Arbitrage opportunities on the OMXS

How to capitalize on the ex-dividend effect

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Investors are continuously looking to increase the return on their investments. In an ideal world investors want to increase their return and outperform the market. Theory states that it is impossible to do so without increasing your risk. Arbitrage is a concept where investors are able to generate risk-free returns exceeding the market. Dividend is a common tool for publicly listed firms when rewarding their shareholders. On ex-dividend day, the day after the dividend payout, the stock price should according to theory decrease in order for the valuation of the stock to be held constant. In our research we investigate if there are arbitrage opportunities in connection to the dividend payouts, namely the ex-dividend effect. We want to generalize our results across experimental settings, thus across different stock markets. As a basis for our research we picked the OMXS.

We base our research on three theoretical areas: the dividend irrelevancy theory, the efficient market hypothesis and the anchoring theory. The dividend irrelevancy relates to how the stock price ought to behave on ex-dividend day whereas the efficient market hypotheses states that prices on a market fully reflects all available information. Both theories concur that no arbitrage opportunities should be available on the financial market. The anchoring theory highlights the fact that investors formulate an anchor price for financial assets, for example stocks. In our research we aim to formulate a practical method on how to make abnormal returns on the ex dividend effect, based on the anchoring theory.

Our census sample consists of dividend-paying firms publicly registered on the OMXS, and consists of 694 observations taken from 2009 to 2012. The sample was picked on the basis of characteristics, for example that the firm has been registered for at least four years and paid dividend one time during the four years of investigation. In order to tests for arbitrage opportunities on ex-dividend day, we used a simple mathematical model measuring the deviation between the price drop cum-dividend day to ex-dividend day, and the dividend amount. We conclude that the price drop differs from the dividend amount, only accounting for a price drop of 0.73 of the dividend amount. Thus, the price drop for each dividend unit is 0.73, in relation to a perfectly efficient market where there should be no difference; hence the price drop would be equal to the dividend amount, 1.

Research on the ex-dividend effect is a thoroughly investigated area, where the first research was presented in 1955. Previous research all attempts to explain why there are market anomalies, but none examine how one can capitalize on the findings. In our research we examine if it is possible to make abnormal returns based on a segmenting of stocks, depending on their price volatility. This research is thereby first in examining how to capitalize on found arbitrage opportunities.

*Keywords*: stock price behavior, dividends, ex-dividend effect, dividend irrelevancy, OMXS, cum-dividend day, ex-dividend day, anchoring, efficient market hypothesis, arbitrage, abnormal returns, market anomalies.
Acknowledgements

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>1. INTRODUCTION</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Theoretical point of departure</td>
<td>2</td>
</tr>
<tr>
<td>1.2 Research gap</td>
<td>4</td>
</tr>
<tr>
<td>1.3 Purpose, Stakeholders and Expectations</td>
<td>6</td>
</tr>
<tr>
<td>1.4 Limitations</td>
<td>7</td>
</tr>
<tr>
<td>1.5 Definitions</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. THEORETICAL FRAMEWORK</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Efficient Market Hypothesis</td>
<td>9</td>
</tr>
<tr>
<td>2.1.1 EMH on the OMXS</td>
<td>11</td>
</tr>
<tr>
<td>2.1.2 Arbitrage</td>
<td>12</td>
</tr>
<tr>
<td>2.2 Anchoring</td>
<td>13</td>
</tr>
<tr>
<td>2.3 Dividend irrelevancy</td>
<td>15</td>
</tr>
<tr>
<td>2.3.1 Empirical evidence of the ex-dividend effect</td>
<td>18</td>
</tr>
<tr>
<td>2.3.2 Swedish evidence of the ex-dividend effect</td>
<td>21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. THEORETICAL METHODOLOGY</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Methodology within finance</td>
<td>23</td>
</tr>
<tr>
<td>3.2 Philosophy</td>
<td>24</td>
</tr>
<tr>
<td>3.3 Epistemology, Ontology and Human nature</td>
<td>26</td>
</tr>
<tr>
<td>3.4 Pre-understandings</td>
<td>30</td>
</tr>
<tr>
<td>3.5 Evaluation of sources</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. PRACTICAL APPROACH</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Census sampling</td>
<td>32</td>
</tr>
<tr>
<td>4.2 Time-period</td>
<td>33</td>
</tr>
<tr>
<td>4.3 Data collection</td>
<td>33</td>
</tr>
<tr>
<td>4.4 Data segmenting</td>
<td>34</td>
</tr>
<tr>
<td>4.5 Mathematical model</td>
<td>36</td>
</tr>
<tr>
<td>4.6 Market adjustment</td>
<td>37</td>
</tr>
<tr>
<td>4.7 Hypotheses formulation</td>
<td>39</td>
</tr>
<tr>
<td>4.8 Significance test</td>
<td>39</td>
</tr>
<tr>
<td>4.9 Software</td>
<td>42</td>
</tr>
<tr>
<td>4.10 Evaluation criteria</td>
<td>42</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. EMPIRICAL RESULTS</th>
<th>46</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Overview and First impressions</td>
<td>46</td>
</tr>
<tr>
<td>5.2 One-Sample T-test</td>
<td>47</td>
</tr>
<tr>
<td>5.3 Independent Two-Sample T-test</td>
<td>49</td>
</tr>
<tr>
<td>5.4 Regression results</td>
<td>50</td>
</tr>
<tr>
<td>5.5 Empirical summary</td>
<td>52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. ANALYSIS</th>
<th>53</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Efficient Market Hypothesis</td>
<td>53</td>
</tr>
<tr>
<td>6.2 Anchoring</td>
<td>54</td>
</tr>
<tr>
<td>6.3 Dividend irrelevancy</td>
<td>56</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. CONCLUSION</th>
<th>58</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Recommendations for further research</td>
<td>59</td>
</tr>
</tbody>
</table>

REFERENCES

APPENDIX I – SPSS output
FIGURES

Figure 1. The anchoring- and-adjustment heuristic 14
Figure 2. The research onion 25
Figure 3. Subjective-objective dimension 29
Figure 4. OMXS price index 2009-2012 33
Figure 5. Stock price volatility for the two segments 36
Figure 6. Illustration of the market adjustment 38
Figure 7. Illustration of the ratio of the ex-dividend effect 47
Figure 8. Distribution of the ex-dividend ratio 49
Figure 9. Plotting for heteroskedasticity 51

TABLES

Table 1. Previous research investigating the ex-dividend effect 5
Table 2. The four forms of market efficiency 11
Table 3. Empirical evidence of the ex-dividend effect 22
Table 4. T-distribution 40
Table 5. One-Sample T-test results 48
Table 6. Independent Two-Sample T-test results 49
Table 7. Regression results 50
1. INTRODUCTION

Assume an individual whom has been investing on the stock market for a number of years. Historically she has recorded a return equal to index, no more no less. Previously this has been in accordance with her expectations since she is aware of the risks associated with different investment alternatives. That is, she knows that investing in a stock that yields a high return corresponds with high risk taking. In January 2013 her financial situation changes. She books a meeting with her local bank man asking for advice on how to increase her return, preferably a financial solution that comes without additional risk. Her local bank man tilts his head and thoroughly explains that if she wants to have a higher return she needs to take on more risk, he finish up by quoting Milton Friedman (Nobel Prize banquet, 1976) “There is no such thing as a free lunch”.

Even though she finds herself slightly disappointed over these news, she understands what the bank man refers to. She too is well aware of the theories summed up by Fama back in 1970s that established the first theoretical framework regarding efficient markets hypothesis and the random walk. The theory states that there in a perfectly efficient financial market not will be any arbitrary possibilities. She has however heard that, “surely there are arbitrage opportunities on the financial market, the problem is just to identify them – and once you do they will disappear as soon as they emerge”. Determined to find and capitalize on one such event she turns to her old textbooks for guidance and out of the blue finds a concept called dividend irrelevancy. She understands the simple logic behind this reasoning suggesting that there might be situations on the financial market where the price on the cash dividend paying stocks might not drop by the full amount of the dividend being paid, indicating an arbitrage opportunity. After first being positively surprised by the concept she quickly becomes puzzled over the discrepancies that prevail. There is a fundamental piece of research presented by Miller & Modigliani from 1961 that clearly states that the dividend policy decision should be irrelevant since the stock will drop by the amount of the dividend being paid out. This would thus conclude that there could not be any arbitrary opportunities related to dividend payouts, in accordance with dividend irrelevancy. In contrast, she also finds extensive amount of research made in recent years suggesting otherwise. A majority of those conclude that cash dividend paying stocks on average drop by less than the full amount, considered as a market anomaly indicating arbitrage opportunities. With this theoretical disagreement in mind she looks into historical data for dividend payouts and stock market behavior surrounding ex-dividend day and realize that her local bank man may has been wrong. “There might be a free lunch available after all”.

Now, another dilemma arises. Simply having established that there are market anomalies present does not make her wealthier – she needs to establish a method that capitalizes on these opportunities. After having done some research of her own she finds a third theoretical area called anchoring. It was first introduced by Tversky and Kahneman in 1974 and suggests that individuals form an anchor price based on historical prices. That is, investors expect prices of stocks to prevail around a specific price. She quickly draws the conclusion that if this were to be true, stocks being defined as having an anchor price might drop even less than those who do not, to the same degree, hold an anchor price. She might be able to distinguish abnormal returns by
segmenting stocks on their price volatility, thus applying the fundamentals behind the anchoring theory. Thus she could make higher profits without taking on any extra risk – exactly what she was looking for.

The investor could also be the like of a financial institution, investing on the stock market on a regular basis. They want to outperform both their competitors and relevant indexes. The institution is aware of the fact that there exists arbitrage opportunities in connection to dividend payouts, and could make use of a method that captures these market anomalies. Lets consider what the individual investor and the financial institution have in common: Both are looking for a return higher than index to as low risk as possible (preferably risk free). Needless to say this is what the majority of risk-averse and rational investors are looking for when they make their investment decisions. Our two investors have both found indications that arbitrage opportunities exists on the stock market, but are in need of a method capturing these market imperfections.

1.1 Theoretical point of departure

It would seem as if there exist arbitrage opportunities in connection with dividend payouts. Ever since the rise of the first stock market dividends has been used as a reward to investors for staying with the firm (Petram, 2011, pp. 2-3). During the last decade a lot has happened with dividends, both in terms of technicalities (e.g. cash/stock dividend, stock repurchases) and tax policies in the form of different tax systems affecting for example capital gains, according to H.DeAngelo, L.DeAngelo & Skinner (2003, p. 429). The tax issue has been highlighted since the 1950s when capital gains in the US experienced an increase in taxes. This led many firms to move towards alternative ways of rewarding their shareholders. The total number of firms registered on New York Stock Exchange (NYSE) or NASDAQ that used dividends decreased by approximately 41 % for the years 1978-2000 (H.DeAngelo et al., 2003, p. 429). All firms that hands out dividends need to choose an optimal payout policy in terms of capital structure and strategic goals, as suggested by Constantinides, Harris & Stulz (2003). Formulating an optimal payout policy is however irrelevant for the value of the firm according to the research presented by Miller & Modigliani (hereon referred to as MM) (1961). The authors claim that the amount of dividend should be irrelevant from a shareholders perspective and not have an effect on stock valuation. This reasoning is relatively straight forward, and can be divided into two ideas: (i) A shareholder that receives dividends do not loose nor gain, she is simply adjusting her capital structure. (ii) Since the capital structure for all shareholders per definition is unaffected, naturally the price of the stock should neither increase nor decrease in its fundamental value - except by the amount of the dividend being paid. For example, suppose that you own a dividend paying stock valued at 10 SEK. The stock pays out 2 SEK in dividend, which, theoretically speaking, would lead to a corresponding decrease in the stock price by the amount of the dividend, 2 SEK. The stock would therefore hold a value of 8 SEK. The 2 SEK should however not be considered a loss since they have been received as dividend - you have simply adjusted your capital structure. The fundamental reasoning for dividend payout policy is according to MM (1961, p. 411) subject to three distinct market assumptions: (i) Perfect capital markets, (ii) Rational behavior and (iii) Perfect certainty. The theories presented by the authors is based on a theoretical reasoning applicable on all markets, hence we can use this theory as a collation in order to investigate arbitrage opportunities.
Put in other words, what MM (1961) established was empirical conclusions that suggested that there would not be any arbitrary opportunities in perfect capital markets in relation to the dividend payouts. These market assumptions bring us into the topic of efficient markets. In a perfectly efficient market the dividend amount is fully reflected in the stock price, there are by definition no arbitrage opportunities. This is because all prices fully reflect all available information. The Efficient Market Hypothesis (hereon referred to as EMH) describes two main preconditions for a market to be efficient. The first one is the condition of perfect competition, which suggests that all firms in the market compete under the same conditions, according to Carlin & Soskice (2006 p. 260). The second precondition is that all relevant information is fully available to all firms and stakeholders at the same point in time (Bodie, Kane & Marcus, 2011, p. 373). The theory has throughout the years been regarded as a solid foundation for economists studying fluctuations in macroeconomics and investors looking for investments opportunities on different markets. The hypothesis has generated mixed results, much since actual markets not fulfill the two preconditions. All investors seldom or never have the same information available at the exact same time, and markets are rarely perfectly efficient (Chiras & Manaster, 1978; Beechey, Gruen & Vickery, 2000; Einarsson & Wännerdahl, 2007 and Kim & Shamsuddin, 2008). The efficient market hypothesis is according to Fama (1970, pp. 388-395) tested in three different forms, the weak, semi-strong and strong form of market efficiency. Bodie et al. (2011, pp. 388-395) suggest that the weak, semi-strong form tend to hold, whereas the third form is commonly rejected. The level of efficiency is tested using three sufficiently different information subsets. Under the weak form prices are formed only on the basis of historical prices. In the semi strong form prices reflect information from historical prices as well as all publicly available information, whereas prices in the third form uses the information subset of historical prices, all publicly available information as well as company specific information, according to Fama (1970, pp. 388-395).

From what we have observed in previous paragraph there is block of theory stating that there are no arbitrage opportunities on the financial market and that the dividend payout policy should not affect the valuation of the firm. In our thesis we highlight one specific area of the financial market related to the EMH and the concept of dividend irrelevancy, both stating that there are no market anomalies in connection with the firms’ dividend payouts.

There are today several research papers that conclude that the irrelevancy principle not is evident and that all markets not are fully efficient. They conclude that the price drop of dividend paying stocks do not match the amount of the dividend being paid out. Contrary, it has been proved that the stock price tends to drop by less. One example is the research presented by Murray & Jagannathan (1997) suggesting that there are arbitrage opportunities in relation to the dividend payouts. The authors’ research was performed on the Hong Kong Stock Exchange (HKE) and managed to conclude that there in fact were arbitrary possibilities on the HKE in relation to the dividend payouts. The authors found that the corresponding drop in the stock price only accounted, on average, to 50% of the dividend amount. The findings by Murray & Jagannathan (1997) provide empirical evidence in favor of deviations from the fundamental theories presented by MM (1961) and the EMH summarized by Fama (1971).

Having established that there is an antilogy surrounding these two theories we are now moving on to the formulation of a method, requested by our two investors that would capture possible arbitrage opportunities. This leads on to the theoretical area of
The theory of anchoring can be described in terms of both the anchoring-and-adjustment heuristic as well as the reference price theory. The two theories collectively suggest that investors on a market formulate an anchor price of a particular asset. An anchor price is defined by Northcraft & Neal (1987, pp. 121-123) as a valuation estimate of the asset based on the investor’s perceptions. Given historical prices of the asset and in the light of new information, the investors adjust this anchor price, which will generate a final valuation of the asset, and a buy or sell decision. The concept of anchoring has evolved in four different stages. It started from a general perspective but has in recent years developed to cover the financial market mechanism. The anchoring theory has evolved in four stages, it originated from a general point of view using random numbers (Tversky & Kahneman, 1974), developed into an enquiry of real numbers (Northcraft et al., 1987), the formulation of anchor prices in the housing market (Marsat and Williams, 2009) and finally evolved to cover behavior on the stock market (Williams, 2010). The reference price is a concept interconnected with the anchor theory that also investigates how stock prices change in the light on new information and the influence of historical prices on current prices. The reference price has previously been connected with the disposition effect introduced by Shefrin & Statman (1985). The disposition effect is a concept that tries to explain the tendency of investors to hold profitable stocks for a shorter period than that stocks relative peak, and unprofitable stocks too long (Kliger & Kudryavtsev, 2008).

Along the anchoring theory it would, theoretically, be possible to distinguish the firms that to a larger degree returns from deviations to its fundamental value. One such deviation could be caused by the dividend payouts. Based on the anchoring theory it would be possible to establish a method that separates firms that to a larger degree return to its pre-dividend value than others, hence stable firms with low stock price volatility. As mentioned there has along side Murray & Jagannathan (1997) been research suggesting that there are arbitrage opportunities related to the dividend payout. The research provides evidence in one direction but differ in terms of results and explanations. So far no research has however suggested how to capitalize on the concluded arbitrage opportunities.

1.2 Research gap

Previous research collectively concludes an ex-dividend effect between 0.62 and 0.98, thus a drop in stock price equal to between 0.62 and 0.98 of the dividend amount. Research has been carried out on stock markets all over the world, for example: Alm & Årejäll (1999) on the Stockholm Stock Exchange (hereon referred to as the SSE), Kato & Loewenstein (1995) in Japan, Rantapuska (2008) in Helsinki, and Dasilas (2009) in Greece, all concluding arbitrage opportunities. Previous research has discussed different factors that can explain the found arbitrage opportunities, in which three main factors have been repeatedly discussed. (i) The clientele effect, which is the notion that a firm’s stock price move in accordance with investors’ reaction to a policy change, in for example tax or dividend (Elton & Gruber, 1970). (ii) The tax differences in between markets and the fact that the real profit generated from the arbitrage opportunities are minimized by taxes (Bali & Hite, 1998). (iii) The third one is transaction costs, in which the research explains arbitrage through the cost of buying and selling the stock (Boyd & Jagannathan, 1994 and Rantapuska, 2008). Previous research attempts to explain what
factors that causes these market anomalies, but none has so far elaborated on how to capitalize on their findings.

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<th>Authors</th>
<th>Years</th>
<th>Market(s)</th>
<th>Ex-dividend effect</th>
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<tbody>
<tr>
<td>Campell &amp; Beranek</td>
<td>1949-1950</td>
<td>NYSE</td>
<td>0.83</td>
</tr>
<tr>
<td>Durand &amp; May</td>
<td>1948-1959</td>
<td>NYSE</td>
<td>0.90</td>
</tr>
<tr>
<td>Elton &amp; Gruber</td>
<td>1966-1967</td>
<td>NYSE</td>
<td>Exist</td>
</tr>
<tr>
<td>Boyd &amp; Jagannathan</td>
<td>1975-1987</td>
<td>Non-specified</td>
<td>0.90</td>
</tr>
<tr>
<td>Kato &amp; Loewenstein</td>
<td>1992</td>
<td>TSE &amp; NSA</td>
<td>0.72</td>
</tr>
<tr>
<td>Bali &amp; Hite</td>
<td>1962-1994</td>
<td>NYSE &amp; LLC</td>
<td>0.86</td>
</tr>
<tr>
<td>Alm &amp; Årefjäll</td>
<td>1994-1998</td>
<td>SSE</td>
<td>0.62</td>
</tr>
<tr>
<td>Rantapuska</td>
<td>1995-2002</td>
<td>HEX</td>
<td>0.98</td>
</tr>
<tr>
<td>Dasilas</td>
<td>2000-2004</td>
<td>ASE</td>
<td>0.97</td>
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**Table 1.** Previous research investigating the ex-dividend effect.  
Source: Created by the authors (2013)

To seize these arbitrage opportunities one would necessitate an approach, capturing the market anomalies, and a natural first step in doing so is to conclude that there exist arbitrage opportunities in connection with dividend payouts. In contrast to previous research we are not considering why arbitrage exists, but rather how to capitalize on the found opportunities. As discussed, previous research has been carried out on stock markets all over the world, and the market of investigation has been picked based on characteristics suitable to the particular research. For example Dasilas (2009) whom investigated the ex-dividend effect without taxes. The author chose the Greek market due to its tax-free environment.

In selecting what market to conduct our research on, we first considered characteristics of generalizability. The aim with our research is to generalize across experimental settings, for us international markets. There are different characteristics to take into account when generalizing across international markets, and for us the most relevant are that the stock market should have a value of market capitalization close to other markets (Ramchand & Susmel, 1998, p. 398) and the value of the stock market should be sufficiently owned by international investors (Booth, Martikainen & Tse, 1997, p 813). Information must be publicly available and include: data on daily stock prices, dividend payments and cum-dividend – and ex-dividend dates, all easy accessible to researchers. We also consider, as highlighted in previous research that the tax rate on dividend and capital gains to be closely related (Rantapuska, 2008, p. 356). If the tax rates are close the possibility of different preferences would be eliminated, thus not be a factor contributing to market anomalies. The Stockholm Stock Exchange (OMXS) is a market that fulfills these discussed characteristics. We realise and acknowledge the fact that our research could have been applied on any markets with these characteristics, but as previous research indicate, market anomalies exist on the OMXS (Alm & Årefjäll 1999), providing us with a necessary indication. Similar stock markets to the OMXS are for example the stock exchanges in Amsterdam, Berlin, Helsinki and Lisbon. Due to the
merger in 1998 between the OM and SSE, the SSE is as of 2006 known as OMXS (OMX, 2013). Hereon after we will therefore refer the SSE to OMXS.

Having our theoretical point of departure, the indications of market anomalies in relation to dividend payouts and the intuitions of our two investors in mind, we formulate our research question:

*Can abnormal returns be made on the ex-dividend effect by segmenting stocks based on their price volatility?*

### 1.3 Purpose, Stakeholders and Expectations

The main *purpose* is to establish a method that can make abnormal returns by segmenting stocks based on price volatility, capturing arbitrage opportunities. Therefore, our first sub-purpose is to determine if there exists arbitrage opportunities in relation to the ex-dividend day on the OMXS. Implicitly the second sub-purpose is to conclude if the OMXS is to be considered as an efficient market.

There is little doubt that the area of the ex-dividend effect holds a wide spectrum and involves several *stakeholders*. The results generated in this research will be of interest to individual investors since the purpose is to provide one approach on how to make arbitrary profits. Pending on the results from the research, individuals could act on that information and trade upon market anomalies. The same reasoning would also apply to a financial institution that is trading stocks on the financial market. Given that there are arbitrage opportunities on the OMXS, anyone involved in the financial market would take advantage of the suggested method and make abnormal profits without taking on extra risk. And even if the contrary were concluded then, again, anyone trading on the financial market would use this to determine that the OMXS not is a market subject to the patterns of prices dropping by less than the amount of the dividend amount. Thus, private investors or financial institution would make use of our research no matter what conclusions are drawn. Furthermore, we also believe this research to be of interest for managers of publicly listed firms formulating their payout policies. Regardless of the outcome managers will still be given information in regards to how the market is reacting to dividends. That is, the conclusion will indicate to what degree the market is responding to the dividends since this will be reflected in the stock price.

The *expectation* of this research is that it will provide our stakeholders with evidence of whether the OMXS holds arbitrage opportunities or not. If there exist arbitrage opportunities the market is said not to be efficient, indirectly we will in accordance with our second sub-purpose therefore test the market efficient at the OMXS. Einarsson *et al.* (2007) tests the market efficiency at the SSE in their article “*Does Size Matter? Abnormal Return and Market Efficiency at the Stockholm Stock Exchange*”, and concludes that the SSE is efficient at the semi-strong level. From the EMH and the research by Einarsson *et al.* (2007) we can expect that there not will be any arbitrary possibilities present on the OMXS. Following the arguments presented by MM (1961), we would as in the case of the EMH presented by Fama (1970) draw the conclusion that there will be no connection between arbitrage opportunities and dividend payouts. Hence, according to theory the OMXS would be free of market imperfections and thus not hold any arbitrage opportunities.
As presented we have however found a lot of counterweight to the established theories. Turning to the research made regarding the ex-dividend effect the majority concludes that there actually are arbitrage opportunities available on stock markets. This provides us with an indication that the same pattern may follow on the OMXS. In contrast with theory we therefore can expect there to be arbitrary opportunities present at the OMXS. The next step would then be to examine if one could establish a method that can capture these abnormalities. According to Williams (2010), investors formulate an anchoring price. This would then have the implication that those stocks referred to as having an anchor price would decrease by less than firms not having an anchor price. Hence, we expect there to be a possibility to formulate an investment suggestion based on the anchoring theory. We expect the outcome of our research to be in contrast with existing theory but in accordance with recent research.

1.4 Limitations

This research exclusively uses data from firms that are, during the entire period that our research concerns, registered on the OMXS. When performing research of financial markets one must take heed of the market differentials that exists on an international level. That it, stock exchanges will not necessarily follow the same pattern on a day-to-day basis, meaning that a price development on one stock exchange not need to be followed by a corresponding price change on the other. Another aspect is that all firms not are listed on all stock exchanges. In our research we hold a sample consisting of a large span of firms that should minimize the effects of outliers but it is nonetheless important to notice. In addition to the previous mention limitations it is also important to recognize that this research will draw conclusions that are primarily based on investors’ behavior in Sweden. Notice that we make use of the phrasing primarily, since even though the majority of the trades on the OMXS are based on Swedish investors preferences, other nationalities hold a substantial part of the trading as well. Hence, we argue that the conclusions from our research can be generalized to other stock markets. This is an argument in favor of our research since it implies that our results to a higher degree is transferable to other markets simply because traders today have exposure, to not only their national stock exchange.

Another factor of this research that needs to be considered is that only firms paying dividends at some point during our time-period will be included in the research. This means that even though our research draws its conclusions on the OMXS – not all firms registered are included in this research. This also touches upon a related problem, namely that all firms that are registered in the beginning of our research not necessarily are registered throughout our entire time-period. This is unfortunate but there is no way around this problem when using time-series data since firms enter and exit the OMXS on a regular basis. On the other hand, this might serve as a quality indicator of our conclusions since it would rather exclude than include stable firms from unstable firms. Thus, leading our conclusions to be more applicable on long-term stable firms rather than on smaller firms that experience deviating patterns and hence might provide for results acting as outliers to our results. The main purpose is to determine if firms stock price fall by the same amount as the dividend, the ex-dividend effect, and establish a method based on the anchoring theory. Hence, we are only examining if this is the social reality, and not what might be the eventual reason for such a price anomaly. Even though some of the research previous to ours, to some extent takes behavioral finance
into consideration in explaining the stock price behavior, this is not our purpose. We however think it is of importance to realize the differences between these two topics and we will leave the explanatory to further research.

1.5 Definitions

*Abnormal returns:* A stock return exceeding what is predicted by market movements. (Bodie et al. 2011, p. G-1)

*Arbitrage:* An excessive return that is not met by a corresponding increase in risk. (Bodie et al. 2011, p. G-1)

*Cum-dividend day:* The day when the price includes the dividend amount to be received for holding the investment. (Penman, 2007, p. 98)

*Ex-dividend day:* The day after the cum-dividend day when the price is without the dividend amount. (Penman, 2007, p. 98)

*Ex-dividend effect:* In our research we define the ex-dividend effect as the difference between the drop in stock price from cum-dividend day to ex-dividend day, with the dividend amount.

*Firms:* We define firms as publicly listed companies registered on the OMXS.
2. THEORETICAL FRAMEWORK

“The noblest search is the search for excellence”

- Lyndon B. Johnson

As discussed in the introduction, our research takes three theoretical points of departure. In the following chapter we present these areas and connect them to both each other and to our problem statement. Our three theoretical areas are: Efficient Market Hypothesis, the Anchoring theory and Dividend irrelevancy.

2.1 Efficient Market Hypothesis

The first theoretical area concerns the Efficient Market Hypotheses (EMH). It is widely used in the academical world as an assumption in different types of business research, not the least in economics. In economics there are many theories both from the macro- and micro perspective that take standpoints from the assumption that markets are efficient (Carlin & Soskice, 2006 p. 260) and that market prices always reflect all available information. The EMH is defined by Bodie et al. (2011, p. 373) in the context of stock markets, as a market where the movement of stock prices follows a random walk. Bodie et al. (2011, p. 373) continues by describing that the random walk states that changes in stock prices are due to the release of new information, and stock prices fully reflect all available information. As a consequence there is no possibility to achieve returns higher than the average market return, on a risk-adjusted basis. That is, you cannot outperform the market. The random walk is an important concept for our research since it clearly states that stock prices moves in the light of information, thus information about dividend payouts are already reflected in the cum-dividend and ex-dividend price. Hence, the ex-dividend price should be equal to the cum-dividend price subtracting the dividend amount, no more no less. The EMH thus provides a, theoretical, indication of the outcome of our results. All our reviewed literature and research concerning the ex-dividend effect implicitly apply the EMH as the basis for their analysis and as a theoretical benchmark, for example Alm & Årefjäll (1999), Rantapuska (2008) and Dasilas (2009). For this reason we also take the EMH to work as a collation to our findings.

As mentioned in the introduction, there are three different forms of the EMH, all signaling different strength of market efficiency: weak, semi-strong and strong form (Bodie et al. 2011, p. 374). In the authors article “Efficient capital markets” from 1970, Fama discuss and reviews previous theoretical and empirical literature on the EMH. Fama (1970) discusses the basic preconditions for the hypotheses and in depth discuss empirical evidence on the weak, semi-strong and strong form. Fama (1970, p. 388) states that there is a difficulty in testing whether or not prices on an efficient market fully reflects all information available, in particular related to the weakness of the term fully reflects, which Fama (1970, p. 380) describes as a vague. Fama (1970) describes how previous empirical research have been tested using expected returns in a two parameter world, where the equilibrium of the expected returns are formed on the basis of all available information. Fama (1970, pp. 386-387) continues by discussing the Submartingale model and the Random Walk model. The Submartingale model states that the next period’s price of an asset, on the basis of all available information, is equal
to or greater than the current price, given a growing economy. The model has one important empirical implication since it shows that a method based on available information cannot have greater expected return than a policy of always buying-and-holding the security during the future period in question. Fama (1970) describes that the Random Walk model was derived from two main hypotheses: (i) successive one-period price changes are independent and (ii) successive changes are identically distributed. The two hypotheses derived the Random Walk models main argument: that stock market prices evolve according to a random walk and that their prices not can be predicted. Price changes are fully explained by the release of new information. There are a few market conditions that need to be sufficient for the EMH to be applicable. (i) No transaction costs in trading securities, (ii) all available information is free of charge to all market participants, (iii) all participants agree on the implications of current information for the current price and distributions of future prices of each security (Fama 1970, p. 388). In his article Fama (1970) describes and relates these perspectives to the three different tests for the level of strengths in the EMH.

First off is the weak form where the trustworthiness of the hypotheses is tested using only historical market prices as information subset. It incorporates historical prices into current ones, which makes information regarding past prices already reflected in today’s prices (Fama 1970, p. 388). Bodie et al. (2011, p. 348) states that in the weak form of EMH, all possible signals, for instance a buy signal, about a future increase in stock price already would have been fully exploited and reflected through an increase in the stock price. A signal would thereby lose its value. In terms of the ex-dividend effect a weak form of market efficiency would leave room for arbitrage opportunities, how substantial would be dependent on historical prices of that particular stock.

Secondly is the semi-strong form where tests measure the speed of price adjustment to other obviously publicly available information. This means that today’s prices reflect both historical prices as well as all publicly available information about the firm. Fama (1970, pp. 388-390) states that all new released information needs to be homogenously interpreted by the investors. All investors on the market have the same information and interpret it in the same way; it is therefore impossible to generate abnormal returns. They only way to do so would be to use non-publicly available information. Bodie et al. (2011, p. 351) questions the fact that all investors interpret information in the exact same way, and as a consequence diminish all efforts of either fundamental or technical analysis. They argue that investors could gain abnormal returns by conducting superior analysis. Conducting a superior analysis would thereby lead to arbitrage opportunities.

The third and strongest form of market efficiency is the strong form. Here all prices fully reflect available information in every time period: historical prices, all publicly available information and even company insider information. Fama (1970, p. 388) suggest that this is possible in a capital market with no transaction costs; all information is costless and available to all market participants. Bodie et al (2011, p. 376) argues that this hypotheses is extreme and that few would argue with the fact that managers of firms have such information at hand long enough for them to use on the market. As to speak it is quite unlikely that all company insider information is homogenously available to all investors, even publicly available. Bodie et al. (2011, p. 376) also describes the progress of the law making associated with insider information as an obstacle for the hypotheses to be applicable. Fama (1970) concludes that previous empirical research presents strong results for the first two types of market efficiency.
strengths, the weak and the semi-strong form, but is inadequate to hold for the strong test. Fama (1970) suggests that the largest contributor to the rejection of the third, strong form is the human factor. In the strong form there are by definition no arbitrage opportunities available, the dividend amount is fully reflected in the ex-dividend stock price.

Johansson & Määttä (2012) bring up a fourth component to the measure of market efficiency, which is a market with no efficiency at all. The authors state that there in such a market is possible for investors to predict future prices based solely on historical data and at the same time earn superior returns. As to speak the market price is not a reflection of the available information, hence the market is not efficient. In this undeveloped (and possibly unlikely) market there would be arbitrage opportunities everywhere.

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Arbitrage opportunities</th>
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<tbody>
<tr>
<td>Strong Efficiency</td>
<td>All information is reflected in stock prices</td>
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<tr>
<td></td>
<td>No arbitrage opportunities available</td>
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<tr>
<td>Semi-strong Efficiency</td>
<td>Stock prices reflect all publicly available</td>
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<td>information as well as historical prices</td>
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<td></td>
<td>Available solely on non-publicly information</td>
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<tr>
<td>Weak Efficiency</td>
<td>Historical prices are reflected in stock prices</td>
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<tr>
<td></td>
<td>Available through fundamental analysis and insider information</td>
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<tr>
<td>No Efficiency</td>
<td>No assumptions about what information is reflected in stock prices</td>
</tr>
<tr>
<td></td>
<td>Available through technical and fundamental analysis</td>
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Table 2. The four forms of market efficiency. 
Source: Created by the authors (2013)

2.1.1 EMH on the OMXS

Previous empirical research and evidence from the Stockholm Stock Exchange (OMXS) has generated mixed results and indicate that OMXS not is an efficient market at the semi-strong level. One example is Einarsson et al. (2007) whom analyze if a buy recommendation issued by Avanza.se has an effect on stock prices on the OMXS. They use a quantitative research approach with data gathered from the OMX-Group’s website and run their tests in the software SPSS. The authors investigate buy recommendations in between November 2006 and October 2007. The aim is to investigate if the recommendation’s effect with respect to abnormal return and market efficiency differ significantly depending on the company’s capitalization value. In an efficient market it should have no impact on the stock price. In opposition to the EMH the authors conclude that there is a connection between a buy recommendation and the stock price,

Avanza.se is the website of the Avanza bank. The website provides analyses and stock recommendations available private investors (Avanza, 2013).
which means that they in their article states, under their assumptions, that the OMXS not is efficient at the semi-strong level. In accordance with earlier research they explain it as due to human factors. Einarsson et al. (2007) provides results relevant for our research. The authors can conclude that the OMXS for their years of investigation has been characterized not to be fully efficient, and that it thereby might exist arbitrage opportunities. This provides indication to our research that the stock prices on OMXS do not, necessarily, drop by the full dividend amount on ex-dividend day.

2.1.2 Arbitrage

“Arbitrage is a zero-risk strategy that still generates profits, and arises when an investor can earn riskless profits without making a net investments” Bodie et al. (2011, p. 352).

If the strongest form of the EMH holds there are no arbitrage opportunities since all available information is fully reflected in the stock prices. No fundamental or technical analysis of publicly information can generate returns higher than market average. As defined by Dubil (2005) there are two kinds of arbitrage, pure and relative. Dubil (2005, pp. 12-16) pure arbitrage is defined as generating riskless profit today by statistically matching current and future obligations that exactly offset each other. Relative arbitrage is on the other hand defined as generating abnormal returns today by statically matching current and future obligations to nearly offset each other. The main difference between the two definitions, as defined by Dubil (2005, pp. 12-16) is therefore that relative arbitrage is associated with some risk-taking. Pure arbitrage is limited in today’s high-speed information markets. It is almost impossible to find an arbitrage opportunity where you make a riskless investment and walk away with abnormal returns (Damodaran 2012). Another article by Heath & Jarrow (1988) relates ex-dividend stock prices to arbitrage and test whether one can make predictions that a drop in stock price ex-dividend day will result in arbitrage opportunities. Heath & Jarrow (1988) describes a background to the ex-dividend day stock price behavior, which in a developed theorem concludes that the stock price drop can differ from the dividend amount, but still there are no general strategies that can generate arbitrage. Empirical evidence indicates that arbitrage opportunities exist and are available, but not possible to grab. The authors discuss that this has to do with the speed of which information flows in today’s market and the fact that no previous theory is able to explain that investor’s behavior and their need to develop a general theorem. The articles are important for us as they lay the ground for our own investigation into arbitrage opportunities on the OMXS. All empirical evidence points to the fact that there in fact exist arbitrage opportunities. Dubil (2005) highlights pure- and relative arbitrage, in our research it is not of grave importance as to define our results as either pure or relative. However, we expect our results to be of relative arbitrage since it is unlikely that a market anomaly, by definition, consistently occurs.
2.2 Anchoring

In our second theoretical point of departure we investigate previous research in the field of both anchoring theory and the connected concept of reference pricing. The two lines of research provide similar conclusions in terms of anchoring effects, but have been tested differently. We have decided to take both into consideration in our theoretical framework, one more than the other. As we want to examine if it is possible to capitalize on arbitrage opportunities by segmenting stocks on price volatility, we think it is important to take a comprehensive theoretical perspective and examine both the development in the anchoring theory as well as the reference pricing. We believe that both concepts contribute to our theoretical framework, both by themselves but also as synergies to each other. Especially since the reference pricing is a general concept and the anchoring theory a developed theory (Kliger & Kudryavtsev, 2008). The anchoring theory is concerned with the fact that investors formulate an anchor price for a particular stock, and that this price is influenced and reformulated using both current stock prices, as well as historical (Williams, 2010, pp. 16-17). The reference pricing theory suggests that investors on a market reformulate their reference price in the light of new information. For simplicity reasons we have chosen to use the anchor price definition in describing the literature related to the anchoring theory and the reference price definition when discussing reference price theory, although they in fact, in our research, represent the same type of reasoning.

Academical research on anchoring has evolved over time and can be highlighted into four different stages. Firstly from a generalization using random numbers, secondly to an investigation into real numbers and lastly two tests of anchoring behavior in stock prices by investors. (i) The anchoring-and-adjustment heuristic was first documented by Tversky et al. (1974). It is a psychological heuristic that influences the way people intuitively assess probabilities. It states that if people starts with an implicitly suggested reference point (the “anchor”) and then adjust it in the light of additional information, they finally reach their approximation. Tversky et al. (1974) conclude this by providing results that their subjects were highly influenced by an arbitrary chosen anchor when asked to assess the number of African countries member of United Nations Organization. They spun a wheel-of-fortune to generate a random number, which influenced the estimate made by the subjects as to how many African countries that are members of the UN. To take an extreme example, if the wheel-of-fortune generate the number 11, then the respondent answered that there was approximately 11 African countries represented in the UN. Thus an anchoring of some sort was existent. (ii) Northerraft et al. (1987) brought the anchoring-and-adjustment heuristic one step further, when they investigated real values, and not just random numbers. In their research they brought experimental evidence that property listed prices have a biasing influence on the fair value assessment made by their subjects. Connecting this to our research one could suggest that a recommended stock price, as in Einarsson et al. (2007), has a biased influence on the price eventual paid by the investor. (iii) For our research the anchoring-and-adjustment heuristic took an important step when Marsat et al. (2009) tested the effect of actual stock prices on the subjects’ fundamental valuation. The
authors concluded and found evidence that subjects that are asked to assess the intrinsic value of a stock are influenced by the stock market price. The median fundamental valuation of a stock rose when the anchor value (stock market price) increased. As to speak the article proves that actual stock prices have an impact on investor’s fundamental valuation of the stock. (iv) Williams (2010) finally investigated the role that anchoring play in speculative bubble dynamics. The article derives a model that suggests that current price is a function of fundamental value, past price, noise and anchoring level. Williams (2010) presents evidence that large speculative bubbles only can occur when fundamental traders, to a high degree anchor, to stock market prices. Thus the noise cannot in itself cause such phenomenon. Thus, Williams (2010) concludes that anchoring prices exist on stock markets. Below follows a figure explaining the reasoning behind the anchoring theory, as expressed by Williams (2010).

![Figure 1. The anchoring- and-adjustment heuristic. Source: Williams (2010)](image)

These four academical reasoning’s provide our research with a, in our view, solid theoretical benchmark that supports us when formulating an approach for capturing arbitrage returns, pending on the anchoring theory. Through these articles we can prove that anchoring price is an important part of an investors valuation of stock prices, and that stocks with an anchor price has lower price volatility.

Previous empirical research discuss how the concept of reference price is taking place by investors, and how reference price is affected by the release of new information. Kliger & Kudryavtsev (2008) discusses in their article "Reference Point Formation by Market Investors" the so called disposition effect. The disposition effect, introduced by Shefrin and Statman (1985), is defined by the authors as the disposition to sell winner stocks too early and hold on to loser stocks for too long. The disposition theory is based on the concept that a reference point distinguishes losses and gains. Kliger & Kudryavtsev (2008) discusses the formation of the concept reference price and shed light on the fact that investors change and reformulate the price in light of company-specific events such as stock price data and analysts forecasts. Kliger & Kudryavtsev (2008) is important to our research since it shows that investors formulate their reference price on the basis of company-specific event, for us dividend payouts. In our research we use the notion that investors have a reference price that they use as a benchmark for their investments. As to speak, if the price of a stock in their respective portfolio decrease, holding all other variables constant, it do not change their reference
price and their overall perception of the stock. They keep the particular investment because their reference price is higher than the cum-dividend stock price.

Grant & Westerholm (2006) also investigates, in the article “Reference price and mental accounting effects on portfolio performance and the disposition effect”, how reference price formulation has an effect on the disposition theory. The authors discuss that investors compare the current stock price with their own formulating reference price, thus leading to a conclusion regarding if it is a winning or losing investment. The authors also discuss that the reference price often is the same as the purchasing price for the respective stock. Our research aims to use a company-specific event in order to capture arbitrage opportunities pending on the anchoring theory, and the concept of reference price provide us with a comprehensive background to do so. The authors’ research shows that investors take company-specific data into consideration when formulating their reference price. Thus, a measure of volatility in stock price can be regarded as a measure of what reference point the market has in the stock. Kliger & Kudryavtsev’s (2008) research also discusses what influences the reference point, which is important in our regression formulation.

The anchoring theory and the reference price concept both by themselves, and as synergies to one other, are important to our research. The theories provide a theoretical framework for segmenting stocks based on the stocks price volatility.

2.3 Dividend irrelevancy

The third theoretical area is the dividend irrelevancy theory, which focus on how stock prices behave on ex-dividend day. That is, how well the dividend amount corresponds to the price drop between cum-dividend- and ex-dividend day. The fundamental idea would be that the price drop is matched by the amount of dividend, since it is capital that is withdrawn from the firm, hence decreasing the value of the individual stock. The dividend irrelevancy is a theoretical framework in our research since it explains the complex nature of ex-dividend behavior in stock prices. The aim with this section is to shine light upon the fundamentals behind the reasoning and also to summarize previous empirical evidence, derived from various stock markets. The dividend irrelevancy theory is presented by Miller-Modigliani (1961), in their article “Dividend policy, growth and the valuation of shares”. Their work is based on mathematical reasoning and assumptions related to the area of stock valuation. The authors discuss the effects the firms’ dividend payout policy has on the firms’ stock price. That is, do the stocks of the firms with generous payout policies sell at a premium, compare to firms that chose to have a more conservative payout policy? If this would be the case, under what conditions is this would it be apparent?

MM (1961) starts of by describing the assumptions their reasoning is built upon: perfect capital markets, rational behavior and perfect certainty. These are the fundamental assumptions that, according to MM (1961, pp. 412-414) would lead to an ideal economy. The first precondition is perfect capital markets, which according to MM (1961, p. 412) is defined as a situation where no buyer, seller, issuer of securities is of size enough to have an actual impact on the current market prices. All traders on the market will have equal and costless access to price information and all other information that concerns stocks. Also, there will not be any transaction costs such as
brokerage fees or transfer taxes and there will not exist tax benefits connected to either capital gain, dividends, distributed or undistributed profits. The second precondition concerns that of rational behavior. This area concludes that individuals always prefer more wealth to less and also are indifferent to whether their wealth takes the form of a cash increase or an increase in the value of their securities.

Perfect certainty is the third and last of MM’s (1961) preconditions and it concerns the assurance of all investors regarding the future investment program and future profits of all corporations. Due to this assurance there is no need to distinguish between stocks or bonds as different sources of funds and this reasoning lets MM (1961) continue in their reasoning as if there was only one type of investment available on the market, which throughout the authors research is assumed to be shares of stocks. Given these assumptions, MM (1961) further examine what effects the firms’ dividend payout policy will have on its respective share valuation. MM (1961, pp. 412-414) focuses on what could happen when the assumptions of perfect certainty are omitted, and examine whether or not these new modifications have an impact on the dividend payout policy.

MM (1961, p. 421) establishes the fundamental principle of valuation, explaining that the price of each share must be set so that the return for each share is the same throughout the market over time-periods, according to:

**Equation 1:**

\[ P_j(t) = \frac{1}{1+\rho(t)} [d_j(t) + P_j(t+1)]. \]

**Explanation**

- \( P_j(t) \): The price (ex any dividend in \( t-1 \)) of a share in firm \( j \) at the start of period \( t \)
- \( d_j(t) \): Dividends per share paid by firm \( j \) during period \( t \)

This formula holds, otherwise, investors would simply choose to sell their relatively more expensive stocks holding a low return and instead buy shares with higher returns. This process would eventually push down the prices of the initial low-return stocks until the differences in terms of returns between the two different stocks would have been eliminated.

Given the fundamental principle of valuation one can, according to MM (1961), examine the effects of dividend policy on share prices. MM (1961, p. 413) derives this by adding dividends to equation (1) and instead of viewing the formula as a share of the stock \( (p_j(t)) \) viewing it as the value of the firm \( (V(t)) \). By reshaping equation (1) one can, according to MM (1961, p. 413) determine the three different ways of how dividends being paid can affect the market value \( (V(t)) \) of the firm or its share price \( (p_j(t)) \). By closer examination of equation (2) one can conclude that \( D(t) \) will affect \( V(t) \) trough the first bracket, and via the second term. It will also affect the third term since dividends paid during one period must be offset by new capital raised through stocks in order to maintain the desired level of investments, according to:
Equation 2:
\[ V(t) = \frac{1}{1 + \rho(t)} [D(t) + V(t + 1) - m(t + 1)p(t + 1)] \]

Explanation
V(t) = The value of the enterprise
D(t) = Total dividends paid during t to holders of record at the start of t
m(t+1) = The number of new shares (if any) sold during t at the ex-dividend closing price p(t+1)

The conclusions drawn from these two equations are that dividend decisions affects the price in two conflicting ways: (i) through D(t) and, conversely, (ii) through \(-m(t) p(t+1)\). Given that the three pre-conditions presented hold, the conclusion can be made that the effects of dividends will always cancel out. This in turn concludes that the different payout policy’s of dividend has no effect on the price at (t). Re-arranging equation (2) with consideration to the previous conclusion gives a new expression of the firms value V(t), according to:

Equation 3:
\[ V(t) = \frac{1}{1 + \rho(t)} [X(t) - I(t) + V(t + 1)] \]

Explanation
I(t) = Given level of the firm investment or increase in its holding of physical asset in t
X(t) = The firm total net profit for the period

Since all terms in equation (3) are independent of D(t) it must follow that V(t) is independent of the payout policy. Redoing the previous calculations for V(t+1) or V(t+n) will provide for the same conclusions according to MM(1961, p. 414). This conclusion would thus lead on to the conclusion that the firms’ investment policy or payout policy will affect neither the firms stock price nor its total return for its shareholders.

MM (1961) concludes their research by examining some of the market imperfections that has had implications for the dividend policies, and their corresponding effect on stock valuation. The presented findings by MM (1961) are important to our research since it lays down a fundamental understanding of the effects of managers’ choices when it comes to dividend payout policies. Even though the theory is somewhat old, the assumptions it relies on are still applied in today’s financial market. Hence, it provides indications of what results we ought get in our research - given that the assumptions of MM’s theory holds in our research as well. One could view this theory as the fundamental cornerstone in the area of dividends, and we therefore include it in our research. The theory presented by MM (1961) will thus help us interpret our findings, act as a collation towards our results and provide explanations for eventual deviations.
2.3.1 Empirical evidence of the ex-dividend effect

As discussed, the theories of dividends having no effect on the ex-dividend day stock price do from a theoretical standpoint hold. However, as suggested in the Research gap, there has been several authors presenting results that contradicts the research presented by MM in 1961, (Campell & Beranek, 1955; Durand & May, 1960; Elton & Gruber, 1970; Boyd & Jagannanthan, 1994; Kato & Loewenstein, 1995; Bali & Hite, 1998; Alm & Årefjäll 1999; Rantapuska 2008 and Dasilas (2009).

Looking at it from a historical perspective Campell & Beranek (1955) were the first ones to draw attention to the ex-dividend effect with their article “Stock price behavior on ex-dividend dates” published in the Journal of Finance. In their article they discuss the general assumption among shareholders and brokers that a stock price should drop on the ex-dividend day by the amount of the dividend. Campbell et al. (1955) was hence the first that concluded that the ex-dividend price do not drop by the full amount of the dividend. The authors’ research is based on the NYSE and carried out in between October 1949 and April 1950. A second test was performed during the time period between October 1953 and December 1953. The first test on the NYSE consisted of 199 observations and the second test of 200. Campbell et al. (1955, p. 426-427) concluded that the average price drop on the ex-dividend day during the first test period accounted to 92% of the dividend amount and 83% correspondingly for the second. Furthermore, Campbell et al. (1955, p. 428) recommended a strategic decision for investors when taking taxes into consideration, suggesting investors to sell the dividend paying stocks on cum-dividend day. Doing otherwise would incur the investor to pay a relatively higher tax on the dividends than it would on the capital gain. The authors’ conclude evidence in favor of the fact that the price drop on ex-dividend day does not amount to 100% of the dividend amount. Campbell et al. (1955) also conclude that different tax-rates should influence the sell or buy decision of the investor. Durand & May (1960) is two researchers who have dwelled upon the ex-dividend behavior of stocks and presents their findings in “The Ex-Dividend Behavior of American Telephone and Telegraph Stock”. Just as Campbell et al. (1955), Durand & May (1960) challenges the beliefs of the established financial community at the time and states that the price of stocks would drop by less than the amount of the dividend being paid out. Durand & May (1960, p. 19) derives their results from experiments performed on the American Telephone and Telegraph capital stock (heron referred to as AT&T) by using time-series analysis to monitor the price changes in relation to cash dividends being paid. The authors finds AT&T to be a suitable firm for examination of the ex-dividend effect since the firm enjoys a active, broad and orderly market. AT&T paid out dividends every quarter for the entire period of their study that lasted between 1948-1959. Between the chosen periods, Durand & May (1960, p. 20) managed to examine 43 events, and managed to conclude that the AT&T stock, on average, tended to fall between 90-102% of the dividend amount. The conclusion the authors’ made was hence that the stock of AT&T tended to drop by approximately the amount of the dividend (Durand & May 1960, p. 28). Hence, the discrepancy was not great. Durand & May (1960, p. 28) do however conclude that, on average, the stock tended to drop off by less than the dividend, not more. They also developed the investment strategy suggested by Campbell et al. (1955), that investors belonging to different tax brackets should plan their sales and purchases after the dividend yield being high or low.
Another article is “Marginal Stockholder Tax rate and the Clientele Effect” presented by Elton & Gruber in 1970. The authors expand the reasoning’s presented by Campbell et al. (1955) by further examining the shareholders tax rate on dividend from the average ex-dividend day price drop. They raise the importance of the tax brackets role in stock valuation and more importantly, in the dividend policy models. Elton & Gruber (1970) based their findings on the behavior of all stocks registered on the New York Stock Exchange that paid dividends during the period of April 1966 and March 1967. They made use of closing prices on all of their observations rather than opening prices since all orders that are registered on the specialists books will be adjusted by the amount of the dividend, hence not useful (Elton & Gruber 1970, p. 70). The authors manage to conclude that there is evidence of prices during this period not dropping by the full amount of the dividend payment. They explain this behavior by relating their conclusions to the clientele effect, suggested by MM (1961) to any deviations of the dividend irrelevancy. That is, the reason for prices to not drop by the full amount of the dividend should be explained by the different tax rates that different investors are subject to. Hence, an investor belonging to a lower tax bracket should be keener to purchase/hold high dividend yield paying stocks and vice versa. The authors also confirm that there is a situation during this period on the NYSE where the prices do not drop by the same amount as the dividend being paid. They do conversely explain these market deviations by suggesting that investors creates these patterns since they will be more/less keen to purchase/sell stocks that matches their current tax situation (Elton & Gruber, 1970, p. 68). Summarizing these three historical observations we can conclude that there are some discrepancies related to the reasons for the ex-dividend behavior of stock prices. There are several different markets present in the studies and the markets might not be identical which should lead to deviations in the findings –even though everyone studies the same phenomena. What they all have in common is that the drop in stock price on the ex-dividend day not falls by the dividend amount.

So far we have observed what more recent authors continuously refer to as the founders of the fundamental ideas of the ex-dividend behavior of stock prices. In recent years there has been an extensive amount of research measuring the ex-dividend effect. We think these research first off provide an indication to what degree the ex-dividend effect still is relevant or not. Secondly, they also provide a perhaps more updated view on what, both practically and theoretically, models to apply and what theory our research should rely upon. The upcoming section will highlight what the development has been from the 1950’s up to the 2000s, and give an update on research measuring the ex-dividend effect. Picking up where Elton & Gruber (1970) left off, Boyd & Jagannanthan (1994) presents their research that examines the stock prices around ex-dividend dates. Boyd & Jagannanthan (1994, p. 5) takes explicit account of two of the stylized fact that has been concluded from previous research made within this topic of ex-dividend behavior: (i) transaction costs are important (ii) there are several different classes of traders with different costs connected to their transactions and correspondingly different tax levels. Boyd & Jagannanthan (1994, p. 5) takes these facts into consideration by including them into their model so that transaction costs plays a larger part and there are possibilities to identify tree different types of traders: (i) taxable individuals (ii) tax advantaged dividend capturers (iii) tax neutral arbitrageurs. Furthermore, the author’s employ an extraordinary large sample compared to previous studies made. Boyd & Jagannanthan (1994, p. 21) uses data collected from 25 years (1975-1987) which Boyd & Jagannanthan (1994, p. 8) argues should make their results more précis than previous research since time series data may vary from year to year. The usage of 25 years of data provides the authors with 132000 observations according
to Boyd et al (1994, p. 6). Boyd et al (1994, p. 26) manages to conclude from their vast sample that the expected price drop would amount to 90 % of the dividend amount. Hence the authors provide evidence for arbitrage opportunities in relation to the ex-dividend day. Kato & Loewenstein (1995) follows in the footsteps of Boyd & Jagannathan (1994) and presents in 1995 a comprehensive analysis on ex-dividend stock price behavior. Kato & Loewenstein (1995, p. 818) performs their research on the Japanese market and motivate their choice by explaining that the institutional features of the Japanese market differs from the American market where most other research has been carried out throughout the years. Kato & Loewenstein (1995, p. 818) provides an example of these differences by exemplifying that investors in Japan should not hold any preferences towards long- or short-term trading because of their tax structure. Kato & Loewenstein (1995, p. 821) base their conclusion on a sample consisting of 1203 firms registered on the Tokyo Stock Exchange and their sampling period contains observations from January 1992 to the end of July in the same year. The authors collect their data from firms registered on the Tokyo Stock Exchange (TOPIX) and the Nikkei Stock Average (Nikkei). In total the authors managed to collect a sample of 18869 ex-dividend observations and conclude that these observations, on average, to 0.72 % of the dividend amount. Hence, Kato & Loewenstein (1995) could conclude that there existed arbitrage opportunity on the Japanese market during the years they examined. Bali & Hite (1998) tries not only to establish if there are market imperfections in relation to the ex-dividend day on stocks but also further explain the role of taxes in this situation. The authors' provide reasons for why prices decline by less than the dividend amount and why this does not necessarily has to be explained by tax induced dividend clients. Bali & Hite (1998, p. 131) research is based on price series data from July 1962 to December 1994. The observations are based on firms' price data that are registered on the New York and American Stock Exchange. Bali & Hite (1998, p. 131) manages to collect 207499 observations that are subject to ex-dividend price developments. Bali & Hite (1998, p. 136), does in line with much of the observations that we have accounted for, manage to conclude that the average price drop only amounts to approximately 86% of the dividend amount. Hence, Bali & Hite (1998) also manages to conclude that there exist arbitrary possibilities on their chosen markets. Rantapuska (2008) investigates the ex-dividend behavior on the Finnish stock market. In line with previous research Rantapuska (2008, p. 356) concludes that it is unlikely that trades made related to ex-dividend days are populated by only one particular group of investors and therefore focuses his research on not only examining if there are arbitrary possibilities on the Finnish Stock Exchange but also concludes who trades on these days. Rantapuska’s research is based on data from firms listed on the Helsinki Exchange (HEX) between January 1995 to November 2002 (Rantapuska, 2008, p. 360). During this period Rantapuska (2008, pp. 356-360) manages study 885 ex-day events that are generated during both bull and bear market periods. Rantapuska’s (2008, p. 356) concludes that taxes will influence investors on how to invest in relation around the ex-dividend day. The author also concludes that, on average amongst the different clientes that he identifies, arbitrageurs that engage in short-term trading can make an overnight 2 % excessive return after transaction costs.

As observed in the research presented it is clear that the question of ex-dividend stock behavior is and has been discussed during a long period of time. What we can observe from previous research is a common notion that the stock price tends not to drop by the amount of the dividend; hence there are arbitrage opportunities available on several markets. However, much of the research deviates to a large degree on three main points:
(i) The effect on preferences between capital gains and dividends due to different tax rates and regulations (the tax-effect hypothesis). (ii) The influence of transaction costs on the ex-dividend behavior of stock prices (the short-term trading hypothesis). (iii) The microstructure, such as aspects as tick sizes and bid-ask spreads. The research presented by Dasilas (2009) also examines the ex-dividend stock price behavior but on the Greek Stock market during the period 2000-2004. The author chooses the Greek market due to its good fit towards the above-mentioned three most discussed areas of ex-dividend behavior. Dasilas (2009, p. 60) argues that the Greek market provides a somewhat unique institutional environment that would erase much of the factors that creates deviations in previous made research. There are neither tax on capital gains nor on dividends, according to Dasilas (2009, p. 60). Dasilas (2009, p. 60) further argues that macrostructure impediments e.g. price discreteness and bid-ask spreads do not seem to play an influential role on the Greek stock market. Hence, what Dasilas (2009) suggests is that the Greek market would be a somewhat ideal market to study if one wanted to overcome much of the deviating arguments that have developed in previous research. Dasilas (2009, p. 73) builds his research on findings from the Athens Stock Exchange (ASE) where during his chosen years were able to derive a sample of 256 observations. Dasilas (2009, p. 76) manages to conclude that the average drop of stocks on the ex-dividend day only amounts to 96.8%, which ultimately would provide evidence for arbitrage opportunities on the ASE.

It has already been concluded that the market imperfections in relation to the ex-dividend behavior was present in the 1950’s 60’s and 70’s. One would perhaps suspect that these market imperfections would have vanished as an effect of the development of the Internet and IT-communication platforms making it easier for agents around the world to share information. The increased transparency and sophisticated information flows would reasonably lead to arbitrage opportunities disappearing at a higher pace, as discussed by D’Avolio, Gildor & Shleifer (2001, pp. 4-6). But from what we have observed from more recent research presented during the 1990’s and 2000’s this reasoning do not necessarily seem to be the case. All of the more recent observations points out there actually exists arbitrage opportunities. Hence, the phenomena of ex-dividend behavior seem to be of ongoing concern.

2.3.2 Swedish evidence of the ex-dividend effect

Thus far we have been able to conclude that ex-dividend behavior of stocks has caused market anomalies continually from the 1950’s up to the 2000’s. We have however not had any indications of what the situation looks like on the Swedish market. In the research “Arbitrage possibilities on the ex-dividend day”, Alm & Årefjäll (1999) examines the ex-dividend behavior in stock prices on the Swedish market. The authors conducted a similar research to that of the abovementioned researchers but on the SSE, between 1994-1998 and consisted 837 observations that focused on cash dividends. Alm & Årefjäll (1999, p.51) concluded that the average price adjustment against the dividend paid amounted to 62.3% on average. Hence, Alm & Årefjäll (1999, p.51) was able to determine that exist an ex-dividend effect on the SSE. Alm & Årefjäll (1999, p.59) also managed to conclude that there was no significant difference in the ex-dividend effect for those firms that were cross-listed on both the SSE as well as the New York Stock Exchange. The authors’ could also conclude that there was proof of the
clientele effect, presented by MM (1961) since the high yield dividend stocks attracted more short-term investors than do low dividend yield stocks.

<table>
<thead>
<tr>
<th>Study</th>
<th>Examined period</th>
<th>Examined market</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Campbell and Beranek (1955)</td>
<td>1949–1950</td>
<td>USA</td>
<td>$\Delta P/D &lt; 1$</td>
</tr>
<tr>
<td>2 Durand and May (1960)</td>
<td>1948–1959</td>
<td>USA</td>
<td>$\Delta P/D &lt; 1$</td>
</tr>
<tr>
<td>4 Litzenberger and Ramaswamy (1979)</td>
<td>1936–1977</td>
<td>USA</td>
<td>Tax effect</td>
</tr>
<tr>
<td>21 Wu and Hsu (1996)</td>
<td>1984–1990</td>
<td>USA</td>
<td>Tax effect</td>
</tr>
<tr>
<td>31 Milonas and Travlos (2001)</td>
<td>1994–1999</td>
<td>Greece</td>
<td>$\Delta P &lt; 1$</td>
</tr>
<tr>
<td>34 Graham et al. (2003)</td>
<td>1996–2001</td>
<td>USA</td>
<td>Tax effect</td>
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**Table 3.** Empirical evidence of the ex-dividend effect.  
Source: Dasilas (2009)
3. THEORETICAL METHODOLOGY

“The only way around is through”

– Robert Frost

In our methodology chapter we start by discussing the fundamental differences between, what we refer to as, a general methodological approach to business research and our chosen methodological path. The aim is to throughout the chapter distinguish between the general approach and the applied one for finance. We continue by arguing why we have a positivistic approach in epistemology, a realistic in our ontology, and take a deterministic approach in the human nature perspective. Lastly we highlight our defined pre-understanding, motivate our choice of sources and their limitations.

3.1 Methodology within finance

Business research separates itself from other research areas largely due to its diversified nature. It covers research fields ranging from management, marketing, accounting and entrepreneurship - all the way to finance (Ryan, Scapens & Theobold, 2002, p. 24). Since research fields are diversified, one might assume that the objects’ being studied differs as well. If this were to be the case, would it not be reasonable to assume that different objects need to be handled with diverse approaches? Ryan et al. (2002, p. 24) contribute to this reasoning by suggesting that a plurality of methodological approaches would be needed in order for the research to be successful. We therefore believe it is of utmost importance to apply both methodological considerations in accordance with general business research, along with considerations for the particular research field, for us finance. Our research aim is to throughout the methodological chapter highlight main differences between what we refer to as the general methodological approach applied within business research and how it separates and contributes to the methodological approach when performing our finance research. The general approach is defined by Zenman, Babin, Carr & Griffin as a business method applicable to all fields within business research (2013, pp. 6-7). Ryan et al. (2002, p. 24) further argues that since business research is diversified, it would be reasonable to take the differences into consideration when applying your particular research. In many ways we will still follow this general approach to methodology, but think it is vital to discuss the potential limitations. Schmidt (1982, pp. 391-392) is one of several authors, for example, Borokhovich, Bricker, Brunarski & Simkins (1995, pp. 1691-1717), who have dwelled upon the differences between finance research and other fields of business research. Schmidt (1982, p. 401) pinpoints three main reasons as to why the general methodology approach not is suitable for financial research. (i) Schmidt (1982) argues that the requirements for, what the author refer to as the general methodology, are so strict and limiting that no research possibly can meet them. (ii) The theoretical framework in general business research ignores the fact that it only is an intermediate step between past and future theories. We argue that it is important for any finance research to notice this reasoning, in particular for us since we make use of theories, e.g. established in the 1960s. In our research we use our theoretical framework as a basis, but realize that the theories applied only are intermediate steps in between previous - and future theories. (iii) In order to describe research, as satisfactory one not only wants it to elucidate
social reality but also describe something relevant. Schmidt (1982, p. 401) argues that there is a conflict between observability-testability on the one hand and importance-depth on the other. Our research tests an in-depth behavior on the OMXS by investigating the stock price movements in connection with the dividend amount. We argue that the tests we are conducting are in-depth since we are looking at a certain behavior in order to establish a general pattern.

Another area that has been problematic when applying general methodology to finance research is according to Schmidt (1982, pp. 391-392) replication. The author presents reasons for why it is in many instances difficult for researchers to follow in other researchers footsteps when applying, what the author refer to as, a general methodological approach is fully applied in finance research. (i) The researcher might be reluctant to describe her methodology approach since she considers herself to perform a successful research irrespectively. She therefore considers the methodological considerations superfluous. In our case we aim for our research to be replicable and in order for it to be so we thoroughly describe our approach both theoretically and practically. (ii) The second reason is based on the idea that researchers within finance perceive many of the concepts presented by the general approach as inadequate for finance, thus not useful. In some ways we contradict this reasoning by applying general concepts, which we think is adequate for our research, for example our epistemological and ontological considerations. (iii) The third reason for the reluctance to describe the methodological approach is due to the fear of being questioned. Not the research in itself but rather the methodological considerations for finance. As we aim to use a finance approach different from general business research it will not be problematic to replicate our research, and as authors we therefore have no fear of being questioned. In particular we aim to highlight the issues important for finance research and interpret their meaning. For us, Schmidt’s (1982) three reasons collectively highlights why a different methodological approach is fruitful, and specifies how we in our research can avoid missteps. Schmidt (1982, pp. 391-392) concludes his reasoning by stating that much of the literature in general business research supports the fact that the general approach is inadequate for finance research, and strongly recommend researchers within finance to notice specific considerations.

3.2 Philosophy

It is important for the researcher to pinpoint their beliefs about the topic they are investigating, defined as the research philosophy, according to Saunders, Lewis & Thornhill (2009, p. 82). The authors describe three main paths of thinking in terms of research philosophy: (i) interprevitism, (ii) realism and (iii) positivism. The figure below shows how these three main philosophic paths are used when conducting business research:
Interprevitism is defined by Bryman & Bell (2011, p. 17) as a concept of how people and their institutions are fundamentally different from natural science. The research within the social world therefore requires an approach that distinct humans against the general natural order. Looking at it from the practical perspective interprevitism is the study of face value, defined when the behavior studied is determined from direct experience and not from external observation (Cohan & Manion, 1987, p. 34). Realism is a concept simply stating that what we observe with our senses is reality (Bryman & Bell, 2011, pp. 16-17). In contrast to realism and interprevitism, is positivism. Bryman & Bell (2011, pp. 15-17) defines it as a philosophical standpoint in which the researchers apply methods of natural science when studying the social reality. Although finance research distinguishes itself from general business research, as discussed, positivism is the philosophical way of thinking commonly applied. In our research we follow previous research and take positivism as our philosophic standpoint (Ryan et al., 2002, p. 13). This is because of the fact that we study the social reality, the OMXS, from a perspective close to natural science. Rather then either using interprevitism by studying the OMXS from direct experience, or relying on our senses through realism we make us of natural science in the form our mathematical and statistical models. Although we, alongside previous finance research, adapt a positivistic philosophical standpoint we believe it is of importance to even further explore the difference between general philosophical considerations in business research and research within finance. Schmidt (1982) further analyzes the relationship between philosophy and finance research, and aims to explain that traditional philosophical standpoints are inappropriate to use for research within finance. Although we follow the reasoning by Ryan et al. (2002) and take a positivist approach to philosophy, we think that it is important to take Schmidt’s (1982) suggestions into account. The author argues for an alternative philosophic position. Schmidt (1982, pp. 406-407) brings forward three alternative positions. The first one is called naive realism and suggests that you should ignore the conflict between the philosophical approach in, what the author refer to as, the general approach and research in finance. One should thus continue to strive for research that is not affected by it. The authors’ argument is that better theories not will raise essential problems of observability, and are by that logic naive to the conflict between
philosophy and finance. The second position aims to become modest in the aim and adopt a position of positivism-instrumentalism. By adapting this strategy we are able to say something about the observed social reality but not explain what the underlying cause of the observed. Thirdly is the position called dynamic evaluation, which regards the theoretical framework as intermediate steps on the way to future theories. Schmidt (1982, pp. 401-402) summarizes the three alternative solutions by arguing that the concept of naive realism is better suited for market-oriented research, for example the research in stock markets. That is, naive realism states that what we observe is the observed, based on our perceptions. If we, in our research, observe stock prices, the naive realism concept suggests, that the stock prices in fact are what we observe, based on our perceptions. One drawback of the naive realism concept is that if observers have different perception, they observe things in a dissimilar manner (Schmidt, 1982 pp. 401-402). In our research, this is not a concern since stock prices by definition is what they appear to be, a subjective interpretation is hence unlikely. We have in our investigation into finance methodology seen a total lack of philosophical considerations, and has taken Schmidt’s (1982) considerations, alongside Ryan et al.’s (2002), into account when formulating our philosophical approach. In conclusion we therefore take a positivistic approach in which we apply Schmidt’s (1982) reasoning concerning the concept of naive realism.

3.3 Epistemology, Ontology and Human nature

In accordance with our philosophical considerations, see Figure 2, we use one of the two approaches available for researches, namely deductive and inductive. In our research we take a deductive approach where we as researchers deduces a hypothesis, that on the basis on what is known must be subjected to empirical scrutiny (Bryman & Bell 2011, pp. 11-12). The authors explain that we as researchers first must formulate the hypotheses and then try to translate it our testable data. For us this means to translate our theoretical framework into a formulated hypothesis and then collect sufficient data to conduct the testing. After the hypotheses testing we present our findings and accept or reject the hypothesis. In contrast to the deductive approach is the inductive, which we feel is important to briefly describe in the context of theoretical approaches. In the inductive approach the researcher starts with specific empirical observation with the sole aim of establishing new theory. The approach is commonly used in in-depth interviewing or more qualitative approaches (Bryman & Bell, 2011, p. 11-12). Since our research aim is to quantitatively examine a pattern of association and collide it to previous research, our research takes a deductive approach. Taking a deductive approach we know aim to explain what considerations in terms of epistemology, ontology and human nature that collectively has defined us in the objectivistic corner of Burrell & Morgan’s (1985, p. 2) subjective-objective dimension, Figure 3.

One of the first to influence the concept of epistemology was Plato, according to Ryan et al. (2002, pp. 9-11). The authors define epistemology as the concept on what is regarded as acceptable knowledge or not, and states that Plato has influenced epistemological thoughts by introducing the concept of justified true belief. Justified true belief came to spur future development and is still today one of the corner stones in epistemology (Ryan et al. 2002, pp. 11-13). It formulates how researchers require acceptable knowledge. Then main argument is that the requirement of knowledge is a central within any researchers epistemological considerations (Ryan et al. 2002, p. 11),
and we believe that our research is in need of knowledge that is widely acceptable. We will therefore take heed of the three substantive issues, highlighted in the justified true belief concept: (i) The nature of belief, is a concept where there are, according to Ryan et al. (2002, p. 11) consisting of several sources: perceptual belief, memorial belief, introspective belief, rational belief and testimonial belief. The authors argue that the sources of nature belief could be summarized in two general ones. The first one is rational belief and concern what is grounded within our rational processes as the enquiring subjects. In our research this could be how we interpret information from the OMXS given our own beliefs and experiences. Thus resulting in biased conclusions. The second general source is perceptual belief, which concerns how we as researchers interpret the world around us, based on our grounded perceptions. As researchers in Sweden we might interpret the observable in a particular manner, different to researchers in for example the US. Simply put, these two sources suggest that researchers not need to search beyond themselves in order to formulate a justified true belief about the world. As mentioned in the Philosophy our research is free of problems of perception, since our data is given. (ii) The basis of truth is in the epistemological context a discussion of whether belief is the proper truth. That is, can we state that whether someone’s belief is true, not is a creation of that person’s own belief? In our research we reconnect the basis of truth in the way that we make little use of perceptive information. Throughout we use data that by definition is non-dependent on perceptions of either the observer or the object being observed. Thus, our research exclude whether or not the observer or the observed beliefs are true or not. (iii) The problem of justification is connected to the basis of truth and is concerned with the reliability of whether or not someone’s beliefs are true. In our research we are not using either own perceptions nor someone else’s beliefs and are therefore not subject to either of the two substantive issues, and by using unperceptive data we minimize the effect of our own perceptions. The reasoning behind the justified true belief concept can, according to Ryan et al. (2002, pp. 11-12) be interpreted as propositional knowledge. That is, it does not need to be perceived by the researchers in order to establish itself as knowledge about what is. Ryan et al. (2002, pp. 11-12) continues the epistemological discussion in finance research by describing how Socrates founded that the initial ideas about knowledge are innate and that one could draw knowledge from others by formulating leading questions. Plato, his apprentice, extended these ideas into what is known as the Platonic ideal forms. These forms describe the abstractions of pure geometry and not the material world that individuals refer to as a sensation, thus leading to the highest kind of reality. The fundamental thoughts by Plato have had an influence in finance research in the sense that the concepts of ideal or perfect capital markets could considered to be platonic abstractions. Plato’s main interest might not have been the concept of perfectly efficient capital markets but if he were to comment he would probably, in our view, in relation to his thoughts describes it as a real being which could be understood by the simple exercise of reason. Thus Plato would view the characteristics, for example volatility, of the capital market as one basis for which to acquire genuine knowledge. The reasoning’s of Socrates and Plato has thus far introduced the three-part concept of justified true belief, which as mentioned, still today is one of the cornerstones of how researchers acquire knowledge.

These concepts were challenged and revised by Plato’s pupil Aristotles², whom later, based on these ideas, influenced the concept of empiricism (Ryan et al., 2002, p. 12).

² For further investigation into their philosophical dispute: http://plato.stanford.edu/entries/aristotle-politics/
Empiricism designates an approach in which researchers only can acquire knowledge through our senses (Bryman & Bell, 2011, pp. 10-11). What classical empiricists all have in common is according to Ryan et al. (2002, p. 12-13) that they accept the following three arguments: (i) Ones certainty of what we actually know could only be pending on perception. (ii) All knowledge must be derived through perception from our senses. (iii) The statements made will either be true of false pending on the world that surrounds us or simply due to the properties of the language we apply when explaining them. The conclusions to be made are according to Ryan et al. (2002, p. 13) that beliefs that are based upon methods and not upon experimental ground should be considered as metaphysical, hence useless. Reasoning alone cannot be the only determinant of the beliefs about the world. Thus, leading to the ideal that science should be value free, stating that the conclusions made should be free from ones beliefs and ideologies. Empiricism is connected to our research since we research experimental evidence rather than methodological derived observations. The difference between two is that the later relies, to a further extent, on perceptive interpretation. We experiment on data from the OMXS and look for evidence in order to answer our problem statement. In accordance with empiricism we therefore rely on evidence in order to derive conclusions, thus having empiricism as our epistemological standpoint. Connecting to our philosophical considerations the values in empiricism has been influential in the development of our chosen philosophical standpoint, positivism (Ryan et al. 2002, p. 13). In business research Bryman & Bell (2011, p. 15) discusses five principles that researchers with a positivistic approach should reflect over. (i) Only knowledge confirmed by ones senses can be considered as knowledge. (ii) The purpose of theory, an also in line with a deductive approach, is to generate a testable hypothesis. (iii) Knowledge will be derived from facts. (iv) Science must be value free (objective). (v) There is a clear distinction between scientific statements and normative ones. In relation to the definitions from Bryman & Bell (2011, p. 15) and their belonging principles we fulfill the five principles. Our methods are based on mathematical models, hence our conclusions should not be considered to be drawn out of beliefs and observations of behavior, and thereby be considered to be metaphysical. Related to the second principle we use a deductive hypothesis approach that includes hypotheses testing (Bryman & Bell, 2011, p. 11). Our results rely on data that are value free in the way that they are a result of several factors in which none of them depend or rely on observation. In relation to the discussion about what should be and ought to be contrary to what is testable, observable, predictable, we manage to separate these apart by only applying natural scientific methods in order to evaluate what the result actually is. Without preconceived believes of what should be or ought to be.

Epistemology is the concept of what is regarded as acceptable knowledge or not (Ryan et al., 2002, pp. 11-13). Alongside is Ontology which is defined by Ryan et al. (2002, p. 13) as the study of existence and what is discern to be real, and reality is accordingly concerned with the construction of existence in objects. The reality can either exist independent from social actors or be created by social actors, according to (Ryan et al. 2002, p. 8). These two opposite positions in terms of ontological considerations, is defined as a realist who suggests that reality is existent within objects, and an idealist who holds that it exist within the mindset of the subject. Thus, after determining what ought to be regarded as acceptable knowledge, we as researcher have to determine our ontological position. Our ontological approach is realistic, since we believe that objects we describe has a reality independent of our perception of it. We thus believe that the OMXS and its traded assets have a reality independently from our research. Schmidt’s
(1982) states that ontological considerations not are fully applicable in finance research, we however think that it is important to consider the path chosen in business research. Burrell & Morgan (1985, p. 5) brings forward a third set of assumptions in association with the ontological and epistemological considerations, namely assumptions concerning human nature and the relationship between human beings and their environment. The authors distinguish between two sets of views: deterministic and free will. In the deterministic view human beings and their experiences are regarded as products of the environment. To put it simply: human beings are products of their environment. In the free will view, human beings control the environment and are said to have a creative role and regarded as the creator of the environment. In our research we expect investors to, according with the EMH, act rationally and therefore take the deterministic view. Our investors are a product of the environment.

Our epistemology, ontology and approach to human nature classify us in the objectivistic corner of Burrell & Morgan (1985) subjective-objective dimension. Burrell & Morgan (1985, p. 2) regards the three sets of assumptions to have direct implications about the methodological nature of the research. Each one has consequences for how we as researchers try to obtain knowledge about the social reality. Different choice regarding epistemological, ontological and human nature considerations generate different methodologies. There are an endless number of possibilities. According to Burrell & Morgan (1985, p. 3) our research belongs to the objectivist approach of social science. We have a realistic approach in our ontology, a positivistic approach in our epistemology and take a deterministic approach in the human nature perspective.

![Figure 3. Subjective-objective dimension. Source: Burrell & Morgan (1985)](image)

Ryan et al. (2002, p. 30) argues that there is a difficulty in stating what position regarding epistemology and ontology that is advocated by the researchers. According to Ryan et al. (2002, p. 30) it is possible to have a plurality of methodologies. Different methodological approaches can lead to fruitful research in their own respect. Thus, it is important to make methodological decisions based on your own research and line of investigation. We are confident we have done so by taking the fundamental differences in methodology between, what Schmidt (1982) refer to as the general business research and finance research into consideration. In line with Ryan et al. ’s (2002, p. 30-35) reasoning we have taken both a third consideration, namely human nature, and a fourth consideration, Schmidt’s (1982) alternative approach to finance research, into account when deciding upon our theoretical path. Lastly we fulfill our theoretical considerations by putting ourselves into Burrell & Morgan’s subjective-objective dimension. In our
research we aim to investigate if stock prices on ex-dividend day drop with the same amount as the dividend amount and whether these results can be generalized to be statistically significant. By using statistical languages we believe that we can link theory with empirical observations. We test existing theories and do not aim to generate new theory. In conclusion we adapt a general approach to business research but are aware of the shortcomings related to research within finance.

3.4 Pre-understandings

Studying the last year on our master in international business we do both have certain pre-understandings of the subject finance and how efficient markets and arbitrage opportunities work. Niklas is taking the degree with a finance specialization and Gustav with an auditing specialization. Besides our master in international business we both study towards a bachelor’s degree in economics. Collectively we have taken courses in the areas of international business, advanced finance and auditing, law, micro-and macroeconomics and a variety of courses on our respective experiences from exchange studies. Our previous studies have prepared us well for the subject of our research, since we both have been studying finance as well as macroeconomics on a more advanced level. The finance courses have helped us gain knowledge in different financial tools and the fundamentals of the stock markets. Whereas the courses in economics have helped us understand the assumption that an efficient market is an important tool in investigating arbitrage opportunities on the stock market. We think our academical pre-understandings will improve our research since it relates to our subject both in terms of theoretical frameworks and the general understandings. Besides our pure academical pre-understandings we are both active investors on the stock market that in turn makes having a personal relation to this very topic of investing on the stock market and trying to find arbitrage opportunities. We are weekly investors on various stock markets and read on a daily basis up-to-date related literature. We view this pre-understandings as a positive component to our research since it could facilitate the understandings of financial concepts and thereby lead us to choose, evaluate and make a more knowledgeable decision regarding what theories to use.

3.5 Evaluation of sources

For our investigation and analysis we have used different data sources in order to get the overall picture. We have used academical articles, publicly available annual reports, newspapers and journals available from the Umeå University library. In our investigation for academical literature, mostly used in our theoretical framework we search for phrases like ex-dividend, dividend irrelevancy, anchor pricing, efficient market hypotheses etc. Our data collection of stock and dividend are taken from the library source Thomson Reuters DataStream.

For our research we wanted to use a broad range of sources to cover the whole spectrum surrounding dividend irrelevancy and ex-dividend stock price behavior. We have used both up-to-date sources and established sources with a solid theoretical standpoint, for example the MM theorem (1961). The sources used in our research are mostly collected

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3 www.ub.umu.se
from established business journals, previous academical research. We think that the sources we have used are to be regarded as reliable, because of the fact that most of them are taken from established journals is an indication of the truthfulness of the source. It also ensures the quality of the research, which indirectly contributes to the reliability criteria. For us as business students at Umeå University it is however difficult to assess the quality, reliability and truthfulness in our sources. What we can do is to critically assess the quality of the source from which the article, theory derived from. By the use of secondary data we are by definition exposed to the risk of using and/or misinterpreting the wrong data. We think that this is of minor significant to us since we use well established data software throughout our data collection. By using articles and textbooks we are subject to the possibility of the human biasness, since we are not familiar with the authors and might overlook preferences of the authors, for example their personal opinion.
4. PRACTICAL APPROACH

“Technical skill is mastery of complexity. Creativity is mastery of simplicity.”

– E.C. Zeeman

In the practical approach we describe how our problem statement is examined in terms of sampling, data collection, mathematical model, hypothesis formulation and significance testing.

4.1 Census sampling

The purpose of sampling is to minimize cost and time for data collection by segmenting the whole population into a small group of observations. The conclusions drawn from the small group can work as a reflection of the conclusions that would have been drawn for the whole population (Saunders et al. 2007, pp. 204-206). Saunders et al. (2007, p. 212) states that if it is possible sampling the whole population is considered optimal, since it by definition would generate the most accurate results. The authors however states that this is not possible in most cases, and highlight four main reasons for why it is more convenient to sample the population. In our research we take the whole population, the OMXS, as our sample, by Saunders et al. (2007, p. 210) referred to as a census. Although we realize the convenience of taking just a sample of the population, we aim to generate as accurate results as possible that can be generalized across experimental settings. Our population and sample is all firms paying dividends on the OMXS between our years of investigation.

There could have been a few potential obstacles for us in our sampling process. Of which one could have been lack of sufficient data in the DataStream software. A lack of sufficient data, in for example dividend payouts would have decreased our population to only cover firms where dividend payouts were collectively available. Another problem could have been in the sampling selection, if we chose to pick only firms on the A-list for example (OMXS largest firms), which would have decreased our population. Our sample and population consists of 694 observations, and was picked on the basis of the following three criteria’s:

(i) The firm paid dividend during at least one of the years of investigation. If it did not the firm would not be relevant in our research since we need the dividend payment, the cum-dividend- and ex-dividend dates in order to measure the ex-dividend effect.

(ii) The dividend has to be paid as cash and not as a for example stock repurchase option. This is because we investigate a drop in stock price, and measure it against the dividend amount. If the dividend is in cash this is possible.

(iii) Registered on the OMXS for at least the entire time-period of our research. All firms that have been registered less are not included in our data. In order to measure the anchoring theory’s effect on the ex-dividend effect we segment our observations based on its stock price volatility, and we therefore need daily stock price for the entire time-period.
4.2 Time-period

The area of the ex-dividend effects is not a new phenomenon, (see Empirical Observations) where one can find results lingering back to 1955. Looking at observations from the Swedish stock market one finds research as far back as from 1978-1985, summarized and presented by Claessson (1987). De Ridder & Sörensson (1995) performed a similar research for the years ranging 1980-1993. Alm & Årefjäll (1999) continued where De Ridder & Sörensson (1995) left off and drew conclusions based on observations from the years 1994-1998. What all research has in common is that they try to assemble as large number of ex-dividend day observations as possible in order for the results to become as accurate as possible, since a large sample increase the statistical accuracy (Studenmund, 2011 pp. 554-558). The most up to date research performed on the Swedish stock market, in terms of investigated time-period, is thus over 15 years old. Our research will in a similar manner, using the most recent possible year, 2012, and go back four years in time. Alm & Årefjäll (1999) uses 5 years of data but we have limited our research to four since we do not want to add the year of 2008, due to its extreme economic climate, as argued by Grigor'ev & Salikhov (2009, pp. 35-36). By applying four years we are able to gather a sufficient sample in order to generate statistically relevant results, according to Studenmund (2011, p. 148). The OMXS development during the four years of investigation:

![OMXS price index 2009-2012](Figure 4. OMXS price index 2009-2012. Source: Created by the authors (2013))

4.3 Data collection

Data is in the essence of most business research. In order to answer a research question or in other ways meet the objectives of a research, it is recommended to first evaluate all alternative ways of collecting data (Saunders et al. 2007, p. 281). Along Saunders (2007) reasoning we first evaluated different ways for us to obtain the data needed in order to answer our research question:
Can abnormal returns be made on the ex-dividend effect by segmenting stocks based on their price volatility?

For our research it was important to collect information regarding stock prices, ex-dividend dates and the corresponding dividend amounts. We therefore mainly evaluated the software programs DataStream and Google Finance. In the end we picked the DataStream software as the basis for our data collection. This was due to the comprehensive set of data the software could generate, both in terms of stock prices but more relevantly the complete data set of ex-dividend dates and dividend amounts. It is also important to stress the convenience criteria and the easiness with which we could extract data when selecting DataStream. In research there are two sources of data available, primary and secondary data (Saunders et al. 2007, pp. 142-150). In our research we extract data from a secondhand source, DataStream, which by definition is secondary data. In order to translate our secondary data into a testable data set we followed the following steps: (i) The first step was to extract the relevant data. From DataStream we gathered four-year daily stock prices for all companies on OMXS, the dividend amount paid in those four years and the ex-dividend dates. (ii) After gathering the data we sorted the relevant information and formed one comprehensive data sheet in Microsoft Excel. The data sheet covered 694 observations and contained the following variables and information:

- Cum-dividend stock price.
- Market adjusted cum-dividend stock price.
- Ex-dividend day stock price.
- The calculated ratio of stock price dip.
- Market adjusted stock price dip ratio.

4.4 Data segmenting

If there are arbitrary possibilities present, can we establish a method capturing these anomalies, pending on the stocks price volatility (anchoring theory)? This can be answered by dividing our sample into two different segments, separating them on the basis of stock price volatility. The following section will explain how we have derived our two segments. When examining the volatility one should calculate the standard deviation, which is the standard error of the estimate and denote it by \( \sigma \). In order to derive the standard deviation we calculate the variance of the sample, which is the dispersion of the sample distribution around its own mean (Studenmund, 2011, pp.108-109). In order to calculate how the distribution surrounds its mean we convert stock prices into a percentage, hence daily returns. All calculations can be divided into three separate parts, accordingly:

(i) Returns

In order to convert the stock prices into returns we divide the change between two observations with the first observation according to the formula:

\[
R_i = \frac{(P_t - P_{t-1})}{P_{t-1}}
\]
(ii) **Variance**

The variance of the observations is centred on the mean (or expected value), which is the discrete variable $X$, as a weighted average of all the possible values of $X$ amongst the distribution. It can be calculated according to:

$$E[X] = \sum_{i} X_i P[X_i]$$

**Explanation**

$E(X)$ = The expected value of the discrete variable $X$
$X_i P$ = The discrete variable $X$ probability

The next step is to measure how much the observations differ from the calculated mean. Thereafter remains to compare each and every one of the observations to the mean and square the difference, and multiply them with the probability of each $X$ value according to:

$$\sigma^2 = \sum_{i} (X_i - \mu)^2 P[X_i]$$

**Explanation**

$\sigma^2$ = The variance of the discrete variable $X$
$\mu$ = The mean for the discrete variable $X$

(iii) **Standard Deviation**

The standard deviation is the square root of the anticipated long-run average value of the squared deviations of possible values of each observation from its calculated mean. In the same manner as the variance is the standard variation a probability-weighted measure of the dispersion of the observations around its expected value (Studenmund, 2011, p. 545). The volatility has hence been calculated using the following formula:

$$\sigma = \sqrt{\sigma^2}$$

**Explanation**

$\sigma$ = The standard deviation of the discrete variable $X$

After deriving our measures of volatility we are now able to divide our 694 observations into two segments. According to the anchoring theory stocks with low price volatility are defined as having an anchor price, and stocks with relatively high price volatility do
not. The anchoring theory do not suggest what is considered high or low stock price volatility, but in our research we will consider low as being below average, and high as above. The average stock price volatility between 2009-2012 on the OMXS was approximately 4 %. As for our segmenting we therefore regard observations with stock price volatility above 4 % as not having an anchor price, and observations below 4 % as having an anchor price. For a graphical illustration see Figure 5:

![Figure 5. Stock price volatility for the two segments. Source: Created by the authors (2013)](image_url)

### 4.5 Mathematical model

Our research investigates if there are arbitrage opportunities on the OMXS. We do so by comparing the difference in stock price between the cum-dividend day and the ex-dividend day, with the dividend amount. Our census sample is firms listed on the OMXS that paid dividend at least one of the years, 2009-2012, being listed on the OMXS for at least four years. This generated 694 observations out of the 278 firms registered on the OMXS. By analyzing and conducting statistical tests on the difference between the change in stock price and dividend amount we are able to draw conclusions if there exists arbitrage opportunities accordingly with the ex-dividend effect.

The mathematical model we use, in order to measure the ex-dividend effect was developed by Elton & Gruber (1970). In the model a ratio between the stock price drop and the dividend amount is calculated. An average ratio is calculated for all stocks. The ratio is interpreted as the price drop per SEK of the dividend amount. The model is the most widely used model when measuring the ex-dividend effect. Numerous studies have been done applying this method, for example: (Boyd & Jagannathan, 1994), (Kato & Loewenstein, 1995) and (Alm & Årefjäll, 1999).

In contrast to the mathematical model developed by Elton & Gruber (1970) is the research done by Lakonisho & Vermaelen (1986) and Claessson (1987). The two articles use a different method when calculating the ex-dividend effect. The authors divide both the price fall on ex-dividend day and the dividend amount by the stock price on both cum-dividend day and ex-dividend day. An average of each of those measures is
generated, and a ratio between the two numbers is calculated. Both authors claim this to be a more accurate measure since it captures the differences between the dividend amounts, and thereby represent equally weighted dividend amounts. In the method by Elton & Gruber (1970) low dividend amounts are given a higher weight than high dividend amounts. This is due to the dividend amount and the numerator being smaller and thereby generating a high ratio. Although considering the disadvantage with Elton & Gruber’s (1970) model we apply it as a basis for our research since it is the most used.

The formula we use to measure the ex-dividend effect, the price drop between cum-dividend day and ex-dividend day, on the OMXS is the following:

\[
\frac{(P_c - P_e)}{Div} = R
\]

Explanation

- \(P_c\): Stock price Cum-dividend day
- \(P_e\): Stock price on ex-dividend day
- \(Div\): Dividend amount paid out in cash
- \(R\): Ratio of the ex-dividend effect

In our hypothesis testing we have excluded certain observations that we define as outliers. In terms of the ex-dividend ratio we excluded those above 6 and below -6. A ratio of 6 indicates that the price drop is 6 times larger than the dividend amount. For example: A stock with a cum-dividend price of 10 SEK paying a dividend of 1 SEK, would correspondingly have a stock price of 9 SEK on ex-dividend day. A ratio of 6 means that the stock price instead dropped to (10-6)= 4 SEK. The ratio becomes 6/1=6. In contrast is a ratio of -6 the opposite, the stock price increase six folds higher than the dividend amount, (10-16)/1 = (-6). We argue that such a dramatic drop or increase in stock price on a daily basis is due to other effects than the ones we are examining. For the case of discussion we reason that this is likely to be firm specific information that signals strengths or weakness, for example the release of information revealing a lowered order take in or the discharging of employees. One example is the observation of Stora Enso R in 2012 that had a cum-dividend stock price of 47.33, ex-dividend stock price of 45.76 and a dividend amount of 0.3. The resulting ratio was 5.23 unadjusted for market returns and 7.51 adjusted for market returns. The relatively small dividend amount (small numerator) generated a high ratio. The ratio is likely to be due to one of the signaling factors mentioned above, and the observation is therefore excluded. This kind of effects is not included in our model and we therefore exclude extreme outliers. All and all we excluded 5 % of our observations due to this reason.

4.6 Market adjustment

In order to investigate the change in stock price between cum-dividend day and ex-dividend day we want to neutralize the effect in the stock price as a consequence of general market fluctuations. Thus, we have adjusted the cum-dividend price with corresponding daily return on the OMXS, obtained from DataStream. The result for adjusted daily return will provide a market adjusted cum-dividend price and thereby a new adjusted ratio of the ex-dividend effect.
The market adjusted cum-dividend price was calculated by using the following formula:

\[ P_m = P_e \times (1 + (\text{Daily return})) \]

\[ \text{Daily return} = \frac{(G_{It} - (G_{It-1}))}{(G_t - 1)} \]

**Explanation**
- \( P_m \) = Market adjusted cum-dividend price
- \( P_e \) = Unadjusted cum-dividend price
- GI = General Index
- GI\(_t\) = General Index for day T
- GI\(_{t-1}\) = General Index for day T - 1 (on day before day T)

\[ \frac{(P_m - P_e)}{\text{Div}} = \text{Ad R} \]

**Explanation**
- Ad R = The market adjusted ratio of the ex-dividend effect

A different model that could be used when adjusting for market returns is to apply a market adjusted method where the price is modified for the firms own beta, which would give a risk adjusted market return. We did not calculate the beta values since it would mean to estimate 694 beta values. Moreover, Alm & Årefjäll (1999) and Brown & Warner (1985) both indicate that both models generate similar results, estimating beta values could thus considered superfluous. Along this reasoning our research uses daily returns as an adjustment method. The effect of our market adjustments on the stock prices is illustrated below in Figure 6, using H&M from 2012 as an example:

![Figure 6. Illustration of the market adjustment. Source: Created by the authors (2013)](image-url)
4.7 Hypotheses formulation

In order to test if there exists arbitrage opportunities on the OMXS we first have to formulate our hypotheses, which will be tested and either rejected or accepted. In general hypotheses testing the null hypothesis (H0) and alternative hypothesis (HA) are compared. The null hypothesis is a statement about one or more parameters, (Studenmund, 2011, pp. 122-124), and is typically a statement about values in a parameter that the researchers do not expect. The null hypothesis is assumed to be true until you have statistical evidence enough to reject it in favor of your alternative. As we compare H0 to HA, the alternative hypothesis takes all values not covered in the H0, and correspondingly stands for all statements that the H0 do not include. For us to be able to reject or accept our null hypothesis we need a decision rule describing the conditions for when we reject our H0. When rejecting the null hypothesis we automatically accept the alternative hypothesis. There are two common mistakes when making a rejection or accepting decision on a hypothesis, Type 1 and Type 2 error.

Type 1: Rejection of a true null hypothesis
Type 2: Acceptance of a false null hypothesis

The first hypotheses to be tested is whether or not there exists arbitrage opportunities on the OMXS in connection to the ex-dividend date and the dividend payouts. Hence, we are testing if the difference in stock prices between cum-dividend day and ex-dividend day is equal to the dividend amount:

Ho: There are no arbitrage opportunities on ex-dividend day; the price fall in the stock price is equal to the dividend amount.

Ha: There are arbitrage opportunities on ex-dividend day; the price fall in the stock is less than to the dividend amount.

If we reject the first null hypothesis we test if the concluded arbitrage opportunities can be explained by stock price volatility:

Ho: The arbitrage opportunities cannot be explained by the stocks price volatility.
Ha: The arbitrage opportunities can be explained by the stocks price volatility.

4.8 Significance test

The t-test is the most widely used test when testing the relevance of the null hypotheses in comparison to the alternative hypotheses (Studenmund, 2011, p. 128). In business research the t-test is used as a first step in developing a regression model, according to Greene (2012, p. 1101). In order to test our first null hypothesis, of whether there exist arbitrage opportunities on the OMXS, we apply the one-sample t-test. The t-test measures if the ratio of the ex-dividend effect deviates from 1, hence we assess if the ratio of the ex-dividend effect is equal to 1. In order to do so we included a new variable in our testing in which we subtracted 1 from the ratios and conducted the t-test as a test of whether the mean is equal to zero. The t-test will generate a mean and statically measure if that mean is representative for the whole population, thus stating whether or not there exists arbitrage opportunities on the OMXS. In order to test our second
hypothesis, if the arbitrage opportunities are explained by stock price volatility, we compare our two segments by carrying out an independent two-sample t-test. When conducting t-test researchers choose between a one-sided and a two-sided test, depending on the formulation of the alternative hypothesis (Studenmund, 2011, pp. 122-123). If one has an alternative hypothesis that only can take a value of one side of the null hypothesis, for us that would be that the price drop on ex-dividend day is less than 1, you are defined to conduct a one-sided t-test. A two-sided t-test has in contrast an alternative hypothesis that can take values on both sides of the null hypothesis, for us both higher and lower than 1. However, to conclude that there is arbitrage opportunities we need to determine that the mean of the ratio of the ex-dividend effect is lower than 1. In the one-sample t-test we therefore apply a one-sided distribution. For the independent two-sample t-test our alternative hypotheses can take values on both side of the null hypotheses, hence a two-sided test.

In order to create our decision rule regarding our null hypothesis we need to set a significance level for rejecting or accepting our null hypothesis. Level of statistically significant is usually set to be 0.01, 0.05 or 0.10 (Studenmund, 2011, p. 584). Those levels indicate that one with a 99, 95 or 90 % respective confidence can reject the null hypotheses, and thereby accept the alternative hypotheses and its statement. We will apply a significance level of 0.10, a 90 % confidence interval. The level of significance measures how likely we are to reject a true null hypothesis, a Type I error. If we use a 10 % significance level and falsely reject a true null hypothesis we can statistically conclude that this is unlikely to occur again, a maximum of 1/10 of the time (Greene, 2012, p. 1101). In the t-test we refer to the t-distribution in order to formulate a decision rule. For the One-Sample t-test, a 90 % confidence interval with corresponding significance level of 0.10, our null hypothesis is rejected if the t-value is below or equal to -1.282. The t-distribution looks as follows in Table 4:

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<thead>
<tr>
<th>One Sided</th>
<th>75%</th>
<th>80%</th>
<th>85%</th>
<th>90%</th>
<th>95%</th>
<th>97.5%</th>
<th>99%</th>
<th>99.5%</th>
<th>99.75%</th>
<th>99.9%</th>
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<tr>
<td>Two Sided</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
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<td>99.8%</td>
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<td>Source: Studenmund (2011)</td>
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The two t-tests applies the following formulas:

\[
 t^1 = \left( \frac{\text{Mean}}{\text{Std}/(\sqrt{n})} \right) \quad \text{and} \quad t^2 = \left( \frac{\text{Mean} 1 - \text{Mean} 2}{\text{Std}/(\sqrt{n})} \right)
\]

**Explanation**
- \( t^1 \) = One-sample t-test
- \( t^2 \) = Independent two-sample t-test
- Mean = The mean of the price drop from cum-dividend and ex-dividend day
- Std = The standard deviation for the population – see formula Data segmenting
- n = Number of observations
Our decision rule for the Independent two-sample t-test is two-sided, and based on our confidence interval of 90%. Decision rule: Reject H0, in favor of HA if: t-value ≥−1.645.

Thus far we have relied on the t-test for our significance testing, but in order to suggest a method that can make abnormal returns by segmenting stocks based on price volatility, we have to apply a regression estimate. In the regression estimate we want to apply an independent dummy variable, the segmenting of firms, in trying to explain the ex-dividend effect. The most-used regression model estimation technique is the Ordinary Least Squares (OLS) model, according to Studenmund (2011, pp. 34-35). Studenmund (2011, p. 93-101) describes seven basic assumptions that must be met for the OLS-model generates the most accurate estimate model. Among which assumption IV, V and VI concerning serial correlation, heteroskedacity and multicollinearity are the most relevant for us. Serial correlation is commonly existent in time-series data and is therefore possibly an issue for us. We will test for serial correlation, but expect our error terms to be independent of each other (Studenmund, 2011, pp. 304-305). Multicollinearity describes a situation in which two or more independent variables are highly correlated, hence describes the same movement in the dependent variable (Studenmund, 2011, pp. 99-100). Along Studenmunds (2011) definition we are therefore not subject to multicollinearity since we only have a single independent variable. Heteroskedasticity is in general more likely to occur in cross-sectional data, but has, according to Studenmund (2011, p. 337), turned out to be an important factor when making use of time-series data, from financial markets. In accordance with Studenmund (2011, p. 337) we will therefore plot the residuals of our error term and determine the effect of heteroskedasticity on our regression model. In the single independent variable model the aim is to take a theoretical equation like:

\[ Y_i = Bo + B1 \times X1i + B2 \times X2i + B3 \times X3i \pm \ldots \pm Bn \times Xni + \varepsilon_i \]  
(Studenmund 2011, p. 24)

**Explanation**

Yi = Estimation for the dependent variable  
Bo = Constant variable, the intercept on the y-axis  
B1 \times X1i = Estimation of the first independent variable  
\varepsilon_i = Error term

And by the use of data create estimation:

\[ Y_i = Bo + B1 \times X1i + \varepsilon_i \]

The purpose behind the estimation technique is to generate numerical values for the estimates and test how well the independent variables explain the dependent variable. Our regression model consists of one independent variable that aims to explain the dependent variable. In the regression model we look for the significance level for our independent variable, which will be the same significance as when conducting the independent two-sample t-test. Conducting a linear regression model one also conduct a \( f-test \) of overall significance. Studenmund (2011, p. 161) describes that although the \( r^2 \) and \( r \) measures the overall degree of fit of an equation, they do not provide a formal hypothesis test of that overall fit. The \( f \)-test formulate a hypothesis for the overall fit of
the model by setting the null hypotheses so that all coefficients equal zero simultaneously (Greene, 2012, p. 158):

Ho: $B_1 = B_2 = B_3 = B_4... = B_K = 0$

Ha: H0 is not true

If we are able to reject the null hypothesis we can show that the estimated equation is statistically significant. Decision rule: Reject the H0, in favor of HA if $f$-value $\geq 2.706$.

$$F = \frac{ESS/K}{RSS/(N - K - 1)} = \frac{\sum(y - \bar{y})^2/K}{\sum e_i^2/(N - K - 1)}$$

Explanation:
ESS = Explained sum of squares
K = Number of independent variables
RSS = Residual sum of squares
N = Number of observations in the sample N
F = F-value

4.9 Software

In all our testing we use the SPSS software as the basis for our hypotheses testing. It is the most widely use statistical program when conducting significance testing. In our line of research it is commonly used to test variables relationships and their relative significance. As business students at Umeå University it was also the best-suited software program due to its availability within the business school.

4.10 Evaluation criteria

In the last section we described where our epistemological, ontological and human nature considerations define how we perceive what is true and what knowledge is. We now move on to consider how we can draw solid and valid results from our hypotheses testing. Within finance research Ryan et al. (2002, p. 92) discusses that internal - and external validity are the two most prominent validity criteria’s for research designs, not least specific for finance. Internal validity measures if our conclusions hold water and external validity describes the generalizability of our research. For us internal validity is if the relationship between the ex-dividend effect and the anchoring theory holds water, and external validity whether or not we are able to generalize our results beyond the OMXS. Although we are conducting a finance research we aim, as discussed in previous sections, to consider general aspects to business research as well. (Bryman & Bell (2011, p. 41) states that the validity criteria’s in many ways are the most important for business research, and discuss that it is concerned with the integrity of the conclusions generated. The authors define two additional types of validity applied in general business research. (i) Measurement validity is a criterion that primarily applies to quantitative research and is often referred to as construct validity. It is concerned with if the measure of a concept really reflects that concept. Is our research measuring what
it was set out to measure? For our research this is concerned with if our results actually measure the ex-dividend effect that we were set out to measure. In order to avoid a misinterpretation we follow previous research in terms of mathematical models, testing and empirical results analysis, and thereby in our view minimize the probability of misstatements. (ii) Ecological validity is concerned with the question of whether the results and conclusions generated are applicable to people’s everyday life, and that the material, methods and settings of the research must be an appropriate estimation of the social reality the research is investigating. Since we are looking for experimental evidence in examining our research question we think it is of important to take ecological considerations into account. In our view we use material, methods and settings that an exact estimation of social reality, for example since stock prices reflect information and behavior derived from the real world. Having stated the four validity criteria’s we now go with the reasoning of Ryan et al. (2002, pp. 92-94), suggesting a further need to discuss on how internal – and external validity affect our finance research.

Ryan et al. (2002, p. 122) describes internal validity as a measure of how much control that has been achieved in the research, the greater the control - the higher the internal validity. Ryan et al. (2002, p. 122-124) describes that the internal validity of a research thus determines whether valid conclusions can be drawn or not. When the internal validity is said to be high, it means that changes in the dependent variable can be explained through the independent variables. Studenmund (2011, p. 548) discusses the relationship between a dependent variable and independent variables in terms of hypotheses testing. The author continues by stating that a sample that systematically differs from the population is biased. Since it do not represent the view of the entire population, it will generate a false view of reality and thereby make it impossible to draw any conclusions from it. As observed in previous research this biasness often occurs in testing for ex-dividend effect when the data collection is insufficient (Elton & Gruber, 1970, pp. 70-71). In most cases this arise from the fact that the data not is available, for example dividend payout for certain firms, or stock price movement during the investigated time period. In order to avoid this problem our census sample is firms with sufficient data information. All the firms investigated have sufficient data when it comes to both dividend payout and stock price movement. Ryan et al. (2002, p.123) continues by pointing out that biasness is a concern in both internal- as well as external validity. Examples that can result in low internal validity are measurement errors in the variables, regressions towards the mean and maturity effects. In our testing we will clearly move away from such errors and aim to use an unbiased sample of the population with a reduced risk of measurement errors by using a census sample, further discussed in the sampling process. Measurement errors are differences between the actual value and the value as given by the measurement. The values we measure in our research are daily stock price for a given time period, dividend payout and cum-dividend and – ex-dividend dates. The risk for us is that these measurements are wrongly stated in our used software program, but as previous authors (see Empirical evidence) have been doing, we accept that risk and rely on the fact that the information given in our software is correct. Because we are more or less taking the independent variables as they are found in the software, we avoid errors in our own measurements.

External validity it is according to Ryan et al. (2002, p. 123) an important consideration in any line of research project to be able to draw conclusions that are valid and generalizable. Ryan et al. (2002, p. 123) defines the external validity as the extent to
which the results of a study can be generalized to different samples and settings. Ryan et al. (2002, p. 123) continues by highlighting three broad categories of problem that threatens the external validity of a research. The first one is the population validity, where the validity is seriously threatened when biasness exist in the population under investigation. In our research we use stock price data, and given that our software is accurate, we can consider our research to be unaffected by the problem of population validity. Secondly is the threat of time validity, the question of whether the results of a research at a particular point in time can be generalized to other time periods. In our research we take data from a given time-period and aim to generalize across experimental settings and not time-periods. Hence, our derived results should be interpreted as relevant for the investigated time-period, and we therefore consider our research to be time-sensitive. Lastly Ryan et al. (2002, p. 123) highlights the environmental validity as a threat to external validity. This has to do with the generalizability across experimental settings. In finance this is largely a concern when trying to generalize results and conclusions internationally. As mentioned, we aim to generalize our results across experimental settings, to stock markets with similar characteristics. OMXS fulfils the listed criteria’s of generalizability as discussed in the Research gap. The OMXS is a stock market where all data is publicly available, the tax on dividend and capital gains is equal 30 %, the total wealth in shares owned by foreign investors accounts to approximately 40 % and the market capitalization value is 4038 billion SEK (SCB, 2013). These characteristics are in our opinion somewhat standardized, as most markets allow for international investors, and dividend and capital gains are tax equally. It is therefore possible for our research to be generalized across experimental settings. Thus environmental validity is of concern to us. We however argue that we minimize the issue by formulating characteristics of generalizability (see Research gap). In general business research Bryman & Bell (2011, pp. 42-43) relates external validity, in line with the reasoning of Ryan et al. (2002) to the question of whether the results of a research can be generalized beyond its specific research context. Bryman & Bell (2011) pinpoints a common example and compare a random sample with a non-random sample, where the random sample is likely not to fulfill the external validity criteria. We believe that our research is free from the issues highlighted by Ryan et al. (2002, p. 123) and Bryman & Bell (2011, pp. 42-43). In our research we do not generalize over time-period and but are trying to draw conclusions across experimental settings. The authors continues to describe that by aiming to increase one validity criteria often results in a reduction of the other criteria. In general terms, it is according to Ryan et al., (2002, pp. 123-125) argued that in fundamental research internal validity is prioritized, while external validity is of higher importance in applied work. In our research we put emphasis on internal validity and the robustness of our results. Our testing will be carried out using a dependent variable and testing it against an independent variable, for our research it is therefore of grave importance that the relationship holds water.

The concept of reliability is concerned with the question of whether the research can be repeated and generates the same results and conclusions, as to speak if the results of the research are repeatable. Bryman & Bell (2011, p. 41) states that reliability is an issue foremost in connection with quantitative research. The quantitative researcher is more likely to be concerned with issues of whether the measure is established or not. In connection to our quantitative analysis the question is if our research is reliable, thus can be repeated to generate the same results. Since we use secondary data it is relatively easy to compute the same type of data analysis, and since we describe how we have
conducted our hypotheses formulation and testing, we think our research is repeatable. Can the study be replicable by other researchers? The question is answered under the replication criteria, according to Bryman & Bell (2011, p. 41). In order for a research to be replicable it is vital that the authors describe how and what they have been doing throughout the research so the researcher in a correct way test their results against yours. For our research the replication criteria is a minor issue. We use secondary data and a computed and descriptive method for testing our hypotheses. It is therefore, in our view, safe to state that our research fulfill the replication criteria.
5. EMPIRICAL RESULTS

“It is the mark of a truly intelligent person to be moved by statistics.”

- George Bernard Shaw

In this chapter we discuss our SPSS testing and the derived results. As mentioned in the practical approach we will conduct three different tests in order to examine the ex-dividend effect on the OMXS. (i) The One-Sample T-test to test if there are arbitrage opportunities on the OMXS. (ii) The Independent Two-Sample T-test testing if the results from the first T-test can be explained by our segmenting. (iii) Our regression model estimates the effect of our segments on the calculated ex-dividend effect.

5.1 Overview and First impressions

Let’s beginning with an overview. The one sample t-test was used to reject or accept our first null hypothesis: Whether or not there exist arbitrage opportunities on the OMXS. The value we look for in the T-distribution in order to reject the null hypotheses (no arbitrage opportunities) is ≤1.282. If we have a t-value fulfilling the decision rule we can statistically determine that the generated mean is representative for the whole population, thus stating that there are arbitrage opportunities present. Our second test is the independent two-sample t-test where we test if the result from the first one sample t-test can be explained by stock price volatility, measured as an independent variable of the two segments of firms. The value we look for in the t-distribution is a t-value above or equal to ±1.645. The independent two-sample t-test will generate two independent means for the two samples, our two segments, through which we can discuss mean differences and thereby conclude difference in terms of arbitrage opportunities. The third test is a linear regression model, in which we use the OLS-model. The test will generate a f-value that will reject the null hypotheses, in favor of our alternative hypothesis if it is ≥ 2.706. The null hypotheses in the f-test are that all independent variables coefficient has zero impact on the dependent variable. All three tests were carried out on 666 of our 694 observations, taken from 2009-2012. As discussed in the sampling process we have excluded extreme outliers, accounting for roughly 5 % of the total number of observations.

In accordance with previous research, both International and Swedish observations we expected there to be arbitrage opportunities on the OMXS. Although we are investigating another time-period and take a slightly different theoretical standpoint we expected our results to go in line with previous research. For the first t-test we expected the results to be statistical significant for a confidence level of 90 %. The size of our sample, 666 observations made a significant t-value likely. According to Studenmund (2011, p. 148) an increase in the sample will correspondingly improve the accuracy of the t-test. At first impressions our results from the first t-test corresponded with our expectations. We were able to reject the null hypotheses at our confidence interval of 90 % and therefore accept the alternative hypotheses and state that there in fact exists arbitrage opportunities on the OMXS for the covered time-period. In order to illustrate our first impressions we plot the ratio of the ex-dividend day, as below. In Figure 7 we see that the ratio of the ex-dividend effect fluctuates around 0 to 2, indicating values between 0 and 2.
Figure 7. Illustration of the ratio of the ex-dividend effect
Source: Created by the authors (2013)

For the second test we had no previous research to benchmark and form our expectations against, but based on the anchoring theory we expected the variable to have a statistical influence. Our aim was to try to explain the results from the first t-test with our independent dummy variable, the two segments of firms. At first look we observed that the independent variable showed statistical significance at the 90% confidence interval, and a corresponding 0.10 significance level. The test showed a statistical difference in means that will be discussed in depth in the upcoming section. The test of the overall fit of our regression model generated the same significance level and t-value as for the independent two-sample t-test, also defined by Studenmund (2011, pp. 102-105). In terms of the f-value we expected it to show an overall significance for our regression model in order to conclude that our segmenting variable had a statistical influence on the ex-dividend day price drop. At first glance our results were significant and our overall model showed to be statistically applicable.

5.2 One-Sample T-test

In our one-sample t-test we tested the following hypotheses:

Ho: There are no arbitrage opportunities on ex-dividend day; the price fall in stock price is equal to the dividend amount.

Ha: There are arbitrage opportunities on ex-dividend day; the price fall in stock is less than the dividend amount.

Our aim was to reject or accept the null hypotheses in order to determine whether or not arbitrage opportunities exist on the OMXS. The decision rule for our t-test was to reject the null hypotheses if the test generated a value in the t-distribution of ≤ - 1.645. In SPSS we had the following output:
In order to conduct the one-sample t-test and conclude that there exist arbitrage opportunities on the OMXS, we needed to statistically determine a mean that differ from 1. A mean of 1 would state that the drop in the stock price is equal to the dividend amount, indicating that there are no arbitrage opportunities on the OMXS. In order to conduct the one-sample t-test we therefore required an input in SPSS with test value = 1. We therefore created a new variable in which we withdraw 1 from the initial ratio of the ex-dividend effect. The new variable therefore became the one we conducted our one-sample t-test on, thus the SPSS output above, see Table 5, is actually testing if the mean differ from 1. When we can statistically determine that is does, we need to determine a mean for the initial variable representative for the whole population. Hence, we first determine that the mean differ from 1 and deduce this result by 1 in order to conclude the actual mean representative for the whole population. Our t-value of -5.989 is well above the decision-rule of -1.645 and we therefore reject the null hypothesis, in favor of the alternative. The alternative hypothesis is in contrast to the null hypotheses, indicating that there are arbitrage opportunities present. In Table 5 we find our generated mean that is representative for the whole population at the 90 % confidence interval and 0.10 significance level, a mean of 0.73. The mean is interpreted as by how much the stock price dip on ex-dividend day, for every dividend SEK paid out. 0.73 can be interpreted as the amount that the stock prices drop on ex-dividend day, for every dividend SEK paid out. For example: A firm that pays out a dividend of 1 SEK having a cum-dividend stock price of 10 SEK, will according to our testing have a corresponding ex-dividend stock price of 9.27 SEK and not 9 SEK. The arbitrage profit is in this case 0.27 SEK for owning one stock. Summarizing the one-sample t-test we had a results of a mean equal to 0.73, as illustrated below in Figure 8 where the ratio of ex-dividend day circulates around the mean of 0.73. As illustrated in the distribution we can also conclude that our distribution has a normal distribution. An important assumption for the upcoming independent two-sample t-test is that the data is normally distributed as stated by Studenmund (2011, pp. 142-145). The author argues that a normal distribution generates most accurate results, below is the normal distribution for our dependent variable:

<table>
<thead>
<tr>
<th>T-test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T-value</td>
<td>-5.989</td>
</tr>
<tr>
<td>Significance level</td>
<td>0.000</td>
</tr>
<tr>
<td>Mean (-1)</td>
<td>-0.27</td>
</tr>
<tr>
<td>Mean</td>
<td>0.73</td>
</tr>
<tr>
<td>n</td>
<td>666</td>
</tr>
<tr>
<td>df</td>
<td>665</td>
</tr>
</tbody>
</table>

**Table 5. One-Sample T-test results**
Source: Created by the authors (2013)
5.3 Independent Two-Sample T-test

In our second t-test, given that we could reject H0 in favor of Ha in the one-sample t-test, our aim is to explain the arbitrage opportunities with our two segments. We use an independent two-sample t-test when testing the following hypotheses:

Ho: The arbitrage opportunities cannot be explained by the stocks price volatility.

Ha: The arbitrage opportunities can be explained by the stocks price volatility.

<table>
<thead>
<tr>
<th>Independent Two-Sample T-test</th>
<th>Segment 1</th>
<th>Segment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-value</td>
<td>1.869</td>
<td></td>
</tr>
<tr>
<td>Significance level</td>
<td>0.062</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>664</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>323</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.033</td>
</tr>
<tr>
<td></td>
<td>343</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.27</td>
</tr>
</tbody>
</table>

Table 6. Independent Two-Sample T-test results

Source: Created by the authors (2013)
As our results indicate we reject the null hypotheses in favor of the alternative hypotheses and thereby statistically determine that the arbitrage opportunities found in the one-sample t-test can be explained by what segments the firms belong and their corresponding stock price volatility. Our significance level for the independent two-sample t-test is 0.062, which means that we at a 90 % confidence interval and with a 0.10 statistical significance can reject the null hypotheses in favor of the alternative hypotheses. This is interpreted in the statistical hemisphere as saying that the null hypotheses only happens 6.2 % of the times, thus 6.2 times out of a 100. In accordance with our decision rule we can conclude that the t-value generated from the test is 1.869 > 1.645, and thereby state that the arbitrage opportunities found in the one-sample t-test can be explained by stock price volatility.

In terms of the differences in means we observe that observations in segment 2 holds a mean of 0.647 whereas observations in segment 1 holds a mean of 0.816. This can be interpreted along the reasoning in the first test: The stock price drop will be 0.816 SEK for every dividend SEK. Whereas the stock price drop in segment 2 will be 0.64 SEK for every dividend SEK paid out. The differences in terms of mean between the two segments are 0.172, which means that you can make a 0.172 higher profit investing in observations in segment 2, firms with high stock price volatility.

5.4 Regression results

In our third statistical test, our aim was to test the overall applicability of a regression model, where we had the ratio of the ex-dividend effect as the dependent variable and the two segments as a independent variable. Estimating the regression model we use an OLS model. The OLS-model will, according to Greene (2012, p. 158) result in a f-test with the following hypotheses:

H0: B1 = B2 = B3 = B4... BK = 0
HA: H0 is not true

<table>
<thead>
<tr>
<th>OLS-linear regression model</th>
<th>(Constant)</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-value</td>
<td>3.494</td>
<td></td>
</tr>
<tr>
<td>Significance level</td>
<td>0.062</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>665</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.835</td>
<td>-1.869</td>
</tr>
<tr>
<td></td>
<td>0.985</td>
<td>-0.169</td>
</tr>
</tbody>
</table>

Table 7. Regression results
Source: Created by the authors (2013)

Our regression model:

\[ Y_i = 0.985 - 0.169 \times X_{1i} + \epsilon_i \]

In our regression model we can conclude that our single independent variable is significant. We reject the null hypotheses in the f-test and determine that the segmenting of firms have an influence on the ex-dividend effect. The f-value is 3.494, thus greater than the critical \( \geq 2.706 \). By adopting the alternative hypotheses we have concluded that
the segmenting has an effect on the ex-dividend day price drop. In Table 7, the coefficient for our segments provides a value of -0.169, which indicates that if one were to take an observation from, e.g. segment 1, the effect on the ex-dividend day price drop would be 0.985 – 0.169 * 1, resulting in our mean for segment 1, 0.816. This coefficient is thus the estimated effect of either of our segments in our model that captures the arbitrage opportunities on the OMXS.

The value of 0.985 can be interpreted as the point on the y-axis where our linear regression intercepts. Our x-value can take a value of either 1 or 2, since it is an independent dummy variable. A measure of the overall significance is explained by R² value, which in our case is 0.05. The R² value should be as close to 1 as possible in order for the model to show overall significance. In our testing we use time-series data and it is therefore more interesting to look at the f-test and the corresponding f-value in order to prove that our model has an overall significance. In terms of serial correlation we found evidence of either positive or negative, which was of little surprise since our observations are taken from different time-intervals, to a large extent. According to Wooldridge (2003, pp. 56-59) we can detect heteroskedasticity in our independent dummy variable by plotting the squared residuals against the variable, as seen in the figure below. If the means of the squared residuals for the two segments are equal or close to each other your regression not subject to heteroskedasticity. We can observe in Figure 9 that the means for the squared residuals for our two segments are close to each other, and thereby conclude that our model not is subjected to heteroskedasticity.

![Figure 9. Plotting for heteroskedasticity](Source: Created by the authors (2013))
5.5 Empirical summary

From the three-abovementioned tests, the one-sample t-test, independent two-sample t-test and the OLS-model we are able to statistically prove the following: (i) There are arbitrage opportunities on ex-dividend day; the price fall in stock is not equal to the dividend amount. Our results suggest that the price drop in stock, on average, amount to $0.73$ % of the dividend. (ii) The arbitrage opportunities can be explained by the stocks price volatility. We can statistically determine that our independent dummy variable of the two segments have an influence on the ratio of the ex-dividend effect. The effect accounts to -0.169, which is equal to the difference between the two means. The mean for segment 1, stocks with low price volatility is 0.81 and segment 2, stocks with high price volatility is 0.65.
6. ANALYSIS

“To win without risk is to triumph without glory.”

– Pierre Corneille

This section aims to reconnect our empirical findings with our theoretical framework. As stated in the introduction of our research, the purpose was to determine if there are market anomalies present on the OMXS and mainly if one could capitalize on those by making use of stock price volatility. Hence, what we have been looking for has been patterns of association rather than trying to generate new theory (see Theoretical methodology). Therefore the next step in our research will be to contrast our results towards previous research and determine if there are deviations in theory or not. In the following section we have a layout containing each of our three theoretical areas: Efficient Market Hypothesis, Anchoring and Dividend irrelevancy.

6.1 Efficient Market Hypothesis

The first theoretical area that we established in our research was the EMH, which is a measure of the efficiency in the absorption of information on different markets (Fama, 1970). The theory is, rather than an explanation of why things are the way they are, a concept of how well individuals on the market are able to collect and assess the information that is available and how much information that is available to agents. As discussed in the Practical approach, our research is divided into three kinds of statistical test, all with different objectives. This part of the analysis will concern the first of our three tests, the one-sample t-test. As discussed, the aim of the one-sample t-test was to determine if there were any arbitrage opportunities present on the OMXS during our years of examination, 2009-2012. According to the EMH (Fama, 1970) there should not be any arbitrage opportunities and the stocks prices should follow a random walk. Bodie et al. (2011, p. 373) explains that since all changes in stock price would occur due to new information, there cannot be opportunities to achieve returns higher than the average market return. Our results do not support these conclusions. The purpose of the one-sample t-test was to determine if, it did or did not, exist arbitrage opportunities on the OMXS. The results from the firsts test provided a mean value of 0.73 which is lower than 1 – hence our findings do not go in line with the theory presented by Fama (1970). A market characterized by the random walk concept would, theoretically, adjust by the amount of the news (the dividend). Since this is not the case we can conclude that dividend paying stocks on the OMXS do not follow the suggested pattern by Fama (1970). Put in other words – what our results suggest is arbitrage opportunities on the OMXS.

The question now arises whether these opportunities are considered to be pure or relative as suggested by Dubil (2005). One would perhaps like to describe the results of our research as a kind of pure arbitrage since the riskless profit is generated by statistical proven deviations of future stock performance. But in our opinion this would be an exorbitance, simply because the volatile nature of stocks and the effects of human errors. That is, even though our statistics provide a result that conclude arbitrage opportunities it is still a overall measure for all observations, which then takes volatility and the human factor into consideration. Hence, we consider our results to be
considered as relative arbitrage that differs in the sense that the pure arbitrage type generates abnormal returns where the statistical matching’s between the current and future returns nearly offsets each other (Dubil, 2005, pp. 13-14). In our view this is perhaps a more appropriate description of our research since not all of our observations fully show arbitrage opportunities and even if they do, they differ to some extent. What can be discussed however is the pureness of our relative arbitrage. Since our results show such a high statistical significance, it is very likely that the outcome from investing in any stock that is included in our research will provide for abnormal returns. Hence, we would like to describe our research results as showing relative arbitrage opportunities with a high degree of pureness. The main reason for not viewing it as pure arbitrage is due to the reasoning that if an investor were to randomly pick one stock from our sample, it is not totally risk-free. Hence there would be some risk associated with following our suggest method. Our results indicate an average of all included data, which needs to be taken into consideration, thus we conclude relative arbitrage opportunities with a high degree of pureness.

This leads on to the analysis of how efficient the OMXS is during the period that we have observed. As discussed in the Introduction, the third purpose was to examine the degree of efficiency on the OMXS. Fama (1970, p. 388) introduce the idea of three kinds of market efficiency: the weak, semi-strong and strong form. From the Theoretical Framework we know that if a market is to be characterized as having a strong form of market efficiency, all prices fully reflects the information at all times. From our results we can draw the conclusion that the OMXS should not be described as having a strong form of market efficiency. Furthermore, we can also conclude that OMXS is neither an example of a weak form of market efficiency since individuals on the market obviously do take heed of the dividends – even though they do not adjust the prices fully. In contrast, our data provides evidence suggesting that the OMXS should be classified as having semi-strong market efficiency, which indicates that individuals investing on the OMXS make use of historical prices and public available information. This could according to Bodie et al. (2011, p. 351) be explained by the reasoning that perhaps not all investors interpret information in the same way, leading to eventual diminished efforts towards using fundamental or technical analysis. This results in some investors gaining abnormal returns simply by conducting more in depth analysis. Our conclusions are however of no surprise, Fama (1970) suggests that most empirical studies present findings that suggest the first two types of market efficiencies (weak and semi-strong). The author argues that the main reason for this is pattern is the human factor, which is unpredictable and not always rational. This was also the conclusion drawn from the research presented by Einarsson et al. (2007).

6.2 Anchoring

Having discussed the results and the connected EMH regarding the possibilities of arbitrage opportunities, we have so far determined that such anomalies exist on the OMXS. We are now moving on into the main part of our research, concerning if the found arbitrage opportunities could be explained by the segmenting of firms. As stated in our research question we aim to examine if it would be possible to make abnormal returns by segmenting the stocks on their price volatility - given that there exist arbitrage possibilities on the OMXS.
The fundamental idea behind establishing a method based on stock price volatility is derived from the theoretical area of anchoring. As suggested by Tversky et al. (1974), the anchoring-and-adjustment heuristics should influence the investors’ preferences regarding their stock valuation. That is, investors formulate an anchor price around which the future valuation will evolve. This would thus lead to a low volatility surrounding the stocks defined as having an anchoring price since investors do not expect the future value to differ from what has been observed in the past. Our sample was accordingly divided into two different segments on the basis of stock price volatility in order to divide our observations into having, or not having an anchor price. Low price volatility would thus indicate an anchoring price and vice-verse. Based on what we have observed from previous research presented in relation to anchoring price theory presented by Tversky et al. (1974), Northcraft et al. (1987), Marsat et al. (2009), Williams (2010), where all of them point out the existence of anchoring prices. We would expect that those firms belonging to segment 1 would to a larger extend than segment 2 experiences a price drop by less than that of the dividend amount. This reasoning is simply deduced from the reasoning that a stock that to a larger degree than another stock finds its path back to its anchor price would adjust faster than the other type of stock when suffering a price decline that in our case would be that of a dividend payment.

Our result presents findings that provide a perhaps somewhat different take on the previous establish theoretical framework. In order to be able to reason about the effects of different segments on the responsiveness on dividend payments, one first has to start off by examining if the anchoring effect is significant. This was performed in our independent two-sample t-test. The aim of the test was to determine if the market anomalies, that we already have observed, could be explained by segmenting the sample into two different segments, one with low and one with high price volatility. In accordance with what the theoretical framework within this area suggests, segment 1 stocks should show patterns of not dropping by the full amount of the dividend payment. As our results has shown, not only is the segment 1 significant but segment 2 as well. No previous research states how segment 2 should behave in relation to dividend payout but our research can confirm that segment 1 is in line with what is suggested by previous research. These results where however of little surprise since we got such strong indications of arbitrage opportunities from the one-sample t-test. If the results from this test would have been weak it could have been because some groups of the market e.g. high volatility stocks did drop by the full amount, but since our results were that significant it was not surprising that both segments would prove to differ from the mean of 1. After having established that both segment 1 and 2 show patterns of arbitrage opportunities we examined the effects of the different segments. From our empirical observations we find that segment 2 to a larger degree than segment 1 show patterns of arbitrage opportunities. Hence, a stock with high price volatility will drop by even less than a stock with low price volatility after a dividend payment. One would perhaps like to argue that our findings go against the already established theoretical framework within this area but our segment 1 firms also show arbitrage opportunities – but not to the same degree. Thus it would not be correct to reject the theories regarding the effects of anchoring since it is apparent in our research as well even though the effects of high price volatility is a stronger factor in terms of arbitrage. Another aspect to take into consideration when evaluating the anchoring effect is the fact that we measure the ex-dividend effect as the drop in price from cum-dividend to ex-dividend day. That is, we are only comparing the day before and after the dividend have been
paid. The reasoning of having an anchoring effect is that the price will return to its expected value, but it is not mentioned in any theory in what speed this adjustment takes place. Since we are examining only two days whereby the anchoring effect is only present on the ex-dividend day when the price has left its anchor value, there is little time for the stock price to adjust. Segment 2 stocks, which are to a larger degree volatile, would theoretically then be expected to change its price faster or to a higher degree than the segment 1 stocks. In regards to this line of thought one might suggest that the effect of the segment 2 stocks would be neutral since the measure of volatility goes in both directions which would provide for both price gains and drops. Thus the effects on the ex-dividend day would perhaps be neutral in the manner that the up-effects would be eliminated by the down-effects, but from our observations we can statistically secure that there are arbitrage opportunities related to stocks defined as belonging to segment 1, hence the positive up effects clearly outweighs the down effects of the price volatility.

In summary we are not in a position to reject the presented theories regarding the functioning of the anchoring effect. Our results actually concur with previous research, regardless of the fact that high volatility stocks to a larger extend show patterns of dropping by less than the dividend amount.

6.3 Dividend irrelevancy

The theoretical area of dividend irrelevancy is the area, which provides the actual explanations for why stocks should drop by its corresponding dividend amount. We have already discussed the implications and meanings of EMH, which lays down the general idea that there should not exists any market anomalies but it does not in detail specify why the area of dividends should be consistent with the EMH. MM (1961) did however provide explanations for why the dividend policy for any dividend paying firm should be irrelevant for its stock value. MM (1961) provides several mathematical reasoning’s for why dividends should not affect the value of the stock, which implicitly means that the payment of dividends is just a way to rearrange the capital structure for the investor. Simply put, the capital structure is adjusted for the investor but not improved, especially since the firm would need to raise new capital through new stock issues in order to maintain its desired level of investments. Thus, the value of the firm is divided amongst an increased number of stocks than at cum-dividend day. We concluded in our Empirical Results that from the one-sample t-test can conclude that arbitrage opportunities are present in relation to the dividend payments. In the second test we concluded that one could divide OMXS into segments, pending on their price volatility in order to capture these market anomalies. So how do these findings collide to the findings of MM (1961)? At a first glance, one would already at this stage be able to determine that our findings do not go in line with MM (1961) since our observations show patterns of arbitrage. It is perhaps of little surprise since there has been a large amount of research presented previous to ours that pointed in the same direction (Kato & Loewenstein 1995, Bali & Hite 1998, Alm & Årefjäll 1999, Rantapuska 2008 and Dasilas 2009). So how do our results influence the stock value? From our results it is evident that stock prices do not drop by the full amount of the dividend, which it according to MM (1961) should. Hence, an investor being aware of these abnormalities would trade differently around the dividend days. Preferably, an investor would buy a dividend paying stock on the cum-dividend day, hold the stock and gain the dividend amount. The stock price should at this point, if it were to follow
the theories laid down by MM (1961) drop perfectly by the amount of the dividend and there has been no real value creation, just a redistribution of money. This is however not what our results show. In accordance with our results, the investor would at the ex-dividend day be able to sell of the stock and collect a price higher than the expected value of the cum dividend price minus the dividend amount. This investor would thus be able to receive a return higher than what is suggested by the initial level of corresponding risk. Since no new information has hit this specific stock, the risk level should remain the same and thus also the return. But as our results suggest, this is not the case. Taking this reasoning back to the fundamental idea of MM (1961), suggesting that the dividend policy should not affect the valuation of the firms stock. Since the return on the stock has gone up, investors would spot this arbitrage opportunity and money would flow in to this specific stock. This would then, by a simple demand and supply reasoning, raise the price of this specific stock. Hence, the valuation of the stock has appreciated from its initial level and the fundamental idea of MM (1961) is rejected. If we, along our financial investor as presented in the Introduction, take the firm’s perspective rather than the investors’, our results would suggest that the dividend policy does matter. Since investors would recognize this market abnormality they would be looking for firms that hold high dividend yields. This is simply due to the fact that the arbitrage made is realized upon the dividend amount. Thus, a high dividend yield would increase the effect of our results suggesting that the stock price do not drop by the full amount of the dividend. A firm realizing this would thus try to hold a comparatively high dividend yields if it wanted to e.g. increase its stock value since they would realize that a high dividend yield would draw investors and increase their stocks value. The conclusion to be made here is that the dividend policy matters, which is a contradicting suggestion to the Miller & Modigliani theorem (1961).

Summarizing our analyse: We based our research on three separate theoretical areas that suggested that market is to be efficient and not allow for any arbitrary possibilities. Theories suggested that some stocks, defined as holding an anchor price, would revolve around this price. Theories also suggested that it does not matter if and how much dividend that is paid by firms, the value of the stock would be unchanged. Our results suggest that the OMXS not is perfectly efficient and should, according to our findings, be characterized as holding a semi-strong efficiency. Our results furthermore concur with theories suggesting that is an anchoring effect on dividend paying stock registered on the OMXS. Last but not least, our results contradict the theories suggesting that dividend policies of firms are irrelevant and that the larger the dividend yield, the more attractive will the stock be for short-term traders. This result provides evidence for our suggested method: **Trade on stocks price volatility on the cum-dividend day in order to capture dividend payments. Sell the stock on the ex-dividend day in order to take advantage of the unexplained price increase.** It is derived on price-series data from the Swedish market but could be generalized to other markets sharing similar characteristics (see Research gap). In terms of ethical considerations we have derived a method available for all types of investors, and not only institutional investors. We think this is considered as fair, since all investors looking to invest on the OMXS can exploit the found opportunities. Our method is relatively simple, easy accessible and based on publicly available data which makes it available to all investors, for us considered as fair. It is along with any arbitrage opportunity, functional until this market anomaly has fully been abused and the market adjusts back to its equilibrium.
7. CONCLUSION

These chapters aims to summarize what we have derived from our empirical results and compare these findings with previous research and our research question. We will in the upcoming chapter review our research question and purpose, in order to examine how our conclusions are related to these. In the ending section we give recommendations for further research.

Our research has been based upon three different theoretical areas relating to the topic of the ex-dividend effect: efficient markets hypothesis, anchoring and dividend irrelevancy. In line with our deductive approach we have aimed to, through the use of previous theories and methods, derive our own empirical results in order to answer our research question:

**Can abnormal returns be made on the ex-dividend effect by segmenting stocks based on their price volatility?**

Our main purpose with this research was to establish a method that can make abnormal returns by segmenting stocks based on price volatility, capturing arbitrage opportunities. The first sub-purpose was therefore, implicitly, to determine if there exists arbitrage opportunities on the ex-dividend day on the OMXS. The second sub-purpose was to conclude if the OMXS could be considered as an efficient market. Based on our empirical results we are able to draw four conclusions:

(i) There are arbitrage opportunities available on the OMXS. By trading on stocks in connection with the ex-dividend day it is possible to make abnormal returns.

(ii) We can also conclude that these abnormal returns can be found by sorting the dividend paying stocks on the OMXS by their price volatility. Our suggested method is thus: *Trade on stocks price volatility on the cum-dividend day in order to capture dividend payments. Sell the stock on the ex-dividend day in order to take advantage of the unexplained price increase.*

(iii) Furthermore, we can also conclude that the expected returns will increase if one trades on segment 2 stocks with an average yearly volatility over 4%. Statistically we concluded a relationship between our dependent variable, the ex-dividend day price drop and the stock price volatility.

(iv) The OMXS is not fully efficient, rather indicating semi-strong market efficiency.

Our research has contributed to existing theory by concluding that there are arbitrage opportunities present on the OMXS and that the OMXS should not be considered as fully efficient. We have drawn these conclusions from a period that has not been studied before on the Swedish market and thus kept the research on this area up to date. Furthermore, we have practically contributed by providing a method of segmenting the stocks based on price volatility that captures arbitrage opportunities. Hence, we have contributed with both a theoretical as well as a practical base around which both private as well as institutional investors can make use of. Recall our two investors introduced in the introduction: the private investor looking to increase her return without an increased associated risk as well as the financial institution investing to capitalize on their client’s
investments. We have by now provided them with both, theoretical evidence suggesting that they both can make excess returns on the OMXS, as well as a method which will help them to capture these anomalies. As discussed in the Research gap the aim with our research was to generalize our derived results from the OMXS, to stock markets with similar characteristics as the OMXS. We think our results and suggested method can be used on any stock market with these characteristics.

Both our investors could by applying our conclusions make arbitrage returns, that is, making excess returns without taking on any additional risk. We can happily inform our two investors that their intuition was right: “Yes, there is a free lunch after all”.

7.1 Recommendations for further research

The aim of with our research was to shed new light on the subject of ex-dividend effect and in particular how to capitalize on found arbitrage opportunities. As presented in our results and discussed in our analysis, we have concluded that there exists market anomalies on the OMXS and that this behavior can be explained through stock price volatility. In our regression model we have concluded that our only independents variables have influence. Hence, we have laid down one method that captures market anomalies related to cash dividend payouts. We suggest that further research could build on our regression model by including more independent variables in order to even further explain the ex-dividend effect. Examples of independent variables that could be included in the model and tested for in future research are:

- A distinction between Large, Medium and Small Cap
- Trading volumes of the observations both in general and on ex-dividend day
- Ask-Bid price spread both in general and on ex-dividend day
- Neutralize the tax effect on dividend
REFERENCES


Skatteverket (2013). "Tax on Dividend" Vilka Skatteregler Gäller För Ränteinkomster,


### APPENDIX I – SPSS output

#### One-Sample Statistics

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#### One-Sample Test

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#### Independent Samples Test

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### Group Statistics

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### Model Summary

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a. Predictors: (Constant), Segment
b. Dependent Variable: Ratio

d. Predictors: (Constant), Segment

### ANOVA

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a. Dependent Variable: Ratio

### Coefficients

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a. Dependent Variable: Ratio