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Bachelor's Thesis

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# Determinants of Stock Price Volatility

- *A quantitative study on the Swedish stock market between 2004-2016*

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# Preface

*I, the author of this thesis, would like to thank all those who have given me support and inspiration while I wrote this thesis. Also, I would like to express my sincere gratitude to my supervisor, Dag Rydorff for his help along the way.*

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|---|---|
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| **Purpose** | The purpose of this thesis is to investigate whether Payout ratio, Earnings volatility, Size, and Leverage have any effect on the volatility of the stock. Furthermore, this thesis seeks to investigate whether these relationships apply to both Large Cap firms and firms listed on Mid and Small Cap. |
| **Theoretical perspectives** | The theories are based upon prevailing theories in the area, among them Bird in the hand hypothesis, the leverage effect and Dividend signaling effect. |
| **Methodology** | This thesis take a quantitative approach. The data is collected from Datastream where some computations are done in Excel. The regression and other statistical tests are performed in Stata. |
| **Conclusion** | All variables but Earnings Volatility were found to be statistically significant. The significant variables affect the stock price volatility in the same direction, both for firms on Large Cap as well for firms on Mid/Small Cap. |

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# 1. Introduction

## 1.1. Background

It is often said that there is no such thing as “free lunches”. It is a relationship that, within the topic of finance, is called risk-return. The concept shares the same core idea as anything else with life, simply in order to gain something you have to be willing to lose something. You expect that the higher the risk you take, the higher the return.

In a famous article, Markowitz (1952) showed that through diversification an investor can minimize risk while still keeping the return relative constant or, in a perfect scenario, increase the return. The key idea was to reduce the unnecessary risk. Today we know of this kind of risk as diversifiable risk.

A lot of research has been done since Markowitz first proposed the idea of diversification and many financial products have been introduced to minimize risks while still trying to keep the return as high as possible. The first products that may come to mind are options where an investor can hedge his or her investment for a relative small fee. Other products are collateralized debt obligations or CDOs. These products have been developed in order to minimize the risk for the investor.

These products, as magical as they may seem, are not necessarily available to all investors. The reason for this may be high transaction costs, bad liquidity or simply that investors are not informed enough to even dare to use these products. However, there are other factors that should, at least in theory, minimize the risk of the common stock and the aim of this thesis is to explore the impact of these factors on the risk of the stock.

Although the market has come up with new products where an investor can engage in high risk businesses with the potential to make higher returns than would otherwise be possible with stocks (such as ETFs with different leverage levels) the number of financial recommendations on how to reduce the risk seem to be head on heels. This means that there are some investors out there who are interested in investing in “safe” stocks with small, and hopefully, positive changes over a longer period instead of quick but uncertain returns.

Financial advisors may have a long experience in the financial market and may have developed a gut feeling of which stocks are “safer” than others. But what about us mortals? To be fair there exist various funds where investors for a fee can put their life savings in the hands of some financial gurus. However these funds charge fees where the size of the fee depends on how “active” the fund is in its trading. Various studies have tried to investigate whether investors end up with higher returns if they invest in these funds or if they are better off investing in the “benchmark” (i.e diversifying), with various results. Although this thesis does not aim to do a similar study this discussion serves as a springboard to what the thesis will study.

## 1.2. Research question

In light of the discussion above this thesis seeks to investigate whether some specific key ratios of a firm have an effect on the stock price volatility. If such is the case, are the relationships positive or negative and are they significant enough to verify the prevailing theories within that area of corporate finance? This thesis aims to answer the following questions:

- Do payout ratio, level of debt, earnings, and size have any effect on stock price volatility?
- Do the above mentioned key ratios have the same effect on companies listed on Large Cap as on companies listed on Mid/Small Cap?

The purpose of this thesis is to investigate whether these key ratios influence the volatility of the stock price. If the key ratios are found to be statistically significant a discussion will follow that will investigate whether the investors follow the patterns as described by financial theory.

## 1.3. Research Gap

A lot of research has been done on determinants of stock price volatility. However a large part of that research focuses on how volatility levels in previous periods affect the volatility in later periods by using various ARCH, GARCH and EGARCH models. This thesis will differ in the sense that it will disregard past volatility – which is not to say that the past volatility is insignificant. Furthermore, this paper will also compare large firms with smaller firms and see whether the key ratios have different impacts on volatility depending on which list the company is registered on. To the author's knowledge no such research has been done on the Swedish stock market before.

This thesis has taken a quantitative approach in which much focus has been on the regression analysis. Further statistical test have been conducted to verify that the model and methodology are robust.

The results show that leverage, size, and payout ratio are all statistically significant. These result will hopefully narrow the research gap a little bit more.

## 1.4. Disposition

This thesis will be divided into the following chapters:

2. Theory
3. Previous research
4. Data
5.Methodology
6. Results
7. Analysis
8. Conclusion

The theory chapter (2) contains prevailing theories within the research field and in this section I have included what I deem to be the most relevant for the purpose of this thesis. It will be

followed by a short summary of previous research within in this area. This will hopefully introduce a more empirical perspective to the reader and facilitate a greater understanding. The initial descriptive statistics will be presented chapter 4. In this chapter the reader will have a chance to better understand different patterns and distributions in the data. In the methodology chapter (5) an extensive description will be given of how this thesis aim to approach the research question and which tests have been performed. This is done in order to facilitate a better understanding of how the results were achieved and it also enables future researchers to conduct similar studies. Chapter 6 will contain the results from the regressions. A short description and commentary will be given regarding the findings. Chapter 7 will be dedicated for a further discussion and analysis of the results. Key findings will be highlighted and the results of this thesis will be compared against theory and previous research. Also, comparisons will be made and discussed between the two study groups to see if the results match and why there are differences - if they exist. Finally the last chapter (8) of this thesis will contain a conclusion of the discussion. A final summary will be given of the aim of the thesis, how it was conducted and what the key findings have been. Also, suggestions for future research will be offered.

## 1.5. Limitations

This study will only include firms that are listed as Swedish firms. Companies such as ABB and Astra Zeneca were excluded since they are also listed on other stock exchanges.

Another thing to note is that financial institutions were excluded from this thesis. The reason for this was that the way they use debt for financing their business is different from other firms in other sectors.

# 2. Theoretical background and framework

*This chapter is devoted to make the reader familiar with the dominating theories within this area. Theories have been selected so that contrasting views can be presented. This will hopefully help prepare the reader to better understand the analysis.*

## 2.1. Miller & Modigliani

In 1958 Miller and Modigliani published what would later become known as one of the first attempts to explain firms' approach to capital structure and the article may be considered the starting gun for the research within that area of corporate finance. In their research they concluded that the amount of debt in a perfect capital market does not have any impact on the value of the firm. Given that two or more firms were similar in all aspects except for their leverage, Miller and Modigliani (1958) claimed that the value of the firms must be equal – otherwise an arbitrage would arise. This may sound counter intuitive since the stock of a highly leveraged firms would appear to contain more risk than that of a less leveraged firm. They reasoned that firm value as well as stock price was not determined by the level of debt that the company had, rather they were based on the profitability of the company. However in their reasoning Miller and Modigliani assumed that the investor was not subject to taxes, transaction costs, no bankruptcy costs and that the investor had perfect access to any information about the firm.

Their argument was quite simple: under the assumptions of a perfect market any investor could easily buy shares and debt without restrictions. In the case of a highly leveraged firm an investor could just choose to buy a proportion of the debt and stock that corresponded to the debt/equity ratio, thereby securing the return and thus "undo" the leverage. In order words, the amount of debt would not have any impact on the value of the firm – although stock prices may differ.

However, since the stock price is determined by the profitability of the company, and the profitability is partially determined by the leverage – then the stock price is indirectly determined by the amount of debt that a company has. This idea further developed under section 2.5.

In addition to their claim that leverage had no impact on firm value, Miller & Modigliani (1961) also claimed that dividends had no effect on stock prices. The idea behind their reasoning was that a high dividend today would lead to smaller dividends in the future and vice versa. The net effect would however be the same. In addition, investors can in a perfect market replicate a dividend by selling the stock; therefore, the dividend choice of the company is irrelevant.

The assumptions made in Miller & Modigliani theory were, and still are, unrealistic due to the fact that investors are subject to taxes and that there is an asymmetric relationship between the firm's management and the investors in terms of access to information. Because of this the conclusions that were made from Miller & Modigliani are not necessarily applicable in a real world setting. Instead, other theories have sprung out from this theory.

## 2.2. Bird in the hand

The Bird-in-the-hand theory was developed by both Gordon (1963) and Lintner (1962) as a response to the conclusions of Miller & Modigliani. While Miller & Modigliani claimed that dividends were irrelevant to the value of the firm, known as the dividend irrelevance theory, Gordon & Lintner argued that dividends do play an important role. They assumed that investors prefer high dividends today (because that particular cash flow is often considered as certain), as a result the prices of these stocks would be higher and the risk would be lower than that of similar stocks with a low dividend. Furthermore, a reduction of the dividend would suddenly increase the perceived risk of the stock among investors. (Gordon, 1963) (Lintner, 1962)

In addition, Gordon (1959) had argued previously that investors prefer dividends instead of capital gains. Dividends represent more certain cash flows than do capital gains; therefore the risk of the stock would be reduced with a steady dividend policy. In conclusion, any change in the dividend would result in a change of the stock price and therefore dividend policy is a determinant of stock volatility.

## 2.3. Dividend signaling hypothesis

A common theory related to dividend policy is the signaling hypothesis. It acknowledges the fact that there is an information asymmetry between the management of the firm and the investors. In order to reduce the effects of this asymmetry and share a little of the "secret piece of information" to the investors, the management decides to change the dividends. The change in dividends would in theory convey what the management believes lie ahead in the future. This would imply that a positive change of the dividends would mean that the management has a very positive view of the future and this would make the stock price go up. Likewise a decrease of the dividends would mean that the management senses troubles ahead of the road. In summary a change of the dividends, regardless of the direction, would mean that volatility would go up. (Berk & DeMarzo 2014)

This theory has been supported by empirical research where firms between the years 1967-1993 saw an increase in their stock price when they increased the dividend by 10 %. The opposite effect was observed when the companies decided to cut the dividends by 10 %. (Berk & DeMarzo 2014).

## 2.4. Financial distress costs

Miller & Modigliani state that the amount of debt has no implications on firm value. Although this may be true it does not reject that the higher the debt ratio, the higher the risk that a company fails to make its interest payments. This argument goes into what textbooks call Costs of Bankruptcy or Financial Distress Costs. A company goes bankrupt when it fails to pay off its debts. Further, if the amount of debt relative to the amount of equity is very high, there is a risk that a few bad years can wipe out the equity and thus the company ends up in a situation where the value of its debt exceeds the value of its assets.

There are two costs related to financial distress with the first being *direct costs*. These include costs for hiring professionals to help companies in bankruptcy – whether it be for financial restructuring purposes or legal purposes. The second category of costs is called indirect costs.

These kind of costs deal with the various losses that are related to a firm whose existence is in doubt, some examples are human capital as employees move to competitors, inefficient liquidation and selling of assets under their market value in order to attain cash quickly. (Berk & DeMarzo. 2014)

## 2.5. Leverage effect

A theory that tries to capture the effects of leverage to the rate of return for a firm is the leverage effect. The formula is simple, yet powerful in explaining the risk of leverage. Although notation might differ among the scientific field the formula is as following:

$R_E = R_T + (R_T - R_D)*D/E$

Where:
$R_E$ = profitability on equity
$R_T$ = profitability on total assets
$R_D$ = interest paid on debt (cost of debt)
D = total amount of debt
E = total amount of equity

This formula establishes the relationship between return on equity and the leverage where the return on equity can be seen as a function of profitability on total assets, the weighted average interest rate and debt/equity ratio. This implies that if the return on total assets exceeds the weighted average interest rate that the company has to pay, then the company would benefit from being highly leveraged. This also means that if the interest rate exceeds the profitability on total assets (due to the company making a loss or simply not being able to boost profits) the negative impact of leverage to return on equity can be severe.

In order to make this model fit into the research question, a few more conceptual steps have to be taken before we are home free. First note that in good times, financially speaking, a company with little equity but much debt can make higher returns than otherwise would have been possible had it financed its operations solely with its own equity. In bad times however, the negative returns would be more severe than if the company was solely financed by its own equity. This is

just a different phrasing of the previous paragraph. Since stock prices reflect, at least in theory, the profits and the future profits of the company, the stock prices of a highly leveraged firm should make more dramatic upward and downward jumps than the stock price of a company with little or no leverage. This would mean that a high leverage should have a positive impact on stock price volatility.

# 3. Previous research

*This chapter introduces a selection of previous research within the area. These research papers have been carefully selected so that it fits this into the aim of this thesis.*

Dave E. Allen and Veronica S. Rachim (1996) conducted a major study in the Australian stock market to investigate whether the dividend policy of a company had any effect on the volatility of the stock. The firms were observed from 1972- to 1985 and the total sample consisted of 173 firms. They ran a regression of stock price volatility on size, growth, earnings volatility, leverage, dividend yield, and payout ratio where the first four variables served as control variables. They found that earnings volatility, leverage, and size all had a positive effect on stock price volatility whereas the payout ratio displayed a negative correlation. However, dividend yield did not display a significant correlation with the stock price volatility.

Hussainey et al (2010) conducted a research to investigate whether the dividend policy had any impact on stock price volatility in the UK market over a ten year horizon. Although the core of the study of Hussainey et al (2010) was to investigate the impact of dividends on stock price volatility, they also included control variables such as the size of the firm, the amount of long term debt and earnings (defined as EBIT). They concluded that size had a significant negative relationship with stock price volatility which is in line with the intuition that stocks of large firms are less volatile. Furthermore the debt ratio showed a significant positive relationship with the volatility of the stock. This supports the leverage model which states that a high debt ratio implies that returns can vary a lot. According to the results of Hussainey et al (2010) this is reflected by the fact that the debt ratio is a significant determinant of stock price volatility.

In a similar study Nazir et al (2010) investigated whether the same variables as those used by Hussainey et al (2011) had a statistically significant impact on stock price volatility. However the target of investigation was the Karachi stock exchange in Pakistan, an emerging market which may or may not have many similarities with the London Stock Exchange.

In accordance with previous studies (Hussainey et al, 2010), the same control variables were included. The sample consisted of 73 firms listed on the Karachi stock exchange (Pakistan) and the study period ranged from 2003 to 2008. The authors ran regressions with both fixed effects and random fixed effects.

For the regression with a random fixed effects model the dividend payout ratio, as well as size and volatility earnings showed a positive correlation with stock price volatility while leverage and growth were negatively correlated with the volatility of the stock. However, neither of these variables were significant at the 5 % significance level. In the fixed effects model both size and payout ratio were both significant at the 5 % level.

Robert S. Hamada (1972) investigated whether leverage has an impact on volatility. The main goal with his research was to give further input into to the debate concerning the theories developed by Miller & Modigliani on capital structure irrelevance theory. Four regressions were run with cross-sectional data from a sample consisting of 304 firms. He concluded that debt-to-equity does have an impact on volatility and that leverage in fact could explain 21-24 % of the change in volatility.

The results of previous research and the expected signs based on prevailing theories will be summarized below. Since some studies have included certain variables and omitted others, the omitted variables are displayed as n/a if they have not been studied.

| THEORY/RESEARCH | PAYOUT RATIO | LEVERAGE | SIZE | EARNINGS VOLATILITY |
|---|---|---|---|---|
| **M & M** | Has no effect | Positive | n/a | Positive |
| **LEVERAGE MODEL** | n/a | Positive | n/a | Positive |
| **BIRD IN THE HAND** | Positive | n/a | n/a | n/a |
| **DIVIDEND SIGNALING** | Positive | n/a | n/a | n/a |
| **ALLEN & RACHIM** | Negative | Positive | Positive | Positive |
| **HUSSAINEY ET AL** | Negative | Positive | Negative | Positive |
| **NAZIR ET AL** | Negative | Has no effect | Positive | Has no effect |
| **HAMADA, ROBERT S.** | n/a | Positive | n/a | n/a |

**Table 1. Above is a summary of the results of previous research as well as the predictions one can draw from theories. This table only contains the predicted signs that a variable is expected to take. No specific values have been inserted since the aim of this thesis is to investigate the direction of change rather than the magnitude of it.**

- n/a = The theory/research does not take the variable into account.

# 4. Data and descriptive statistics

*This chapter helps the reader to define the variables that will be used in this thesis and which source has been used to collect the data. It also presents some descriptive statistics so that the reader may have chance to get somewhat acquainted with the data*

## 4.1. Definitions of variables

This thesis intend to conform to previous research regarding the definitions of the included variables. This is done in order to facilitate comparisons and the analysis. The risk of choosing different definitions of the variables is that the data may be too different and any comparisons and conclusions from such could be misleading.

### 4.1.1. Volatility

The definitions of volatility may vary depending on the time period from which the volatility will be computed. However previous research has defined volatility as taking the difference of the highest and lowest value of stock price during the year and divided by the average of the highest and lowest values. This ratio was then squared so as to create the proxy for the volatility. This rather unconventional definition may have flaws, the main reason I chose this definition is to make it comparable with previous research. Since previous research is rather limited and most previous research adhere to the same definition, I saw no reason to deviate from it. The values were collected from Datastream.

#### 4.1.2. Payout ratio

The payout ratio was calculated by dividing dividends per share with earnings per share over all the years that were studied. The data for both earnings per share and dividend per share were collected from Datastream. The computation of the payout ratio was calculated manually in excel.

#### 4.1.3. Leverage

The leverage was calculated by dividing Long term debt with total assets. Long term debt is defined as subtracting total debt with any debt which is due within one year. Both values for long term debt and total assets were gathered from Datastream. The computation of the leverage ratio was calculated manually in excel.

#### 4.1.4. Size

The variable size is defined as the natural logarithm of the market capitalization of the common stock. Since the size varies throughout the year, an average was collected. This reduces the risk of any misleading data that stems from a randomly selected snap shot. However, the results also run the risk of being negatively affected by large outliers. Since I have no robust method for choosing a period that would best represent the true annual value of the market value, a simple average was deemed as acceptable.

#### 4.1.5. Earnings volatility

This thesis will, in accordance with previous research, follow the definition of Dichev and Tang (2009). This means that earnings volatility is calculated by computing the standard deviation of the earnings the past five preceding years.

#### 4.1.6. Growth

Growth will be included as a control variable. The reasoning behind this is that this thesis aims to conform with previous studies as much as possible unless there are strong arguments against it. Growth will be defined as the annual change of a firms total assets.

## 4.2. Descriptive statistics

A panel data was constructed which constituted of 32 firms in the Large Cap group and 37 firms in the Mid/Small Cap group. Data was originally collected for 6 variables for each company. However due to various diagnostic tests one variable had to be dropped from each group. The final result was that 5 variables were collected for each firm. Also do note that earnings volatility was not collected for the Mid/Small Cap companies, nor were growth collected for Large Cap companies. The data was collected from Datastream.

The firms that are studied are the same throughout this thesis, and since data could be collected for each variable for each firm, the panel data is balanced.

The sample for the Large Cap group contains 416 observations. The mean of the stock price volatility is 29.3 % with a maximum value of more than 200 %. This may be due to outliers since the mean seem to be closer to lower bound which is a volatility of just 3 %.

| VARIABLE | OBSERVATIONS | MEAN | STANDARD DEVIATION | MINIMUM | MAXIMUM |
|---|---|---|---|---|---|
| **VOLATILITY** | 416 | 0.293 | 0.334 | 0.030 | 2.022 |
| **PAYOUT RATIO** | 416 | 0.601 | 1.332 | -10.479 | 21.739 |
| **SIZE** | 416 | 10.397 | 1.235 | 6.783 | 13.175 |
| **L-T-D/CAPITAL** | 416 | 0.173 | 0.126 | 0 | 0.676 |
| **EBIT VOLATILITY** | 416 | 1.510 | 5.121 | 0.049 | 44.046 |

**Table 2. A summary of the descriptive statistics for the companies in the Large Cap group.**

The matrix shows that a total of 481 observations for each variable have been made. Volatility ranges from 3.1 % up to a staggering 284.5 % with a mean of 38.6 %. Like the case with the Large Cap group, there seem to be outliers in this sample group.

| MID/SMALL CAP | OBSERVATIONS | MEAN | STANDARD DEVIATION | MINIMUM | MAXIMUM |
|---|---|---|---|---|---|
| **VOLATILITY** | 481 | 0.386 | 0.395 | 0.031 | 2.845 |
| **PAYOUT RATIO** | 481 | 0.469 | 1.272 | -20 | 12.346 |
| **SIZE** | 481 | 7.176 | 0.996 | 3.912 | 9.220 |
| **L-T-D/CAPITAL** | 481 | 0.115 | 0.141 | 0 | 0.566 |
| **GROWTH** | 481 | 0.119 | 0.380 | -0.651 | 4.731 |

**Table 3. A summary of the descriptive statistics for the companies in the Small Cap group.**

Between both groups, the mean did not seem to differ substantially although the Large Cap companies on average paid out more of their earnings as dividends, had a higher debt ratio, and, quite naturally considering the definition for each group, Large Cap companies displayed a higher value for the Size variable. The only variable in which Mid/Small Cap companies displayed a higher value was the volatility with a mean volatility of 38.6 % compared to corresponding value for the Large Cap companies which was 29.3 %. The smallest values observed for volatility in each group were similar at around 3 % and both groups showed clear signs of outliers with a maximum value of 202.2 % in the Large Cap group and 284.5 % in the Mid/Small Cap group.

Since the independent variables showed strong indications of not being normally distributed a Skewness-Kurtosis test was performed to investigate whether in fact they were normally distributed or not. Histograms have been added to give the readers a visual sense of the distributions of the independent variables. Among the firms in both groups, only Size was normally distributed as can also be seen in appendix 10.7 and 10.8. This can also be visually confirmed from the histogram that is also included in 10.7 and 10.8 respectively. No further action will be done to correct for these violations of the normality assumption. According to Stock & Watson (2011, p. 146) the normality assumption can be relaxed if the sample size is

sufficiently large. As stated previously, both groups contain more than 400 observations for each variable. Therefore the author of this thesis deems both samples as sufficiently large. A more detailed overview of the test statistics as well as histograms for all independent variables can be found in appendices 10.7 and 10.8.

# 5. Methodology

*This chapter contains a description of how the firms were selected and according to which criteria. It also introduces the reader to the methods which will be used and the various test that will assure the robustness of the results*

This thesis will follow a deductive approach, meaning that the results will be analyzed based on theory and previous research. Regardless if the results are found to be significant or insignificant the aim will not be to try to develop new theories. Instead, the discussion will focus on possible explanations as to why the variables are found significant/insignificant according to existing theories.

Furthermore, this thesis will follow the same pattern as Allen & Rachim (1996), Hussainey et al (2010) as well as Nazir et al (2010). This is done in order to facilitate a comparison in the final discussion. For this reason, this thesis will use the same or similar variables as the previous studies done in this field.

## 5.1. Sample selection

The selection is limited to the Swedish stock market, more specifically firms that are listed on Large Cap, Mid Cap and Small Cap. Since a part of the research question is to see whether there exist any differences between large firms and smaller firms all the firms will be divided into two groups: large firms and small firms. A firm fulfills the criteria of being large if it is listed on Large Cap. Similarly, a firm is considered small if it is listed on either Mid Cap or Small Cap. The original intention was to compare firms from Large Cap with firms listed on Mid Cap.

However this proved to be a difficult task since not enough firms have paid dividends during the period I aim to study. The dilemma was to either drop the dividend variable or relax the size restriction and allow for Small Cap firms to enter the sample. Since theories seem to contradict each other regarding the dividend variable, and previous research seem to prove that it is a significant determinant of stock volatility, I have concluded that the variable is too important to leave out in this study.

If I on the other hand were to just do a study on firms listed on Large Cap, the study would run the risk of being too similar to previous studies and it would not provide any answer as to whether stocks issued by smaller firms follow the same pattern as stocks of larger firms.

By including firms from Small Cap there is a risk that a lot of "young startups" are included. Smaller companies could also possess certain characteristics that are inherent to small companies. Thirdly, Small Cap may contain a lot of firms which are "high-risk-high-reward" firms and therefore they may differ from the rest of the sample population. In order to reduce the risk of including firms that fit into one or more of the above categories, all firms from Small Cap must, in addition to pay dividends, have had a market value exceeding 150 million euros during at least one year during 2004-2016. The 150 million euro mark is set because that is also the criteria to be listed on Mid Cap according to Avanza (2017), the largest online stock brokers in Sweden. This should reduce the level of heterogeneity among the smaller companies. This way of reasoning also allows for some Mid Cap firms that may have been listed on Small Cap anytime during 2004-2016 to be included in the study as well. Therefore, I will not look specifically whether a company has been listed exclusively on Mid Cap or not.

Since the market values are presented in Swedish Krona (SEK) and the market capitalization restriction is in euro, an average of the SEK/EURO exchange rate was used to converse the values into EURO. The period on which the average is based ranges from the inception of the EURO as a currency (January 4$^{th}$ 1999) to December 15$^{th}$ 2017. The average under this period is 9.2313 SEK/EURO. The market value of each company for each year has thus been divided by 9.2313 and if the ratio exceeds 150 million during any year between 2004 and 2016 for a company it has been included in the study – given that it pays/has paid dividends and that there is available data for all the years. Figures were collected from the website of ECB.

Another problem was choosing an appropriate time span that would be studied. The benefit of having more years is that a more nuanced picture of the behavior of stock volatility could be presented. In addition, the effect of the financial crisis of 2008-2009 could be taken into account and therefore broaden the final discussion. However, adding more years comes with a cost – or a few for that matter. The most prominent is that various regulations and changes in the market may have changed the behavior of the volatility, without changing the explanatory variables. For instance, regulations may have changed how investors trade and therefore have changed the pattern of the stock volatility. Another downside of increasing the time span further is that it would reduce the sample size. This proved to be true since some companies were omitted due to the fact that they started their business later in the mid-2000s. A final problem of extending the time span too much was that a financial crisis struck the Swedish market in the late 90s – as well as the rest of the world – known as the dotcom bubble (or IT crash).

Reducing the time span too much does not take into account any cyclical effects – if there are any – and thus could the statistical inferences as well as any predictions of the future be misleading.

To mitigate these issues it was decided to set the time span to be 13 years, starting in 2004 and ending in 2016. By setting the time frame to 13 years it is possible to study the market both before and during the inception of the boom phase of the financial bubble which finally exploded in late 2007. Also, it will be possible to study the market during the crisis and the years that came after the crisis.

## 5.2. Statistical tests

### 5.2.1. Hypothesis testing

A common approach in quantitative research is hypothesis testing. This seems to be especially true in the field of finance. This thesis will not be different in that aspect and will follow what seems to be the norm. A hypothesis is a tool to see whether there exists a relationship between two variables and how reliable or likely this cause and effect relationship in fact is (Brooks 2008 pp. 51-63).

#### 5.2.1.1. Hypotheses for this thesis

It is time to introduce the hypotheses that will form the foundation of the discussion and that will be used to test the theories (as well as the previous research).

Regarding dividends there seem to be no consensus of whether it affects stock price volatility or not and in which direction. However, previous research has found the variable to be a significant determinant of volatility which is why this variable will be tested in this thesis as well.

- $H_{01}$: The dividend payout ratio has no effect on stock price volatility
- $H_{A1}$: The dividend payout ratio has an effect on stock price volatility

Both theory and previous research suggest the leverage has an effect on stock price volatility. Therefore this thesis will investigate whether this is true in the Swedish stock market

- $H_{02}$: The amount of leverage has no effect on stock price volatility
- $H_{A2}$: The amount of leverage has an effect on stock price volatility

Previous research states that the size of the firm shows a negative correlation with stock price volatility. This relationship will be tested in this thesis as well. Therefore:

- $H_{03}$: The size of the firm has no effect on stock price volatility
- $H_{A3}$: The size of the firm has an effect on stock price volatility

According to what can be implied by the leverage model as well as common ideas of the stock as being valued according to its future cash flows, it is relevant to include the earnings volatility to investigate whether it is a determinant of stock price volatility. Earnings volatility have a significant positive effect on stock price volatility according to previous research. However, it will be tested to see if this is true in the Swedish stock market.

- $H_{04}$: Earnings volatility have no effect on stock price volatility
- $H_{A4}$: Earnings volatility have an effect on stock price volatility

### 5.2.2. Regression analysis

The hypotheses tests will be performed in connection with a regression analysis. By running a regression I can not only see whether or not the studied variables are statistically significant but also in which direction they affect the dependent variable. Furthermore, the regression analysis will also present the magnitude of the explanatory power of all these variables combined.

The fact that a variable is statistically significant does not imply that the relationship is a true relationship, rather, it may depend on the significance level chosen. Depending on the confidence level, the same variable can be found to be either statistically significant or insignificant. A common confidence level chosen by researchers is 95 % and this thesis will not deviate from this standard since I cannot find any argument that would justify such a move. As I may use both the terms significance level and confidence level interchangeably in this thesis, I would like to remind the reader that a confidence level of 95 % is equivalent to a 5 % significance level.

The statistical methods that will be used do make some assumptions on the sample distribution of the variables. One of these assumptions is that it is normally distributed. According to Stock & Watson (2011, p.52) this assumption can be said to be approximately true if the sample size exceeds 30 observations. Although both of the groups studied will consist of more than 30 observations, I will also present data to see whether in fact these groups are normally distributed. If the distributions of the variables deviate too much in shape from a “traditional” normal distribution this will be helped by taking the natural log of the values.

Other characteristics need to be tested in order for the regression to be valid. These will be presented under separate headlines below.

#### 5.2.2.1. Unbiasedness

Unbiasedness refers to the concept that a sample has an expected value that is equal to the population characteristic (Dougherty, 2016). It does not make any assumption that any given observed value must equal the true population value only that on average the parameter will take a value that is equal to true value of the population (Brooks, 2008, p.45).

#### 5.2.2.2. Consistency

Consistency is the idea that estimates will converge to their true values if the sample sizes increases (Brooks, 2008, p.45). For this reason, a lot of care was put in the sample selection so that it would be sufficiently large. However the definition of large can be arbitrary but the author deems that at least 400 observations for each variable for each group is sufficiently large.

#### 5.2.2.3. Efficiency

An unbiased estimator means that the expected value of the sample should be the same as the population mean, however efficiency tells how likely the estimator is to take a value that is relatively close to the true value of the whole population. More specifically an efficient estimator is the estimator with the lowest variance - in other words an estimator whose distribution is more centered around its mean than any other unbiased estimator.

#### 5.2.2.4. Goodness of fit

In this thesis the goodness of fit of the regression will be determined by $R^2$. A higher value implies that the regression equation can explain the change of volatility to a greater extent. However, there is a shortcoming to stirring blindly at the $R^2$-value since $R^2$ by construction cannot fall (Dougherty 2016 p.188). In fact $R^2$ increases the more variables you add, regardless if the "new" variables have any real effect on the dependent variable or not. Because of this, the focus will be on the adjusted $R^2$.

There are however some shortcomings with the adjusted $R^2$. Although the value of it has a reduced risk of increasing if more variables are included into the regression, the adjusted $R^2$ may still increase even if the "new" variables are not statistically significant. This is a potential result from the fact that adjusted $R^2$ increases if the absolute value of the t-value of the coefficient for the new variable is greater than 1 (Dougherty 2016 p.188). Therefore one should be critical even

when looking at the adjusted $R^2$. According to Dougherty (2016 p.188) the $R^2$-values should be considered along with several other test results.

#### 5.2.2.5. Nonlinearity and functional misspecifications

A regular linear regression assumes that the relationships between the dependent and independent variables are linear. However this needs not to be the case. It could be the case that some relationship follows a quadratic pattern or any other nonlinear pattern. For this purpose a Ramsey's RESET was performed.

The results from the initial test rejected the null hypothesis of no omitted variables. It turned out that variable Growth was the most significant factor that contributed to the nonlinearity in the Large Cap group. This was concluded by adding one variable at the time and see how each variable contributed to the p-value from Ramsey's RESET test. Therefore, I chose to drop the variable so that a linear regression could be run. After the removal of the Growth variable, the Ramsey's RESET test could not reject the null hypothesis of no misspecification. However the p-value was 0.0595, suggesting that the variables may still be nonlinear after all. However, since the p-value still does not reject the null hypothesis on the given significance level, no further action will be done to transform the variables.

In the case of the Mid Cap group, Ramsey's RESET test could not reject the null hypothesis of omitted variables. After transforming a few variables it was still clear that the null hypothesis was rejected, suggesting that the relationship between the dependent and the independent variables is nonlinear. After some thoughtful consideration and time spent studying literature I decided to drop the variable EBIT volatility since it was the main contributing factor that made the relationship nonlinear. This was done due to the fact a nonlinear relationship should not be estimated using a linear regression. Various nonlinear regressions were considered but they would make the results hard to compare with previous research since their marginal effects would have different meanings. Their interpretation would also be hard to compare.

When a new regression was run without earnings volatility the p-value from Ramsey's RESET test was 0.0585. The fact that there is tendency towards a nonlinear relationship among the

variables, raises the question of whether this is a result of the fact that the sample size is smaller than that of previous research or if the true relationship between the independent variables and the dependent variable is nonlinear. A more extensive summary of the tests for both groups can be found in appendices 10.1 and 10.2.

#### 5.2.2.6. Multicollinearity

One of the problems that arise when running a multiple regression is the presence of a strong correlation between the independent variables. A strong correlation leads to a situation where the regression displays a larger variance for the coefficients of the two variables in question (Dougherty 2016 p.171). The presence of multicollinearity does not make the coefficients biased, however, it may be more difficult to prove them to be statistically significant. This comes as a result of the fact that a larger variance increases the confidence interval, thus making it harder to reject the null hypothesis and detecting significant variables.

For this study, the correlation between all the variables will be presented in a correlation matrix. A suggested rule of thumb is that if the absolute value of the correlation between two independent variables exceeds 0.8, then the model could be said to suffer from severe multicollinearity (Gujarati & Porter, 2009, p.338).

The correlation matrix shows that the data does not suffer from any severe multicollinearity. None of these values exceed the absolute value of 0.8. According to the rule of thumb presented by Porter and Gujarati (2009) these variables could be said to be uncorrelated and therefore no further variable needs to be dropped.

| LARGE CAP FIRMS | PAYOUT RATIO | SIZE | L-T-D/ASSETS | EBIT VOL |
|---|---|---|---|---|
| **PAYOUT RATIO** | 1 | | | |
| **SIZE** | 0.084 | 1 | | |
| **L-T-D/ASSETS** | 0.015 | 0.095 | 1 | |
| **EBIT VOL** | -0.045 | -0.160 | -0.029 | 1 |

**Table 4. A summary of the correlation between each variable for the Large Cap companies which were included in this study.**

Likewise, the variables for the Mid Cap group do not seem to be correlated according to the matrix below. The strongest correlation can be observed between Payout ratio and Size with a correlation of 0.091, corresponding to a correlation of 9.1 %. Once again, no value in this matrix exceed the rule of thumb (a correlation of 0.8 or more) and therefore these variables will be assumed to be uncorrelated with each other for the remainder of this thesis.

| MID/SMALL CAP FIRMS | PAYOUT RATIO | SIZE | L-T-D/ASSETS | GROWTH |
|---|---|---|---|---|
| **PAYOUT RATIO** | 1 | | | |
| **SIZE** | 0.091 | 1 | | |
| **L-T-D/ASSETS** | -0.002 | 0.089 | 1 | |
| **GROWTH** | -0.068 | 0.022 | 0.005 | 1 |

**Table 5. A summary of the correlation between each variable for the companies in the Mid/Small Cap group.**

In summary, the variables for both groups are uncorrelated to one another, meaning that the estimators will not produce unnaturally large variances; therefore, the estimators can be said to be efficient.

#### 5.2.2.7. Heteroscedasticity

Heteroscedasticity is the phenomenon that the variance of the disturbance term is not constant (Dougherty 2016 p.291).

The implication of the presence of heteroscedasticity is that the estimator will no longer be efficient. Further, the regression runs a risk of displaying some coefficients as significant when they in fact are not. This is a consequence of heteroscedasticity causing the standard errors to be underestimated and thus overestimating the t-value. (Dougherty 2016 p.292).

The Breusch-Pagan results also showed presence of heteroscedasticity in both groups with p-values of 0.000. For this reason new regressions were run for both groups, using robust standard errors.

A complete summary of the regressions and the results from the Breusch-Pagan tests for both groups are presented in appendices 10.3 and 10.4.

#### 5.2.2.8. Fixed Effects and Random Fixed Effects

Due to the fact that only 4-5 variables will be included in the regression it is likely that the regression could suffer from omitted variable bias. The bias can stem from two kinds of variables, those that can be measured but also those that cannot (Stock & Watson, 2011, p.351). Dougherty (2016, p.532) explains that if there is a correlation between the observed and unobserved variable the regression will suffer from omitted variable bias, also even if the two variables are not correlated the standard errors will still be invalid and the estimators inefficient. It is therefore of the essence to use tools to overcome this issues. Examples of such unobserved variables could be cultural attitudes towards investing and trading or the impacts of various regulations which cannot be measured. Another example of such a variable is the level of trust that market has for a given company.

A way to go around this problem is to use a fixed effects model where these non-measured variables are assumed to be constant either across entities or time (Stock & Watson, 2011, p. 351). The error term would then be defined as:

$U_{it} = \mu_i + v_{it}$

where μ represents the individual specific effects that are constant (or at least relatively) over time and v represents the remainder disturbance that varies over time and across entities. (Brooks, 2008, p.490)

In the case of time-fixed effects the μ-term in the above equation would represent factors that changes over time but are constant across entities. This is especially important for this thesis where regulatory changes most likely play an important role in explaining stock price volatility.

In contrast, the Random Fixed Effects model assumes that the unobserved variables that causes the bias are random – i.e they are drawn randomly from a given distribution (Dougherty, 2016, p.537). Furthermore, the random effects is the optimal choice if the sample drawn randomly from a larger population (Brooks, 2008 p.500). Since the dividend policy has been the main determining factor in the selection of companies for this thesis one can argue that the selection is not random and therefore that the Random Fixed Effects model is not appropriate.

A so called Hausman test can be used to investigate whether Fixed Effects or the Random Fixed Effects model is the most appropriate. The null hypothesis under a Hausman test is that both the Fixed Effects Model and the Random Effects Model are consistent and that they do not differ to any greater degree. However, under the null hypothesis the Random Effects Model is the most efficient. If the null hypothesis is rejected, only the Fixed Effects Model is consistent and therefore preferable. (Gujarati & Porter, 2009, pp. 604-605)

The results from the Hausman test indicate that the Fixed Effects Model is the most appropriate for both groups. The p-values for the Large Cap group and Mid/Small Cap group were 0.0000 and 0.0247 respectively.

A more detailed summary of the tests can be found in the appendices 10.9 and 10.11.

#### 5.2.2.9. Normality in disturbance term

The linear regression model assumes that the disturbance term is normally distributed with a mean of 0 (Gujarati & Porter, 2009, p.98).

Both a histogram and a so called Jarque-Bera test were used to investigate whether the residuals were normally distributed. This proved not to be the case for the Large Cap companies. The histogram suggests that there is a tendency toward a normal distribution but outliers seem to be the reason why the normality assumption is violated. Similarly, the residuals were not normally distributed among the Mid/small cap either for the same reason as for Large Cap. However, since the samples contain more than 100 observations this assumption can be relaxed (Gujarati & Porter, 2009, p.99).

Chi-statistics and histogram for both groups are presented in appendices 10.5 and 10.6.

#### 5.2.2.10. Specification of the model

This thesis relies on previous research when it comes to specifying the regression equation. It turns out that choosing the correct numbers of variables is a fine balance between acquiring unbiased estimators and reducing the standard errors.

In general estimators tend to be biased if a significant determining variable is omitted from the regression (Dougherty 2016 p.261). This is true if the excluded variable is correlated with a variable that is included in regression. In such a case, neither the t-tests nor the standard errors are invalid (ibid).

The effects of including a variable that in reality has no effect on the dependent variable causes the standard errors to rise. This leads to the estimators not being efficient – however they are still unbiased (Dougherty 2016 p.262).

After having spent some time reading through previous research the following equation for the Large Cap companies has been defined:

$$Volatility = \alpha + \beta_1 Payoutratio + \beta_2 Size + \beta_3 LTDCAP + \beta_4 EBITVol + \varepsilon$$

Similarly the equation for the Mid/Small cap group is:

$$Volatility = \alpha + \beta_1 Payoutratio + \beta_2 Size + \beta_3 LTDCAP + \beta_5 Growth + \varepsilon$$

Where:
Volatility = Volatility of the stock price as defined previously in this thesis.
α is a constant.
Payoutratio = Dividends per share divided by earnings per share
SIZE = the natural log of market capitalization
LTDCAP = Long term debt divided by total assets
EBITVol = The volatility of EBIT based on the preceding five years
Growth = The annual growth of the company's assets
ε = Error term.

## 5.3. Criticism

Although this research is based on previous research in the sense that each variable has been picked so as to make this study as similar as possible to previous papers, it is indeed important to put some focus on whether the data is valid.

The data which has been gathered from Datastream may or may not contain errors. Because of the fact that Swedish sources, from which the data could be gathered, were limited Datastream appeared to be an efficient source. However, since the values have been converted into values in dollars, certain errors, such as rounding errors, may appear in the data. However it is not likely that such errors, if they exist, would result in any invalid result.

# 6. Results from test

*This section contains the test results from the regression. The results and figures will be discussed briefly to better clarify to the reader what they mean and which variables are significant.*

## 6.1. Results from regressions

Table 6 shows that Payout ratio, Size and Earnings volatility (EBIT volatility) do all display negative coefficients while only the Debt ratio displays a positive coefficient. However the null hypothesis for Earnings volatility could not be rejected at the 5 % significance level. This means that no statistical inference can be made. However some discussions will take place regarding some possible explanations why this result differ from previous research.

Regarding all the significant variables, all but Payout ratio display a three star significance. It can therefore be inferred that these variables are with very little doubt significant determinants of volatility.

| LARGE CAP | COEFFICIENT | STANDARD ERROR | P-VALUE |
|---|---|---|---|
| **PAYOUT RATIO** | -0.021 | 0.009 | 0.019 |
| **SIZE** | -0.243 | 0.036 | 0.000 |
| **L-T-D/ASSETS** | 0.584 | 0.202 | 0.007 |
| **EBIT VOLATILITY** | -0.002 | 0.003 | 0.452 |
| **CONSTANT** | 2.738 | 0.379 | 0.000 |

**Table 6. A summary of the values of the coefficients, standard errors, and p-values for each variable in the Large Cap group.**

As for table 7, the coefficients for the variables Payout ratio and Size have, as is the case for the Large Cap companies, a negative effect on Volatility. Both variables are also significant on a three star level, meaning they are significant on the 0.1 % level.

The Debt ratio as well as the Growth variable both displayed positive coefficients. However they cannot be proven to be significant on the level that has been set in this thesis.

Like the significant variables for the Large Cap group, the significant variables display very low p-values, suggesting that the variables almost unquestionably are determinants of stock price volatility.

| MID/SMALL CAP | COEFFICIENT | STANDARD ERRORS | P-VALUE |
|---|---|---|---|
| **PAYOUT RATIO** | -0.033 | 0.008 | 0.001 |
| **SIZE** | -0.176 | 0.049 | 0.001 |
| **L-T-D/CAPITAL** | 0.333 | 0.327 | 0.314 |
| **GROWTH** | 0.083 | 0.103 | 0.427 |
| **CONSTANT** | 1.615 | 0.351 | 0.000 |

**Table 7. A summary of the values of the coefficients, standard errors, and p-values for each variable in the Mid/Small Cap group.**

An interesting pattern is that each common variables between the two groups had the same sign in both groups. Similarly, their marginal effects for each group corresponded relatively well. For instance, the leverage ratio was found to have the biggest impact on stock price volatility in both group with a coefficient value of 0.58 and 0.33 for the Large Cap and Mid/Small Cap group respectively – however the variable was not found statistically significant in the latter group. In addition, Payout ratio had the smallest impact on stock price volatility in both groups with a coefficient value of -0.02 for the Large Cap companies and -0.03 for the Mid/Small Cap companies. The $R^2$ values for Mid/Small Cap Large Cap was 0.077 and 0.105 respectively, meaning that the regression models have been able to explain the variation in stock price volatility with 7.7 % for Mid/Small Cap firms and 10.5 % for Large Cap Firms.

# 7. Analysis

*This section includes the analysis and discussion of results that have been presented in the previous section. This section will be divided into sub-sections where each sub-section is devoted to each variable. Also, the hypothesis that form the research question will be restated as a reminder along the discussion.*

## 7.1. Payout Ratio

A significant relationship between Payout ratio and Volatility could be found in both groups.

- $H_{01}$ Payout ratio does not have any effect on stock price volatility
- $H_{A1}$ Payout ratio does have an effect on stock price volatility

In both groups the coefficient was negative, meaning that an increase in the payout ratio decreases the volatility of the stock price. This result contradicts the conclusions of Miller-Modigliani that dividends have no effect on the stock price. Furthermore, it provides support for the Bird in the Hand theory. Investors seem to prefer that a larger percentage of the earnings be distributed among the owners in form of dividends. Though it impedes future growth and therefore future growth of the stock, it does on the other hand give the investors a “safe” return. Furthermore, it partially confirms the Dividend signaling hypothesis which says that management can use dividend payouts to send out signals to the rest of the market. For instance, an increase in the payout means that investors have little to fear regarding the financial health and the future survival of the company. However the dividend signaling hypothesis also allows for an increase in the stock price if the payouts increase. However this is not observed and it might be due to the fact that since volatility is only measured in positive values while the payout ratio is measured both in positive and negative values, the methodology of this thesis is not adequate enough to facilitate an investigation of whether stock prices move upward or downward if the dividend payout changes.

The market's reaction to the dividend policies among companies from both of the study groups seem to be similar with a minor difference. The marginal effect among smaller companies is a little higher than that for the larger counterparts. This could indicate that a solid dividend policy helps to reduce the volatility more for smaller companies. However no statistical test will be performed to see if this difference is statistically significant or not. The difference in marginal effects could just be the result of the fact that both sample sizes are relatively small in comparison with previous studies and therefore subjects to the impact of outliers. The Mid Cap group does contain companies that belong to the Small Cap and any outliers that exist could be smaller, more volatile, companies.

## 7.2. Long term debt to assets

The data showed that Long term debt to assets and Volatility had a positive relationship.

- $H_{02}$: The relative amount of debt does not have an effect on stock price volatility
- $H_{A2}$: The relative amount of debt does have an effect on stock price volatility

Long term debt to assets has a positive effect on stock price volatility in both groups. However, this variable was only statistically significant in the Large Cap group. This is in line with previous research which conclude that a higher leverage puts the company at a higher risk. The increased volatility, as a result of a higher leverage, captures the effects of the financial distress costs presented earlier in the theoretical framework and it confirms the conclusions of Miller & Modigliani.

The result is also in line with the findings of, Allen & Rachim (1996), Hussainey et al (2010 and Hamada (2012) and also indirectly confirms the leverage model. The increased debt seem to make the stock price more prone to large jumps due to the inherent attribute of high-gain-high-loss which exist in the leverage model. However since the leverage effect model also contains terms such as earnings it is difficult to rule that this result confirms the predictions implied by the leverage effect. Although it does give a partial explanation, one has to look at both the volatility of the earnings together with debt ratio to really confirm the adequacy of leverage effect as a predictor of the volatility of stock price in the Swedish stock exchange.

In addition, these findings confirm that firms which take on too much leverage are seen as more risky. A firm with too much leverage runs the risk of being exposed to financial distress costs as described in the theory chapter.

The results indicate that Debt ratio is a, statistically significant, determining factor for Volatility among the Large Cap firms but not among firms in Mid/Small Cap. This result is interesting since smaller companies should reasonably be more exposed when being highly leveraged due to more limited financial strength compared to their larger counterparts in the Large Cap group. Once again, the leverage effect model as an indirect predictor of Volatility cannot be confirmed nor rejected. Debt ratio is only term in the model and it has to be analyzed jointly with the Earnings volatility in order to make any strong arguments for the validity of the leverage effect. Furthermore since a larger marginal effect was found among the Large Cap firms for any given level of leverage, it does seem to contradict the idea in financial distress cost – or the idea of taking on too much leverage. However the descriptive statistics indicated that Large Cap firms did have a higher leverage in general so a higher marginal effect may be explained by that fact.

### 7.3. Size

Size had a statistically significant negative effect on stock price volatility in both groups.

- $H_{03}$: The size of the company does not have an effect on stock price volatility
- $H_{A3}$: The size of the company does have an effect on stock price volatility

The stock price volatility is affected negatively by the total size of the company in both groups. This suggests that the larger the company, the lower the volatility of the stock.

While it is generally said that the stock of larger companies are less volatile than those of smaller companies, previous research has not been able to agree if this “common knowledge” is actually true. Hussainey et al (2010) found that a negative relationship exist between the size of the company and volatility of the stock while Nazir et al (2010) and Allen & Rachim (1996) found that the opposite is true. The results of this thesis conforms to the former view and thus confirms the common view that larger companies are a less risky investment. This relationship is not

necessarily nonsensical since larger firms tend to be more diversified in both products and also the markets in which they operate. They are therefore not as exposed as their smaller counterparts if the Swedish economy would enter a recession. It could therefore be argued that the total size of a company's assets can be considered as proxy to diversification – keeping in mind that these two things might not be perfectly correlated.

Furthermore, it could be argued that this result is in line with the predicted results from the theories regarding financial distress. These theories may not explicitly suggest that larger companies should be less exposed than smaller companies to these costs, larger companies do however tend to have greater access to different sources of financing – and because of their size, larger companies may have better opportunities to reduce the costs of external financing.

The marginal effect of Size variable is also larger among the Large Cap group that that for the Mid/Small Cap group. This suggests that the investors' confidence for a company's stock grows somewhat nonlinearly for every level of size of the total assets which the company possess. This could confirm the test results from Ramsey's RESET which suggested that there is a tendency toward a nonlinear relationship between the independent and the dependent variables.

## 7.4. Earnings volatility

The regressions suggest that there should be a negative relationship between earnings volatility and stock price volatility.

- $H_{04}$: Earnings volatility does not have an effect on stock price volatility
- $H_{A4}$: Earnings volatility does have an effect on stock price volatility

The regression for the Large Cap companies indicated that there is a weak negative relationship between earnings volatility and stock price volatility. However this result is not statistically significant. This result alone is most likely not sufficient to claim that Earnings volatility does not affect Stock price volatility on the Swedish stock market. As was seen in the case of the Mid/Small Cap group, there seem to be a tendency toward a nonlinear relationship with between these two variables. This calls into question the results of previous studies who have used this

variable, both as a study variable but also as a control variable. Previous research has not presented any test results nor mentioned if they have tested the linearity assumption.

In addition, since the variable was dropped from the Mid/Small Cap group it is impossible to say in which direction the relationship tends to go.

The result from this thesis that investor do not seem to pay much attention to how volatile the companies' earnings are – once again keeping in mind that the functional specification of the model could have been inadequate. Regardless, this result supports the finding of Nazir et al (2010) while it contradicts that of Hussainey et al (2010) and Allen & Rachim (1996). Also, this result does not confirm the expected result that can be derived from the leverage effect. This further divides previous research and theory into two camps – one which states that earnings volatility has a positive statistically significant effect on stock price volatility and the other camp which states it does not have any effect on the volatility of the stock.

Because Earnings volatility is not statistically significant, it is difficult to determine if the leverage effect affects the stock price volatility. Remember that in the previous section that the Debt ratio was a determinant of Stock price volatility but it was not sufficient to confirm that the leverage effect determines the volatility of the stock. The fact Earnings volatility was not found to be statistically significant in this study it therefore cannot be determined if the leverage effect helps explain the movement of the stock price.

# 8. Conclusions

The introduction implied that one of the purposes of this thesis was to facilitate for amateur/private investors to use the results in this thesis in their own investment decisions. By verifying or rejecting previous research and current theories the goal is that the reader has acquired a greater understanding of how certain key ratios affect the volatility of the stock. Further, it is the wish of the author of this thesis that amateur investors now can manage the risk level of their portfolio to a greater degree than before by choosing different stocks according to the key ratios of the company.

This thesis set out to answer two questions. The first was whether Payout ratio, Size, Leverage, and Earnings volatility had any effect on Stock price volatility. The results showed that only Payout ratio, Size, and Leverage could be determined as statistically significant. However, Ramsey's RESET test indicated that there were strong nonlinear relationship in the data and it would therefore be unwise to discard Earnings volatility as a determinant of Stock price volatility. Whether this suspected nonlinearity caused any misleading results could not be determined. For this reason, the results of this thesis should be read with caution until the pattern of the true relationship is fully established.

Having said that, this thesis has contributed to an even more divided community within this topic. Leverage showed to have a positive effect on stock price volatility and thus conform to previous research such as the findings of Miller & Modigliani.

The payout ratio had a negative impact on stock volatility in both groups. The certain cash flows seem to have a calming effect on stock price in the Swedish stock market. However the choice of methodology and definition of the variables limited the abilities to conclude if the Dividend signaling hypothesis applies to the Swedish stock market.

Similarly the results from the size variable confirms the common knowledge that larger companies are less volatile. However, the empirical research remains divided on this issue.

The second question this thesis set out to study was whether the study variables affected the volatility of the stock in the same direction regardless of whether the companies were listed in Large Cap or Mid/Small Cap. Due to nonlinearities in the data, one variable had to be dropped

from the regression in each group. This limited the comparison to a certain degree but the main finding is that among the significant variable, the sign were the same for both groups, meaning that the significant variables affect stock price volatility in the same direction. However the magnitude of change was more pronounced for the Large Cap companies than for the Mid/Small Cap companies. The reason for this could not be determined and it may also be the effect of a relatively small sample.

## 8.1. Suggestions for future research

As mentioned before, due to the small size of the Swedish stock market relative to those of UK and the US, the smaller companies were clustered together into one group. This means that, although they may or may not be too different from each other, certain characteristics that only exist in one group could have had an impact. For instance, a characteristic among the Small Cap companies could have impacted the combined results for the entire group, making any inference misleading. However, this potential drawback was ignored in favor of a larger sample size. For future research it would be interesting to study a market containing more companies and make a similar comparative study.

The test results also indicated a potentially nonlinear relationships among the independent and independent variables. Any variable in this thesis that caused these nonlinearities were simply dropped from the regression. However, the relatively high p-values suggested that nonlinearities may exist even after omitting the variables. For future research it would be interesting to investigate whether in fact the true relationship is linear after all. The results from such a study could provide some insights in how the stock market reacts the key ratios. Also, it could provide insights of whether this phenomenon only exists in a few markets or if this potentially nonlinear relationship is universal. As stated before, previous research has not presented any test results regarding the linearity assumption of OLS. Any research which would conclude that the relationship is nonlinear after all would also challenge the results of existing research.

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(Accessed 10 December 2017)

# 10. Appendix

## 10.1. Appendix 1 Ramsey's RESET test Large Cap

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 6.08723846 | 4 | 1.52180961 | Number of obs | = 416 |
| Residual | 40.3227544 | 411 | .098108891 | F( 4, 411) | = 15.51 |
| | | | | Prob > F | = 0.0000 |
| Total | 46.4099928 | 415 | .111831308 | R-squared | = 0.1312 |
| | | | | Adj R-squared | = 0.1227 |
| | | | | Root MSE | = .31322 |

| Volatility | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Size | -.0796849 | .0127011 | -6.27 | 0.000 | -.1046521 | -.0547178 |
| LTDCAP | .2016271 | .1225459 | 1.65 | 0.101 | -.0392679 | .4425221 |
| Payoutratio | -.0149647 | .0115832 | -1.29 | 0.197 | -.0377344 | .0078051 |
| EBITVol | .0097622 | .0030434 | 3.21 | 0.001 | .0037796 | .0157448 |
| _cons | 1.080493 | .1331786 | 8.11 | 0.000 | .8186971 | 1.342289 |

```
. ovtest

Ramsey RESET test using powers of the fitted values of Volatility
       Ho:  model has no omitted variables
                 F(3, 408) =      2.49
                  Prob > F =      0.0595
```

## 10.2. Appendix 2 Ramsey's RESET test Mid/Small Cap

```
Linear regression                               Number of obs =     453
                                                F(  5,   447) =    9.85
                                                Prob > F      =  0.0000
                                                R-squared     =  0.1434
                                                Root MSE      =  .37641
```

| Volatility | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0320518 | .0099744 | -3.21 | 0.001 | -.0516543 | -.0124492 |
| Size | -.0830852 | .0184491 | -4.50 | 0.000 | -.1193429 | -.0468275 |
| LTDCAP | .2938278 | .154777 | 1.90 | 0.058 | -.0103532 | .5980087 |
| Growth | .0364673 | .0899197 | 0.41 | 0.685 | -.1402504 | .2131851 |
| EBIT_Vol | 6.26e-06 | 1.92e-06 | 3.25 | 0.001 | 2.48e-06 | .00001 |
| _cons | .9496957 | .1374527 | 6.91 | 0.000 | .6795619 | 1.219829 |

```
. ovtest

Ramsey RESET test using powers of the fitted values of Volatility
       Ho:  model has no omitted variables
                 F(3, 444) =      4.25
                  Prob > F =      0.0057
```

The result from Ramsey's RESET test after dropping the Earnings volatility variable

```
Linear regression                               Number of obs =     481
                                                F(  4,   476) =   11.00
                                                Prob > F      =  0.0000
                                                R-squared     =  0.0822
                                                Root MSE      =   .3796
```

| Volatility | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0349895 | .0094699 | -3.69 | 0.000 | -.0535974 | -.0163816 |
| Size | -.0907752 | .017429 | -5.21 | 0.000 | -.1250224 | -.056528 |
| LTDCAP | .2834503 | .1522004 | 1.86 | 0.063 | -.0156174 | .5825179 |
| Growth | .023945 | .0915128 | 0.26 | 0.794 | -.155874 | .2037641 |
| _cons | 1.018625 | .1325168 | 7.69 | 0.000 | .7582343 | 1.279015 |

```
. ovtest

Ramsey RESET test using powers of the fitted values of Volatility
       Ho:  model has no omitted variables
                 F(3, 473) =      2.50
                  Prob > F =      0.0585
```

## 10.3. Appendix 3 Test for heteroscedasticity Large Cap

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 6.08723846 | 4 | 1.52180961 | Number of obs | = 416 |
| Residual | 40.3227544 | 411 | .098108891 | F( 4, 411) | = 15.51 |
| | | | | Prob > F | = 0.0000 |
| Total | 46.4099928 | 415 | .111831308 | R-squared | = 0.1312 |
| | | | | Adj R-squared | = 0.1227 |
| | | | | Root MSE | = .31322 |

| Volatility | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0149647 | .0115832 | -1.29 | 0.197 | -.0377344 | .0078051 |
| Size | -.0796849 | .0127011 | -6.27 | 0.000 | -.1046521 | -.0547178 |
| LTDCAP | .2016271 | .1225459 | 1.65 | 0.101 | -.0392679 | .4425221 |
| EBITVol | .0097622 | .0030434 | 3.21 | 0.001 | .0037796 | .0157448 |
| _cons | 1.080493 | .1331786 | 8.11 | 0.000 | .8186971 | 1.342289 |

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Volatility

         chi2(1)      =   147.38
         Prob > chi2  =   0.0000
```

## 10.4. Appendix 4 Test heteroscedasticity in the Mid/Small cap group

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 6.14055075 | 4 | 1.53513769 | Number of obs | = 481 |
| Residual | 68.5883923 | 476 | .144093261 | F( 4, 476) | = 10.65 |
| | | | | Prob > F | = 0.0000 |
| Total | 74.7289431 | 480 | .155685298 | R-squared | = 0.0822 |
| | | | | Adj R-squared | = 0.0745 |
| | | | | Root MSE | = .3796 |

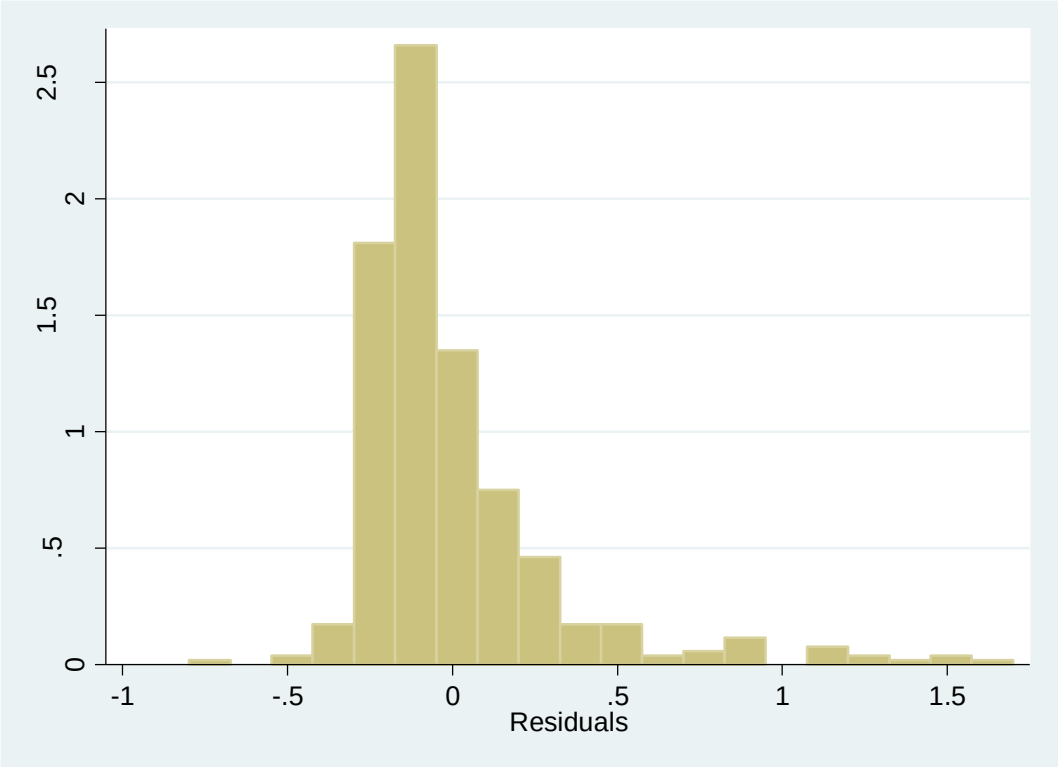
| Volatility | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0349895 | .0137512 | -2.54 | 0.011 | -.06201 | -.007969 |
| Size | -.0907752 | .0175583 | -5.17 | 0.000 | -.1252766 | -.0562738 |
| LTDCAP | .2834503 | .123096 | 2.30 | 0.022 | .0415716 | .525329 |
| Growth | .023945 | .0456795 | 0.52 | 0.600 | -.0658134 | .1137035 |
| _cons | 1.018625 | .1268359 | 8.03 | 0.000 | .7693971 | 1.267852 |

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Volatility

         chi2(1)      =    82.17
         Prob > chi2  =   0.0000
```

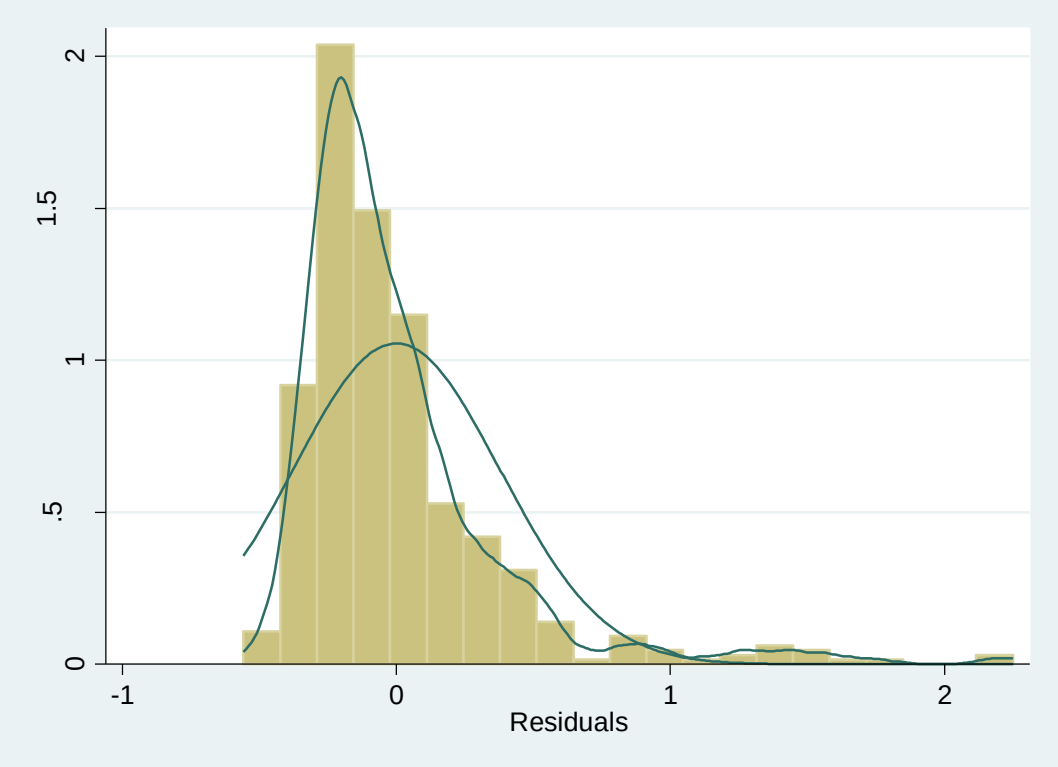
## 10.5. Jarque Bera test Large Cap

```
Jarque-Bera normality test:   1480 Chi(2)       0
Jarque-Bera test for Ho: normality:
```



## 10.6. Jarque Bera Mid/Small Cap

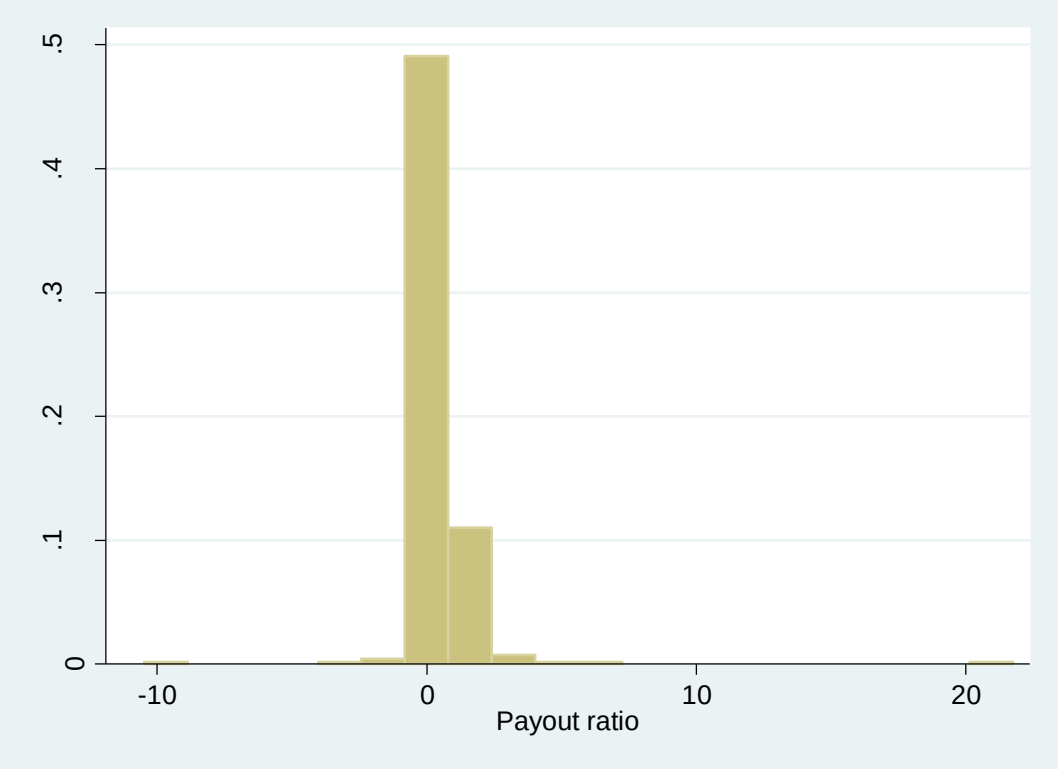
```
Jarque-Bera normality test:    1939 Chi(2)       0
Jarque-Bera test for Ho: normality:
```

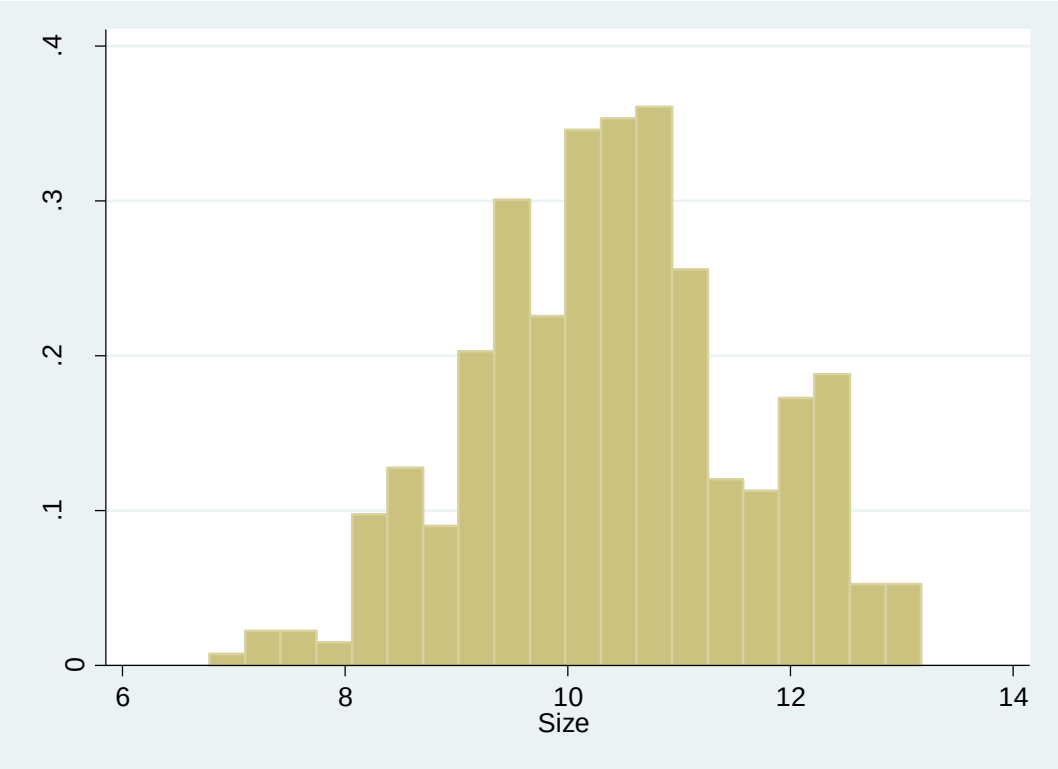


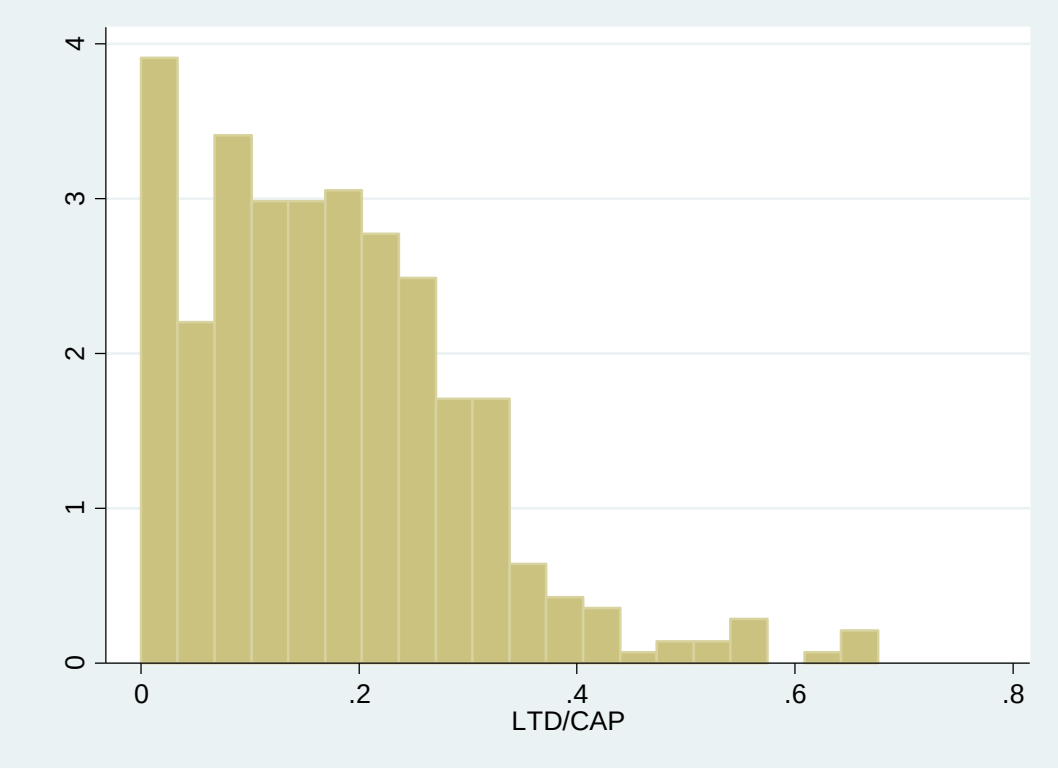
10.7. Test for normality in the variables + histograms for Large Cap

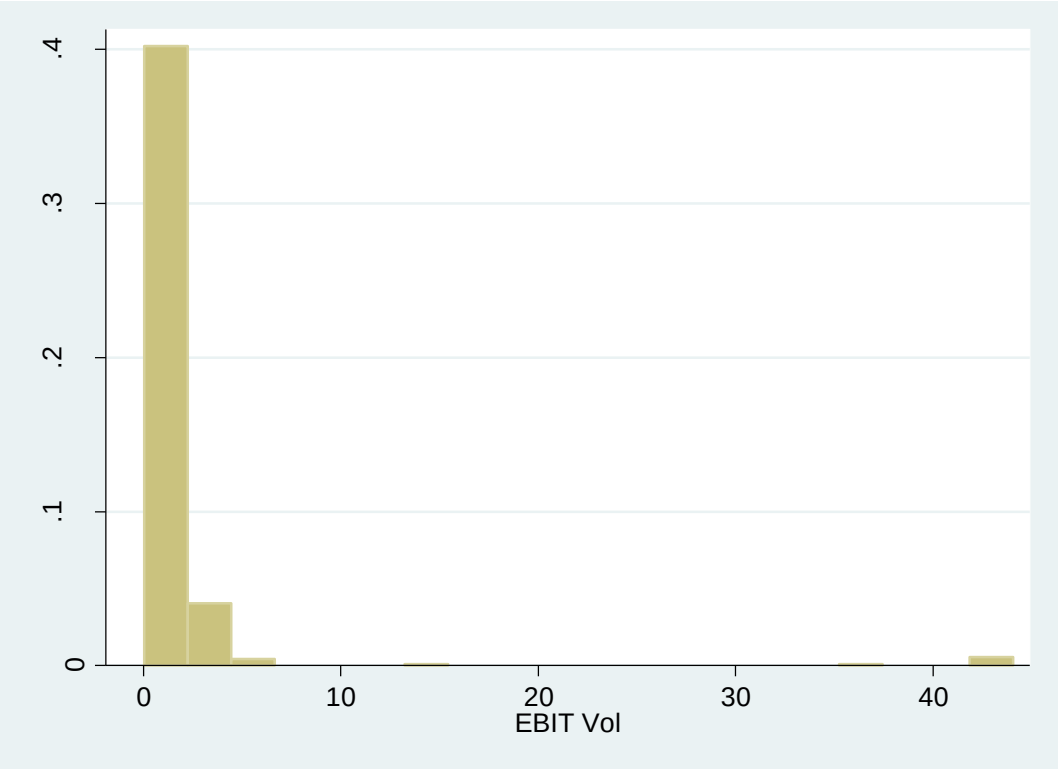
Skewness/Kurtosis tests for Normality

| Variable | Obs | Pr(Skewness) | Pr(Kurtosis) | joint adj chi2(2) | joint Prob>chi2 |
|---|---|---|---|---|---|
| Payoutratio | 416 | 0.0000 | 0.0000 | . | 0.0000 |
| Size | 416 | 0.7245 | 0.1899 | 1.85 | 0.3966 |
| LTDCAP | 416 | 0.0000 | 0.0001 | 51.24 | 0.0000 |
| EBITVol | 416 | 0.0000 | 0.0000 | . | 0.0000 |




0
.1
.2
.3
.4
6
8
10
12
14
Size

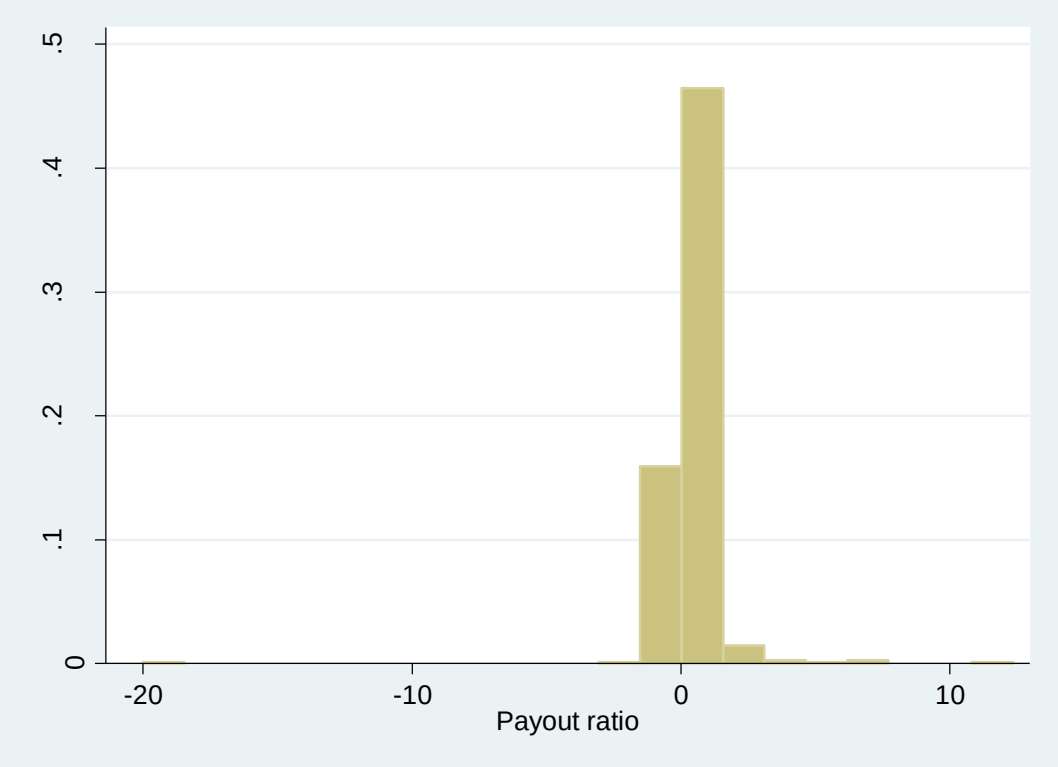

0
1
2
3
4
0
.2
.4
.6
.8
LTD/CAP

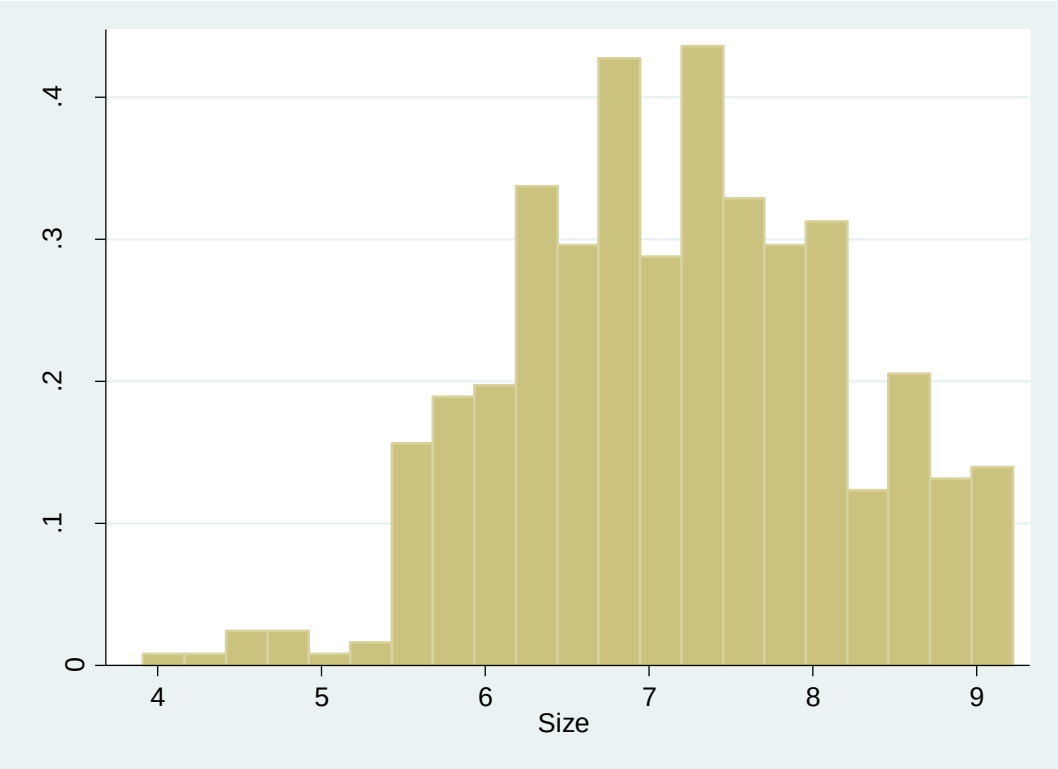

.4
.3
.2
.1
0
0
10
20
30
40
EBIT Vol

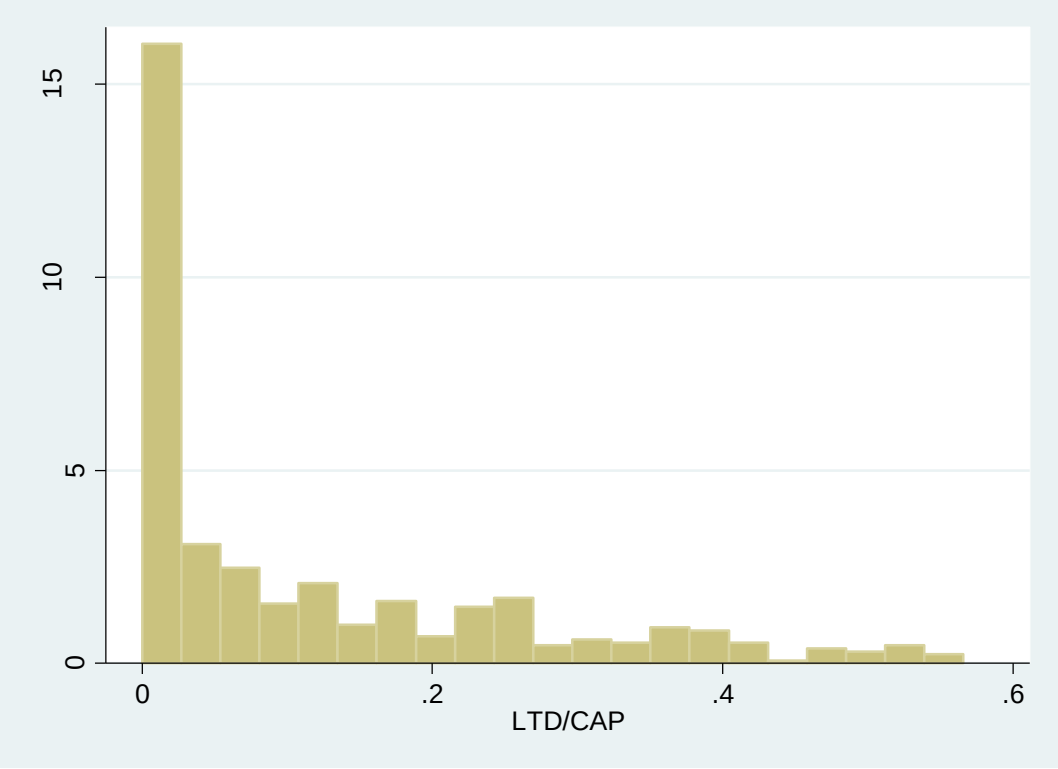
## 10.8. Test for normality in the variables + histograms for Mid/Small Cap

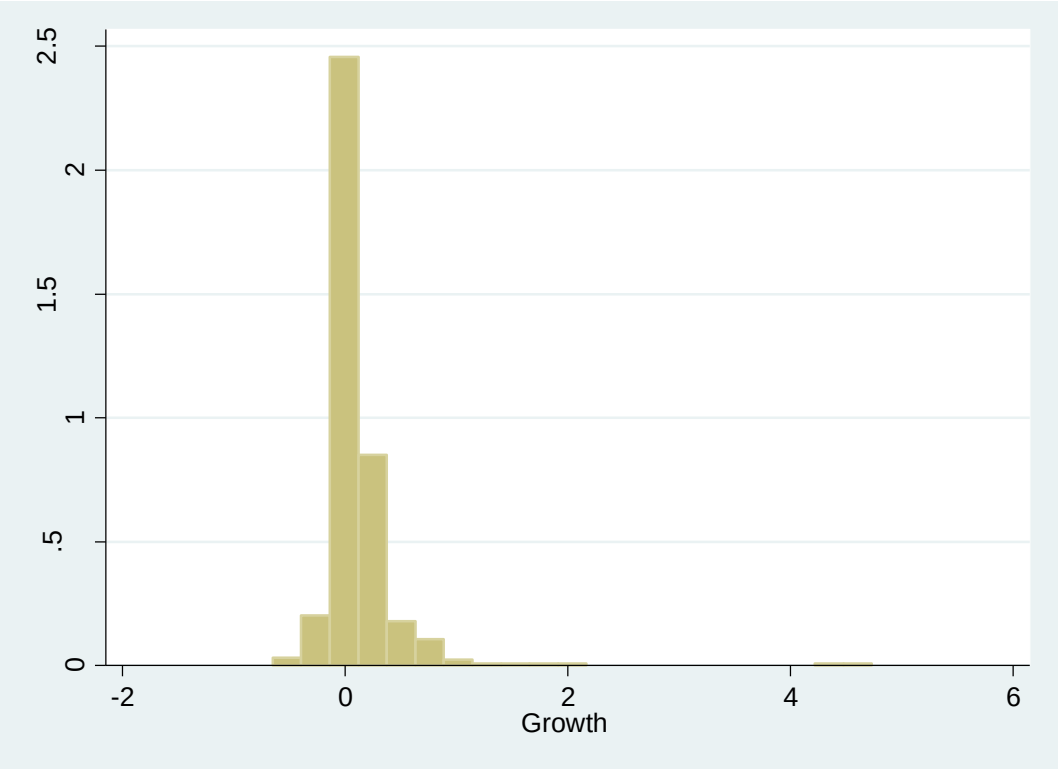
Skewness/Kurtosis tests for Normality

| Variable | Obs | Pr(Skewness) | Pr(Kurtosis) | joint adj chi2(2) | joint Prob>chi2 |
|---|---|---|---|---|---|
| Payoutratio | 481 | 0.0000 | 0.0000 | . | 0.0000 |
| Size | 481 | 0.3835 | 0.0921 | 3.60 | 0.1652 |
| LTDCAP | 481 | 0.0000 | 0.0094 | 70.70 | 0.0000 |
| Growth | 481 | 0.0000 | 0.0000 | . | 0.0000 |




0
.1
.2
.3
.4
4
5
6
7
8
9
Size


0
5
10
15
0
.2
.4
.6
LTD/CAP


2.5
2
1.5
1
.5
0
-2
0
2
4
6
Growth

## 10.9. Hausman test Large Cap

```
Fixed-effects (within) regression               Number of obs      =       416
Group variable: Firm1                           Number of groups   =        32

R-sq:  within  = 0.1875                         Obs per group: min =        13
       between = 0.1653                                        avg =      13.0
       overall = 0.1048                                        max =        13

                                                F(4,380)           =     21.93
corr(u_i, Xb)  = -0.7771                        Prob > F           =    0.0000
```

| Volatility | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0211142 | .0110187 | -1.92 | 0.056 | -.0427795 | .0005511 |
| Size | -.2433653 | .0285626 | -8.52 | 0.000 | -.299526 | -.1872047 |
| LTDCAP | .5836724 | .2065596 | 2.83 | 0.005 | .1775293 | .9898154 |
| EBITVol | -.0020683 | .0034688 | -0.60 | 0.551 | -.0088888 | .0047522 |
| _cons | 2.737981 | .3020479 | 9.06 | 0.000 | 2.144086 | 3.331875 |
| sigma_u | .25660623 | | | | | |
| sigma_e | .28578147 | | | | | |
| rho | .44636481 | (fraction of variance due to u_i) | | | | |

```
F test that all u_i=0:     F(31, 380) =     3.67                 Prob > F = 0.0000
```

```
Random-effects GLS regression                   Number of obs      =       416
Group variable: Firm1                           Number of groups   =        32

R-sq:  within  = 0.1551                         Obs per group: min =        13
       between = 0.2314                                        avg =      13.0
       overall = 0.1253                                        max =        13

                                                Wald chi2(4)       =     58.61
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

| Volatility | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.01594 | .0112927 | -1.41 | 0.158 | -.0380733 | .0061933 |
| Size | -.1060538 | .0161732 | -6.56 | 0.000 | -.1377526 | -.074355 |
| LTDCAP | .3134465 | .1475897 | 2.12 | 0.034 | .024176 | .602717 |
| EBITVol | .0061206 | .0032095 | 1.91 | 0.057 | -.00017 | .0124112 |
| _cons | 1.341452 | .1705064 | 7.87 | 0.000 | 1.007266 | 1.675638 |
| sigma_u | .08371133 | | | | | |
| sigma_e | .28578147 | | | | | |
| rho | .07902227 | (fraction of variance due to u_i) | | | | |

| | ——— Coefficients ——— | | | |
|---|---|---|---|---|
| | (b) fe | (B) re | (b-B) Difference | sqrt(diag(V_b-V_B)) S.E. |
| Payoutratio | -.0211142 | -.01594 | -.0051742 | . |
| Size | -.2433653 | -.1060538 | -.1373116 | .0235426 |
| LTDCAP | .5836724 | .3134465 | .2702259 | .1445136 |
| EBITVol | -.0020683 | .0061206 | -.0081889 | .0013159 |

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 50.31
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

## 10.10. Final regression Large Cap

```
Fixed-effects (within) regression               Number of obs      =       416
Group variable: Firm1                           Number of groups   =        32

R-sq:  within  = 0.1875                         Obs per group: min =        13
       between = 0.1653                                        avg =      13.0
       overall = 0.1048                                        max =        13

                                                F(4,31)            =     26.63
corr(u_i, Xb)  = -0.7771                        Prob > F           =    0.0000

                                    (Std. Err. adjusted for 32 clusters in Firm1)
```

| Volatility | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0211142 | .0085429 | -2.47 | 0.019 | -.0385375 | -.0036909 |
| Size | -.2433653 | .0360715 | -6.75 | 0.000 | -.3169337 | -.169797 |
| LTDCAP | .5836724 | .2023476 | 2.88 | 0.007 | .1709818 | .996363 |
| EBITVol | -.0020683 | .0027179 | -0.76 | 0.452 | -.0076115 | .0034749 |
| _cons | 2.737981 | .3787757 | 7.23 | 0.000 | 1.965462 | 3.510499 |
| sigma_u | .25660623 | | | | | |
| sigma_e | .28578147 | | | | | |
| rho | .44636481 | (fraction of variance due to u_i) | | | | |

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Volatility | 416 | .2925266 | .3344119 | .0302869 | 2.021808 |
| Payoutratio | 416 | .6005674 | 1.332847 | -10.47904 | 21.73913 |
| Size | 416 | 10.39737 | 1.235255 | 6.782997 | 13.17491 |
| LTDCAP | 416 | .1725452 | .1260476 | 0 | .6762316 |
| EBITVol | 416 | 1.510382 | 5.121381 | .0487316 | 44.0462 |

## 10.11. Hausman test Mid/Small Cap

```
Fixed-effects (within) regression               Number of obs      =       481
Group variable: Firms1                          Number of groups   =        37

R-sq:  within  = 0.1100                         Obs per group: min =        13
       between = 0.0793                                        avg =      13.0
       overall = 0.0774                                        max =        13

                                                F(4,440)           =     13.60
corr(u_i, Xb)  = -0.4428                        Prob > F           =    0.0000
```

| Volatility | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0328422 | .0136121 | -2.41 | 0.016 | -.059595 | -.0060894 |
| Size | -.1757616 | .0273495 | -6.43 | 0.000 | -.2295134 | -.1220097 |
| LTDCAP | .3333144 | .2305312 | 1.45 | 0.149 | -.1197646 | .7863935 |
| Growth | .0826653 | .045916 | 1.80 | 0.072 | -.0075767 | .1729073 |
| _cons | 1.61477 | .2002427 | 8.06 | 0.000 | 1.221219 | 2.008321 |
| sigma_u | .1866795 | | | | | |
| sigma_e | .35621403 | | | | | |
| rho | .21546764 | (fraction of variance due to u_i) | | | | |

```
F test that all u_i=0:     F(36, 440) =     2.79                 Prob > F = 0.0000
```

```
Random-effects GLS regression                   Number of obs      =       481
Group variable: Firms1                          Number of groups   =        37

R-sq:  within  = 0.1077                         Obs per group: min =        13
       between = 0.0881                                        avg =      13.0
       overall = 0.0810                                        max =        13

                                                Wald chi2(4)       =     47.33
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

| Volatility | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0332438 | .0134105 | -2.48 | 0.013 | -.0595279 | -.0069597 |
| Size | -.121302 | .0211108 | -5.75 | 0.000 | -.1626784 | -.0799256 |
| LTDCAP | .3172507 | .1573987 | 2.02 | 0.044 | .0087549 | .6257465 |
| Growth | .048838 | .0445574 | 1.10 | 0.273 | -.038493 | .1361689 |
| _cons | 1.230017 | .1541324 | 7.98 | 0.000 | .9279227 | 1.532111 |
| sigma_u | .1231599 | | | | | |
| sigma_e | .35621403 | | | | | |
| rho | .10677673 | (fraction of variance due to u_i) | | | | |

| | Coefficients | | | |
|---|---|---|---|---|
| | (b) fe | (B) re | (b-B) Difference | sqrt(diag(V_b-V_B)) S.E. |
| Payoutratio | -.0328422 | -.0332438 | .0004016 | .002882 |
| Size | -.1757616 | -.121302 | -.0544596 | .0177162 |
| LTDCAP | .3333144 | .3172507 | .0160637 | .1708504 |
| Growth | .0826653 | .048838 | .0338273 | .0124673 |

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 11.17
Prob>chi2 = 0.0247

## 10.12. Final regression Mid/Small Cap

```
Fixed-effects (within) regression               Number of obs      =       481
Group variable: Firms                           Number of groups   =        37

R-sq:  within  = 0.1100                         Obs per group: min =        13
       between = 0.0793                                        avg =      13.0
       overall = 0.0774                                        max =        13

                                                F(4,36)            =      7.64
corr(u_i, Xb)  = -0.4428                        Prob > F           =    0.0001

                                    (Std. Err. adjusted for 37 clusters in Firms)
```

| Volatility | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Payoutratio | -.0328422 | .008978 | -3.66 | 0.001 | -.0510504 | -.0146341 |
| Size | -.1757616 | .049153 | -3.58 | 0.001 | -.2754485 | -.0760746 |
| LTDCAP | .3333144 | .3266813 | 1.02 | 0.314 | -.3292259 | .9958547 |
| Growth | .0826653 | .1028494 | 0.80 | 0.427 | -.125923 | .2912536 |
| _cons | 1.61477 | .3508071 | 4.60 | 0.000 | .9033004 | 2.32624 |
| sigma_u | .1866795 | | | | | |
| sigma_e | .35621403 | | | | | |
| rho | .21546764 | (fraction of variance due to u_i) | | | | |

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Volatility | 481 | .3863309 | .3945698 | .0309749 | 2.844741 |
| Payoutratio | 481 | .4691996 | 1.272075 | -20 | 12.34568 |
| Size | 481 | 7.176122 | .9962899 | 3.912023 | 9.2203 |
| LTDCAP | 481 | .1153498 | .1410369 | 0 | .5659494 |
| Growth | 481 | .1186586 | .3803796 | -.6506686 | 4.732997 |

## 10.13. Correlation matrices

| LARGE CAP FIRMS | PAYOUT RATIO | SIZE | L-T-D/ASSETS | EBIT VOL |
|---|---|---|---|---|
| **PAYOUT RATIO** | 1 | | | |
| **SIZE** | 0.084 | 1 | | |
| **L-T-D/ASSETS** | 0.015 | 0.095 | 1 | |
| **EBIT VOL** | -0.045 | -0.160 | -0.029 | 1 |

| MID/SMALL CAP FIRMS | PAYOUT RATIO | SIZE | L-T-D/ASSETS | GROWTH |
|---|---|---|---|---|
| **PAYOUT RATIO** | 1 | | | |
| **SIZE** | 0.091 | 1 | | |
| **L-T-D/ASSETS** | -0.002 | 0.089 | 1 | |
| **GROWTH** | -0.068 | 0.022 | 0.005 | 1 |

## 10.14. List of firms

| | **Large Cap Firms. If a firm has issued more than one kind of stock, the letter within the parentheses indicates which stock has been studied** |
|---|---|
| **1** | Hennes & Mauritz |
| **2** | Ericsson (B) |
| **3** | AXIS |
| **4** | Atlas Copco (B) |
| **5** | Alfa Laval |
| **6** | Assa Abloy (B) |
| **7** | Billerud Korsnäs |
| **8** | Boliden |
| **9** | Electrolux (B) |
| **10** | Elekta (B) |
| **11** | Getinge (B) |
| **12** | Hexagon (B) |
| **13** | Holmen (B) |
| **14** | Modern Times Group (B) |
| **15** | NCC (B) |
| **16** | NIBE Industrier (B) |
| **17** | Nobia |
| **18** | PEAB (B) |
| **19** | SAAB (B) |

| | |
|---|---|
| **20** | Sandvik |
| **21** | SCA (B) |
| **22** | Securitas (B) |
| **23** | Skanska (B) |
| **24** | SKF (B) |
| **25** | SSAB (B) |
| **26** | SWECO (B) |
| **27** | Swedish Match |
| **28** | Tele2 (B) |
| **29** | Telia Company |
| **30** | Trelleborg (B) |
| **31** | Volvo (B) |
| **32** | ÅF (B) |

| | **Mid/Small Cap Firms. If a firm has issued more than one kind of stock, the letter within the parentheses indicates which stock has been studied** |
|---|---|
| **1** | Acando (B) |
| **2** | Addnode (B) |
| **3** | Addtech (B) |
| **4** | Beijer Alma (B) |
| **5** | Bergman & Beiving |
| **6** | Bilia (A) |
| **7** | BioGaia (B) |
| **8** | Biotage |
| **9** | Clas Ohlson (B) |

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|---|---|
| **10** | Elanders (B) |
| **11** | Fagerhult |
| **12** | Gunnebo |
| **13** | Haldex |
| **14** | HiQ International |
| **15** | I A R System Groups |
| **16** | Lagercrantz Group (B) |
| **17** | Mekonomen |
| **18** | Mycronic |
| **19** | New Wave Group (B) |
| **20** | Nolato (B) |
| **21** | OEM International (B) |
| **22** | Probi |
| **23** | Sectra (B) |
| **24** | SkiStar (B) |
| **25** | VBG Group |
| **26** | Vitec Software Group (B) |
| **27** | Concordia Maritime (B) |
| **28** | ENEA |
| **29** | KABE Husvagnar (B) |
| **30** | KNOW IT |
| **31** | Malmbergs Elektriska (B) |
| **32** | Midsona (B) |
| **33** | Rottneros |
| **34** | Semcon |
| **35** | Studisvik |
| **36** | Viking Supply Ships |
| **37** | XANO Industri (B) |