALY AND ARBITRAGE OPPORTUNITY AROUND EX-DIVIDEND DAY

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ABSTRACT

Purpose of this study is to investigate market anomaly and possible arbitrage opportunity around ex-dividend day. We investigate most liquid common stock prices behavior around the world. Our sample data covers NYSE (Companies from S&P 100 index), London Stock Exchange (Companies from FTSE 100 index), Shanghai Stock Exchange (Companies from SSE180 index) and Tokyo Stock Exchange (Companies from TOPIX 100 index). We also investigate possible arbitrage opportunity based on abnormal return and short-term trading activities around ex-day.

Based on raw price drop ratio, market adjusted price ratio, raw price drop ratio, market adjusted price drop ratio, market adjusted abnormal return and relative trading volume we developed six null-hypotheses and conclude this study. We used t-test to determine the mean differences between theoretical values and observed values and for median differences we used Wilcoxon Sign Rank Test.

This study observed an equal drop of stock prices compared to dividend amount from New York and Shanghai Stock Exchange. We found no evidence of short-term trading activities around ex-date from both markets. In Tokyo Stock Exchange stock prices fall less than the dividend amount and individual dividend amount has higher taxation compare to capital gain. It provides strong evidence in favor of tax effect and we also recorded significant evidence of short-term trading activities before ex-dividend day. However, we documented mixed evidence from London Stock exchange. In London Stock Exchange Stock Prices drop more than dividend amount and dividend has higher taxation than capital gain. This evidence is not consistent with tax hypothesis but we found strong evidence of short-term trading before ex-dividend day.

Key words: Market anomaly, arbitrage opportunity and short-term trading, ex-dividend day.
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Md Mohibul Islam

&

Jessie Cadilhac
# TABLE OF CONTENTS

LIST OF TABLES ................................................................................................................................. vi
LIST OF FIGURES ................................................................................................................................. vi
MOST RELEVANT ABBREVIATIONS AND EQUATIONS ................................................................. vii
KEY TERMS DEFINITIONS .................................................................................................................... ix

CHAPTER ONE ................................................................................................................................. 1
1. INTRODUCTION OF THE STUDY ................................................................................................. 1
  1.1. Problem Background ................................................................................................................... 1
  1.2. Research questions ..................................................................................................................... 3
  1.3. Purpose of the study .................................................................................................................... 4
  1.4. Limitations ................................................................................................................................. 4
  1.5. Disposition .................................................................................................................................. 4
    1.5.1. Chapter 1: Introduction ........................................................................................................ 4
    1.5.2. Chapter 2: Theoretical framework and Literature review .................................................. 4
    1.5.3. Chapter 3: Methodology and Credibility criteria ............................................................... 5
    1.5.4. Chapter 4: Empirical findings and Analysis ....................................................................... 5
    1.5.5. Chapter 5: Conclusion, Theoretical and practical contribution, and Further studies. 5

CHAPTER TWO ................................................................................................................................... 6
2. THEORETICAL FRAMEWORK / LITERATURE REVIEW ............................................................ 6
  2.1. Efficient Market Hypothesis (EMH) ............................................................................................ 6
    2.1.1. The Weak form ....................................................................................................................... 7
    2.1.2. The Semi-Strong form ........................................................................................................... 7
    2.1.3. The Strong form .................................................................................................................... 7
  2.2. Arbitrage ..................................................................................................................................... 8
    2.2.1. Arbitrage opportunity .......................................................................................................... 8
    2.2.2. Limits to arbitrage ................................................................................................................. 10
    2.2.3. Psychology .......................................................................................................................... 11
  2.3. Short-selling rules of the market and short-term trading ........................................................... 13
    2.3.1. Short-term trader Hypothesis ............................................................................................. 14
    2.3.2. Short-term trading ................................................................................................................. 14
  2.4. Dividends and capital gains ....................................................................................................... 16
    2.4.1. Signaling hypothesis ............................................................................................................. 18
    2.4.2. Tax effect .............................................................................................................................. 18
    2.4.3. Clienteles effect ..................................................................................................................... 23
    2.4.4. Taxation in the different markets ........................................................................................ 23
  2.5. Overview of the markets we study in our thesis ...................................................................... 24
    2.5.1. London Stock Exchange ...................................................................................................... 24
    2.5.2. Shanghai Stock Exchange .................................................................................................. 25
    2.5.3. Tokyo Stock Exchange ........................................................................................................ 25
    2.5.4. New York Stock Exchange .................................................................................................. 25
CHAPTER THREE .................................................................................................................. 27
3. METHODOLOGICAL FRAMEWORK .............................................................................. 27
   3.1. Choice of subject ..................................................................................................... 27
   3.2. Perspective ............................................................................................................ 28
   3.3. Preconceptions ..................................................................................................... 28
   3.4. Research philosophy ............................................................................................ 29
   3.5. Research approach ............................................................................................... 30
   3.6. Research strategy .................................................................................................. 31
   3.7. Literature search and criticism ............................................................................. 32
   3.8. Research method .................................................................................................. 32
      3.8.1. Sampling: ....................................................................................................... 32
      3.8.2. Area of sample collection and sample size: ................................................. 33
      3.8.3. Time horizon of the sample ......................................................................... 34
   3.9. Mathematical Model ............................................................................................. 34
      3.9.1. Hypothesis development .............................................................................. 36
      3.9.2. Significance test ............................................................................................ 37
      3.9.3. Sample data .................................................................................................. 38
   3.10. Credibility Criteria ............................................................................................... 39
      3.10.1. Validity ......................................................................................................... 39
      3.10.2. Reliability .................................................................................................... 39
      3.10.3. Generalization ............................................................................................ 40
CHAPTER FOUR .................................................................................................................. 41
4. EMPIRICAL FINDINGS AND ANALYSIS ...................................................................... 41
   4.1. New York Stock Exchange .................................................................................... 41
   4.2. Tokyo Stock Exchange ......................................................................................... 42
   4.3. Shanghai Stock Exchange .................................................................................... 43
   4.4. London Stock Exchange ....................................................................................... 44
CHAPTER FIVE ....................................................................................................................... 46
5. CONCLUSION ................................................................................................................ 46
   5.1. Theoretical and practical contributions ............................................................... 47
   5.2. Further studies ...................................................................................................... 47
REFERENCES ...................................................................................................................... 49
APPENDIX A ......................................................................................................................... 57
LIST OF TABLES

Table 1: Selected stock markets’ country name, market capital and index name.......................3
Table 2: Short selling stock process........................................................................................14
Table 3: Empirical results of the stock price behavior on Chinese market...............................22
Table 4: Resume of the taxation on NYSE, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange (www.direct.gov.uk).........................................................24
Table 5: Top 10 of domestic Stock Exchanges around the world based on market capital...33
Table 6: Selected domestic Stock Exchanges (Based on market capital) and name of their indexes.................................................................................................................................33
Table 7: Theoretical values of RPR, MAPR, RPD, MAPD, MAAR, RTV (-1 to -5) and RTV (1 to 5) of NYSE, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange ..............................................................................................................................................41
Table 8: Observed mean, median, t-test and Wilcoxon Signed Rank Test values of RPR, MAPR, RPD and MAPD from NYSE..................................................................................................................41
Table 9: Observed mean, median, t-test and Wilcoxon Signed Rank test values of RPR, MAPR, RPD and MAPD from Tokyo Stock Exchange........................................................................................................42
Table 10: Observed mean, median, t-test and Wilcoxon Signed Rank test values of RPR, MAPR, RPD and MAPD from Shanghai Stock Exchange.................................................................43
Table 11: Observed mean, median, t-test and Wilcoxon Signed Rank test values of RPR, MAPR, RPD and MAPD from London Stock Exchange..............................................................................44
Table 12: Evidence of acceptance or rejection of hypotheses in different markets.................46
Table 13: p-value of MAAR.......................................................................................................57
Table 14: p-value of RTVt........................................................................................................57
Table 15: p-value of MAAR.......................................................................................................57
Table 16: p-value of RTVt........................................................................................................58
Table 17: p-value of MAAR.......................................................................................................58
Table 18: p-value of RTVt........................................................................................................58
Table 19: p-value of MAAR.......................................................................................................58
Table 20: p-value of RTVt........................................................................................................59

LIST OF FIGURES

Figure 1: Types of Market Efficiency......................................................................................6
Figure 2: A Hypothetical Value Function..............................................................................13
Figure 3: In general, position of Dividend declaration day, cum-dividend day, ex-dividend day and record date and payment date in a calendar year.....................................................17
Figure 4: Normal distribution curve at 95% confidence level............................................37
## MOST RELEVANT ABBREVIATIONS AND EQUATIONS

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Abbreviations</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPR</td>
<td>Raw Price Ratio</td>
<td>Raw Price Ratio is the difference between cum-day and ex-day stock price divided by cash dividend amount.</td>
</tr>
<tr>
<td>MAPR</td>
<td>Market Adjusted Price Ratio</td>
<td>Market Adjusted Price Ratio is the difference of the cum-dividend price and the market adjusted ex-dividend price divided by the current dividend amount.</td>
</tr>
<tr>
<td>RPD</td>
<td>Raw Price Drop Ratio</td>
<td>Raw Price Drop Ratio is the difference between the cum-dividend price and the ex-dividend price divided by the cum-dividend price.</td>
</tr>
<tr>
<td>MAPD</td>
<td>Market Adjusted Price Drop Ratio</td>
<td>Market Adjusted Price Drop Ratio is the difference of the cum-dividend price and the market adjusted ex-dividend price divided by the current cum-dividend price.</td>
</tr>
<tr>
<td>MAAR</td>
<td>Market Adjusted Abnormal Return</td>
<td>Market Adjusted Abnormal Return is the difference between the returns on the ex-dividend and the return from the market on the same day.</td>
</tr>
<tr>
<td>RTVt</td>
<td>Relative Trading Volume</td>
<td>Relative Trading Volume is expressed as the ratio between the trading volume on day ‘t’ of stock ‘i’, and the average trading volume of company ‘i’ estimated over the period of time relative to the ex-dividend day.</td>
</tr>
<tr>
<td>d</td>
<td>Dividend Yield</td>
<td>Dividend Yield is expressed as ratio of current cash dividend amount and the cum-dividend day stock price.</td>
</tr>
<tr>
<td>Ro</td>
<td>Returns on ex-dividend day</td>
<td>Returns on ex-dividend day expressed as the returns on ex-dividend day plus the current cash dividend amount divided by the cum-dividend day stock price.</td>
</tr>
</tbody>
</table>

\[
RPR = \frac{P_{-1} - P_0}{D} = \left( \frac{P_0 + D - P_0}{D} \right)
\]

\[
MAPR = \frac{p_{-1} - \frac{P_0}{1 + R_m}}{D}
\]

\[
RPD = \frac{P_{-1} - P_0}{P_{-1}}
\]
\[ MAPD = \frac{\left[ p_{-1} - \frac{p_0}{1 + r_m} \right]}{p_{-1}} \]

\[ MAAR = R_0 - R_m \]

\[ RTV_t = \frac{V_{it}}{AVTV_i} \]

\[ d = \frac{D}{p_{-1}} \]

\[ R_0 = \frac{p_0 - p_{-1} + D}{p_{-1}} \]
KEY TERMS DEFINITIONS

In this part we define the most important key words related with our study.

**Market anomaly:** According to Ross, Westerfield & Jaffe, (2005) stock prices shall be reflected by all the available information in the market. If stock prices are not reflected by all the available information then it represents market inefficiency in short run. We consider this inefficiency as market anomaly.

**Arbitrage:** According to Ross, Westerfield & Jaffe (2005) Arbitrage is a process where an investor can buy an asset from a market at a low price and sell the same asset at a higher price in the same market or in another market. Arbitrage also can exist if a stock price is undervalued and overvalued.

**Arbitrage opportunity:** We consider arbitrage as an opportunity when an investor can generate profit (after deducting all the expenses) from two different prices of two different markets or two different time periods.

**Ex-dividend day:** Two days prior of dividend record date of a stock is considered as ex-dividend date. In this day earning of a stock recorded to the holder (owner) of the stock.
CHAPTER ONE

1. INTRODUCTION OF THE STUDY

1.1. Problem Background

The concept of public limited company and stock market opened a new era of doing global business in present competitive business environment. Before the concept of public limited company, organizations faced problem to raise large capital and expand the business in the global economy. This concept gives an opportunity to sell ownership by splitting into small parts between large numbers of individuals. By using this concept, organizations solved the problem of raising huge capital for further investment.

After establishing the concept of public limited company, a few questions arose; where to sell the ownership of the company? Who shall sell it? To answer these questions, new concept of financial market appeared. To sell the ownership of firms, two types of financial markets were created: formally organized market (the oldest stock market was established in the 17th Century in Netherlands as Amsterdam Stock Exchange; Neal (1987), NYSE Euronext Timetable, www.nyse.com) and over the counter market (OTC). Formally organized market is well established and officially accepted as stock market around the world. It is known as secondary market where shares are sold to the public after initial public offering (IPO) (IPO: first time an organization asks to sell its ownership to public at a pre-determined price).

The policy an investor follows to invest the money in equity market is to buy stock when it has low price (investors expect that the current stock price is lower than its original value and it will goes up in future) and sell it when the price will rise in future. Most of the investors follow this policy. This profit-making strategy is functional in the long run (if economy does not experience any unanticipated events that cause economy to fall down) only when organization and economy continue to perform towards upward direction. Investors cannot experience any additional abnormal profit in the short run by evaluating existing information. In theory, in an efficient stock market (considered as perfect capital market) stock prices shall be reflected by all the available information and eliminate arbitrage opportunity. (Ross, Westerfield & Jaffe, 2005). Copeland & Weston (1992) implied that in an efficient market there will be no undervalued or overvalued stocks. In stock market, value of stocks depends on average investor’s expectation. Investors evaluate the value of stocks based on past, present and expected future consequences of the organization and the economy.

Due to higher demand, new technology, global business pressure and demand of stable economy stock market became one of the modern business centers. In present times, it is recognized as a perfect capital market where all relevant events of an economy are equally evaluated by investors and have almost equal impact on stock value. Among all events, ex-
dividend day is an important event for investors. In this day profitability of earnings is transferred to the stockowners who keep their ownership till that date.

It is assumed that in a perfect capital market, stock price shall fall by the same amount as dividend paid out on ex-dividend day. But more than 50 years research and more than 100 research papers on ‘Behavior of stock prices on ex-day’ provide mixed evidence. Most of them agreed that stock price should drop less than the dividend amount on ex-dividend day. However, the explanation of such behavior still remains controversial. Among all, most pronounced reasons are (i) differential taxation between dividends and capital gains (Litzenberger & Ramaswamy, 1979; Poterba & Summers 1984; and Barclay, 1987, in US market), (ii) different tax codes in different countries (Booth & Johnson, 1984, for Canada; Hietala & Keloharju, 1995, for Finland; Michaely & Murgia, 1995, for Italy; Lasfer, 1995, for the U.K.; Kato & Loewenstein, 1995, for Japan; and Frank & Jagannathan, 1998, for Hong Kong), (iii) cost of trading (Kalay, 1982; Boyd & Jagannathan, 1994), (iv) changes of tax law (Grammatikos, 1989; Michaely, 1991; Lamdin & Hiemstra, 1993); (v) and the elimination of fixed commission (Boyd & Jagannathan, 1994).

If the stock price does not fall by the same amount then there will be abnormal returns which are the signal of inefficiency of the market. This represents market anomaly (because stock price does not reflected by all the available information, Ross et al., 2005) in a perfect capital market. Short-term investors shall be attracted by such inefficiency of the market (the ones who buy and sell stocks in a short run and try to make profit by using inefficiency of the market) to make arbitrage profit.

M. A. Lasfer & Zenonos, (2003) examined the stock prices behavior on the European market that covers France, Germany, UK and Italy. Prior studies were done on single stock markets and covered most of the stocks of each market. Litzenberger & Ramaswamy, (1979), Poterba & Summers, (1984), and Barclay (1987) studied the stocks on NYSE. Similarly, Kato & Lowenstein (1995) examined the Japanese market, Nikolaos, Travlos & Xiao (2002) investigated the Chinese market and M. A. Lasfer (1995) and M. Lasfer (2008) made their study on London Stock Exchange. Till today, top largest capital markets were not covered within one study. Moreover, there is no study that investigated the most liquid (large capitalized and actively traded) common stocks that are considered as blue chips.
In this thesis we examine the stock price behavior under certain assumptions to see how actively traded common stocks behave around the world. We worked on top four (considering market capital) (World Federation of Exchange, www.world-exchanges.org) stock markets, which are unique in nature. These are:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Exchange Name</th>
<th>Country</th>
<th>Domestic Market Cap (in $ billion)</th>
<th>Indexes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New York Stock Exchange</td>
<td>United States</td>
<td>11,837,793.3</td>
<td>S&amp;P 100</td>
</tr>
<tr>
<td>2</td>
<td>Tokyo Stock Exchange</td>
<td>Japan</td>
<td>3,306,082.0</td>
<td>TOPIX 100</td>
</tr>
<tr>
<td>3</td>
<td>London Stock Exchange</td>
<td>United Kingdom</td>
<td>2,796,444.3</td>
<td>FTSE 100</td>
</tr>
<tr>
<td>4</td>
<td>Shanghai Stock Exchange</td>
<td>China</td>
<td>2,704,778.5</td>
<td>SSE 180</td>
</tr>
</tbody>
</table>

Table 1: Selected stock markets’, country name, market capital and index name.


1.2. Research questions

Do most liquid (large capitalized and actively traded) common stocks behave according to the efficient market hypothesis on ex-dividend day?

If behavior of stock price does not hold the efficient market hypothesis then the market shall experience market anomaly. It will produce abnormal return. Furthermore, we shall look for the answer to the question 2, which is;

Are short-term trading activities active in capturing the abnormal returns around ex-dividend day?
1.3. Purpose of the study

The purpose of the study is to examine the behavior of the most liquid common stocks on ex-dividend day during 2005 to 2009 that covers New York Stock Exchange (NYSE), London Stock Exchange, Tokyo Stock Exchange and Shanghai Stock Exchange. We specifically focused on the question: “does stock price fall by the same amount as dividend paid out”? If it does not then “are short-term traders active to capture this market anomaly in order to make arbitrage profit from it?”

1.4. Limitations

This paper shall not examine all the stock markets around the world. This paper shall not explain the behavior of all the listed companies on New York Stock Exchange (NYSE), London Stock Exchange, Tokyo Stock Exchange and Shanghai Stock Exchange. This thesis shall explain the behavior of stock price on ex-day and arbitrage opportunities during the period 2005-2009. This thesis is functional under the assumptions, sample units and the model that has been used for mathematical conclusion and may not be functional under different assumptions, sample units and with other mathematical models. This thesis shall not explain the scientific reasons if stock price does not fall by the same amount as dividend paid.

1.5. Disposition

We conclude our study under 5 parts which are introduction, theoretical framework and literature review, methodology, empirical results and analysis, and conclusion.

1.5.1. Chapter 1: Introduction

In this chapter we have presented background of the problem, research questions, purpose of the study, and limitations of the study.

1.5.2. Chapter 2: Theoretical framework and Literature review

Under theoretical framework we explain all the relevant theories which shall explain different terms of finance that are relevant to our study. It will be helpful for readers to get detailed explanations of the different terminologies we used in our study. In this chapter we also presented prior studies which are relevant to our thesis.
1.5.3. Chapter 3: Methodology and Credibility criteria

In methodological framework we explain the reasons behind choosing this topic, perspective, research philosophy, research approach, research strategy, sampling procedures and mathematical model that we used in our study. We also present the hypothesis to explain our empirical results. Finally, in this chapter we explained reliability, validity and generalization.

1.5.4. Chapter 4: Empirical findings and Analysis

In this chapter we presented our empirical results and explain how most liquid common stock prices behave in the most efficient stock markets around the world. We also presented previous researches which are consistent and not consistent with our study.

1.5.5. Chapter 5: Conclusion, Theoretical and practical contribution, and Further studies.

To draw the conclusion we used six null-hypotheses and based on them we observed inefficiency and arbitrage opportunities in Tokyo Stock Exchange and London Stock Exchange. However, we did not find any evidence of market anomaly and arbitrage opportunity from NYSE and Shanghai Stock Exchange. We also explained how our study shall contribute to theoretical and practical life.
CHAPTER TWO

2. THEORETICAL FRAMEWORK / LITERATURE REVIEW

In this chapter we attached to give a definition of the key words and concepts of our thesis and relate them to the previous studies done.

2.1. Efficient Market Hypothesis (EMH)

Under the Efficient Market Hypothesis, the players in the market are rational. Under these conditions, they all have access to the same information and all have the same expectations concerning their investment. The stock prices fully reflect the available information. In this condition, the market is in equilibrium. Thus, they can easily decide whether to invest or not on a market. They are aware of the fact that the more risks, the more profits and vice-versa (Fama, 1970). Despite Fama’s theory (1970), the investors cannot outperform under these conditions.

Fama (1970) explained different models to test the efficient market theory. Roberts (1959) was the first to test the weak and strong forms of efficiency. Fama (1970) tested the weak form, the semi-strong form and the strong form of market efficiency to conclude that the efficient market models were hold.

Figure 1: Types of Market Efficiency
2.1.1. The Weak form

A market is weakly efficient if it completely incorporates the information on the past stock prices. With this type of efficiency, the historical prices are the easiest information to acquire concerning a stock. This is why it is the weakest form of efficiency. As Ross et al. (2005) consider it, the random walk can be considered as a synonym of weak-efficiency form. As a resume, the current prices reflect the past prices. Fama (1970) tested the weak form and examined that this form of efficiency was supporting the fair game efficient markets model. In other words, the trade of a security shall be based on the examination of the historical prices or returns of this security. Mollik & Bepari (2009) also studied the weak efficiency and found that this form is not consistent on Dhaka Stock Exchange, conducing to other forms of efficiency which are the semi-strong form and the strong form of efficiency.

2.1.2. The Semi-Strong form

In this type of efficiency, the prices reflect publicly available information. It includes the published accounting statements of firms and historical price information. The semi-strong efficiency is different from the weak efficiency in the sense that the semi-strong form requires the market to be efficient towards the historical price information and also that all the information available to the public is reflected in the prices (Ross et al., 2005, pp. 355-357).

Ball & Brown (1968) studied the effect of annual earnings announcements and found that more than fifteen percent of the information in the annual earnings announcement was not anticipated by the month of the announcement. Fama (1970) tested the semi-strong form of efficiency and concluded with the evidence of the information effect of the common stock returns public announcement which was consistent with the model of the efficiency of the markets.

2.1.3. The Strong form

The market is strongly efficient if the prices reflect all information, may it be public or private. However, the strong form of efficiency is inefficient. Scholes (1969) highlighted that some insiders in corporations have access to information that other sometimes do not have. Thus, the prices reflect available information and no one makes systematically high profits. Fama (1970) demonstrated that the tests of the strong efficiency of the market depended whether investors have monopolistic access to information determining indications for the price formation. In order to avoid this kind of trading, the SEC (Securities and Exchange Commission), which is a Government Agency, controls the exchanges and the registrations of trading (Bodie, Kane & Marcus, 2009, pp.77).

Ross et al. (2005) mentioned the EMH has an effect both for investors and firms as the prices immediately reflect the information. In this condition, investors should only expect a
normal rate of return. The price adjusts before the investor has time to trade on it. Concerning the firms, these ones should expect to receive a fair value of the shares they are selling. Some other mechanisms on the market keep the market efficient and thus, under these conditions, the prices on the markets equal their true value (Ross et al., 2005). One important of these mechanisms is the arbitrage.

### 2.2. Arbitrage

Arbitrage is a process to make profit from two different prices of two different time horizons or two different markets. According to Bodie et al., (2009) the arbitrage allows players to play in the market to generate profits with a zero-net investment strategy at a risk free rate. Dubil (2005) defined (Arbitrage Guide to Financial Markets, pp.12-14), it exists the pure arbitrage and the relative arbitrage. The pure arbitrage is the process “generating riskless profit today by statically or dynamically matching current and future obligations to exactly offset each financing cost” (Dubil, 2005, pp.13). The relative arbitrage is the process “generating profit today by statically or dynamically matching current and future obligations to nearly offset each other, net of incurring closely estimable financing costs” (Dubil, 2005, pp.14).

Ross (1976) developed the Arbitrage Pricing Theory (APT). This theory is an alternative of the CAPM in the sense where APT views risk more generally than does the CAPM with only the standardized covariance of the beta of market portfolio. The APT is thus an alternative of the view of risk and return. Arbitrage is thus a regulator of the market efficiency (Ross et. al. 2005).

#### 2.2.1. Arbitrage opportunity

In general, arbitrage opportunity exits when an economy experiences two different prices in two different markets. It also can exist if price of any commodity or equity varies from its actual price due to information asymmetry. For example, an investor who buys a security for $10 and resells it for $20, this investor makes a $10 arbitrage profit because previously the security was undervalued. Moreover, we can say that arbitrage opportunity exists when the value of the security becomes undervalued or overvalued due to any economic event.

David & Jarrow (1988) study laid on the arbitrage opportunity around ex-dividend day and explained the possibility to grab that opportunity. They performed their study based on two assets, risky stocks and riskless bond which are traded continuously over the time period. The study done by Elton et al. (1984), Kalay (1984), and Lakonishok & Vermaelen (1986) showed the possibility of arbitrage opportunity based on short-term trading hypothesis. They explained, though arbitrage opportunity exists but it is not possible to grab that opportunity.
David & Jarrow (1988) explained their theory based on the characteristic that security market should not have any arbitrage opportunity only if a belief of probability exist of $Q$ on the event set $F$ such that, for any event $A \in F$.

$$Q(A) = 0$$

If and only if $P(A) = 0$ and $Z(t)$ is a $Q$-martingale, that is,

$$E_Q(Z(t)|F_s) = Z(s)$$

With probability one, where $s \leq t$ for all, $t \in [0,T]$.

This theory was developed and justified by Harrison & Kreps (1979, p. 392, corollary b). The definition of this theory also related with the theory of risk neutrality argument given by Cox & Ross (1976). Where the explanation of arbitrage opportunity is, risk neutral investors have belief of probability $Q$ which must be equivalent to old belief (investors are not risk neutral), $P$ which implies the presence of zero probability and thus arbitrage opportunity. But if and only if the value of stock at a given time $t =$ the discounted (at a rate of risk free rate) expected stock value + dividend at time $T$ occurs in the new risk neutral economy then there is no arbitrage opportunity. In conclusion they mentioned though drop of stock price differs from the amount of dividend, it does not have any evidence of short-term trading strategies and thus arbitrage opportunity.

Similar study by Amadi (2005) explained new evidence for stock price behavior. He said future stock price should not be affected by the expected and past dividend since current stock price absorb the reaction, except their information content. His study suggested abnormal return arises due to lack of accrual pricing of dividend. This consequence led to a higher demand for cum-dividend stocks and higher supply for ex-dividend stock and thus to drop of the stock price on ex-dividend day. The paper suggested such stock price behavior on ex-dividend date was an effect of dividend, which is non-accrual in nature. According to his point of view, investors could participate in dividend capturing, but the current price of the asset reflects the expected future cash flow of the asset. And it would continue because dividend amount was not promised and because of the difficulty to estimate the actual dividend amount within payment date. He argued against traditional argument. Where traditional argument says that due to higher tax rate on dividend amount than on the capital gains, the equilibrium-determined value of stock drops less than the amount of dividend which was suggested by Campbell & Beranek (1955), Durand & May (1960), Elton & Gruber (1970), Hess (1982), Kalay (1982), Lakonishok & Vermaelen (1983), Eades et al. (1984), Elton et al. (1984), Kalay (1984), Barone-Adesi & Whaley (1986), Kaplanis (1986), and Lakonishok & Vermaelen (1986).

Dai & Rydqvist (2009) investigated the arbitrage opportunity around ex-dividend day on the Norwegian stock market. They used costly-arbitrage model which was introduce by Boyd & Jagannathan (1994). They documented that the tax-clientele model is rejected while costly-arbitrage model gives mixed evidence. However, consistence has been
recorded for risk adverse model. They mentioned that the arbitrageur could not predict the step-up amount which takes one year after the trade. It introduced risk of miscalculating the actual amount of step-up but this risk is possible to diversify. They suggested that it requires further research to find the limits of arbitrage. However they concluded that the uncertainty about the future cash flow did prevent the arbitrage opportunity as it could create better arbitrage opportunity later on in the year.

By arguing with arbitrage opportunity, Rantapuska (2008) tried to present who, how much and why investors do trade on ex-date. The study was performed on all investors on the Finnish stock market. He made an argument for two types of investors, one who prefers dividend as income and second who are interested for capital gain. Those investors who prefer dividend as income buy shares on cum-dividend day and sell on ex-dividend day, which is vice versa for those investors who are interested in capital gain. He divided his analysis in two parts; first part explained who trades, the trade volume and direction of trade. The paper strongly suggested that due to different tax status (different tax code on dividend and capital gain), investors tried to change the direction of trading (buy and sell) around ex-date for arbitrage opportunity. In the second part, he presented pragmatic evidence on short-term-trading by domestic households and non-financial corporate investors. It has been observed that investors involved were obtaining tax arbitrage by considering the facts of low risk, lower trading cost, lower idiosyncratic risk, higher yield on dividend and in which they have insignificant position in past time. The paper identified that mutual funds were involved in trading and obtained positive abnormal returns (before transaction costs) because domestic taxable investors were engaged in buy-sell tax arbitrage. Same evidence was also obtained by Grinblatt & Keloharju (2001, 2004) from the same market and Barber & Odean, (2003) from United States which implied that though tax is a considerable matter to influence the trading activities, it is not necessary that individual investors shall behave in a tax-optimal way.

The Behavioural Finance challenges the notion of the investor’s rationality. Thaler & Barberis (2002) proposed an alternative theory of Expected Utility Hypothesis (developed by Bernoulli, 1738, who stated that people should meet their expectations based on their choice) and have developed the fact that the investors are entirely rational. They stated that some deviations exist in the market efficiency which is limited. One of these limitations is related to the arbitrage and another one concern for the cognitive bias. In other words, the investors in the market are not as rational as they are supposed to be under the EMH, mainly because of deviations which take place on the market: limited arbitrage and psychology are two elements of these deviations.

2.2.2. Limits to arbitrage

Vishny & Shleifer (1997) and Thaler & Barberis (2002) exposed the limits of the arbitrage. They introduced two types of agents of the market. The noise traders and the arbitrageurs normally are supposed to create equilibrium. The noise traders are irrational. They are
investors who are not professionals. They are sometimes too optimistic and sometimes too pessimistic towards their expectation. Thus, the value of the securities is leading to change from their true value and then make the effect of mispricing. The arbitrageurs are the rational agents. They correct the value that the noise traders have modified and thus the price of the securities meet again the fundamental value, thereby the true value. The point is that if the noise traders create mispricing, we could think that this represents opportunities for the arbitrageurs to make money and then benefit from the deviation to make profit from their investments. Thought Fama (1965) was aware of these anomalies, he defended that they could appear in a random way and be compensated, thus be in line with the market efficiency.

Thaler & Barberis (2002) pointed the fact that when mispricing happen, it creates risks (two types of risk: fundamental and noise trader) which raise the costs. Besides, the implementation costs are very high when a security faces mispricing. In other words, the arbitrageurs tend to be very careful concerning their investments and then become risk averse. This is because there is neither any perfect efficient security nor any substitute of that security. The fundamental risk is systematic and the associated costs due to the implementation are really expensive. Vishny & Shleifer (1997) insisted on the fact that there are just a few arbitrageurs in the market. There are more investors who are amateurs and thus have lack of skills about the market.

Investors rely on the past performances of the arbitrageurs to be convinced to entrust the arbitrageur with investing their money. When the arbitrageurs manage the money of an investor, they only focus on the losses even if the expected return from their operations rises. In this case, investor prefers take his money back but then, he prevents the arbitrageur from the capital he might need to perform and improve the expected return of his trade, that is to say, to improve his performance. In this way, the arbitrageur can miss opportunities. Vishny & Shleifer (1997) stated, “the larger are the shocks, the further are the prices from fundamental values” (p.44) (the shocks are done by the noise traders). Based on the fear the investor takes his money back, the arbitrageur takes smaller positions on the market and then limits the market efficiency. This case also highlights the problem of the agency information. Indeed, the investors have no available information about the market and the real values of the funds, whereas the arbitrageurs have this knowledge.

2.2.3. Psychology

As said above, the psychology is also a deviation of the market efficiencies. Indeed, how do people meet their expectations? How do they make their decisions? Thaler & Barberis (2002) divided the investors’ decision process into two components which are beliefs and preferences. Thaler & Barberis (2002) mention the beliefs by exposing different aspects of the behavioural finance:

- Overconfidence
- Anchoring (Kanehman & Tversky, 1974, pp 46-52)
- Representativeness heuristic
- Conservatism
- Belief persistence
- Optimism
The overconfidence effect is an extreme belief the investors can have which makes them feel that they cannot fail whatever decision they take. Unfortunately, this feeling misleads the investor in the majority of the cases. The conservatism, as defined by Thaler & Barberis (2002) is the practice to overweight rates. Kanheman & Tversky (1974) defined the anchoring bias as a strong reference for the investor to his own past, his own experience over his life when making a decision. Belief persistence is a bias that reflects the investor’s belief, and makes him sure to know the truth although in most cases this bias makes the investor mistaken. Representativeness heuristic is a consistent rule people use to consider two data and how much they are related to each other. They examine the probability of a hypothesis thanks to these two related data. The optimism is the tendency for people to consider too optimistically the future outcome of a financial decision. We list the preferences as we mentioned above the beliefs:

- Loss aversion
- Certainty effect
- Isolation effect
- Framing
- Mental accounting

People make decisions under their preferences (Thaler & Barberis, 2002, and Kanheman & Tversky, 1979). To understand loss aversion we use two theories. Bernoulli (1738) demonstrated with his Expected Utility Theory that people make decisions in function of their expectations. The Prospect Theory created by Kanheman & Tversky (1979) is an alternative to the Expected Utility Hypothesis.

When people want to invest in the market, they have to make decisions and every decision faces a kind of risk, which is more or less probable and thus the gain can be reduced as well as the risks can rise. Kanheman & Tversky (1979) proposed different phases when people make a choice. Firstly, the investors edit the prospect and then they evaluate it. People think about the loss or the gain their investment will result in. They do not consider the final assets. The players have a reference point which corresponds to the status quo point. It means that gain = loss = 0. It is from that point that they finally make their decision.

In order to evaluate his investment, the investor would make a simplification and thus make a combination of the probabilities of the loss and the gain. For example, the prospect (1000, 0.15 ; 1000, 0.25) can be combined as (1000 ; 0.4). As a contrary, Kanheman & Tversky (1979) explained that investors first segment the prospects and then based on segmentation and decomposition, evaluate the prospect. As an example, the prospect (500 , 0.30 ; 350 , 0.15) is decomposed into a sure gain of 350 and (500 ; 0.30) as a risky prospect. An other analyse is made when a prospect is presented as (401 ; 0.48), the investor will see the prospect as (400 ; 0.5). This presents the simplification and the detection of dominance the investor can apply to analyse a prospect. Indeed, people choose the prospect with the highest value, even if it is less probable, and thus more risky, or the smaller value with certainty depending on the outcome. Again, the investor thinks in terms of gain and loss and not in terms of final assets.

There are two cases to consider. The positive prospect and the negative prospect (Kanheman & Tversky, 1979). For the positive prospect, (means that will give a neutral or positive outcome), people will prefer the one with the highest value. People will not
consider the probability to earn the outcome even if it is really small rather than a prospect whose value is less important but is sure to be earned (meaning with certainty). For the negative prospect (means that will give a neutral or negative outcome), people prefer once again the prospect with the highest value even if the probability to lose is more important. In other words, if a prospect is (-4000, 0.40 ; -3000), it means that the investor has the choice between losing $4000 with a probability of 0.40 or to lose $3000 with certainty. As Kanheman & Tversky (1979) demonstrated, the investor will choose the most risky alternative. Their experiences demonstrated that the investor is risk seeking for a positive outcome, and risk aversion for a negative outcome.

Kanheman & Tversky (1979) have defined a value function of the decision people make.

![Figure 2: A Hypothetical Value Function](image)

Source: Kanheman & Tversky (1979, pp. 279).

We suppose this phenomenon of the arbitrage happens on the ex-dividend day when market anomalies are created. At this time, we observe the short-term trading.

### 2.3. Short-selling rules of the market and short-term trading

Short-term trading, as well as called day trading, is a trading strategy. Short sellers are playing in the market as they bet that the markets are not efficient. By short selling, the investor sells the shares without holding them and then buys them. This process permits the investor to make profits when they expecting that the stock price to go down in near future (Bodie et al., 2009, pp.74).
Table 2: Short selling stock process

<table>
<thead>
<tr>
<th>Time</th>
<th>Action</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Borrow; sell it</td>
<td>+ Initial price</td>
</tr>
<tr>
<td>1</td>
<td>Repay dividend and buy share to replace the share originally borrowed</td>
<td>- (Ending price + Dividend)</td>
</tr>
</tbody>
</table>

Profit = Initial price – (Ending price + Dividend)

Source: Investments, Bodie et al. (2009, pp.75).

With short selling, the short seller will be able to buy a security at a cheaper price than it initially sold for. In this way the short seller will make a profit. It will lead to a loss if the investor’s prediction is wrong. This is a risk of short selling. We cannot eliminate this risk but we can limit it by entering stop-buy orders. By making the law of stop-buy order security exchange commission can protect the investors if the security’s price goes up. Another way to limit this risk is the short-term trading (Fabozzi, 2004).

2.3.1. Short-term trader Hypothesis

Elton & Gruber (1970) argued that on the ex-day the marginal long-term traders were indifferent about selling or buying shares. Consequently, the differential taxation of dividends and capital gains should be shown by the ex-day premium. Kalay (1982) disagreed with Elton & Gruber (1970) and stated that the investors, who do not face differential taxation on the dividends and the capital gains, could make arbitrage profit on the ex-day. These investors were called the short-term investors. Indeed, these investors could make arbitrage profits on the ex-dividend date if the share price does not equally drop as the dividend amount. This phenomenon has developed the short-term trader hypothesis (Kalay, 1982 and Miller & Scholes, 1982). But these opportunities of arbitrages could be bothered by the transaction cost, if it is large enough. However, nowadays the transaction cost is limited by the electronic trading on internet, particularly used by short-term traders.

2.3.2. Short-term trading

Short-term trading is one of the pronounced causes behind the stock price behavior on ex-date. Booth & Jonhston (1984) considered the transaction costs and stated the limits constraints within the ex-dividend day price ratio must lay:

\[ 1 - 2\alpha \frac{\bar{p}}{D} \leq \frac{P_B - P_A}{D} \leq 1 + 2\alpha \frac{\bar{p}}{D} \]

Where \( \alpha \) represents the transaction costs.

In this model Booth & Johnston (1984) introduced institutional and professional short-term trading hypothesis. These two hypotheses differ in case of tax treatment. They finally found
that the ex-dividend day is an important input in the trading strategy for investors and traders.

Study by Shantanu et al. (2004) showed strong evidence for short-term trading hypothesis. They re-examined the behavior of stock prices and volume of all listed companies of Canadian stock market from year 1996 to 2003. They used several approaches to realize the final result. First, they used price of cum-dividend stock to ex-dividend stock ratio,

$$\frac{P_{cum}}{P_x}$$

Secondly they used price-drop-to-dividend ratio on ex-day, which was introduced by Elton & Gruber (1970),

$$\frac{P_{cum} - P_x}{D}$$

Shantanu et al. (2004) also used market model to capture the amount of abnormal return on ex-divided day. They identified four major impacts which are: “first, stock price drop more than the amount of dividend paid out, which is more pronounced for higher divided yield stocks. Second, every year the price drop to dividend ratio is always less than one, illustrating the tax effect. Third, insignificant evidence of short-term trading activities for those stocks whose have higher dividend yield. Fourth, evidence of significant amount of abnormal return on ex-divided day.” (p.19-20) They found strong evidence of short-term trading around ex-dividend day and short-term trader’s pressure of buying before the event date and selling pressure after the event.

In support of short-term trading, a study done by Frank & Jagannathan (1998) examined ex-dividend day stock prices in Hong-Kong during the period from 1980 to 1993. They recorded the price drop on the ex-day is, on an average, around 43 percent of the dividend which is leading to an ex-day return of 1.33 percent. This return is much larger compared to 0.17 percent which was reported by Bali & Hite (1998) from U.S market. Another study done by Kadapakkam (2000) on Hong-Kong market (where dividends and capital gains are tax free) before and after the electronic settlement suggested that there were significant amount of abnormal return on ex-date and presence of short-term trading before electronic settlement. After the electronic settlement, abnormal returns declined to 0.17%, which is more applicable for higher yield stocks.

In contrast with short-term trading activities, Jakob & Akhmedov (2006) investigated the behavior of 130 cash dividends paying common stock of Copenhagen Stock Exchange from year 1991 to 2005. They did this investigation based on certain atmosphere where market has straightforward tax rates, fluctuate tick size and adjustment mechanisms for limit order. They found anomalies of Danish stock market around ex-dividend day where investors receive after tax dividend, but in general dividend amount is pre-taxed. They computed
several ratios based on four hypotheses on price-to-drop ratio, short-term trading amount, tick size model and automated limit order adjustment mechanism. They concluded that there is no strong evidence of stock price drop of Copenhagen Stock Exchange due to tax clientele effects, tick size, and short-term trading.

Lasfer (1995) found short-term trading does not significantly affect the prices or the returns on ex-day, especially after the tax treatment of 1988 in the United Kingdom. He found several investors from the market and determined their corresponding behavior around the ex-dividend day. According to his opinion, first the individual investors shall sell their shares before the ex-day and buy them again afterward. Second, the tax-exempt investors buy shares before the ex-dividend date and sell them afterward. Third, the broker or the corporate investors are trading around ex-day and keep the stocks for a period less than one month. He implied investors preferred tax advantage from different tax law.

Another study by Bauer et al. (2006) supported short-term trading instead changes of tax code. They did their study on Canadian stock market from 1977 to 2000. In this time frame tax code for investment return changed and went in favor of dividends rather than capital gains. In 1996 the stock exchange also set new tick size which was minimized from before and market switched to decimal trading. From this condition, Bauer et al. (2006) examined tax and tick size effect on ex-date and take position against tax effect, tick and therefore consequently dividend clientele or the Bali & Hite (1998) pricing model. The paper supported short-term activities for the behavior of stock price on ex-date. Short-term trading also supported by Lakonishok & Vermaelen (1986), Eades et al. (1994) and Liljeblom et al. (2000) for higher yield stock. Kadapakkam (2000) examined before and after electronic settlement and documented short-term trading activities around ex-date. Karpoff & Walking (1988, 1990), Liljeblom et al. (2001) also in favor of short-term trading.

2.4. Dividends and capital gains

It is important to understand the dividend procedures. Normally, the dividends are paid quarterly. But it depends on the country. Distribution of dividend policy can be annually, semi-annually or quarterly. The amount of dividend to be distributed is expressed as dividend per share, dividend yield (which is a percentage of the market price) or dividend payout (which is the percentage of earnings per share) (Ross et al., 2005, pp. 503). The process is following the declaration date, the hold-of-record date, the ex-dividend date and finally the payment date.

**Declaration date:** On this date, the Board of Directors declares the amount of the regular dividend, the date of record and the payment date (Ross et al. 2005, pp. 503).

**Hold-of-record date:** This date indicates the listing of the current shareholders. The firm closes the stock transfer books. All the shareholders listed will receive the dividend. The
other investors who bought shares between the hold-of-record date and the payment date will not receive the dividend (Ross et al., 2005, pp. 503).

**Ex-dividend date:** The security industry has created a statement so that the right to the dividend is still valid for the stock until two business days prior to the holder-of-record date. Then, on the date two days before the holder-to-record date, the right to the dividend does not hold anymore with the shares. This date is called the ex-dividend date. Consequently, if a new buyer of the shares wants to receive the dividend, he/she has to buy the security before the ex-dividend date. Otherwise, if he/she buys the shares on the ex-dividend date, the seller would receive the dividend because he/she still would be the official owner of the shares recorded (Ross et al., 2005, pp. 503).

**Payment date:** The holders recorded on the hold-of-record date of receipt of a check from the company.

![Diagram of Dividend Dates](image)

**Figure 3:** In general, position of Dividend declaration day, cum-dividend day, ex-dividend day and record date and payment date in a calendar year.
*Source: Corporate Finance, Ross et al. (2005, pp. 503)*

The main concern of the managers is to maximize the shareholders value. In this way it is important to know if the investors prefer dividends or capital gains and thus respectively to know if the investors prefer the firm distributes income as cash dividends or repurchases the shares and invests the earnings into the business (capital gains). Managers have to find the optimal dividend policy, which considers both current dividends and maximizes the firm’s stock price. Related to the investor’s preference, three theories are exposed (Brigham & Houston, 2004)

The Dividend Irrelevance Theory sustained by Miller & Modigliani (MM) (1961, cited in Brigham & Houston, 2004, pp.523-524), explains that the dividend policy a firm sets has no impact on either its value or its cost of capital. MM also stated the Bird-in-the-Hand theory as the theory that setting a high dividend payout ratio will maximize the value of a company and thus that the investors would prefer dividends rather than capital gains. The last theory related to the dividends is the Tax Preference Theory. Despite this theory, investors might prefer a low dividend ratio is to high payout. In fact, if the capital gains are taxed at a higher rate than the dividends, the investor would prefer the company to retain and invest the earnings within the company. This would lead to a higher share price and thus lower-taxed capital gains would be substituted for higher-taxed dividends (Brigham & Houston, 2004, pp.523-524).
These three theories are competing with each other. It shows the complexity of the dividends-related issues. There are two other dividend policy issues: the information content, or signaling, hypothesis and the clientele effect.

### 2.4.1. Signaling hypothesis

Ross (1977) proposed that capital structure and the dividends could be used as signals concerning future prospects of the company. MM (1961, cited in Brigham & Houston, 2004, pp.523-527) discussed the higher-than-expected dividend raise as a signal for investors for good future earnings forecasts of the company, and vice-versa. MM (1961, cited in Brigham & Houston, 2004, pp.523-527) stated that the investors react to the changes in dividend policy and that it is not necessarily manifesting that investors prefer dividends rather than retained earnings. However, the changes in the price behavior following the dividend moves and show the importance of the information or signaling the content in dividend announcements (Brigham & Houston, 2004, pp.527).

### 2.4.2. Tax effect

Clientele effect is linked to the tax effect. Indeed, the tax will have an impact on the decision of the amount a firm will pay for the dividends. Ross et al. (2005, pp. 522) mentioned that if corporate tax is lower than personal tax rate, a company would tend to reduce the dividend yield. As a contrary, if the corporate tax rate is higher than personal tax rate, the company would tend to increase the dividend yield.

The oldest study of stock price behavior on ex-dividend day by Campbell & Beranek (1955) recorded that the price of stock drops less than the dividend amount but that this differentiation has little spread. The debate of such differentiation and reasons behind it became wide spread after the publication of Elton & Gruber (1970). Their paper suggested that the stock price falls less than the dividend amount on ex-dividend day due to the effect of taxation. According to their view, after-tax dominates the market and investors are neutral in trading for cum and ex-dividend when

\[
\frac{P_{\text{Cum}} - P_{\text{ex}}}{D} = \frac{1 - t_d}{1 - t_g}
\]

Where,
- \(P_{\text{Cum}}\) = the stock price cum-dividend
- \(P_{\text{ex}}\) = the expected price on the ex-dividend day
- \(D\) = the amount of the dividend per share
- \(t_g\) = the capital gains tax rate and
- \(t_d\) = the tax rate on dividends.
Elton & Gruber (1970) study implies that when dividends contain higher taxed than capital gains, (i.e. $t_d > t_g$), then price drop ratio is less than one. It explains the value of stock on ex-date is higher than it is supposed to be. Their model suggested, due to higher taxation on dividends than long-term capital gains, the drop of stock price does not need to drop by the same amount as dividend amount. They found evidence that the investors who are under higher tax brackets are interested in lower dividend yields whereas lower tax bracket investors prefer the opposite.

After the Elton & Gruber (1970) debatable explanation, several researchers did extensive research on it and found mixed results. Study by Douglas & Hiemstra (1993) worked on Tax Reform Act of 1986, which sample data covered the period from 1982 to 1991. They suggested traditional view and mentioned differential taxation has effect on the valuation of capital gains and dividends. Similar outcome also performed by Litzenberger & Ramaswamy (1979), Poterba & Summers, (1984), Barclay (1987) and Litzenberger & Ramaswamy (1979) recorded a strong positive relationship between dividend yield and expected return from NYSE stocks. These studies also presented significant evidence for clientele effect.

It is difficult to say that the tax code on dividends and capital gains has significant influence on investor’s behavior. Chaplinsky & Seyhun (1990), Blose & Martin (1992) studied the differential taxation and found it had impact on investment return and had influence on portfolio holding of investors. Another study in the United States: Lakonishok & Vermaelen (1986); in Canada: Booth & Johnston (1984) explained that differential taxes creates ex-day trading which is not applicable in a country like Hong Kong (Frank & Jagannathan, 1998) as both dividends and capital gains are free of taxes. According to Frank & Jagannathan (1998), institutional investors act as noise trades as they try to get arbitrage opportunity from differential tax code on capital gains and dividends.

Kato & Lowenstein (1995) concentrated on Japanese market where the tax treatment does differ from countries which were previously studied. In Japan, investors have no difference in taxation concerning either the short-term or the long-term trading and information is difficult to obtain. Japanese industry is unique and likely to influence the corporate trading. They documented, the stock price behavior around ex-dividend day is not influenced by either dividend or tax effect. The volume explanation around ex-date suggested for selling pressure before the event date and buying pressure afterwards.

Some researchers presented evidence for changes of tax code that have distinguishable impact on stock price behavior on ex-date. Michaely & Murgia (1995) presented evidence for changes of tax code that have significant impact on stock price behavior and volume around ex-date. A. Lasfer (1995) study was performed on U.K. market and showed the effect of the changes of income and corporate tax act before and after 1988. Their model recorded positive and significant return on stock before 1988 due to the differentiation in
taxation (on capital gains and dividends). The model also documented negative and insignificant return after 1988 when there is no significant difference of taxation law (on dividends and capital gains). Their paper also recorded positive return on ex-date is a cause of dividend yield and duration of the settlement period which has no effect of transaction cost, bid-ask spread, short-term trading or other means of dividend distribution strategies. Study by Barclay (1987) examined ex-day behavior of common stock before the federal income taxes. They found on average that the stock price falls by the same amount as dividend amount. It implies investors equally value both dividends and capital gains in the pre-tax period.

In support of A. Lasfer (1995), study performed by M. A. Lasfer & Zenonos, (2003) on European firms examined behavior of stock price in France, Germany, Italy and in the UK market. They wanted to see how different taxation rules in different country could have impact on stock price behavior. They recorded significant positive return on ex-date in each country. They also documented higher differences of tax rate in between dividends and capital gains that contribute to higher returns on ex-date and vice versa for low differences. The paper also implies the changes of tax law on capital gains and dividends that lead to remarkable changes in ex-date returns. At the end, the model goes against the impact of transaction costs and market microstructure theory. Yahyae & Pham (2008) supported the microstructure theory. They examined their study under four certain conditions. Firstly, capital gains and dividends are free of tax, secondly the price of stock shall be counted as decimal number, thirdly company shall pay annual dividend and lastly it is possible to analyze the consequence of bid-ask bounce. Their study argued for microstructure models and found no evidence of short-term trading around ex-date to grab the differences between price drop and dividend amount.

Another recent study done by Lasfer (2008) documented higher ex-day return from UK where tax differential is high and short-term trading is limited. He found insignificant presence of market microstructure and short–term trading. In contrast, his model supports for short–term trading and market microstructure effects in German market. His view is, though the similar taxation code exists, due to different institutional law of these two countries lead to different determinants on ex-day return.

Similar study was done by Bauer et al. (2006) but argues for short-term trading. They performed their study on stock price behavior at ex-date of Canadian Stock Market from 1977 to 2000. In that time frame, tax code for investment return changed and went in favor of dividends rather than capital gains. In 1996, stock exchange also set new tick size, which was minimized from before, and market switched to decimal trading. Under these conditions, they examined tax and tick size effect on ex-date and took position against tax effect, tick and therefore against dividend clienteles or the Bali & Hite (1998) pricing model. The paper supported for short-term trading activities of such stock price behavior on ex-date. Beyond equity market, study on Swedish lottery bonds by Green & Rydquist
(1999) argued for tax effect under a certain condition which is, if capital gain has lower tax than dividend, short-term trading is limited by law.

In favor of tax effect, the stronger evidence comes from Barclay’s (1987). In his paper he explained, before ratification of income tax in US market, the price drop amount was equivalent to dividend amount. In another way, Eades et al. (1994) suggested, no taxable dividend was possible to interpret under the tax code. Another study by Fedenia & Grammatikos (1991), and Lamdin & Hiemstra (1993) implied that equal taxation on dividends and capital gains for individual investors reduced the price drop ratio but did not eliminate it. Similar outcome were also observed by Cloyd, Li & Weaver (2006). Study by Lakonishok & Vermaelen (1983) and Booth & Johnston (1984) in Canada; Lasfer (1995) in U.K; Sarig & Tolkowsky (1997) in Israel; Jacob & Akhmedov (2006) in Denmark; and Hietala & Keloharju (1995) on some Finnish shares are consistent with the previous studies supporting tax hypothesis (share price drop less than the dividend amount).

In contrast to these studies Nikolaos et al. (2002) observed the price drop for taxable dividend was more than the dividend amount if the taxation on dividend was higher than the capital gain. Their paper laid on the behavior of common stock of Chinese stock market and focused on both taxable and non taxable cash dividends (some stock’s earnings are free of tax, like mutual funds, and some stocks have higher tax rate on dividends like institutional investments in the stock market). The main aspiration of their study was to find out:

-Does taxable and non-taxable cash dividend paying common stock drop the same amount as dividend amount?

For both taxable and non-taxable dividends, Nikolaos et al. (2002) tested four hypotheses, which are based on raw price ratio (RPR), Market adjusted price ratio (MAPR), Raw price drop ratio (RPD), Market adjusted price drop ratio (MAPD). Sample data of their study does cover from January 1996 to December 1998 which contain total 353 companies (taxable divided 297 and non-taxable 56 companies).
Table 3: Empirical results of the stock price behavior on Chinese market

<table>
<thead>
<tr>
<th>Ratios</th>
<th>Non-taxable dividend</th>
<th>Taxable dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean value</td>
<td>Corresponding t-statistic (p-value)</td>
</tr>
<tr>
<td>RPR</td>
<td>2.329 (1.90)</td>
<td>1.59 (0.208)</td>
</tr>
<tr>
<td>MAPR</td>
<td>1.331 (0.769)</td>
<td>0.602 (0.951)</td>
</tr>
<tr>
<td>RPD</td>
<td>0.012 (0.010)</td>
<td>0.008 (0.007)</td>
</tr>
<tr>
<td>MAPD</td>
<td>0.008 (0.006)</td>
<td>0.008 (0.006)</td>
</tr>
</tbody>
</table>

The model for non taxable dividend suggested that there are no significant statistical differences from the corresponding theoretical value which imply the drop of stock price is equal to the amount of dividend paid.

For taxable dividend, Nikolaos et al. (2002) models suggested, p-values of RPR, MARP differ by 0.01, which implies the value of stock drops more than the amount of dividend on ex-divided date. RPD and MAPD value statistically significant at 0.05 levels or better which suggested to conclude, the changes of stock price is higher than the corresponding dividend yield. Their associated finding does match with the tax hypothesis.

Kalay (1982) was the first researcher who went through the challenge against tax hypothesis as a cause of differentiation in price drop and dividend amount. He adjusted two potential biases, which are

"First, the documented positive correlation can be the result of an incomplete adjustment for the "normal" daily price movement and the use of closing prices on the ex-dividend day." (p-1067)

"Second, the statistical significance of the measured correlation is questionable as some of the observations are likely to be dependent." (p-1067 & 1068)

Though Kalay (1982) adjusted these two potential biases, positive re-measured correlation exists and recorded insignificant price drop ratio. His model suggested, in relation with price drop, stockholders cannot be directed under the rule of marginal tax rate. According to his view, such behavior on ex-date is not the effect of tax or clientele. Therefore he
supported for short-term trading and transaction costs to mitigate the abnormal return, if any. However Kalay (1982) could not explain the reasons behind changes of tax rate within dividend yield. Miller & Scholes (1982) further explain Kalay’s study stand against previous study that showed evidence for tax-clientele effects.

Study by Jakob & Tongshu (2007), documented strong evidence against tax effect and recorded new evidence for drop of stock price on ex-date. According to their view:

- If size of the dividend is significantly large than the tick, then with increases of dividend, size of dividend yield also increase but price-drop-to-dividend ratios decline.
- If tick is larger than the dividend then there is no evidence of price drop to dividend ratio because of dividend yield.
- If tick is double than the dividend size then dividend amount is lower than the average price drop to dividend ratio.

These makes argument against the tax hypothesis which is qualitatively consistent with the theory of market microstructure model by Dubofsky (1992).

This result also supported by Nikolaos & Travlos (2006). They had done their study on Athens Stock Exchange with a sample date from 1994 to 1999 where both dividends and capital gains were considered as tax-free income. Their model suggested that the stock price drops less than the dividend amount and realized the cause is microstructure effect.

2.4.3. Clientele effect

When we speak about clientele, we speak about different groups of stockholders preferring dividend payout policies. Indeed, investors in zero or low tax brackets are indifferent to taxes. These investors need current income. However, the investors who do not need current income (because they are wealthier) would rather like the reinvestment of the dividend received, after paying income taxes on these dividends. To conclude, the investors with low tax brackets and who need current investment income would prefer high shares in firms with high dividend payout. As the contrary, investors without needs for current investment income would prefer to own shares in firms with low dividend payout (Brigham & Houston, 2004, pp.528 and Ross et al, 2005, pp. 522).

2.4.4. Taxation in the different markets

Different markets have different tax code on dividend and capital gain. The below table represent the tax rat of different stock markets.
Table 4: Resume of the taxation on NYSE, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange.

<table>
<thead>
<tr>
<th></th>
<th>Individual Dividend tax rate</th>
<th>Capital gain tax rate</th>
<th>Corporate tax rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYSE</td>
<td>10% to 35%</td>
<td>0% for low-income earners. Usually 15%</td>
<td>15% to 35%</td>
</tr>
<tr>
<td>Tokyo Stock Exchange</td>
<td>20%</td>
<td>10%</td>
<td>30%</td>
</tr>
<tr>
<td>Shanghai Stock Exchange</td>
<td>5% to 45%</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>London Stock Exchange</td>
<td>10% to 40%</td>
<td>18%</td>
<td>28%</td>
</tr>
</tbody>
</table>


2.5. Overview of the markets we study in our thesis

2.5.1. London Stock Exchange

London Stock Exchange is one of the oldest exchanges in the world and began in the 17th Century in London. In 2007, London Stock Exchange and Borsa Italiana merged together. As a result, London Stock Exchange is called FTSE 100 and is the largest exchange group in Europe concerning cash equities, fixed income and post trade services. London Stock Exchange Group is divided into two main categories. First, the Main Market where around 1500 companies are listed, representing for some of them a capitalization of more than £90 billion. On this market, the companies are subject to a certain regulation and have to provide audit statements for a minimum of the last three years. Second, the AIM is the market for smaller companies. 1450 companies are operating over 39 sectors within 100 countries (London Stock Exchange, 2010).

Both London Stock Exchange and the Financial Times own FTSE group. The FTSE 100 was created in 1984 and is the most famous index in the UK. It represents the 100 largest companies listed on the London Stock Exchange. The base level of the index is 1000 and varies despite the performance of the 100 companies listed in it. A large number of companies are listed on the London Stock Exchange. The smallest are capitalized at less than £1 million, whereas the biggest are valued at more than £90 million. The companies are either situated in the UK or some of them are based abroad, and all of them operate in different sectors like the banking industry, biotechnology, engineering, oil exploitation, among many others (London Stock Exchange, 2010).

The trading system used by London Stock Exchange is TradElect. It is organized as different market structures, segments sectors and instruments, each of them having a specific trading model. In this way, the different rules driving the operations and the trading services, on TradElect system, are separated. The trading services are the trading models.
the Exchange is operating for. TradElect calculates all along the day the reference data, which are opening and closing prices, and other reference prices (London Stock Exchange, 2010).

2.5.2. Shanghai Stock Exchange

The SSE (Shanghai Stock Exchange) was created in 1990. Three indexes are operating on the SSE: SSE 50, SSE 180, SSE Composite Index. In 2010, SSE registers 879 companies representing key industries and their sectors as the high tech and infrastructures. The SSE trading system is able to register more than 8000 transactions per second. The SSE is related to all other markets around the world thanks to their satellite and makes the communications, the information and the transactions very efficient and makes the SSE connected with trading terminals around the world. (Shanghai Stock Exchange, 2010).

According to the Trading Rules of Shanghai Stock Exchange, “the tick size of the quotation price of an order for A shares, bond trading, and bond buyout repo trading is RMB 0.01 Yuan and that for mutual funds and warrants is RMB 0.001 Yuan, while that for B shares and bond collateral repo trading are USD 0.001 and RMB 0.005 Yuan respectively” (3.4.11). Also, “the Exchange may adjust the maximum quantity of one order and the tick size of a quotation in line with market conditions” (3.4.12). (Shanghai Stock Exchange, 2010)

2.5.3. Tokyo Stock Exchange

Tokyo Stock Exchange was created in 1878. After a stop in activity because of the war, the trading started again at the end of the year 1945. Several stock exchanges have been created in Japan between 1947 and 2000 to finally state 5 stock exchanges in Japan. In 2007, Tokyo Stock Exchange Group, Inc. was created. TOPIX (stated for Tokyo Stock Price Index) is the main index and is calculated by Tokyo Stock Exchange, Inc. In our thesis we consider TOPIX 100. This index is measured as a base of 1000 points. The stocks in TOPIX 30 and TOPIX Large 70 compose TOPIX 100. Thus, TOPIX 100 regroups the 100 most liquid and highly market capitalized stocks. (Tokyo Stock Exchange, 2010)

2.5.4. New York Stock Exchange

The New York Stock Exchange was originated in 1792. On this date, 24 stockbrokers and merchants agreed on Buttonwood Agreement. In 2007, NYSE Group, Inc. and Euronext N.V. merged to create NYSE Euronext. This merger regroups the major marketplaces both in Europe and United States. NYSE Euronext group is the most liquid equities exchange group in the world, trading cash equities and all types of derivatives products. 8000 listed companies compose it. (New York Stock Exchange, 2010)
The 18\textsuperscript{th} of May 2010, the NPR news (www.npr.org) published the declaration of the SEC on new trading rules. Mary Schapiro, the SEC Chairman declared “marketwide rules for circuit breakers for individual stocks would help to limit significant volatility”. These new rules will stop trading of some stocks showing a too high volatility (+ or - 10\%) within five minutes. These rules would be applicable on the S&P500 stocks and will be affected in mid-June to “avoid market plunges”.


CHAPTER THREE

3. METHODOLOGICAL FRAMEWORK

This chapter shall explain the methodological framework of our study which consists of several parts; choice of subject, perspective, preconceptions, underlying philosophy, scientific approach and research method.

Around the world the word ‘research method’ and research ‘methodology’ are used by different books and researchers as equivalent of each other but Saunders et al. (2009) define differently. According to them ‘methodology’ imply “the theory of how research should be undertaken” and ‘method’ means “techniques and procedures used to obtain and analyses data” (Saunders et al., 2009, pp.3).

Easterby-Smith et al. (2008) (as cited in Saunders et al., 2009:5-6) suggested four major aspects that can make a research distinguishable than others, which are

- How managers and researchers work on studies that were done by others?
- Due to busy work schedule and power by organizational personal, they do not allow spending their valuable time without potential opportunity.
- Researchers are required to achieve proper academic qualification as managers possess higher academic qualification.
- The research should have practical consequence.

We try to keep in mind all these four mean of aspects while we are undertaking our research. However, we try to concentrate on three research books (Lewis & Thornhill, 2009, Bryman & Bell, 2007 and Adams, Khan & White 2007) and other relevant research articles to present an acceptable research approach for our study.

3.1. Choice of subject

Being students of finance background we always had, have and will have interest in equity markets and investment banking. Since we do not have proficient background in investment banking and have strong academic and practical knowledge on different equity markets; we find it useful to know how stock prices move according to information flow in the economy.

After studying theoretical definition of efficient market hypothesis we always had curiosity to know how it works in practical life in global standing. It is assumed that the stock
markets are efficient as stock prices absorb all information flow. We intend to know by practical work, if it does really work or not.

To analyze our study we considered two issues; do stock markets react according to information flow in the economy and do stock markets accept possible arbitrage opportunity without absorbing the information flow accurately.

There are many research papers which try to show the behavior of stock price around ex-divided day and possibility to have arbitrage opportunity. Our study will open a new era to show how actively traded common stocks (considered as most efficient common stocks) behave around ex-dividend day and the existence of arbitrage opportunity which touches most efficient stock markets and indexes around the world. So it became an interesting topic for us to understand how information asymmetry works in the 21st century and for investors to know how existing information has impact on stock price valuation for further investment decision. It is also an interesting topic for other researchers to know what is going on in most efficient markets around the world.

3.2. Perspective

The theoretical definition of perspective in research is where it is standing and where it intended to go. It shows the problem background to researchers and how to approach toward the problem with reasonable explanation.

Our study concerns on four stock markets among top six stock markets (based on market capital) around the world. More specifically we looked at most popular indexes and from them large cap common stocks which are considered as most liquid common stocks. From previous study, we realized that the information flow in the economy does have huge impact on stock price valuation. In this study we wanted to understand how actively traded common stocks behave on ex-day and does it produce any arbitrage opportunity for investors?

3.3. Preconceptions

It is accepted in the research world that research should follow specific objective where researcher shall not have any means of influence to change that objective. In reality it fails continuously due to researcher’s preconception drive researcher to draw another means of conclusion. That depends on researcher’s knowledge, skills, experience and background related with that research phenomenon.

We have theoretical preconception about ‘how stock markets behave on ex-day’. Our hypotheses are based on the previous studies examining this phenomenon. This study area
has already largely been a subject for famous researchers. We develop this point in hypothesis development parts. However we knew that our study is different than prior studies.

### 3.4. Research philosophy

Saunders et al (2009) explained three distinctive ways of thinking for research philosophies which are ontology, epistemology and axiology. More specifically he presented four (Saunders et al., 2009, pp.119) key philosophies for conduction quality research.

- **Positivism:** Researchers consider the research topic as external view and independent in nature. That implies that observed facts can produce acceptable outcome. It does focus on generalization. In short, research has no bindings upon any data as well as any values. It also means the practical application of natural science to get out from social science. It follows scientific approach and based on hypothesis testing, this approach aims to develop new knowledge (Bryman & Bell, 2007 and Saunders et al., 2009).

- **Realism:** It is considered the topic of research has objectives. It is also independent from knowledge, belief and human thoughts. This gives similar meaning of positivism that the knowledge is developed. Observable facts produce acceptable outcome but insufficient data of that particular observation produce unacceptable consequence. Researcher/s concentrates on particular phenomena but due to knowledge, experience and view of the researcher/s lead to a research bias (Saunders et al., 2009).

- **Interpretive:** Interpretive philosophy is highly suitable for the field of business and management research. It is known that the business settings are unique and comprise with different functions of a particular job in where an individual work under a particular time frame. As a fact, research choices are always constructed by social phenomena which are subject to change under different circumstances. Not necessarily that the research shall only look upon the objective of the social facts but also provide details explanation behind such phenomena (Saunders et al., 2009).

- **Pragmatism:** In this philosophy researcher/s shall consider both objective and subjective view points. They also consider external and multiple views to answer the raised problem. More specifically under this philosophy researcher focused on practical application and different means of data interpretation (Saunders et al., 2009).

To conclude our thesis we have chosen epistemology and from it we selected positivism approach. The critic against this approach is that they heavily depend on the existing theory.
and create a barrier for defining the research (Bunge, 1996). However, our study heavily
depends on observation of data under different settings where we do not have any means of
influence to change the information. It is a quantitative study which depends on scientific
model. We concentrated on hypothesis testing to develop new knowledge which is the final
outcome of scientific model.

3.5. Research approach

Saunders et al. (2009) and Bryman & Bell (2007) suggested two research approaches for
conducting a research which are deductive and inductive. These two approaches also
confirmed by Adams et al. (2007).

**Deductive:** Deductive approach is widely used in scientific research (Saunders et al., 2009).
It started with a general theory and ended with a specific point (Adams et al., 2007, pp. 29). In
this approach researcher develop theory, set hypothesis and carefully test them (Saunders et
al., 2009 and Bryman & Bell, 2007). By support of Saunders et al., Bryman & Bell, Adams
et al. (2007, pp. 30) explained that deductive approach demonstrate a process where a
group of facts from a given phenomena come to an end with testing of hypothesis./hypotheses.
Researcher/s undergoes with their hypothesis by inputting their
data and the consequence may or may not be same with the original theory (Adams et al.,
2007). The outcome of the study is the output of the scientific model (Quinton & Smallbone,
2006). Bryman & Bell (2007) suggested the process as,

Theory→ Observation/findings

**Inductive:** Inductive approach is commonly used to understand the nature of the problem of
any social phenomena (Saunders et al., 2009). Adams et al. (2007, pp.29) imply that this
approach opens with a specific problem and moves to a general interpretation. In this
approach researcher/s presents informative theory after interpretation of his/her collected
data (Saunders et al., 2009). Other way, this approach draw general conclusion from limited
number of observations (Adams et al., 2007, pp.29), more specifically Adams et al. (2007,
pp.29) explained that, “observation reveals patterns or trends in a specific variable of
interest, and these patterns lead to the formulation of a general theory concerning the
nature and behavior of the variable and other variables which are in the same class of
phenomena”. Quinton & Smallbone (2006) imply that this approach is becoming a popular
method to develop theory from a set of data with detailed explanation. This implies the
qualitative analysis of a data without using any statistical methods to process the data for
certain outcome (Quinton & Smallbone, 2006, pp.6). According to Bryman & Bell (2007),
it follows

Observation/ findings →Theory
Our study starts with a general theory and based on observable phenomena we draw specific conclusion. We collected data from different sources and used as input of our scientific method and reach to a specific point. Based on differentiation of inductive and deductive approach we believe deductive approach more fits with our research process. Therefore it is a quantitative research that draws an acceptable conclusion which is the final output of a scientific model.

3.6. Research strategy

Quality research depends on proper research strategy. According to Saunders et al. (2009), researcher/s requires research question/s, objective/s, background knowledge, time to conduct the research and other resources in their research strategy. Saunders et al. (2009, pp.142-150) suggested seven research strategies which are experiment, survey, case study, action research, ethnography, grounded theory and archival research. Among them we used archival research strategy in our study.

Archival research: If the conclusion of research is drawn from major sources of data, that research strategy considered as archival research (Saunders et al., 2009). Here researchers look for secondary sources of data, like data from statistic department, stock market library, central bank library or other media who keep records of primary data. The criticism of this strategy is that sometimes the data can be manipulated. So the researchers need to be careful about the reliability and accuracy of the source from where it is going to be collected.

We worked on 150 companies around the world and the research approach is quantitative. We also focused on historical information to find a trend of the consequence. So we used archival research strategy in our study. We collected last five years data from different reliable sources that are equally accepted in any form of research. In other way it is almost not possible to conduct this research in another form of research strategy. Archival research strategy was also used by Rantapuska (2008), Kadapakkam (2000), Jakob & Ma (2007), M. A. Lasfer (1995).

Survey research is a kind of approach involving collection of data from a large population at a low cost and then based on justification; use them to get the research outcome, Saunders et al., (2009). It could be possible but it is not applicable for our thesis because of time limitation, difficult to communicate with different traders from different markets and gather accurate information from them.
3.7. Literature search and criticism

In our study we used secondary sources of data. Saunders et al. (2009) insisted on some parameters to take in account when doing a research, especially the publication language, the literature type as well as publication date, among other parameters.

When doing this research we attached particular attention to the source of our references. Indeed, we estimate all our sources to be reliable and relevant. In order to conduct our research we have used several databases which access is available through Umeå University Library. Among these databases, we especially used Business Source Premium (EBSCO), Social Science Research Network (SSRN), JSTOR and Emerald Fulltext. Finally, we used Google Scholar to find some references.

We used different keywords to conduct our literature search: *Market anomaly, arbitrage opportunity and short-term trading, ex-dividend day.*

We found hundreds of articles related to our subject because a lot of researches have been done in the area of our research. We used articles and books in order to find support and to compare the prior studies to each other. However, some articles were most relevant for our study than other and thus we focused on them.

The criticism of secondary sources is that they may not be reliable and may be produced for another purpose. In our study we used those sources because they are well known in the research area. We also focused on related articles that are written for similar purposes.

3.8. Research method

3.8.1. Sampling:

To gather the data we used convenience and justified sampling procedures. The limitation of this sampling process is that it is selected based on researcher’s choice and it leads to a bias in research outcome.

In our study we worked on well known public limited organizations from different stock markets where we do not have any influence to change the value of the stock. These stocks are considered as highly liquid and actively traded stocks in each stock exchange. In other words, these stocks are considered as blue chips. People are always aware of each event related with these stocks and react according to the new available information. So here sampling procedures do not have any means of influence to affect the final outcome of the research. Due to time fact and difficulty of gathering information we have chosen convenience and justified sampling process to get the sample of our study.
3.8.2. Area of sample collection and sample size:

According to statistic of ‘World Federation of Exchange’ (World Federation of Exchange, www.world-exchanges.org), top 10 domestic large capital stock markets around the world in 2009 are;

<table>
<thead>
<tr>
<th>Rank</th>
<th>Exchange Name</th>
<th>Country</th>
<th>Domestic Market Cap (in $ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New York Stock Exchange</td>
<td>United States</td>
<td>11,837</td>
</tr>
<tr>
<td>2</td>
<td>Tokyo Stock Exchange</td>
<td>Japan</td>
<td>3,306</td>
</tr>
<tr>
<td>3</td>
<td>NASDAQ</td>
<td>United States</td>
<td>3,239</td>
</tr>
<tr>
<td>4</td>
<td>Euronext</td>
<td>Belgium, France, Holland, Portugal</td>
<td>2,869</td>
</tr>
<tr>
<td>5</td>
<td>London Stock Exchange</td>
<td>United Kingdom</td>
<td>2,796</td>
</tr>
<tr>
<td>6</td>
<td>Shanghai Stock Exchange</td>
<td>China</td>
<td>2,704</td>
</tr>
<tr>
<td>7</td>
<td>Hong Kong Stock Exchange</td>
<td>Hong Kong</td>
<td>2,345</td>
</tr>
<tr>
<td>8</td>
<td>Toronto Stock Exchange</td>
<td>Canada</td>
<td>1,608</td>
</tr>
<tr>
<td>9</td>
<td>BM&amp;FBovespa</td>
<td>Brazil</td>
<td>1,337</td>
</tr>
<tr>
<td>10</td>
<td>Bombay Stock Exchange</td>
<td>India</td>
<td>1,306</td>
</tr>
</tbody>
</table>

Source: World Federation of Exchange

From them we have chosen top four large capitalized stock markets for our study. More specifically we have selected our sample units from the following indexes:

<table>
<thead>
<tr>
<th>Stock market</th>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York Stock Exchange</td>
<td>United States</td>
<td>S&amp;P 100</td>
</tr>
<tr>
<td>Tokyo Stock Exchange</td>
<td>Japan</td>
<td>TOPIX 100</td>
</tr>
<tr>
<td>London Stock Exchange</td>
<td>United Kingdom</td>
<td>FTSE 100</td>
</tr>
<tr>
<td>Shanghai Stock Exchange</td>
<td>China</td>
<td>SSE 180</td>
</tr>
</tbody>
</table>

Source: World Federation of Exchange

We excluded Euronext from our analysis because this stock market consists with different countries whereas we concentrated on individual country. We also excluded NASDAQ because we choose one stock market from each country. We have selected 30 companies from each index which gives us total 120 companies around the world.
3.8.3. Time horizon of the sample

Saunders et al., (2009) suggested that time is an important fact and needs to decided for acceptable research conclusion. He proposed (2009, pp.155) two ways of deciding the time horizon which are,

- **Cross-section study:** This way of deciding time horizon considered as selecting a single point of time known as “snapshot” for conducting the research. The outcome of this means of research depends on specific time when it is carried out. A number of researches have been conducted in this way before in ‘academic course’ (Saunders et al., 2009:155).

The criticism of this kind of specification is that it does not provide any pattern. In which time it is conducted it is heavily influenced by that single point of time. This outcome may differ in another point of time. Surrounding atmosphere also influenced the research outcome.

- **Longitudinal study:** Saunders et al., (2009:155) explained that this form of study requires ‘number of observations’ or ‘series of snapshots’ or ‘diary’ other the period of time.

Example of such study can be, researcher/s need to know last five years daily stock price changes.

By considering the fact of financial crisis and dramatic changes of different governments and private laws we considered longitudinal study for our thesis. From this we shall able to avoid any snapshot bias that can be cause of economic downfall. To find a pattern of our study we have looked on data from 1st January 2005 to 31st December 2009.

3.9. Mathematical Model

Concern of our study is to explain the behavior of most liquid common stocks and possible arbitrage opportunity. To draw our conclusion, we are going to use a scientific model that has been partly used to explain the stock price behavior of Chinese market (Nikolaos et al, 2002) and of Dhaka Stock Exchange (Rahman & Lutfur, 2008). It was fully used on Athens Stock Exchange to draw the magnitude and direction of stock prices (Nikolaos & Travlos, 2006).

In general (no short selling, call option and put option strategy) before ex-dividend day an individual investor has two choices;

1. To keep the stock on the last cum day and enjoy dividend as earning,
2. Sell the stock on last cum day to enjoy the share value.

If an investor chooses to sell his/her share on last cum day, it implies that investor will receive only stock price and lose the claim on dividend. Under this condition investor does not need to wait for payment of dividend. In other way, if investor chooses to keep the
stock on last cum day (assumed that constant of other market or unsystematic influence and no effects of taxes) then the investor is entitled to receive the total wealth which is equal to stock price plus the dividend amount.

Let’s assume,

\[ P_0 \] = Stock price on ex-dividend day
\[ P_{-1} \] = Stock price on cum-dividend day
\[ D \] = Dividend amount

Mathematically the wealth of an investor on ex-dividend day will be equal to equation (1)

\[ P_{-1} = P_0 + D \] …………………………Equation (1)

Now if we deduct ‘\( P_0 \)’ from both side and divided the remaining value by dividend ‘\( D \)’ then we receive (equation 2),

\[ \frac{P_{-1} - P_0}{D} = \frac{P_0 + D - P_0}{D} = 1 \] …… Equation (2)

This ratio named as raw price ratio (RPR), explain the price changes from cum-dividend day to ex-dividend day. This ratio explains the changes based on the amount of dividend paid out. The criticism of this ratio is that raw price ratio is subject to market influence from cum-dividend day to ex-dividend day. To adjust the bias we computed market adjusted price ratio (MAPR). The value of MAPR is equal to discounted (by daily market return) ex-dividend day price that express in equation (3)

\[ \text{MAPR} = \frac{\left[ \frac{P_{-1} - P_0}{1 + R_m} \right]}{D} \] ……………Equation (3)

We also compute the Raw Price Drop Ratio (RPD):

\[ \text{RPD} = \frac{P_{-1} - P_0}{P_{-1}} \] ………………….. Equation (4)

And the Market-Adjusted Price Drop Ratio (MAPD):

\[ \text{MAPD} = \frac{\left[ \frac{P_{-1} - P_0}{1 + R_m} \right]}{P_{-1}} \] ………………Equation (5)

In addition, we compute the dividend yield, \( d \)

\[ d = \frac{D}{P_{-1}} \] ………………….. Equation (6)
The Raw ex-dividend day return, $R_0$

$$R_0 = \frac{P_0 - P_{-1} + D}{P_{-1}} \quad \text{Equation (7)}$$

And the market adjusted ex-dividend day abnormal return, $MAAR$

$$MAAR = R_0 - R_m \quad \text{Equation (8)}$$

Furthermore, we examine the behaviors of the trading volume by computing the relative trading volume, $RTV_t$ for day ‘t’ around the ex-dividend day ($t = -5$ to $+5$)

$$RTV_t = \frac{V_{it}}{AVTV_i} \quad \text{Equation (9)}$$

Where,

$V_{it}$ = the trading volume on day ‘t’ of stock ‘i’, and

$AVTV_i$ = the average trading volume of company ‘i’ estimated over the period of $-30$ to $-5$ and $+5$ days relative to the ex-dividend day.

### 3.9.1. Hypothesis development

Our analysis is based on six null-hypothesis which we developed from raw price ratio (RPR), market-adjusted price ratio (MAPR), raw price drop (RPD), market-adjusted price drop (MAPD), market adjusted abnormal return (MAAR) and Relative Trading Volume (RTV). Similar hypothesis also developed and justified by prior study (Rahman & Lutfur, 2008 on Dhaka Stock Exchange; Nikolaos & Travlos, 2006 on Athens Stock Exchange; Nikolaos et al. 2002 on Chinese Stock Exchange)

In our study, for statistical analysis we tested following null-hypothesis:

H1: the mean (median) of raw price ratio (RPR) = 1;
H2: the mean (median) of market-adjusted price ratio (MAPR) = 1;
H3: the mean (median) of raw price drop (RPD) = dividend yield;
H4: the mean (median) of market-adjusted price drop (MAPD) = dividend yield and,
H5: the mean (median) of market adjusted abnormal return (MAAR) = 0,
H6: for each day, around the ex-dividend day $RTV_t$ (Relative Trading Volume) = 1
Explanation of hypotheses:

Null-hypothesis H1 and H2 will be true if stock prices drop by the same amount as dividend paid out. Null-hypothesis H3 and H4 will be accepted if they are equal to dividend yield.

H5 explain the amount of adjusted abnormal return, expected to be 0 on and around ex-dividend day then the null-hypothesis will be accepted. H6 explain the related trading volume around the ex-dividend day. It would be accepted if the observed value is equal to 1.

3.9.2. Significance test

To find the differences of observed mean (of RPR, MAPR, RPD and MAPD) value from its corresponding theoretical mean value, we used t-test. Wilcoxon Signed Rank Test has been used to find the differences of observed median value form its theoretical value. T-test also used to determine the significance of MAAR and RTV.

\textbf{T-test:} The theory of significance in statistic is based on assumptions. Theory explains that the event that has chance to occur 5\% is statistically significant. In normal distribution the score stands outside of -1.96 and +1.96 (See figure 4).

![Normal distribution curve at 95% confidence level](image)

\textbf{Figure 4:} Normal distribution curve at 95\% confidence level

In general t-test is used to determine the significance of mean difference of two statistically independent variables. In our case, two statistically independent variables are theoretical mean and observed mean. The formula we used to find the mean differences is:

\begin{equation}
\text{t}_2 = \left( \frac{(\text{Mean}_1 - \text{Mean}_2)}{\text{Std} / \sqrt{n}} \right) \text{.........................Equation (10)}
\end{equation}

\text{t}_2 = \text{t-value of the t-test}
\text{Mean}_1 = \text{Mean of observation}
\textbf{Mean}2 = Mean of theoretical value  
\textbf{Std} = The Standard Deviation of observation  
\textbf{n} = Number of observations

**Wilcoxon Signed Rank Test:** Wilcoxon significance test perform for two matched pairs. It provides more accurate median difference of two variables. The power of Wilcoxon Signed Rank Test is approved and assured by Gaito (1980) and Nanna & Sawilowsky, (1998) to find the differences between two median values. The test classifies the data from smallest to largest and provides rank to absolute values. Afterward it sums the ranks to find the positive differences. To accept the null-hypothesis, the sum of positive differences must be equal to sum of the negative differences (Rees 1990).

The formula of Wilcoxon Signed Rank Test is

\[ Z = \frac{(T - E(T))}{\text{Std}(T)} \]  \hspace{1cm} \text{Equation (11)}

In which:

\[ E(T) = \frac{(n) \times (n - 1)}{4} \]  \hspace{1cm} \text{Equation (12)}

and

\[ \text{Std}(T) = \sqrt{\frac{(n) \times (n + 1) \times ((2 \times n) + 1)}{24}} \]  \hspace{1cm} \text{Equation (13)}

Where:
\begin{itemize}
  \item \textbf{Z} = The distribution of the random variable
  \item \textbf{T} = The Wilcoxon statistic
  \item \textbf{E}(T) = Expected value of the distribution
  \item \textbf{Std}(T) = The standard deviation of the distribution
\end{itemize}

**3.9.3. Sample data**

The data we collected to examine the stock prices behavior around ex-dividend day that covers time period from 2005 to 2009. We selected the companies from New-York Stock Exchange, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange. Our sample data must meet certain criteria which are:

- Companies must be listed under S&P 100 index, TOPIX 100 index, SSE 180 index and FTSE 100 index
- Companies must hold large capital among all the companies from the index.
- Selected companies should pay cash dividend.
Selected companies stock price must be available 35 days prior of ex-dividend day and 5 days after the ex-dividend day.

To conclude our empirical results we have studied all the observations (ex-dividend day) which are 550 observations from NYSE, 287 observations from Tokyo Stock Exchange, 148 observations from Shanghai Stock Exchange and 332 observations from London Stock Exchange. For some parts of our calculation we deducted some extreme values based on our justification which could provide unacceptable research outcome.

From Thomson DataStream we collected daily stock price, daily trading volume, cash dividend amount, ex-dividend date and annual market capital of each company. Finally we collected daily index price (S&P100, TOPIX100, SSE180, and FTSE100) from same DataStream. Jakob & Akhmedov (2006), M. Lasfer (2008) and M. A. Lasfer & Maria Zenonos, (2003) collected data using DataStream for their study.

### 3.10. Credibility Criteria

This standard explains the research reliability, validity and generalization to any form of research community. Based on scientific approach of the research, data collection sources, and other sources that used to conclude the study we explained reliability and validity of our study.

#### 3.10.1. Validity

A research can be valid if it fulfills the objective that it is intended to perform. This theory is supported by Easterby-Smith et al, (1991) who explained that validity purpose shall be fulfilled if an instrument measures what it suppose to measure. Another way to assess validity of a study is whether or not it gathers sufficient information in support of objective which it can fulfill through clearly explaining the purpose of the study.

Purpose of our study is to find market anomaly and arbitrage opportunity around ex-dividend day from most efficient stock markets. We found sufficient evidence in favor and against market anomaly (Gruber, 1970; Douglas & Hiemstra, 1993; Litzenberger & Ramaswamy, 1979; Poterba & Summers, 1984; Barclay, 1987; Chaplinsky & Seyhun, 1990; Blose & Martin, 1992; Lakonishok & Vermaelen, 1986; Booth & Johnston, 1984; Barclay, 1987; and Frank & Jagannathan, 1998) and arbitrage opportunity (Chaplinsky & Seyhun, 1990; Blose & Martin,1992; Lakonishok & Vermaelen, 1986; and Booth & Johnston,1984). The model we used also been used in prior research (Nikolaos &. Travlos, (2001), on Athens Stock market; and Nikolaos et al., (2006), on Chinese Stock Market).

#### 3.10.2. Reliability

We collected data from Thomson DataStream which is equally accepted to any means of research as reliable source of secondary data collection. We also used others means of
secondary information (scientific journal, text books, valid online sources and other means of sources) that is already published and accepted as reliable source in research community. To perform our mathematical model (for collected data) we used Microsoft Excel and SPSS software to eliminate human error in calculation. In sample estimation we took 30 sample sizes from each market which covers on an average 30% of total population.

Easterby-Smith et al (1991) explained that an experiment is reliable if it produce similar outcome in different occupations. Our study is consistent with prior study (Gruber, 1970; Douglas & Hiemstra, 1993; Litzenberger & Ramaswamy, 1979; Poterba & Summers, 1984; Barclay, 1987; Chaplinsky & Seyhun, 1990; Blose & Martin, 1992; Lakonishok & Vermaelen, 1986; Booth & Johnston, 1984; Barclay, 1987; Frank & Jagannathan, 1998, Chaplinsky & Seyhun, 1990; Blose & Martin, 1992; Lakonishok & Vermaelen, 1986; and Booth & Johnston, 1984) which assure the reliability of our study.

3.10.3. Generalization

General definition of generalization means how one scientific outcome can be adapted in another setting. In support of this definition, Ghauri & Gronhaug (2002) stated that how one findings of a study can be use in another process of study. The mathematical model that we used in our study is already generalized as these models has been used by Nikolaos et al. (2002) on Chinese market, Rahman &. Lutfur (2008) on Dhaka Stock Exchange and by Nikolaos & Travlos (2006) on Athens Stock exchange to draw the magnitude and direction of stock prices.


Our study can be used in further research in market efficiency determination, stock price behavior explanation as well as it could explain the behavior of other financial instruments like bond (after reasonable modification).
CHAPTER FOUR

4. EMPIRICAL FINDINGS AND ANALYSIS

The below table represents the theoretical (hypothesized value) mean and median value of Raw Price Ratio (RPR), Market Adjusted Price Ratio (MAPR), Raw price Drop ratio (RPD), Market Adjusted Price Drop ratio (MAPD), Market Adjusted Abnormal Return (MAAR) and Relative Trading Volume (RTV) (before and after ex-day) of New York Stock Exchange, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange. To document the market anomaly and arbitrage opportunity we used t-test for mean differences and Wilcoxon Rank Test for median differences at 95% confidence level. T-statistic also used to find the evidence of arbitrage opportunity (MAAR represent inefficiency and thus arbitrage opportunity) and short-term trading around ex-date.

Table 7: Theoretical values of RPR, MAPR, RPD, MAPD, MAAR, RTV (-1 to -5) and RTV (1 to 5) of NYSE, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange.

<table>
<thead>
<tr>
<th>Theoretical values</th>
<th>NYSE</th>
<th>Tokyo Stock Exchange</th>
<th>Shanghai Stock Exchange</th>
<th>London Stock Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>RPR</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MAPR</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>RPD</td>
<td>0.0069</td>
<td>0.0062</td>
<td>0.0084</td>
<td>0.0074</td>
</tr>
<tr>
<td>MAPD</td>
<td>0.0069</td>
<td>0.0062</td>
<td>0.0084</td>
<td>0.0074</td>
</tr>
<tr>
<td>MAAR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RTV (-1 to -5)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>RTV (1 to 5)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

4.1. New York Stock Exchange

Table 8: Observed mean, median, t-test and Wilcoxon Signed Rank Test values of RPR, MAPR, RPD and MAPD from NYSE.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>t-test</th>
<th>Median</th>
<th>Wilcoxon</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPR</td>
<td>1.0514</td>
<td>0.3204</td>
<td>0.9016</td>
<td>0.694</td>
<td>3.7349</td>
</tr>
<tr>
<td>MAPR</td>
<td>1.0073</td>
<td>0.0435</td>
<td>0.8788</td>
<td>0.407</td>
<td>3.9322</td>
</tr>
<tr>
<td>RPD</td>
<td>0.0073</td>
<td>0.4563</td>
<td>0.0065</td>
<td>0.642</td>
<td>0.0183</td>
</tr>
<tr>
<td>MAPD</td>
<td>0.0077</td>
<td>0.9564</td>
<td>0.0066</td>
<td>0.512</td>
<td>0.0185</td>
</tr>
<tr>
<td>Dividend yield</td>
<td>0.0069</td>
<td>0.0062</td>
<td></td>
<td></td>
<td>0.0040</td>
</tr>
</tbody>
</table>
Considering the sample from US market (see table 8), mean (median) of RPR with associated t-statistic (median) suggested that there is no significant difference from the corresponding theoretical value 1.00(1.00). The mean (median) of MAPR and related t-test (median) suggested insignificant difference from theoretical value 1.00 (1.00). The mean (median) of raw price drop ratio and market adjusted price drop ratio with associated t-value (median) imply that price of stock drop by the same amount as dividend paid out. This analysis also conclude that there is no significant (p-value: 0.362 see table 12 in appendix A) market adjusted abnormal return and thus no evidence of short-term trading (before ex-day p-value of RTV is 0.300 and afterward it is 0.197, see table 13 in appendix A) before and after ex-date.

This study is not consistent with Campbell & Beranek (1955), Elton & Gruber (1970) in general (they documented stock prices fall less than the dividend amount) but consistent with Barclay (1987). The evidence also not consistent with Fedenia & Grammatikos (1991), and Lamdin & Hiemstra (1993) whom implied that equal taxation on dividend and capital gain for individual investor reduce the price drop ratio but do not eliminate it. Similar outcome also observed by Cloyd, Li & Weaver (2006).

### 4.2. Tokyo Stock Exchange

Table 9: Observed mean, median, t-test and Wilcoxon Signed Rank test values of RPR, MAPR, RPD and MAPD from Tokyo Stock Exchange.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>t-test (mean)</th>
<th>Median</th>
<th>Wilcoxon (median)</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPR</td>
<td>0.3927</td>
<td>-3.0582</td>
<td>0.7044</td>
<td>0.0050</td>
<td>3.3465</td>
</tr>
<tr>
<td>MAPR</td>
<td>0.4147</td>
<td>-2.9328</td>
<td>0.7071</td>
<td>0.0070</td>
<td>3.3633</td>
</tr>
<tr>
<td>RPD</td>
<td>0.0054</td>
<td>-2.6566</td>
<td>0.0060</td>
<td>0.0560</td>
<td>0.0185</td>
</tr>
<tr>
<td>MAPD</td>
<td>0.0056</td>
<td>-2.4838</td>
<td>0.0061</td>
<td>0.0670</td>
<td>0.0188</td>
</tr>
<tr>
<td>Dividend yield</td>
<td>0.0084</td>
<td>&lt;0.0074</td>
<td>0.0074</td>
<td>0.0050</td>
<td></td>
</tr>
</tbody>
</table>

In case of Japan the mean (median) of RPR and MAPR (see table 9) with associated t-test (median) imply significant differences from their corresponding theoretical value 1.00(1.00). If we look at the RPR and MAPR that imply that stock prices drop less than the dividend amount on ex-date. In Japan tax rate (20%) on individual dividend is double than tax rate on capital gain (10%). This study is consistent with prior study (Elton & Gruber, 1970) which implies that when dividends contain higher taxed than capital gains, that is \(t_d > t_g\), then price drop ratio is less than one.

For RPD and MAPD the median (Wilcoxon) (0.0560 and 0.0670) values suggest that there are no significant differences (in border line of 0.05 level) from their theoretical value. However, the t-value (-2.6566 and -2.4838) rejected the null-hypothesis. RPD and MAPD less than the dividend yield which also support that the price drop less than the dividend amount.
We observed MAAR and found (p-value: 0.000, see table 14 in appendix A) significant differences from its theoretical value that signal for abnormal return around ex-dividend day. We also documented significant (p-value: 0.008, see table 15 in appendix A) evidence of short-term trading before ex-dividend day but insignificant (p-value: 0.270, see table 15 in appendix A) evidence of short-term trading after ex-dividend day.

Evidence from Tokyo Stock Exchange implies that most liquid common stock prices does not absorb the existing information and it is possible to make arbitrage profit by doing short-term trading before ex-date. This evidence is not consistent with prior study (Kato & Lowenstein, 1995) which implies that the stock prices behavior around ex-dividend day is not influenced by either dividend or tax effect. But this study is consistent with Elton & Gruber (1970), Douglas & Hiemstra (1993), Litzenberger & Ramaswamy (1979), Poterba & Summers, (1984), Barclay (1987), and Litzenberger & Ramaswamy (1979) on NYSE (recorded strong evidence for differential tax effect on dividend yield and capital gain). This also supported by other studies on US market by Chaplinsky & Seyhun (1990), and Blose & Martin (1992); on Canadian market by Booth & Johnston (1984) (imply that differential taxes creates ex-day trading). This study is not applicable for a country like Hong Kong (Frank & Jagannathan, 1998) where both dividend and capital gain is free of tax. Lakonishok & Vermaelen (1983), Canada; Lasfer (1995), U.K; Sarig & Tolkowsky (1997), Israel; Jacob & Akhmedov (2006), Denmark; and Hietala & Keloharju (1995) on some Finnish shares also consistent with the previous studies that represented under the tax rule price drop is less than the dividend amount.


**4.3. Shanghai Stock Exchange**

Table 10: Observed mean, median, t-test and Wilcoxon Signed Rank test values of RPR, MAPR, RPD and MAPD from Shanghai Stock Exchange.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>t-test (mean)</th>
<th>Median</th>
<th>Wilcoxon (median)</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPR</td>
<td>0.9117</td>
<td>-0.2538</td>
<td>0.9400</td>
<td>0.8580</td>
<td>4.1020</td>
</tr>
<tr>
<td>MAPR</td>
<td>0.9660</td>
<td>-0.0988</td>
<td>0.9249</td>
<td>0.9060</td>
<td>4.0599</td>
</tr>
<tr>
<td>RPD</td>
<td>0.0174</td>
<td>0.4375</td>
<td>0.0175</td>
<td>0.0390</td>
<td>0.0319</td>
</tr>
<tr>
<td>MAPD</td>
<td>0.0178</td>
<td>0.5576</td>
<td>0.0171</td>
<td>0.0360</td>
<td>0.0320</td>
</tr>
<tr>
<td>Dividend yield</td>
<td>0.0162</td>
<td>0.0123</td>
<td></td>
<td></td>
<td>0.0136</td>
</tr>
</tbody>
</table>

In Shanghai Stock Exchange, large cap. common stocks drop by the same amount as dividend on ex-dividend day which is suggested by the mean (median) values of RPR and MAPR (see table 10) with its associated t-values (median). Stock prices drop by the same amount as dividend which also explainable through RPD and MAPD ratios. The mean
(median) of RPD and MAPD related with t-values (median) imply that there are no significant differences from its theoretical values (dividend yield).

We have documented no significant (p-value: 0.632, see table 16 in appendix A) evidence for market adjusted abnormal return at 95% confidence level and no evidence of short-term trading (before ex-date p-value: 0.822 and after ex-date p-value: 0.493 of RTV suggested insignificant differences from its theoretical value, see table 17 in appendix A) around ex–date. This study is consistent with the evidence that we observed from NYSE.

This evidence is not consistent with Nikolaos et al. (2002) (on Chinese market) who suggested that, for taxable dividend stock prices fall more than the dividend amount.

### 4.4. London Stock Exchange

Table 11: Observed mean, median, t-test and Wilcoxon Signed Rank test values of RPR, MAPR, RPD and MAPD from London Stock Exchange.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>t-test (mean)</th>
<th>Median</th>
<th>Wilcoxon (median)</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPR</td>
<td>5.9173</td>
<td>3.3795</td>
<td>0.9938</td>
<td>0.1690</td>
<td>25.4532</td>
</tr>
<tr>
<td>MAPR</td>
<td>5.9512</td>
<td>3.4041</td>
<td>0.9879</td>
<td>0.1580</td>
<td>25.4432</td>
</tr>
<tr>
<td>RPD</td>
<td>0.0144</td>
<td>2.1230</td>
<td>0.0129</td>
<td>-3.6900</td>
<td>0.0199</td>
</tr>
<tr>
<td>MAPD</td>
<td>0.0146</td>
<td>2.2387</td>
<td>0.0130</td>
<td>0.0000</td>
<td>0.0201</td>
</tr>
<tr>
<td>Dividend yield</td>
<td>0.0121</td>
<td>0.0100</td>
<td></td>
<td></td>
<td>0.0119</td>
</tr>
</tbody>
</table>

The mean of RPR and MAPR (see table 11) associated with t-values implies that there are significant differences between theoretical value and observed value. However, Wilcoxon (median) test accepted the null-hypothesis. But higher standard deviation (RPR: 25.4532 & MAPR: 25.4432) supports for t-test. T-test also supported by higher differences of mean (RPR and MAPR) from its theoretical values which imply stock prices fall more than the dividend amount. We also can explain by mean (median) of RPD and MAPD. The mean (median) of RPD and MAPD with associated t-values (median) suggested that null-hypothesis is rejected. Comparing dividend yield with RPD and MAPD we can conclude that the stock prices drop more than the dividend amount.

Too high standard deviation and too high mean of RPR and MAPR associated with t-values suggested that the market experience higher volatility than the other markets. Further study is required to find the evidence against such volatility of the market.

We also documented significant evidence of MAAR (p-value: 0.003, see table 18 in appendix A). In short-term trading investigation, we documented significant evidence of short-term trading (P-value: 0.000, see table 19 in appendix A) before ex-dividend day but no evidence of short-term trading (p-value: 0.593, see table 19 in appendix A) after ex-day. In tax rate investigation, we observed that dividend has higher tax rate (10 to 40%
individual and 28% corporate) than the capital gain (18%). This evidence is not consistent with the evidence that we observed from Tokyo Stock Exchange.

Our study is consistent with M. A. Lasfer (1995) and M. Lasfer (2008) (study was performed on U.K. market and documented strong evidence of differential tax code on capital gain and dividend) in case of tax explanation but not consistent with short-term trading (according to him differentiation of tax code create significant positive return but not the short-term trading). This study also supported by M. A. Lasfer & Zenonos, (2003) on European firms and documented positive abnormal return from UK.


Possibility of having arbitrage opportunity around ex-date from London Stock Exchange and from Tokyo Stock Exchange is not consistent with prior studies by David & Jarrow (1988), W. Amadi (2005), Dai & Ryqvist (2009) and Barber & Odean, (2003). However, our study is consistent with the study by Rantapuska (2008). Others studies by Elton et al. (1984), Kalay (1984), and Lakonishok & Vermaelen (1986) also supported short-term trading but was against the possibility to make arbitrage profit.
CHAPTER FIVE

5. CONCLUSION

The purpose of this study is to examine the market anomaly and possible arbitrage opportunity from New York Stock Exchange, Tokyo Stock Exchange, Shanghai Stock Exchange and London Stock Exchange. Among all stock markets, in general these stock markets are considered as most efficient stock markets. We have studied most liquid common stocks which are included in S&P 100 index (listed in both NYSE and NASDAQ Stock Exchange), FTSE 100 (London Stock Exchange), SSE 180 (Shanghai Stock Exchange) and TOPIX 100 (Tokyo Stock Exchange). We chose these stock markets because each of the stock market is situated in different geographic locations where behavior of investors, institutional trading rules and tax code are different.

We concluded our study based on six null-hypotheses which are developed from raw price ratio, market adjusted price ratio, raw price drop ratio, market adjusted price drop ratio, market adjusted abnormal return and relative trading volume. To find the mean differences from theoretical values we used t-test and for median differences we used Wilcoxon Sign Rank Test. In the following table we present our hypothesis and evidence of acceptance of hypotheses from different markets.

Table 12: Evidence of acceptance or rejection of hypotheses in different markets.

<table>
<thead>
<tr>
<th></th>
<th>NYSE</th>
<th>Tokyo Stock Exchange</th>
<th>Shanghai Stock Exchange</th>
<th>London Stock Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1:</td>
<td>RPR = 1</td>
<td>Do support</td>
<td>Do not support</td>
<td>Do support</td>
</tr>
<tr>
<td>H2:</td>
<td>MAPR = 1</td>
<td>Do support</td>
<td>Do not support</td>
<td>Do support</td>
</tr>
<tr>
<td>H3:</td>
<td>RPD = d</td>
<td>Do support</td>
<td>Do not support</td>
<td>Do support</td>
</tr>
<tr>
<td>H4:</td>
<td>MAPD = d</td>
<td>Do support</td>
<td>Do not support</td>
<td>Do support</td>
</tr>
<tr>
<td>H5:</td>
<td>MAAR = 0</td>
<td>Do support</td>
<td>Do not support</td>
<td>Do support</td>
</tr>
<tr>
<td>H6:</td>
<td>RTVt = 1</td>
<td>Do support</td>
<td>Do not support</td>
<td>Do support</td>
</tr>
</tbody>
</table>

We have recorded mixed evidence from different markets. From London and Tokyo Stock Exchange we have documented strong evidence in favor of market anomaly and possible arbitrage opportunity. In contrast, in both market, stock price movements are different from each other on ex-date. In Tokyo Stock Exchange stock prices fall less than the dividend amount which is consistent with tax hypothesis (meaning higher taxation on dividend income than capital gain). However, stock prices drop more than the dividend amount in London Stock Exchange which is consistent with prior studies on UK market done by M. A. Lasfer (1995) and M. Lasfer (2008) but not consistent with the tax hypothesis. From both markets, we recorded strong evidence of short-term trading before ex-dividend day. In case of Tokyo Stock Exchange this result is not consistent with prior study on Japanese market by Kato & Lowenstein (1995). Higher volatility of stock price movement around ex-day and too high stock price fall than dividend amount in London Stock Exchange suggests for further study to investigate the causes behind such volatility.
We documented equal drop of stock price compared to dividend amount from New York Stock Exchange and from Shanghai Stock Exchange. In case of NYSE this evidence is consistent with prior study conducted by Barclay (1987) but not consistent with Fedenia & Grammatikos (1991), Lamdin & Hiemstra (1993) and Cloyd, Li & Weaver (2006). For Shanghai Stock Exchange, we documented strong evidence which is not consistent with Nikolaos et al. (2002) (for higher yield stocks). Nevertheless, we find no evidence of short-term trading and arbitrage opportunity around ex-dividend day from New-York and Shanghai Stock Exchange.

Overall summary of our study provides strong evidence in favor of market anomaly and arbitrage (by doing short term trading) opportunity in Tokyo Stock Exchange and in London Stock Exchange. We did not find any evidence of market anomaly and arbitrage opportunity (no evidence of short term trading) in NYSE and in Shanghai Stock Exchange.

5.1. Theoretical and practical contributions

In research community this paper shall explain the behavior of most liquid common stocks which are traded in NYSE, London Stock Exchange, Shanghai Stock Exchange and Tokyo Stock Exchange. In case of efficient market hypothesis, this paper making a comparison among four largest (based on market capital) stock markets. By explaining the stock market efficiency this studies making a link between the stock market efficiency of 20th century and the 21st century.

From investors view point, this paper explaining which market has more possibility to make arbitrage profit by doing short term trading. Before investment decision on each market, this paper creates awareness by explaining the efficiency level of each market. It also documented the volatility of each market which must be considered before any investment decision.

5.2. Further studies

Except M. A. Lasfer & Zenonos, (2003) who based their study on French, German, English and Italian stock markets, without this no study was done on different stocks markets at the same time. We conducted our study on four of the biggest domestic stock markets in the world and we specifically focused on most liquid stocks. However, further study can be performed to use different mathematical models in order to justify the theory of price drop compared to dividend amount, arbitrage opportunity and short-term trading activities. In London Stock Exchange we documented stock price falls more than the dividend amount which is not consistent with the tax hypothesis (meaning that the stock price drops less then the amount of the dividend). As contrary, evidence from Tokyo Stock Exchange is consistent with the tax hypothesis. Further studies require finding the actual causes behind such mixed evidence. We also found higher volatility of the stock prices which is not consistent with other markets. More in-depth study is needed to find the behavior of
investors (as average investors expectations determine the stock price) of such volatility in the market.

Further study can be done by a cross analysis on different stock markets and on total population of the market to find the actual outcome of the market. Further studies also can be performed to understand the exact causes that guide such price movements around ex-dividend day in different time horizons and in different geographic locations (under different trading rules, tax code and investors behavior). Indeed, making a qualitative research on Behavioral finance related to the behavior of the investors would be a good completion of our study. In fact, interviewing different types of investors like individual investors, institutional investors or mutual funds, etc. could add value to this research.
REFERENCES

LIST OF BOOKS


**LIST OF ARTICLES**


LIST OF ARTICLES (ELECTRONIC)


LIST OF WEBSITES


APPENDIX A

P-values of the t-test for the MAAR and RTVt

NYSE

Table 13: p-value of MAAR

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAR</td>
<td>.913</td>
<td>549</td>
<td>.362*</td>
<td>.0018504</td>
<td>-.002132 to .005833</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level

Table 14: p-value of RTVt

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTV (-1 to -5)</td>
<td>1.038</td>
<td>549</td>
<td>.300*</td>
<td>.0129350</td>
<td>-.011551 to .037421</td>
</tr>
<tr>
<td>RTV (1 to 5)</td>
<td>1.292</td>
<td>549</td>
<td>.197*</td>
<td>.0207250</td>
<td>-.010791 to .052241</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level

Tokyo Stock Exchange

Table 15: p-value of MAAR

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAR</td>
<td>7.692</td>
<td>286</td>
<td>.000*</td>
<td>.0074626</td>
<td>.005553 to .009372</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level
Table 16: p-value of RTVt

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTV (-1 to -5)</td>
<td>2.677</td>
<td>286</td>
<td>.008*</td>
<td>.0593221</td>
<td>.015701, .102943</td>
</tr>
<tr>
<td>RTV (1 to 5)</td>
<td>1.104</td>
<td>286</td>
<td>.270*</td>
<td>.0261864</td>
<td>-.020491, .072863</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level

Shanghai Stock Exchange

Table 17: p-value of MAAR

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAR</td>
<td>-.480</td>
<td>147</td>
<td>.632*</td>
<td>-.0010294</td>
<td>-.005268, .003209</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level

Table 18: p-value of RTVt

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTV (-1 to -5)</td>
<td>.226</td>
<td>147</td>
<td>.822*</td>
<td>.0098647</td>
<td>-.076532, .096261</td>
</tr>
<tr>
<td>RTV (1 to 5)</td>
<td>.687</td>
<td>147</td>
<td>.493*</td>
<td>.0384018</td>
<td>-.072044, .148848</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level

London Stock Exchange

Table 19: p-value of MAAR

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAR</td>
<td>-3.009</td>
<td>331</td>
<td>.003*</td>
<td>-.0024884</td>
<td>-.004115, -.000862</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level
Table 20: p-value of RTV

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTV (-1 to -5)</td>
<td>5.031</td>
<td>331</td>
<td>.000*</td>
<td>.1295384</td>
<td>[0.078891, 0.180186]</td>
</tr>
<tr>
<td>RTV (1 to 5)</td>
<td>0.535</td>
<td>331</td>
<td>.593*</td>
<td>0.0122007</td>
<td>[-0.032626, 0.057028]</td>
</tr>
</tbody>
</table>

*Statistically significant at the 0.05 level