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Testing market efficiency in an ex-dividend setting

-Could the market be efficient in the presence of inefficiency?

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Abstract

Market efficiency in an ex-dividend context is still a disputed matter in the world of finance. Even though numerous articles have been published in the area, with several different approaches, this anomaly is still contested. Overall, the consensus is that the stock price falls less than the dividend amount on ex-dividend day, meaning that there is an excess return to be made at this period. In the Swedish market, previous studies are also ambiguous, with results of both efficiency and inefficiency. Because of that fact, this thesis aims to determine the level of efficiency in a Swedish mid-cap, ex-dividend setting, by implementing the methodology of Elton & Gruber (1970). Studying mid-cap listed companies provides an additional approach, since earlier studies have investigated the large- and/or small-cap. Also, the Swedish market provides a useful setting, since there is equal taxation on capital gain and dividend and a large amount of companies that pays dividend to their shareholders. In addition, we explore if investors are compensated for the inefficiency through higher returns per unit of risk, by implementing the Sharpe ratio, Treynor's performance index and the mean-variance criterion. According to Fama & French (1993), the market is efficient if investors are compensated through higher returns for taking additional risk. Therefore, in order to determine if the market is in fact efficient, we include a variable for risk. The findings are that the market is inefficient for three of the five years studied. However, since the measure for risk, volatility, has an significant impact on the inefficiency, and the Sharpe- and Treynor's ratios are higher for the inefficient years than the non-inefficient, the market may very well be efficient after all.

Keywords: Market efficiency, inefficiency, volatility, risk-return, compensation, Sharpe ration, Treynor's performance index.

Table of contents

Tables

1. Introduction

The stock price movement of a dividend paying company, on ex-dividend day, should fully reflect the amount that is to be distributed to the shareholders. That is, the stock price should drop by the corresponding dividend amount. This is a result of the efficient market hypothesis, i.e., that an efficient market should always reflect the true value of available information (Fama, 1970). In a Miller & Modigliani (1961) world, where the market is frictionless, that may very well be true. In practice, however, this is not always the case (Blandon & Blasco, 2012). As early as in the 50's, Barker (1959) showed that stock prices tend to fall, on average, less than the dividend. Even though numerous articles have been published in the area, with several different approaches, this anomaly is still contested (Akhmedov & Jakob, 2010; Dimson & Mussavian, 1998; Dasilas, 2009).

According to Akhmedov & Jakob (2010), the stock price movement on ex-dividend day can be used to investigate the market efficiency, where a violation of theory represents a non-efficient market. Testing for market inefficiency constitutes searching for investments that can earn excess returns, for example, in an ex-dividend setting. In most part, previous research has concentrated on tax clienteles, trading volume, market microstructure and the firm size as possible explanations for the anomaly (Elton & Gruber, 1970).

As Schiller (1981) and LeRoy & Porter (1981) independently demonstrates, volatility can have a destabilizing effect on market efficiency. As volatility implies risk, and potentially can disrupt efficiency, investors need to be compensated for the ineffectiveness through higher returns. Methods that provide a degree of performance are the Sharpe ratio and Treynor's performance index, which measures the excess return per unit of risk. By utilizing these measures, one can get an idea of how investors are compensated with regards to volatility, or risk. Furthermore, Fama & French (1993) claim that the markets actually are efficient if investors are compensated through higher returns for investing in high risk assets. Subsequently, if there is evidence of an inefficient market that is attributable to risk, and investors are compensated for the inefficiency, markets may very well be efficient after all.

1.1 Thesis motivation and contribution

As mentioned above, extensive research has been conducted on ex-dividend price behavior, with different approaches. The overall results and explanations are very much ambiguous. Older studies, for example, Barker (1959), Elton & Gruber (1970) and Claesson (1987) have found that the stock price of a given security tends to fall less than the dividend, hence, there

is an excess return. In contrast, newer studies both find results of efficiency and inefficiency. Every so often, the pricing of assets lose their ground in reality. Historically, this has happened several times, and due to different reasons. One example is the financial crises of 2008, in which the US subprime mortgages played the leading role (Ivanshina & Scharfstein, 2010). At the time of such bubbles, it is hard to defend the fundamental values of assets, i.e. its efficiency. Although not obvious at the moment of such an event, this sort of enlightenment may only become obvious in retrospect (Bodie et al, 2009). Therefore, since financial markets are fast-moving environments, due to for example advancing technology and shifting market climate, we argue that market efficiency is still a topic of interest, especially at the time of an unstable market. Besides, with the expansion of the financial markets, there is an increasing level of information that is distributed to the general public, which accordingly should bring higher efficiency to the markets (Jones & Netter, 2013).

Measuring the degree of market efficiency is also important from an investment analysis point of view, since an essential way to obtain any above average returns, is to exploit any market anomalies. In that sense, it is important to know what to expect from any market when investing (Claesson, 1987; Stanley & Kinsman, 2009). Also, Yalcin (2010) claims that the market rules and dynamics will be questioned in the absence of market rationality, because efficiency is vital in order to organize the markets.

Following the methodology of Elton & Gruber (1970), with additions from Claesson (1987), this thesis will examine if Swedish mid-cap companies exhibit efficiency, in the sense that, the stock price movements are consistent with the dividend amount. The study is performed for the years 2008-2012. If some level of inefficiency is observed, we test if the inefficiency can be explained by the risk, measured as volatility. As previously mentioned, it is documented that volatility can have a destabilizing effect on market efficiency. These studies have mainly consisted of testing the market reaction to earnings announcement and short-and long term bond yields, and how the volatility evolves as an effect. While an ex-dividend setting is also a period of conveying news (Blau et al, 2009), volatility has not been used as an explanatory variable for testing market efficiency in an ex-dividend setting, and not on a Swedish market in particular.

Further, we explore if investors are compensated for the potential inefficiency through higher returns, measured as excess return per unit of risk. Since one of the fundamentals of finance is that there should be a positive risk-return relationship, (Hussman, 1998) and Fama & French (1993) argue that this very relationship makes the markets efficient, we aim to shed some light on, and contribute to, whether investors should expect a higher return per unit of

risk. Consequently, if this is true, the market may be efficient even if the initial findings point to inefficiency. Implementing the performance measures offers an additional aspect in relation to efficiency in an ex-dividend investigation.

1.1.1 Why study the Swedish mid-cap segment?

Studying mid-cap listed companies in particular provides a supplementary approach for testing market efficiency in Sweden, since the existing studies mainly have focused on the market as a whole, or the large-cap and small-cap specifically. There is a growing interest for mid-cap listed stocks, both from institutional- and private investors. This is a consequence of the fact that the mid-cap recently has outperformed the large-cap, with regards to return. Since mid-cap listed companies exhibit less transparency, due to less analyst coverage than the large-cap listed companies, there should be a larger focus on this segment to inform investors about the conditions. (Ridgeport, 2010; Bodie et al 2009; Barclays Compass, 2011) Lastly, the mid-cap should, intuitively, trade with a higher volatility, which should have a negative impact on market efficiency, provided that the risk is not compensated with higher returns (Comin & Philippon, 2006).

In terms of geography, it is beneficial to study the Swedish market for a number of reasons. For one, there is equal taxation on dividend and capital gain. This fact removes the taxation argument as a potential reason in terms of inefficiency. (Daunfeldt, 2002). Furthermore, a large amount of Swedish companies tends to pay dividends (Ewing & Magnusson, 2010). This ensures an adequate number of observations involved in the study, and thereby, increases the validity of the tests. Swedish companies only pay dividends once a year compared to the US, where it is common to pay several times a year (Dunfeldt, 2002). This means that the ex-dividend effect will be less comprehensible to investigate in a Swedish context (Alm & Arefjäll, 1999). Combining the reasons for investigating mid-cap listed companies in particular, and the Swedish market in general, the study should provide meaningful theoretical and practical contributions for investors and researchers.

1.2 Research questions

- Are Swedish mid-cap companies efficient, in the sense that, price movements on ex-dividend day are consistent with the dividend amount?
- Can the potential inefficiency be explained by risk?
- If evidence of an inefficient market is found, are investors compensated?

1.3 Purpose

This thesis aims to test the level of efficiency of Swedish mid-cap listed companies, through examining the stock price movement on ex-dividend day. Further, if the potential inefficiency can be explained by risk, the objective is to investigate whether investors are compensated through higher returns per unit of risk, thereby possibly making the market efficient.

1.4 Thesis structure

The thesis is structured as follows. The next section provides an overview of previous research in the field of market efficiency and ex-dividend. Based on the theory from previous research, the third chapter states the hypotheses. The fourth chapter describes how the study has been conducted. The remaining parts contain the results of the tested hypotheses and the analysis. Lastly, the conclusion is stated.

- *Chapter 2* - Literature review and theoretical framework
- *Chapter 3* – The hypotheses are stated
- *Chapter 4* – Methodology of the study
- *Chapter 5* – Results of the study
- *Chapter 6* – Analysis of the results
- *Chapter 7* – Conclusions and suggestions for further research

2. Theoretical framework and literature review

2.1 Review of previous studies testing the EMH in an ex-dividend context

In theory, the efficient market hypothesis (EMH) states that the rational price of a security should fully reflect all available information on the market. The hypothesis is one of the most central theories in the subject of finance and has been greatly debated during the last decades (Ogden et al, 2002).

Adjacent to the Swedish market, Claesson (1987) investigated the efficiency of the then upward trending Stockholm Stock Exchange and found that the Swedish stock market in the 1980's is not completely efficient. This is similar to the result from the US stock market during the same period. As a result, the author point out that it could be misleading to investors and have a negative impact for the entire capital market, since the market does not effectively allocate new capital (Claesson, 1987). Market efficiency is essential to ensure that the capital is allocated to the highest-valued projects, which is only possible if the market is efficiently priced (Hameed & Ashraf, 2006).

Previous studies regarding the subject of market efficiency in an ex-dividend context has generally focused on these following arguments as explanation for the market inefficiency.

2.1.1 The taxation argument

In their groundbreaking article, Elton & Gruber (1970)[1] elaborated a widely used method for testing market efficiency of the US market. They based their study on the fundamentals that an investors should be indifferent between selling a security on the pre-dividend day, as appose to, owning it until the ex-dividend day. The reason being that the price drop should equal the dividend. Since the level of taxation can differ between capital gain and dividends, how the levels relate, govern how the stock price will evolve on ex-dividend day. Accordingly, the main conclusion in Elton & Gruber (1970) methodology is that the price drop on ex-dividend day does not necessarily have to correspond to the dividend, due to difference in taxation. This statement is founded in Miller & Modigliani's theory about dividend clientele, meaning that investors are attracted to companies that have a payout policy that suit their requirements, according to whether they prefer taxation on dividend or capital gain (Miller & Modigliani, 1961). The Elton & Gruber (1970) proposition was tested by

[1] The method is further described in section 4.3.1

Daunfeldt (2002) and De Ridder & Sörensson (1995), where they investigated if the Swedish tax reform in the early 90's had an impact on the ex-dividend price. The conclusion from their studies was that ex-dividend price did not correspond to the dividend amount and that the tax reform did not have a significant impact.

2.1.2 The short-term trading argument

In opposition to the taxation argument, Kalay (1982) examined the US stock market and proposed an alternative view to explain the inefficiency at the ex-dividend day. He instead argued the concept of short-term trading as a more appealing explanation. The meaning is that arbitrage traders eliminate any difference between the price drop and the dividend amount caused by taxation, leaving transaction costs as the lone explanation for the discrepancy. In line with Kalay (1982), Dasilas (2009) examined the Greek stock market and found support for the short-term trading argument. He also found evidence that the trading volume increased around the ex-dividend day, which is consistent with the hypothesis.

2.1.3 The volume argument

According to the EMH, rational investors only trade their securities when they need liquidity or to redesign their portfolios (Yalcin, 2010). However, it has been shown that a lacking volume has an impact on market efficiency. The basic argument is that constrained liquidity adds a transaction cost and that this cost makes the market inefficient, due to the fact that investors will demand a higher risk-adjusted return (Amihud & Mendelson, 1986). Studying the stock price behavior during the ex-dividend period in the Spanish market, Blandon & Blasco, (2012), found evidence of abnormally high trading volume. Conversely, it has also been showed that the most liquid securities are exhibiting the largest price anomalies (Tetlock, 2007).

2.1.4 The market microstructure argument

The market microstructure argument refers to the fact that the price of a stock moves in ticks. A tick is the minimum amount that the stock can move, in either direction. This reality means that the price may not be able to correspond to the dividend amount for technical reasons (Bali & Hite, 1998). As a consequence, Bali & Hite (1998) claimed that the closing price will equal the pre-dividend price less the dividend amount, but within a tick of the amount. Their study was conducted on the US market with data from 1962 to 1994. Previous studies testing

the market microstructure argument as the explanatory variable has generally found that the relationship is insignificant between the tick-size and the price-drop anomaly on ex-dividend day. However, these studies have been conducted in markets where there is taxation on dividend and capital gain. This makes it difficult to differentiate between what is explained by the taxation- and tick size argument (Al-Yahyaee, 2012). Interestingly, Frank and Jagannathan (1998) investigated the efficiency on the Hong Kong market, which does not have taxation on dividend and capital gain, between the years 1980-1993. Using what they called the "bid-ask bounce effect", which is a form of market microstructure argument, they found a connection between the inefficiency and the bid-ask bounce.

2.1.5 The firm size argument

It is a documented fact that smaller firms tend to outperform larger ones, over a long period of time (Banz, 1981). This is evident in a study that contained data between the years, 1927-2007, where the difference between the portfolio containing the largest firms, and the portfolio containing the smallest firms, were as much as 8,8% in return. The question becomes to what degree this represents an inefficient market. Smaller firms are generally riskier, but if adjusted for the risk using the Capital asset pricing model (CAPM), still, there seems to be a premium associated with smaller firms (Bodie et al, 2009).

2.1.6 Ex-dividend studies in present time

Recently performed studies regarding ex-dividend price behavior have generally focused on, and tested, the same arguments as the originators of the respective arguments. For example Isaksson & Islam (2013) researched four different markets, USA, UK, Japan and China, and found differing results as for the price evolvement. The NYC- and Shanghai stock exchanges did not yield any abnormal return on the ex-day, while the Tokyo and London equivalents gave a price drop less than the dividend amount and in London, greater than the dividend amount. Further, Okafor & Warsame (2012) investigated tax clientele effects on the Canadian market, during a time when taxes were reduced on dividends. The results were that the tax hypothesis was valid, and that there exists a relationship between taxation and ex-dividend price behavior.

2.2 Volatility and its impact on market efficiency

Volatility tests are responsible for one of the first documented anomalies in market efficiency models (Cochrane, 1991). According to Hameed and Ashraf (2006), volatility is defined as

the tendency for prices to fluctuate up and down, and is often interpreted as a measure for risk. High volatility, or an increase in volatility, can be attributed to new information being sent out to the market. This kind of volatility is not impeding on the market efficiency. However, if the volatility is high, or increasing, with no base in the fundamentals, then it could have a negative effect on the market efficiency. As Schiller (1981) reported, stock price volatility is generally too high to be justified by the new information of future dividends, which means that it has a negative impact on market efficiency. In contrast, Flavin (1983) argued that these findings are often overstated when performing volatility tests with small samples. Instead of rejecting market efficiency because of excess volatility, it can be the very sampling properties that make the tests biased. Still, the relationship between the economics and volatility and how they interact, is still somewhat of an unresolved issue. For smaller firms, less information is spread to the public, which is because larger institutions concentrate on larger firms as potential investment targets. The absence of information makes the companies not listed on the large-cap riskier (Arbel & Strebel, 1983).

The very notion of testing market efficiency, using volatility as a measure, has been under scrutiny. As Cochrane (1991) stated, many economists have in the past misinterpreted the volatility tests. To them, prices seem to fluctuate too much to be efficient, i.e. that the mere presence of volatility rejects market efficiency (Schiller, 1981). Nevertheless, the interpretation is not that volatility does not obstruct efficiency; rather, the explanation why it does is incorrect (Cochrane, 1991). Instead, volatility tests only test discount-rate models, which leave a residual, and this residual is unaccounted for. Cochrane (1991) listed a number of possible explanations for the residual, for example, “fads”; an irrational burst of optimism or pessimism in the markets. Moreover, noise trading is mentioned as trading without bases in the fundamentals.

2.3 Risk-return relationship

In the absence of market efficiency, it is important for investors to know the best alternative for risk-adjusted returns (Varamini & Kalash, 2008). This is because of one of the most fundamental premises of finance, the positive relationship between risk and expected return (Hussman, 1998). The intuition is that a higher exposure to risk should imply a higher expected return on the investment, as compensation, which is a basic conclusion of the CAPM (Bachrach & Galai, 1979). In CAPM, the non-diversifiable risk is the one that is compensated with higher expected returns, and the level of compensation relates to the individual aversion to risk. In addition, the lack of information available for smaller firms, along with lower stock

liquidity, makes the operation riskier, and increases the required return in order to invest (Arbel & Strebel, 1983; Amihud & Mendelson, 1986).

Although theoretically accepted, empirically, there is evidence that the relationship between risk and return is negative (Hussman, 1998). This conclusion is reinforced in Ang et al (2009), where the findings were that investors are not compensated with higher returns for exposing themselves to higher risk in the European and Asian regions. In contrast, Liang & Wei (2012) and Amihud & Mendelson (1986) found that investors actually are compensated.

Nonetheless, as previously mentioned, Fama & French (1993) argued that if investors are compensated for the risk associated with the asset, the market is efficient. Using their three-factor model, firms with high betas, i.e. risk, have higher average returns. Another interpretation was offered by Lakonishok, Shleifer & Vishny (1994), with the opposite opinion that this is evidence of an inefficient market. Their belief is that analysts infer good and bad news too far into the future, meaning that firms with a recent certain performance, will therefore be overpriced or underpriced, until it is detected and corrected. This argument is reinforced in a study by La Porta (1996), where it was found that firms with low expectations about future earnings perform better than firms with high expectations. This suggests that the perception seems to be overly pessimistic about companies with low growth prospects and the opposite for high growth companies.

2.3.1 Sharpe ratio

Extracted from the CAPM, the Sharpe ratio is one of the most influential models in assessing financial performance. The reason is that it produces a measure that captures the level of risk involved to make a profit. Consider two different portfolios with the same excess return, but with different volatility. According to the Sharpe ratio, the portfolio with the lowest volatility is displaying the greater performance. That is, the same profit is achieved, but one of the portfolios is taking a lower risk to achieve it. This makes the Sharpe ratio a very simple, but yet powerful, tool to analyze and evaluate performance. Empirically, the ratio is calculated as dividing the difference between the excess return of the asset by the assets standard deviation, or volatility. (Scholz & Wilkens, 2005)

2.3.1.1 Drawbacks of the Sharpe ratio

Although widely accepted and used, the Sharpe ratio has some drawbacks. For one, the method relies heavily on volatility as a risk measure, which can give very incorrect implications for non-normal returns. In addition, it only measures historical data, which does

not guarantee meaningful inferences for the future (Varamini & Kalash, 2008). Also, as Scholz and Wilkens (2005) showed, the Sharpe ratio is not capable of capturing the market climate and is not suitable as a performance measure when negative excess returns is included. As a consequence, Israelsen (2003) presented an augmented method that can accommodate both negative- and positive excess returns. The argument is that a negative excess return will be treated as a positive one, by adding an exponent that takes the absolute value of the excess return. Originally, the idea came to life after it was discovered that the Sharpe ratio will give wrong implications when comparing two assets with the same negative excess return, but with different volatilities. The asset with higher volatility will give a less negative, i.e., a better ratio, when instinctively this should not be the case. This augmentation means that two assets with both negative- and positive excess returns can be analyzed with the Sharpe ratio. (Israelsen, 2003)

2.3.2 Mean-variance criterion

Similar to the Sharpe ratio, the mean-variance criterion (MVC) is a model for ranking portfolios according to their means, or expected returns, and their respective variances. Hence, the investment with the higher expected return and the lowest variance is outperforming the portfolios with both lower expected returns and higher variance. Since variance is a measure for risk, it is obvious that investors aim to minimize the risk and maximize the return. (Batur & Choobineh, 2010) Being a very crude measure, the ranking is not possible if either of the two parameters is not fulfilled and other measures, for example stochastic dominance, could be utilized. In terms of reliability, the mean-variance criterion requires a normally distributed sample to produce dependable results. (Lean et al, 2010) Using the mean-variance methodology, Hameed & Ashraf (2006) studied the Pakistani stock market and if investors are rewarded for taking additional risk, with the outcome that the investors are not rewarded.

2.3.3 Treynor's performance index

Similar to the Sharpe ratio, the Treynor's performance index also measures the excess return per unit of risk, the only difference being that the risk is measured as beta, the systematic risk, instead of volatility. Sharpe (1966) and Reilly (1986) conducted studies to test the rank correlations between the two measures and found a correlation of 0,94 and 1, meaning that the

two methods should yield very similar results. As Shamsabadi et al (2012) disclosed, the overall results of the measures can depend on the sample size and market conditions.

2.4 Summary of literature review

To summarize, many studies have tested market efficiency in an ex-dividend setting with different orientations. Mainly, the arguments for the anomaly have consisted of different level of taxation on dividends and capital gain, market microstructure, short-term trading, the size of the firm and the trading volume. Another possible explanation is that volatility has a negative impact on market efficiency. Since volatility implies risk, investors should be compensated through higher returns. Methods that measures the excess return per unit of risk is the Sharpe ratio and the Treynor's performance index. The mean-variance criterion is a way of ranking portfolios/investments with regards to their return and risk, measured as variance. Also, Fama & French (1993) suggested that the market is efficient if investors are compensated for inefficiency that is attributable to risk. The following table summarizes some of the previous research conducted in the field of ex-dividend price behavior. The method of investigating the ex-dividend price evolvement is further described in section 4; however, the ratio between pre-dividend price and ex-dividend price is denoted π in this study.

Author	Year	Country	π	Argument
Barker	1959	USA	0,974	-
Elton & Gruber	1970	USA	0,78	Tax
Kalay	1982	USA	0,73-0,88	Short-term trading
Claesson	1987	Sweden	0,96	-
De Ridder & Sörensson	1995	Sweden	0,52	Tax
Frank & Jagannathan	1998	Hong Kong	0,43	Market microstructure
Bali & Hite	1998	USA	0,76-0,86	Tick size
Daunfeldt	2002	Sweden	0,48	Tax

Table 1: Summary of previous studies

3. Hypotheses

3.1 Hypothesis 1

Initially, a test for market efficiency is conducted through the following hypotheses, which in words can be defined as;

H_0: Mid-cap listed companies exhibit market efficiency in an ex-dividend setting.

H_1: Mid-cap companies do not exhibit market efficiency in an ex-dividend setting.

3.2 Hypothesis 2

The second hypothesis is concerning the explanation of the inefficiency;

H_0: There is no a relationship between inefficiency and volatility.

H_1: There is a relationship between inefficiency and volatility.

3.3 Hypothesis 3

The third hypothesis relates to the investigation whether investors are compensated for holding inefficient assets, through higher return per unit of risk;

H_0: Investors are not compensated for the inefficiency through higher return per unit of risk.

H_1: Investors are compensated for the inefficiency through higher return per unit of risk.

A further explanation of the implementation of the hypotheses is illustrated in chapter 4.3

4. Methodology

This section is used to explain the way the research has been conducted. The design and approach of the thesis is important to identify, and critically examine, in order to form the most suitable method of research (Saunders, 2009).

4.1 Method of choice

The thesis used a quantitative method. It took a deductive research approach, since hypotheses were developed and a predetermined framework of theory was used to test the market efficiency and the level of compensation to investors holding an inefficient asset (Saunders, 2009). Further, an exploratory- and explanatory philosophy was used, due to the fact that the thesis aimed to *explore* if the market is efficient, *explain* the inefficiency and *explore* if the investors are compensated. As an effect of this mix of philosophies, different approaches were used to answer the research questions stated in the introduction. All uses hypotheses, but the method to reach a conclusion about rejection or non-rejection, differed.

4.2 Population and time-horizon

The population in the study consisted of dividend-paying companies listed on the Swedish mid-cap. The study was conducted over the years of 2008-2012. The period was chosen since five years should provide a sufficient level of dividend payments and also because it was interesting to see how market efficiency behaves in a volatile market period. We also argue that it was more relevant to explore a more recent period, since previous studies generally have been conducted on earlier years. From the population, which consisted of 56 companies, the sample turned into companies paying dividends more than once over the investigated period. We claim that including companies that only paid dividends once would possibly bias the sample, since these observations may not be representative of the sample. Thus, the sample equaled 44 companies and the total observations were 195. As a consequence of the selection, any inferences drawn from the study are only attributable to mid-cap listed companies that distribute dividends to their shareholders, not the mid-cap segment as a whole. Although the sampling restricts the generalizability of all the companies listed on the mid-cap, including every dividend-paying company that pays dividend more than once should ensure higher reliability of the results.

4.3 Testing the hypotheses

The first and second hypotheses were conducted via significance tests, a credibility assessment. The test provides a p-value, a sort of guidance, whether to reject or not reject the null hypothesis. The value represents a level where the critical value and the test statistic intervene, which eludes an arbitrarily set significance level, α. Nonetheless, the researcher needs to determine at what level to reject or not reject the hypothesis, meaning that an indirect significance level is set at the researcher's discretion (Brooks, 2008). This study rejected the null hypothesis if the p-value was less than 0, 05.

4.3.1 Hypothesis 1

According to Elton & Gruber (1970) hypothesis, the price ratio (π), should be equal to one if the market is efficient. The ratio (π) is calculated by taking the difference between P_{cum} and P_{ex}, divided by the dividend. Using Elton & Gruber (1970)[2] methodology of testing ex-dividend price behavior, our first hypothesis was implemented with the following equations;

$$\pi = \frac{P_{cum} - P_{ex}}{D} = 1 \qquad \textit{(efficient)}$$

$$\pi = \frac{P_{cum} - P_{ex}}{D} \neq 1 \qquad \textit{(inefficient)} \tag{1}$$

Where;

P_{cum} = Pre dividend stock price

P_{ex} = Ex-dividend stock price

D = Dividend.

π = Price ratio

Next, the ex-dividend price has to be adjusted for the overall market return, to control for any market bias (Claesson, 1987). In detail, due to the fact that the market influences the individual company's price, that effect had to be excluded. The adjustment was made with the mid-cap index, since it is the most related to the mid-cap listed companies. If another index had been used, different results may have been received. Nevertheless, it would most likely

[2] Elton & Gruber (1970) included an adjustment for taxes, which is not incorporated in this thesis.

not have been a significant deviation and the result should not have been fully representative of the mid-cap.

The adjustment was computed in the following manner;

$$P_{adjusted} = \frac{P_{ex}}{(1+(\beta * Index_{Mid-cap}))} \quad (2)$$

Where;

β = beta of the company

$Index_{Mid\text{-}cap}$ = Swedish mid-cap index.

Finally, the hypothesis is tested with;

$$\pi = \frac{P_{cum} - P_{adjusted}}{D} = 1$$

$$\pi = \frac{P_{cum} - P_{adjusted}}{D} \neq 1 \quad (3)$$

In a second step, the excess return was calculated around the ex-day, to see if there was any possibility of a short-term profit. This was done based on the methodology from Claesson (1987),

$$\frac{P_{adjusted+D}}{P_{cum}} - 1 = \%\ excess\ return \quad (4)$$

4.3.1.1 Validity and reliability of the tests

In order to verify if the ratio differs from one, three different tests were performed; two parametric t-tests and a non-parametric. In the first one, outliers were included, which resulted in a somewhat non-normal distribution of the data. Second, the outliers were removed to acquire normal distribution. Since the outliers were few, and the tests gave the same result, we chose to proceed with the original sample. In order to control for the robustness of the result, a third test was added, the Wilcoxon test. The Wilcoxon is a non-parametric test, which is comparable to the t-test, but does not rely on a normal distribution to produce reliable results. Nonetheless, the Wilcoxon does not produce results at the same strength as a parametric test (Chen et al, 2002).

4.3.2 Hypothesis 2

For every inefficient year, the following regression aimed to determine the relationship between the dependent variable, π, and the explanatory variable, volatility. To safeguard from omitted variable bias, a number of control variables were included in the regression, which were held fixed for each of the five years. The variables were selected from previous research that used them as the explanatory variables in their respective studies. The multiple regression is explained in the sections below.

$$\pi = \beta_1 + \beta_2 volatility + \beta_3 volume + \beta_4 ticksize + \beta_5 firmsize + u_t$$

4.3.2.1 Dependent variable

As explained in the section of 4.3.1, π is the ratio of the sample for each year. To achieve a level of relationship, the explanatory- and control variables were tested on π for each of the inefficient years.

4.3.2.2 Explanatory variable

- *Volatility* – The volatility was calculated as the standard deviation of the sample for each of the years. We expected the volatility to have significance for two reasons. First, Schiller (1981) and LeRoy & Porter (1981) have concluded that volatility can have an impeding effect on market efficiency, by being larger than can be explained by new information being sent out to the market. Second, smaller firms tend to have less transparency, and less informational distribution. This should decrease the amount of volatility that can be explained by information for mid-cap listed companies, and subsequently increase the unexplained volatility. Regarding the sign, the expectancy was that an increase in volatility would mean an increase in inefficiency, i.e. a positive sign.

4.3.2.3 Control variables

- *Volume* - The volume was computed as the mean of the turnover of the shares for the whole period, for each company. Amihud & Mendelson (1986) argued that a low liquidity adds a transaction cost, which will lead investors to demand compensation through higher risk-adjusted returns. Since mid-cap listed companies should have a lower volume than the large-cap, we expected the volume variable to be significant and have a positive sign.

- *Tick size* - The tick size is the interval which the stock is traded between, depending on the stock price, for the whole period. Bali & Hite (1998) claimed that the ex-dividend price ratio will be within a tick of one, because of technical reasons. According to Al-Yahyaee (2012), the general consensus is that there is no relationship between tick size and ex-day anomalies. Since these studies are performed on markets with taxation on dividend and capital gain, just as in Sweden, we did not expect any significance.

- *Firm size* - The firm size was measured as the mean of the market capitalization for the whole period. The expectation of significance for the firm size variable had to do with if mid-cap companies can be deemed small or not. Banz (1981) claimed that, even after risk-adjustment, small firm tend to outperform larger ones, which is impeding on market efficiency. Since it was unclear if mid-cap listed companies can be thought as small, the expectation was inconclusive.

Variable	***Variable***	***Calculated as***	***Expectations***
π	*Dependent*	*Mean of sample*	
volatility	*Explanatory*	*Standard dev of sample*	+
volume	*Control*	*Mean of stock turnover*	+
tick size	*Control*	*Trading interval*	*insignificant*
firm size	*Control*	*Market cap*	*0*

Table 2: Summary of regression variables

4.3.2.4 Validity and reliability of the regression

- *Testing for normality*

  The data of the samples was tested for normality for each of the years. Since none of the residuals of the regressions exhibited normality, some actions were taken. Initially, the variables of volume and firm size were transformed taking the logarithms of the series. Still, the regression was non-normal. Next, dummy variables were added to remove outliers, with a differing quantity from year to year. Since adding dummies can be accompanied by less desirable properties, a comparison was made to ensure that the same conclusions could be drawn from both the non-normal- and normal samples.

- *Testing for heteroscedasticity*

  The White's test was implemented with the result of homoscedasticity, i.e. that the variance of the errors is constant, for each of the years.

- *Testing for autocorrelation*

  The Durbin-Watson statistic was close to 2 for each year, exhibiting no significant sign of error correlation.

- *Testing for multicollinearity*

  A correlation matrix of the explanatory- and control variables concluded that there was no sign of significant correlation between the variables. This was evident for every year in the study.

	StDev	*Volume*	*Ticksize*	*Firmsize*
StDev	*1*	*0,0739*	*0,0836*	*-0,0306*
Volume	*0,0244*	*1*	*-0,4067*	*0,1086*
Ticksize	*0,0836*	*-0,4067*	*1*	*0,228*
Firmsize	*-0,0306*	*0,1086*	*0,228*	*1*

Table 3: Correlation matrix of explanatory- and control variables (on average)

4.3.3 Hypothesis 3

In the third hypothesis we explored if investors are compensated for holding inefficient assets. Using the Sharpe ratio, Treynor's performance index and the mean-variance criterion, the ratio for inefficient years were compared to the ratio of the non-inefficient year. Combining the different measures ensures validity of the results and also serves as a robustness test, because of the fact that a certain result from the Sharpe ratio, should be confirmed by the Treynor's index. In order to see if investors are compensated for an inefficient market, a benchmark was set, which is the Sharpe-and Treynor's ratio for the non-inefficient year. A higher ratio for inefficient years is then interpreted as investor compensation.

The original Sharpe ratio is expressed the following way;

$$S_r = \frac{\mathrm{E(R)} - \mathrm{R_f}}{\sigma} \tag{5}$$

Since the original Sharpe ratio does not accommodate negative excess returns, the augmented version was used, derived by Israelsen (2003). An exponent to the denominator was added,

which takes the excess return divided by the absolute value of the excess return. This enables the Sharpe ratio to account for negative returns.

$$S_r = \frac{\mathrm{E(R)} - \mathrm{R_f}}{\left(\frac{E(R)-R_f}{\sigma^{ABS\left(E(R)-R_f\right)}}\right)} \tag{6}$$

The Treynor's performance index is;

$$T_r = \frac{\mathrm{E(R)} - \mathrm{R_f}}{\beta} \tag{7}$$

For the equations;

- $E[R]$ = average yearly return for the stocks
- R_f = 10 year Swedish government bond (risk free rate)
- σ = standard deviation of the sample
- β = average beta of the sample

4.4 Validity and reliability of the study

In terms of reliability, it is difficult to tell if the results of this study would hold in a different time-setting, with different conditions. Nonetheless, extensive effort has been done to ensure that similar results would be found if others would perform the same study. As previously stated, any conclusions from the study are only attributable to companies listed on the Swedish mid-cap segment that pays dividend more than once. As a result, it would be wise to exercise caution regarding transferring any inferences onto the large- or small cap or markets in other countries. (Saunders, 2009)

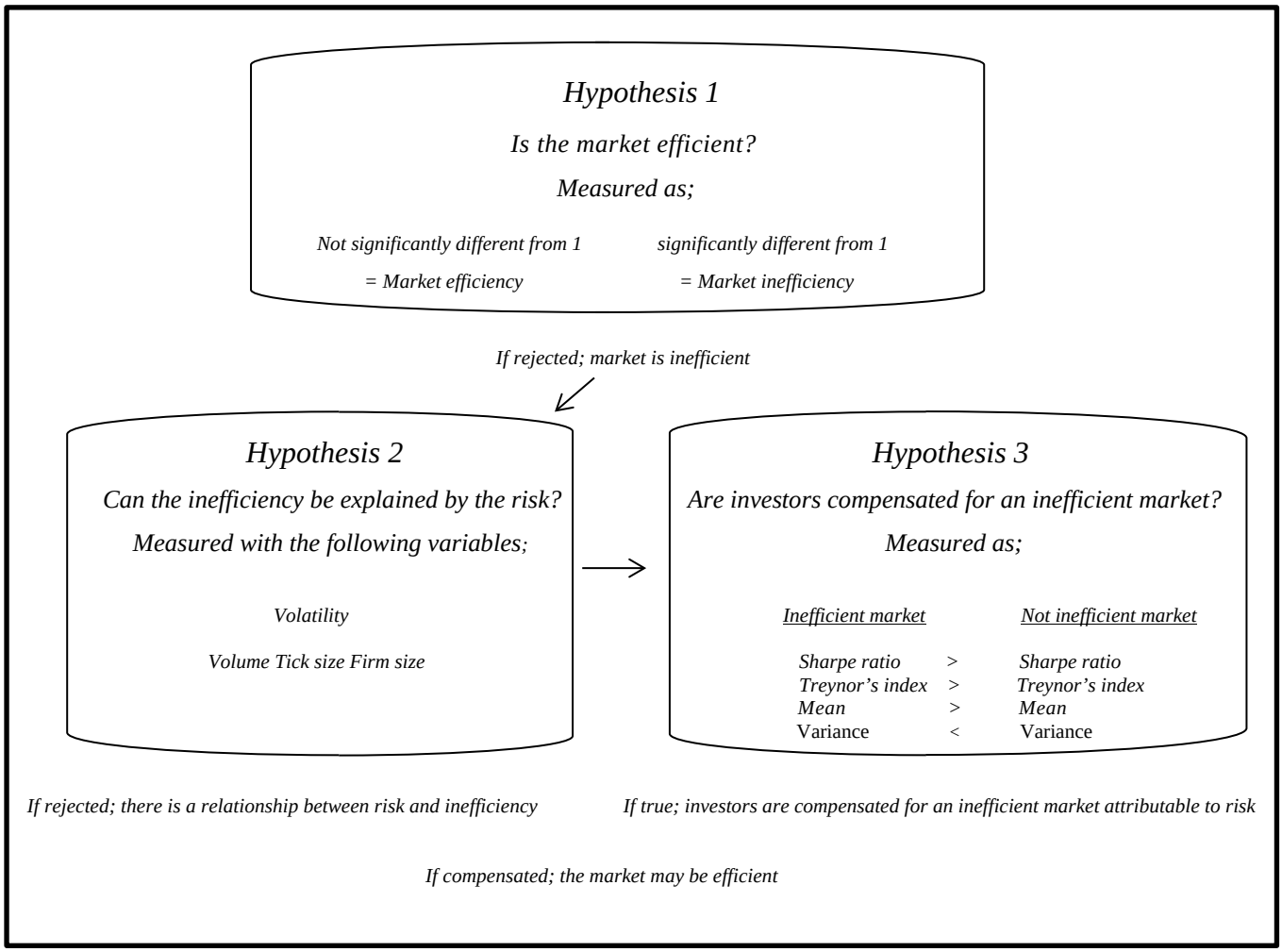
The data included in the study was gathered and analyzed through Datastream, Eviews, Excel and SPSS, which are commonly used programs for data processing and should guarantee a high reliability and validity of the data. In terms of selecting the literature, there was a lot of theoretical findings and methodology available to choose from. Since it is not effective to retell every study, we argue that the ones included are the most prominent in the field. The selection was mainly done according to the level of references included in similar studies. Besides, some previous articles are considered to be the foundation in the segment of market efficiency in an ex-dividend setting, which has led to many other authors building their studies on that methodology. Overall, the criteria were that the theories included in this

thesis should be relevant to the different scopes of the study, and have high validity and reliability.

4.5 Operationalization of the variables

To summarize, the hypotheses represent a premonition about how different variables should relate to one another, according to what previous research have discovered. How these variables are implemented and measured in this study, have been described in the respective sections, as well as, depicted in the following table.

Table 4: Operationalization of the variables



5. Results

5.1 Hypothesis 1

In the initial hypothesis, the goal was to investigate whether efficiency could be detected for the mid-cap segment, or not. The following results were obtained for each year 2008-2012.

Year	***N***	***π***	***%***	***T-test***	***Wilcoxon***	***H_0***
2008	*37*	*0,483*	*3,045*	*<0,01*	*<0,01*	*Rejected(Inefficient)*
2009	*35*	*0,746*	*3,046*	*0,323*	*0,077*	*Not rejected(Not inefficient)*
2010	*38*	*0,400*	*1,718*	*0,086*	*0,016*	*Inconclusive*
2011	*43*	*0,442*	*1,891*	*<0,01*	*<0,01*	*Rejected(Inefficient)*
2012	*42*	*0,663*	*1,511*	*0,022*	*<0,01*	*Rejected(Inefficient)*
2008-2012	*195*	*0,542*	*2,242*	*<0,01*	*<0,01*	*Rejected(Inefficient)*

Table 5: Result of hypothesis 1

As can be seen from the table, the market is both non-inefficient and inefficient during the period 2008-2012. A ratio that is less than one can be interpreted as an opportunity to earn an excess return. The table suggests that an investor, on average, can expect to make a positive return at the ex-dividend period, if these findings can be extrapolated into the future. For example, the ratio for 2008 is 0,483, which could be translated to a profit of 3,045%. A similar result is shown for the other years. Overall, for the period 2008-2012, π is 0,542, which gave an opportunity of a 2,242% excess return.

For the years 2008, 2011 and 2012 we reject the null that the market is efficient. In contrast, the null is not rejected for 2009, and is thus not inefficient. The p-value from the t-test for 2010 is inconclusive, in the sense that, the t-test gives support for the null, and the non-parametric approach rejects it. Overall for 2008-2012, we reject the null hypothesis of the market exhibiting market efficiency.

5.2 Hypothesis 2

The following is the result of the regression run in order to obtain a level of relation between inefficiency and risk, measured as volatility. Market inefficiency was found for three years, 2008, 2011 and 2012. The explanatory- and control variables stated below, were tested on the dependent variable, π.

2008

Variable	*Sign*	*T-stat*	*P-value*
St deviation	+	*3,16*	*<0,01*
Volume	+	*0,142*	*0,888*
Tick size	+	*0,383*	*0,704*
Firm size	+	*0,334*	*0,740*

2011

Variable	*Sign*	*T-stat*	*P-value*
St deviation	*(-)*	*-7,870*	*<0,01*
Volume	+	*0,270*	*0,787*
Tick size	+	*1,255*	*0,217*
Firm size	+	*0,730*	*0,469*

2012

Variable	*Sign*	*T-stat*	*P-value*
St deviation	+	*9,787*	*<0,01*
Volume	+	*1,208*	*0,235*
Tick size	+	*1,061*	*0,296*
Firm size	+	*1,955*	*0,0593*

Year	*2008*	*2011*	*2012*
N	*37*	*43*	*42*
R^2	*0,286*	*0,677*	*0,871*
Adj R^2	*0,197*	*0,624*	*0,834*

Table 6: Result of hypothesis 2

The tables show the different t-statistics and p-values of the explanatory variables for the years of market inefficiency. Standard deviation, the measure for volatility, is as expected rejected for every of the three years, meaning that there is a relationship between inefficiency and volatility. Since the coefficient is positive, an upward change in volatility would be accompanied by an upward change in π, expect for the 2011, where the opposite is true. As disclosed in the appendix 9.4, the only year that market inefficiency could not be established, 2009, the volatility did not have any significance.

The control variables, which were held fixed in the regressions, do not indicate explanatory power. This is somewhat consistent with the expectations about how the variables would relate to the dependent variable. For the firm size variable, the beforehand expectation

was deemed inconclusive. Although also insignificant for the three years, there is almost a relationship for the year of 2012. The R^2, the measure for how well the variables fit in the regression, is significantly higher for the year 2012 than the other years. This is probably due to the fact that the number of dummy variables was the highest at this year.

5.3 Hypothesis 3

Finally, the Sharpe ratio and Treynor's performance index was computed in order to establish if the ratios is higher for inefficient years, 2008, 2011 and 2012, than for the efficient one, 2009. Also, the mean-variance criterion adds a complementary measure for how to rank the performances of the different years. The result being;

Year	*Sharpe ratio*	*Treynor's index*	*Market efficiency*	*Mean*	*Variance*	*Ranking*
2008	*0,595*	*0,953*	*No*	*-55%*	*25%*	*5*
2009	*0,550*	*0,899*	*Not inefficient*	*73%*	*18%*	*Inconclusive*
2010	*0,661*	*0,971*	*Inconclusive*	*34%*	*7%*	*Inconclusive*
2011	*0,807*	*0,993*	*No*	*-18%*	*12%*	*Inconclusive*
2012	*0,776*	*1,000*	*No*	*15%*	*2%*	*Inconclusive*

Table 7: Result of hypothesis 3

The only year of the study that did not show market inefficiency was the year of 2009, which makes 0,550 the benchmark value for the Sharpe ratio and 0,899 for the Treynor's performance index. As represented in the table, the inefficient years outperforms the not inefficient one for both the performance measures. In terms of the mean-variance criterion, as expected, the ranking of the years, according to their respective mean returns and variance, is inconclusive. It can be determined that 2008 is the worst, due to the lowest (negative) return and highest variance. For the remaining years, though, a ranking is not possible. For example, the highest mean of return, 2009, also has the highest variance. The year with the lowest variance, 2012, does not exhibit the highest return.

6. Analysis

6.1 Hypothesis 1

The purpose with the first hypothesis was to explore if companies listed on the mid-cap exhibit efficiency or not. As showed in the previous section, the result indicated an inefficient market for 2008, 2011 and 2012, but yielded insignificance for 2009 and 2010. In relation to other studies in the ex-dividend literature, the results are very similar. Interestingly, it clearly differs from Claesson (1987), who found a price ratio of 0,96, which is indicative of an almost effective market. One explanation for the discrepancy is that this thesis only studies one segment of the Nasdaq OMX, the mid-cap, and Claesson the whole market. Another potential difference could be the market climates during the time of the studies. At the time of Claesson's research, it was a booming market. Conversely, this study is conducted during a market climate that can be characterized as volatile, with both bearish and bullish features.

Moreover, De Ridder & Sörensson (1995) and Daunfeldt (2002), also explored the Swedish market, with a ratio of 0,48 and 0,52, which is a very similar outcome to this study. Both these studies mainly explored if the tax reform in the 90's had an impact on the ex-dividend price behavior. Since the result of our study, De Ridder & Sörensson and Daunfeldt differs greatly from Claesson`s, one could argue that the reform could have had an effect on the ex-dividend ratio. Nevertheless, as mentioned earlier, the authors did not find any evidence that the reform had an impact.

Compared to international studies, Elton & Gruber (1970), Kalay (1982) and Barker (1959) studied the US market and found that the ratio was significantly higher than ours. Since these findings are old, and took place on a different market, it may not be a surprise that the result differs. The US market also has different taxes on dividends and capital gain, which could be the reason for the deviation. Furthermore, Frank and Jagannathan (1998) examined the Hong Kong market, and found a more comparable result to ours. As both Sweden and Hong Kong have the same level of taxation on both dividends and capital gain, there could to be a connection between the value of ratio and taxation.

In practice, the result of our study, and the majority of similar studies, show that you can make short term profit on the mid-cap market, since, on average, there has been an excess return at the ex-dividend period. Since these studies are old, it is interesting to see that newer studies in the field, for example, Isaksson & Islam (2013) and Okafor & Wersame (2012) found similar results.

6.2 Hypothesis 2

6.2.1 The explanatory variable

The purpose with the second hypothesis was to explore if inefficiency can be explained by volatility. The results indicated that there is a positive relationship between an inefficient market and the level of risk involved, at least for the risk measured as volatility. This result is not surprising; since Schiller (1991) and LeRoy & Porter (1981) documented that volatility can have an impeding effect on market efficiency. However, it is also disclosed that volatility only has an impeding effect if it is not based in the new information that is sent out to the market. It is a fact that at the ex-dividend period a lot of new information is distributed to the markets, making it very difficult to determine if there is "excess" volatility, with no base in the fundamentals, or not. According to Schiller (1981), though, the volatility is too high to be explained by the information about future dividends. This is potentially connected to Arbel & Strebel's (1983) argument, that smaller firms exhibit less informational transparency. Higher volatility, combined with less information spread to the public, makes the Schiller (1981) argument compelling. Since volatility is positively related to market inefficiency in this study, it may very well be the case that volatility is obstructing market efficiency for the mid-cap listed companies. Still, it could also be as Flavin (1983) argues, that the tests are biased because of the characteristics of the sample, namely that it is too small to accommodate such a test. Why volatility impedes market efficiency, and why the excess volatility exists, is debated. According to Cochrane (1991), volatility tests are only discount-rate models that leave a residual, which is the reason for market inefficiency. Still, the reason for the residual is also unclear. It could be the result of noise traders, or periods of optimism or pessimism, in the markets.

6.2.2 The control variables

The control variables included in the regression all yielded insignificant result. Although Bali & Hite (1998) claim that the ex-dividend price will close within a tick of the efficient price, Al-Yahyaee (2012) reports that previous studies have generally not been able to find any significance between the ex-day anomaly and the tick size. This is confirmed in our test.

Amihud & Mendelson (1986) concluded that low liquidity has a negative impact on market efficiency, because of the fact that investors will demand higher returns for the transaction cost. In contrast, Dasilas (2009) and Blandon & Blasco (2012) suggest that market volume increases around the ex-dividend period. Due to the fact that the volume variable did not have

significance in this study; it could very well be that the liquidity was sufficient and not a constraining factor.

Arguments' regarding the firm size is founded in the fact that smaller companies tend to earn abnormal returns. Since the firm size variable was insignificant in our study, this may not be applicable to mid-cap sized companies. Also, it may therefore be viewed as in line with Fama & French (1993) argument, that this is not an anomaly, since smaller firms are associated with higher risk, and should therefore have higher returns.

Though not included as a control variable, another possible explanation is the short-term trading argument. It could very much be that the discrepancy in the prices is the results of transaction costs that are left after the arbitrageurs have traded away the price difference. The explanation presented by Kalay (1982) rests on the idea that the price difference in the first place is a result of difference in taxation, which as stated, is not possible on a Swedish market.

6.3 Hypothesis 3

In hypothesis 3, the purpose was to examine if investors are compensated for potential inefficiency through a higher excess return per unit of risk. According to Fama & French (1993), this would make the market efficient if the inefficiency can be connected to risk. Although straight forward, Lakonishok et al (1994) and LaPorta (1996) critiques the argument, instead claiming that analysts extrapolate news too far into the future. Intuitively, if an investor takes on more risk he/she will demand an extra return for bearing that risk, which is the base in finance regarding risk-return. Previous empirical findings, with regards to risk-reward, have pointed to inconclusiveness when it comes to investor compensation. For example, Hussman (1998) and Hameed & Ashraf (2006) indicated that the risk-reward relationship could be negative, while Liang & Wei (2012) presented a positive result. In section 5.3 we presented results, which indicated that inefficiency is compensated in the form of a higher excess return per unit of risk for the mid-cap in general. This confirms the common perception about risk-taking and also indicates that the market may be efficient even if initial findings say otherwise. Whether the compensation is sufficient, and if investors are eligible for compensation or not, is another discussion. According to the CAPM, compensation is only applicable if the risk cannot be diversified. If the risk is systematic, it is impossible to diversify in order to eliminate the specific risk. Therefore, one could argue that, on an individual level, if an investor possesses a portfolio containing securities associated with high risk, the investor should not be compensated with higher returns, since diversification is a possibility. However, for the mid-cap on average, compensation is in

order, due to the fact that it could be viewed as a systematic risk. How high the Sharpe ratio and Treynor's index should be, is very much determined on an individual basis, since it has to do with the level of risk aversion. Depending on the aversion, an investor will determine the appropriate level of compensation in order to invest.

7. Conclusion

This thesis has tested the market efficiency in a Swedish mid-cap setting, by investigating the ex-dividend price behavior for the years 2008-2012. Further, we implemented measures for investigating the level of compensation to investors for an inefficient market. Risk, or volatility, was introduced as an explanatory variable.

The findings are that the market is inefficient for three of the five years studied, by exhibiting a price significantly less than one on ex-dividend day. These findings are consistent with the overall consensus of previous ex-dividend studies. However, since the testing in the second hypothesis pointed to a relationship between volatility and the inefficiency, and investor compensation could be established, the market could very well be efficient. As stated in the introduction, it is important for the financial markets to be efficient for a number of reasons. One such argument is that capital would be effectively allocated to the highest valued projects. Another argument is that efficiency represents equilibrium, where no one can earn excess returns, because of the fact that every individual is expected to have the same information at all time. It is imperative in this case to distinguish between excess- and higher returns. The market may be efficient, in the sense that, investors are compensated through higher returns for the risk-taking, or the inefficiency. This does not represent an excess return. Instead, an excess return would be a return greater than the average return others make from investing in a risky, inefficient asset, subsequently making the asset inefficient. It is important to note that the whole argument depends on that the cause of inefficiency can be connected to risk. If this was not the case, and there was an alternative explanation for the inefficiency, investors would not be eligible for compensation to the same extent. The absence of compensation would then leave the market inefficient.

Lately, there has been a growth in individuals' own money management through internet brokerage, instead of letting banks, or funds, handle it. This will probably mean an increase in placements outside of the large-cap segment. Consequently, for individual investors, this study could be of assistance for the strategy regarding portfolio management at the ex-dividend period. If history has any implications for the future, the plan should be to hold on to the stock and collect the dividend, since the price, on average, should not drop the full dividend amount. It could also serve as confirmation that the risk-return relationship seems to hold in a mid-cap setting. This has for long been theoretically accepted, but is perhaps empirically not as obvious in all contexts.

7.1 Suggestions for further research

This study has taken place during a turbulent period in time, where the financial markets experienced both great down- and upturns. We argue that it was interesting to see how the theories hold up in an extreme-, as well as, the most recent setting. Further research could constitute performing a similar study in a calmer market climate or/and in different market segment, for example the large-cap or small-cap. Although numerous studies have investigated the market efficiency similar to our first hypothesis, they have not researched the level of risk-compensation for investors. Since the large-cap is more transparent, it could therefore be of higher interest to study the small-cap.

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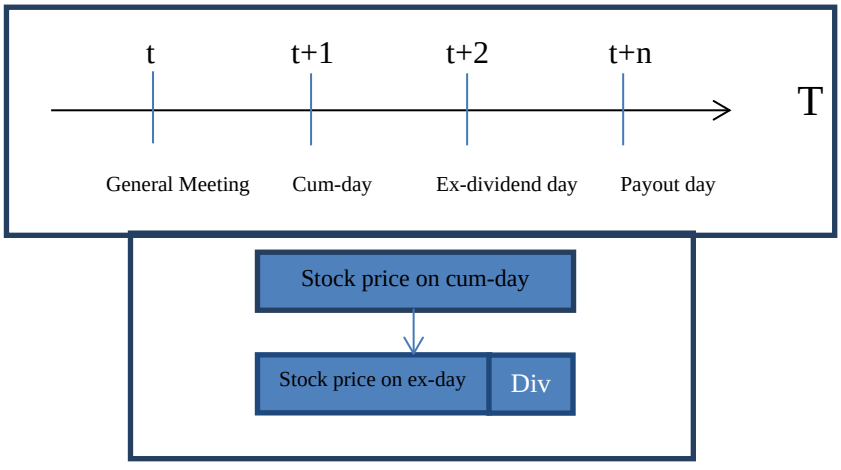
9. Appendix

9.1 Efficient market hypothesis

There are three different forms of market efficiency; weak, semi-strong and strong. The weak form tests the hypothesis when the information available is historical prices. This form is the one that has the most empirical support (Fama, 1970). The semi-strong form investigates if the market is efficient when all public information is reflected in prices, and they can be adjusted to new information on the market. The new information could be stock splits, annual earnings announcement or that the government just released new macroeconomic information. Finally, the market is a strongly efficient when both public and private information is reflected in the price. This means for example information held by insiders should not help investors identify potential mispriced stocks. Research has shown that both weak- and semi-strong form of efficiency has been found on the stock markets, while the strong form is absent (Hansson. 2005, Fama, 1970).

9.2 Sequence of events

The sequence of events regarding dividend payments and the stock price movements of a security is given different notations. The cum-day is the date before the ex-dividend day. At this date, the stock is traded at a higher price since the overall value of the company is higher before the dividend is distributed to the shareholders (Elton & Gruber, 1970, s.69). At the ex-dividend day, the day after the cum-day, the stock is traded without dividend rights and should consequently be traded at a lower price (Elton & Gruber, 1970, s.69). Later on, the firm pays out the actual dividend. The sequence can be illustrated with the following depiction.



9.3 T-tests

2008

	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
V8	-5,058	36	,000	-,5165518	-,723684	-,309420

2009

	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
V9	-1,004	34	,323	-,2537206	-,767467	,260025

2010

	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
V10	-1,767	37	,086	-,6000386	-1,288205	,088128

2011

	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
V11	-2,881	42	,006	-,5579761	-,948765	-,167187

2012

	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
V12	-2,380	41	,022	-,3372477	-,623464	-,051032

Wilcoxon test

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of 2009, equals 1,000	One-Sample Wilcoxon Signed Rank Test	,077	Retain the null hypothesis.
2	The median of 2010, equals 1,000	One-Sample Wilcoxon Signed Rank Test	,016	Reject the null hypothesis.
3	The median of 2011, equals 1,000	One-Sample Wilcoxon Signed Rank Test	,002	Reject the null hypothesis.
4	The median of 2012, equals 1,000	One-Sample Wilcoxon Signed Rank Test	,003	Reject the null hypothesis.
5	The median of 2008, equals 1,000	One-Sample Wilcoxon Signed Rank Test	,000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.

9.4 Regressions

2008

Dependent Variable: MEAN
Method: Least Squares

Sample: 1 37
Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.804348	2.210020	-0.363955	0.7183
STDEV	4.196651	1.327793	3.160622	0.0034
YVOLUME	0.010708	0.075340	0.142133	0.8879
TICKSIZE	0.214419	0.558888	0.383652	0.7038
YFIRMSIZE	0.050315	0.150424	0.334488	0.7402

R-squared	0.286720	Mean dependent var	0.500629
Adjusted R-squared	0.197560	S.D. dependent var	0.607466
S.E. of regression	0.544162	Akaike info criterion	1.745948
Sum squared resid	9.475590	Schwarz criterion	1.963640
Log likelihood	-27.30005	Hannan-Quinn criter.	1.822695
F-statistic	3.215793	Durbin-Watson stat	1.642993
Prob(F-statistic)	0.025083		

2009

Dependent Variable: MEAN
Method: Least Squares

Sample: 1 35
Included observations: 35
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.940938	5.452016	1.273096	0.2128
STDEV	2.298829	2.983894	0.770413	0.4471
YVOLUME	0.075263	0.161883	0.464922	0.6453
TICKSIZE	1.866513	1.556193	1.199409	0.2398
YFIRMSIZE	-0.499214	0.377228	-1.323375	0.1957

R-squared	0.182563	Mean dependent var	0.749595
Adjusted R-squared	0.073571	S.D. dependent var	1.498838
S.E. of regression	1.442650	Akaike info criterion	3.702404
Sum squared resid	62.43715	Schwarz criterion	3.924596
Log likelihood	-59.79206	Hannan-Quinn criter.	3.779105
F-statistic	1.675014	Durbin-Watson stat	2.121917
Prob(F-statistic)	0.181764		

2010

Dependent Variable: MEAN
Method: Least Squares

Sample: 1 38
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.733613	4.277654	-0.639045	0.5276
STDEV	-4.383102	1.206151	-3.633957	0.0010
YVOLUME	-0.050823	0.169654	-0.299565	0.7666
TICKSIZE	2.470395	1.338196	1.846064	0.0748
YFIRMSIZE	0.206395	0.298893	0.690532	0.4952
DUM18	5.239594	1.169772	4.479157	0.0001
DUM7	11.91903	1.697528	7.021406	0.0000
DUM28	-2.775250	1.503293	-1.846114	0.0748

R-squared	0.791706	Mean dependent var	0.399961
Adjusted R-squared	0.743104	S.D. dependent var	2.093653
S.E. of regression	1.061166	Akaike info criterion	3.141278
Sum squared resid	33.78220	Schwarz criterion	3.486032
Log likelihood	-51.68427	Hannan-Quinn criter.	3.263939
F-statistic	16.28960	Durbin-Watson stat	2.184141
Prob(F-statistic)	0.000000		

2011

Dependent Variable: MEAN
Method: Least Squares

Sample: 1 43
Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.624257	2.945149	-0.551502	0.5847
STDEV	-6.770815	0.860318	-7.870127	0.0000
YVOLUME	0.032111	0.118490	0.270997	0.7879
TICKSIZE	1.126280	0.897102	1.255464	0.2174
YFIRMSIZE	0.153599	0.210264	0.730505	0.4698
DUM26	2.151628	0.788747	2.727906	0.0098
DUM39	3.217782	0.802231	4.011041	0.0003

R-squared	0.677841	Mean dependent var	0.442416
Adjusted R-squared	0.624148	S.D. dependent var	1.259219
S.E. of regression	0.771986	Akaike info criterion	2.468201
Sum squared resid	21.45467	Schwarz criterion	2.754908
Log likelihood	-46.06631	Hannan-Quinn criter.	2.573929
F-statistic	12.62434	Durbin-Watson stat	1.938529
Prob(F-statistic)	0.000000		

2012

Dependent Variable: MEAN
Method: Least Squares

Sample: 1 42
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.996980	1.358546	-2.206020	0.0347
STDEV	7.252116	0.740989	9.787080	0.0000
YVOLUME	0.073320	0.060656	1.208787	0.2356
TICKSIZE	0.479413	0.451653	1.061464	0.2964
YFIRMSIZE	0.192944	0.098679	1.955257	0.0593
DUM11	-4.061954	0.404573	-10.04009	0.0000
DUM14	-2.124776	0.356165	-5.965710	0.0000
DUM27	-2.687946	0.380390	-7.066289	0.0000
DUM31	-1.476423	0.360735	-4.092817	0.0003
DUM34	-3.122780	0.382225	-8.169998	0.0000

R-squared	0.871211	Mean dependent var	0.648070
Adjusted R-squared	0.834989	S.D. dependent var	0.830857
S.E. of regression	0.337507	Akaike info criterion	0.869795
Sum squared resid	3.645149	Schwarz criterion	1.283526
Log likelihood	-8.265700	Hannan-Quinn criter.	1.021444
F-statistic	24.05205	Durbin-Watson stat	2.292995
Prob(F-statistic)	0.000000		

9.5 Overview of the sample and the means, π.

Company	**2008**	**2009**	**2010**	**2011**	**2012**
AarhusKarlshamn	1,16349	0,6875	1,42486	1,26639	1,78947
Addtech	0,4914	1,03129	1,53247	0,28182	0,70831
Avanza	0,99328	1,40073	-1,08044	1,1223	0,90034
B&B Tools	0,44472	-1,21971	2,23721	1,56897	0,53934
Beijer Alma	0,54631	1,611749	-0,35546	1,04378	1,57522
G&L Beijer	0,1452	0,1237	0,4197	0,3625	0,4929
Bilia	1,18893		0,02565	0,65897	1,08766
Biogaia		3,84928	7,90399	-5,48874	3,70563
Bure equity	-0,22585		-3,24831	0	0,15042
Byggmax				0,79753	0,51631
Claes Ohlson	0,53235	-0,39226	0,56495	1,29675	1,14694
Corem property		-0,01204	0,16906	-0,89842	-1,53005
Dios	0	0,813084	0,926858	0,192383	0,135555
Duni	0,1355	0,1623	-0,72	0,6252	1,0414
East Capital Exp				1,7847	0,2952
Fagerhult	0,41230329	1,445151	-1,67249	-0,60629	-0,75569
Fast Partner	0,3904	0,646	-0,602	0,4915	0,9296
Fenix Outdoor	0,833	0,0249	0,4764	0,7185	0,5744
Gunnebo	0,8802			0,3407	-0,296
Haldex	-0,006	-0,036		0,283	1,3261
Heba	-0,194		-0,591	1,1073	1,0807
Hexpol			-5,649	-1,929	-0,847
Indutrade	-1,5560102	1,381653	1,536002	1,663339	0,249158
Intrum justitia	0,5408	-0,019	1,0522	1,0398	0,4721
Jm	1,1437		2,2223	-0,118	0,5613
Kappahl	1,668	5,7959	0,4885		
Klövern	1,00971343	0,777282	1,144236	1,252148	0,906216
Kungsleden	1,02075	0,75108	1,05259	1,2715	0,68051
Lindab	0,93875	1,42551		-1,28805	-0,45207
Loomis		-0,93564	-0,01875	0,47493	1,04107
Mekonomen	0,86851	0,83849	0,98891	0,70553	0,31678
New Wave	0,75292	3,33333	0,57678	1,29209	1
Nolato	1,54355	1,25481	0,20677	1,07745	0,40786
Nordnet	0,43615	-0,71877	-3,90719	-1,26072	0,27207
Proffice			3,35997	0,10333	0,48223
Sagax	0,09985	0,03743		-0,06222	0,06552
Skistar	-0,06514	0,79081	1,79194	1,51316	1,12804
Sedol	0,318	-0,767	-0,707	0,2953	0,2767
Systemair	-0,112	-2,625	0,406	2,3619	1,5501
Sweco	-0,44369	0,55407	0,30233	0,84497	0,73499
Unibet	0,7937	2,6648	1,7628	1,1122	0,211
Wihlborgs	0,6959	0,6349	0,6729	0,3789	1,3411
ÅF	0,3086	-0,014	0,6928	0,696	1,4075
Öresund	0,83	0,9395	-0,188	0,6505	