



Turun yliopisto  
University of Turku

# **BEHAVIOR OF EQUITY RISK PREMIUM AFTER A CATASTROPHIC EVENT**

**European Financial Institutions Post-Financial Crisis Era**

Master's Thesis  
in Accounting and Finance

Author:  
Sami Toivonen 505375

Supervisors:  
Ph.D. Erkki Vuorenmaa  
M.Sc. Minna Vähäsalo

13 February 2018  
Pori



Turun kauppakorkeakoulu • Turku School of Economics



# Table of Contents

1	INTRODUCTION .....	7
1.1	Background of the Thesis.....	7
1.2	Objectives and Research Limitations of the Study .....	8
1.3	Data and Sample Selections .....	9
1.4	Research Methods .....	11
1.4.1	Equity Risk Premium.....	11
1.4.2	Free Cash Flow to Equity .....	11
1.5	Structure of the Study.....	12
2	INVESTOR BEHAVIOR AND FINANCIAL CRISES .....	14
2.1	Investor Psychology .....	14
2.1.1	Limits of Arbitrage .....	14
2.1.2	Investor Sentiment .....	16
2.1.3	Anchoring Bias and Belief Perseverance.....	17
2.1.4	Comovement .....	19
2.1.5	Herd Behavior .....	21
2.2	Characteristics of Financial Downturns .....	23
2.2.1	Equity Risk Premia and Business Cycles .....	23
2.2.2	Catastrophic Events .....	24
2.2.3	Role of Investor Behavior in Crisis .....	26
3	EFFICIENT MARKETS, EQUITY RISK PREMIUM, AND BANKING INDUSTRY .....	29
3.1	Theory of Efficient Equity Markets .....	29
3.1.1	Efficient Market Hypothesis .....	29
3.1.2	Criticism to Efficient Market Hypothesis.....	31
3.2	Equity Risk Premium .....	32
3.2.1	Investor Preferences.....	32
3.2.2	Information and Liquidity.....	33
3.2.3	Government and Monetary Policies.....	34
3.2.4	Other Factors.....	35
3.2.5	Bank Sector Specific Risks.....	35
3.2.6	Time-Varying Risk Premia .....	36
3.3	Financial Institutions .....	37
3.3.1	Valuation of Financial Institutions.....	37
3.3.2	Value Creation in Financial Institutions .....	38
3.3.3	Risk Management in Banks .....	39

3.3.4	Capital Structure in Banks .....	41
3.3.5	Stress Tests in General.....	42
3.3.6	European Banking Environment.....	44
3.4	Forming the Hypothesis .....	45
4	ANALYSIS OF EMPIRICAL EVIDENCE.....	46
4.1	Estimation of Historical Equity Risk Premium.....	46
4.1.1	Discounted Cash Flow Model.....	46
4.1.2	Cost of Equity and Equity Risk Premium.....	47
4.1.3	Country Risk Premium .....	49
4.2	Stress Tests and Previous Results .....	50
4.3	Statistical Analysis .....	53
5	RESULTS AND DISCUSSION.....	55
5.1	Timeline of Financial Crisis and the Effects on Equity Risk Premium .....	55
5.2	Behavior of Equity Risk Premium .....	56
5.2.1	Capital Market Efficiency.....	57
5.2.2	Behavioral Finance Aspect .....	59
6	CONCLUSIONS .....	63
	REFERENCES.....	66

## List of Tables

Table 1	Number of financial institutions based on the home country .....	10
Table 2	Country Risk Premiums.....	50
Table 3	Results of Previous EU Wide Stress Tests .....	52
Table 4	Correlation in 2010 .....	53
Table 5	Correlation in 2011 .....	53
Table 6	Correlation in 2014 .....	54
Table 7	Correlation in 2016 .....	54
Table 8	Results of Stress test, sorted by 2016 results .....	60

## List of Figures

Figure 1 Development of German 10-year Government Bond.....	47
Figure 2 Development of 10-year German Government Bond and Average Equity Risk Premium .....	48
Figure 3 Five highest and five lowest ERPs in 2015 and their development before .	48
Figure 4 Timeline of important events and equity risk premium.....	55
Figure 5 Scatter Plot of Stress Test Placements and Equity Risk Premium .....	57
Figure 6 Breakdown of 2011 and 2016 stress test results by country.....	61
Figure 7 Selected 6 banks' market values development and overall average 2010- 2015	62
Figure 8 Important Events and the Average ERP in the Sample .....	63

## List of Abbreviations

FCFE	Free Cash Flow to Equity
EMH	Efficient Market Hypothesis
ERP	Equity Risk Premium
LTROs	Long Term Refinancing Operations
TLTROs	Targeted Long Term Refinancing Operations



# 1 INTRODUCTION

## 1.1 Background of the Thesis

For a long time efficient capital markets have been the most supported financial theory. Very closely related to efficient capital markets are the theory of rational investors, meaning that investors seek for the highest possible wealth, and random walk theory, which states that share prices develop independently from day-to-day. Since the 1980s the development of behavioral finance these theories have started to face scrutiny. The consensus on efficient market hypothesis has not been established in previous studies and it is continually under scrutiny by the academic literature. Although the hypothesis holds in some empirical tests, there are cases when the hypothesis does not hold. (Malkiel 2003) Also, other studies have cast doubt on the random walk hypothesis of stock prices (Fama & French 1988; Lo & MacKinlay 1988). These studies found that (US) stock prices are mean reverting and thus doubt the claims that markets are efficient.

The traditional finance paradigm assumes that investors are “rational.” The market is observed through the eyes of rational investors. Investor rationality means two things. When investors receive new information, they will adjust their beliefs accordingly and given their beliefs they will make decisions based on their subjective utility. This framework is very simple and provides very straightforward predictions. However, through empirical studies it has been found that the basic facts about trading behavior, the aggregate stock market, and the cross-section of average returns are not well understood in this framework. (Barberis & Thaler 2005, 1)

Behavioral finance is a relatively new approach to financial markets that has emerged in response to the difficulties faced by the traditional finance research. Behavioral finance argues that not all agents are completely rational. Specifically, behavioral finance studies what happens when one condition is loosened. (Barberis & Thaler 2005, 1-2)

According to the efficient market hypothesis, all available information is reflected in the stock prices, to give them their true value. Efficient market hypothesis (EMH henceforward) is one of the most tested and supported (by empirical evidence) economic propositions. The hypothesis has been tested and found consistent with a wide variety of data. But since data has become better and econometric sophistication has increased, the exceptions have become more evident. (Jensen 1978, 95) The efficient market hypothesis was widely accepted a generation ago and it was generally believed that stock market fully reflects all the available information. Thus, neither technical analysis nor fundamental analysis would enable an investor to achieve greater returns than passively managed

portfolio or an index fund. In the 21st century, focus of studies explaining market movements shifted from EMH to psychological and behavioral aspects of investors. Economists now believe that markets are at least partially predictable. (Malkiel 2003)

After the global financial crisis of 2007, EMH has been singled out and blamed for the economic downturn. The reasoning behind this is that as EMH stands, the market prices reflect all available information, meaning the market is in an equilibrium. But investors and regulators failed to look into and verify the true values for various assets, and failed to detect the bubble. Investors who poured money in various markets believed that the prices would continue to rise, thus further driving the prices up. This would implicate that they believed that the then-current prices were incorrect. Yet this is the exact opposite of what EMH claims and stands for. (Ball 2009)

Another important outset is to make clear what is meant by the term “efficiency.” Malkiel (2003) defined efficient markets as “[...] such markets do not allow investors to earn above-average returns without accepting above-average risks.” This is the view held throughout this study. This means that a higher amount of risky assets in the balance sheet should mean a higher risk premium, thus meaning the financial institutions with such characteristics may perform better. However, the performance of banks in the market is not part of this study.

Equity risk premium is one of the most important numbers in finance. Equity risk premium (ERP, henceforward) reflects the premium investors require to invest in an equity or other asset, relative to a risk-free investment. ERP also functions as a figure in the evaluation of financing and investment opportunities, commonly used in the capital asset pricing model. Risk premium can also be used in the case of debt or bonds. In this case risk premium is a default spread, which is added on the risk free rate to get the market interest rate on the bond. (Damodaran 2010, 3)

ERP is based on fundamentals of a company and it will vary as a function of uncertainty in the economy, fear of catastrophes, and the risk aversion of investors. This would indicate that when fundamentals change, the risk premium should also change. In practice, it is usually assumed that risk premiums are constant or at least revert back to historical average quite quickly. Assuming that risk premiums do not change is also assuming that none of the fundamentals mentioned above will change either. As we know catastrophic events and changes in economy do happen. (Damodaran 2010, 21-22)

## **1.2 Objectives and Research Limitations of the Study**

This thesis studies the effect of industry uncertainty and how it reflects to different companies within the industry. More specifically, the uncertainty of banking industry globally and the effects on the risk premium locally in Europe. Especially the differences, or lack



of them, between banks from different regions in Europe. According to stress tests conducted by the EBA (European Banking Authority), Nordic banks hold significantly lower amounts of risky assets in their balance sheet. This in turn would mean that, under duress, banks with lower amount of risky assets will suffer smaller losses. This indicates that such banks should be compensated for their more risk averse behavior by the market. Thus, this study takes part in the ongoing debate on the efficiency of capital markets by testing if the risk premium differs between financial institutions with different levels of risky assets on their balance sheet. Another objective is to see whether equity risk premium changes drastically after a catastrophic event and how it behaves after such an event.

Based on these notions, the following set of sub-questions have been formulated to guide this study to reach its objectives:

- What is the effect of higher risk exposure on the risk premium in the case of financial institutions?
- How does the equity risk premium behave after a catastrophic event?

In order to fulfil the objectives of the study, several problems need to be taken into account. First, have the previous shocks in the market affected all companies or are there company specific shocks. Hence, controlling market performance needs to be considered. Second, the impact of monetary policy is uncertain. Traditionally, lowering interest rates have thought not to affect equity risk premium. However, recent studies have found that there could be a significant impact. Third, the traditional framework in study of finance investors are assumed to be rational and act rationally in the financial markets. This view, however, has been challenged by the academic research. Thus, the role of investor behavior needs to be covered.

The efficient market hypothesis, risk components, and financial industry are covered to establish a sufficient understanding of the markets regarding to financial institutions. Prospect theory will be shortly discussed to provide more criticism to efficient market hypothesis and to further the understanding of irrational investors. Also the financial industry is covered to gain more insight on the role of debt in financial institutions. Further, the role of debt has an effect on how banks and other financial institutions are valued.

### **1.3 Data and Sample Selections**

The financial institutions included in this study have been selected on the basis that they featured in the latest stress test conducted by the EBA. In addition, sample was limited to

financial institutions that are publicly traded in a European stock exchange. This limitation reduces the number of financial institutions from 51 to 30. This limitation to publicly traded financial institutions with sufficient track record is done because of the objective of this study. To be able to determine if the market misvalues the amount of risky assets to risk premium, the companies naturally need to be publicly traded.

In the table 1 below are listed the countries of origin of the financial institutions covered in this study.

**Table 1** Number of financial institutions based on the home country

Home Country	Nr. of FI in this study
Austria	1
Belgium	1
Denmark	2
France	3
Germany	2
Hungary	1
Ireland	2
Italy	3
Netherlands	1
Norway	1
Poland	1
Spain	4
Sweden	4
UK	4
<b>Total</b>	<b>30</b>

As we can see from table 1, most of the financial institutions are from Western Europe. Only two are from Eastern Europe (one from Poland, one from Hungary). For the purpose of this study the lack of Eastern European financial institutions does not present any problems as Eastern European financial institutions do not play significant role in the European banking sector.

The main source of information in this study is the Thomson Reuters Datastream. Additional databases may be used to obtain other information, if not found in the fore mentioned database. For information on the risky assets in financial institutions the 2016 EBA stress test is considered to be the main source, older stress test are used to provide historical comparison. The results from the stress test will provide valuable information for the analysis of the impact on risk premia.

Data will be presented as end of the year. Risk free rate in this study will be 10-year German government bond (10-Y Bund). Because this study focuses on the European market, it is justifiable to use 10-Y Bund instead of 10-year treasury bond (T.Bond).

## 1.4 Research Methods

### 1.4.1 Equity Risk Premium

This study examines the effect of risky assets to the equity risk premium (ERP, henceforward). ERP is the measure of compensation that the investor wants so that he will invest to a risky equity instead of risk free government bonds. To be able to examine the effect, the company specific ERP needs to be determined for each financial institution. First, ERP needs to be calculated. Second, the effect of country risk needs to be factored out to determine the company specific risk premium. This, in turn, is compared to the amount of risky assets in the corresponding balance sheet.

Damodaran (2012) concluded that the beliefs about markets influences the choice of estimate. If the markets are believed to be efficient, the current implied equity premium is the best choice as it is conducted from the current level of the index. On the other hand, if markets are seen as inefficient, average or historical implied equity risk premium is a better choice. As this study focuses on the post-financial crisis era, it is logical to use historical implied equity risk premium.

Value of equity is, by the classical definition, the future expected cash flows discounted to present day. In this study the free cash flow to equity (FCFE henceforward) is used as the proxy for shareholder returns. Implied ERP is calculated as follows:

$$Value\ of\ Equity = \sum_{t=1}^{t=N} \frac{E(FCFE_t)}{(1+k_e)} + \frac{E(FCFE_{N+1})}{(k_e - g_N)(1+k_e)^N} \quad (1)$$

In this equation N is the number of high growth years,  $E(FCFE_t)$  is the potential return to shareholders in year t,  $k_e$  is the expected rate of return by equity investors and  $g_N$  is the stable growth rate (after year N). Given the FCFEs and prices today, expected rate of return can be solved from the equation. Subtracting out the risk free rate the result is an implied equity premium. (Damodaran 2015)

### 1.4.2 Free Cash Flow to Equity

Because of the nature of financial institutions and the current economic situation in Europe, the traditional valuation methods are out of the question. Simple dividend and buy-back models cannot be used as post-financial crisis regulatory actions have prevented banks from paying out dividends or buying back stock. Free cash flow to equity is the method in this case.

Free Cash Flow to Equity (FCFE) takes into account more cash flows than just the dividends paid and buy backs. This approach is needed as the banks have not paid out dividends or bought back shares after the financial crisis, thus making dividend based models pointless. Also, concentrating on FCFE, the value of equity is more accurate, especially if the companies are paying less or more in dividends than they could.

Free Cash Flow to Equity is calculated as follows:

$$FCFE_{Financial\ Firms} = Net\ income - Reinvestment\ in\ Regulatory\ Capital$$

As it states in the formula, this is a financial company specific calculation. The “normal” calculation of FCFE cannot be used, as net capital expenditures and non-cash working capital cannot be identified as easily as in non-financial companies. Financial services firms do not normally reinvest in plant, equipment or other fixed assets. However, banks usually invest money in the regulatory capital required by regulatory institutions, such as the Basel Committee and implemented by local central banks. This reinvestment level is determined by book equity capital ratio. It is determined by regulatory requirements but also the banks own choices. A more conservative bank will hold a higher capital ratio, whereas some banks may choose to hold the minimum amount required by forementioned authorities. (Damodaran 2009) Overall, reinvestment in regulatory capital is an increase in equity. As financial firms grow they need to hold more capital to meet the capital requirements.

The Basel Accords (Basel I, II, and III) set the capital requirements to a certain level. The ratio is calculated by dividing the Common equity tier 1 with risk-weighted assets in the balance sheet. From external perspective it is unlikely to obtain information on the risk capital per business unit. Because of this, when valuing from outside in, it is assumed that the amount of risk capital employed by the bank is equal to the book value of equity. (Koller, Goedhart & Wessels 2005, 684)

## 1.5 Structure of the Study

The first chapter is an introduction to the study and presents the data used and the research methods. After the introduction the availability and suitability of the data is introduced. Also the methods for the analysis of the data are presented.

The second and third chapter will provide the theoretical framework of this study. First the chapter begins with a discussion of behavioral finance and a few subjects relevant to this study. This is done to achieve a deeper understanding of how behavioral finance views investors in general and to provide reasonable background for the analysis in the

fifth chapter. Second chapter also covers characteristics of financial crises and black swan events. The role of investors in crises is discussed briefly.

The third chapter begins with discussion of capital market efficiency. In addition, the random walk theory is covered. This study, in part, test the efficiency of markets. So it is essential to understand the theory behind efficient markets theory. As a part of this discussion some critique against the efficient market hypothesis is presented. Another important subject of this study is equity risk premium. Equity risk premium is also covered in chapter three. A few aspects of equity risk premium are discussed in more detail. Lastly the special nature of debt in financial institutions. This is done to understand the special needs of the valuation of financial institutions.

In the traditional research of finance there is a dominant framework on which the theories developed are based on. This framework has three key assumptions. First, the market participants formally act rationally. Second, the market is perfectly competed. Third, all information is available for free. This study challenges especially the first point on this framework. If the markets are indeed efficient, banks with less risky balance sheet should be more compelling to investors.

Fourth chapter will present the analysis on the data presented in the first chapter. The methods for this analysis are also introduced in the first chapter. The analysis presents equity risk premiums for all of the 30 banks presented in the data.

The fifth chapter will draw conclusions based on the analysis made in the fourth chapter and compare the results on the theoretical framework provided in the second and third chapter. Also further research possibilities are considered.

## 2 INVESTOR BEHAVIOR AND FINANCIAL CRISES

### 2.1 Investor Psychology

The traditional view of investors as rational agents has been challenged since the emergence of behavioral finance<sup>1</sup>. Through behavioral finance academics have sought a way to explain numerous anomalies that could not be explained by the traditional framework. The traditional framework consider arbitrageurs to be the main agent in correcting mispricing in the market. However, as mispricing does occur, there has to be some limitations in the way arbitrageurs can act. This is covered in the first subchapter.

The rest of the chapter provides coverage on some behavioral finance theories considered to be crucial for this study. The aim of these subchapters is to provide sufficient understanding on how investor psychology can affect the markets and cause the markets to be less efficient. The points made are later used in the analysis of the empirical data. For this study comovement, herd behavior, and belief perseverance are considered to be most important.

#### 2.1.1 Limits of Arbitrage

Traditional finance assumes agents who participate in all markets costlessly and without risk. Arbitrage is one of the fundamental concepts in finance. Arbitrage is defined as “the simultaneous purchase and sale of the same security in two different markets for advantageously different prices.” The arbitrageurs are essential to efficient markets, because the effect of arbitrageur’s actions is to bring prices to fundamental values. When an arbitrageur buys a cheaper security and sells a more expensive one he gets his profits up front, rather than getting cash flows in the future. Typically arbitrageurs are professional and highly specialized investors who combine their knowledge with resources of outside investors to take large positions. A feature of arbitrage is that the knowledge and resources are separated by an agency relationship. (Shleifer & Vishny 1997, 36-37)

Arbitrageurs are essentially agents who look to exploit market mispricing and anomalies. By doing so they assure that the markets are efficient and reflect the “true” fundamental value. Arbitrageurs’ actions even out the action made by less rational investors furthering the efficiency of markets. Yet market anomalies and mispricing occur regardless of arbitrage and arbitrageurs. Limits of arbitrage are viewed as one of the two building blocks needed to explain anomalies, the other being demand shocks experienced by

---

<sup>1</sup> To find out more on behavioural finance see for example Thaler, R. (2005) *Advances in Behavioral Finance Volume II*, Princeton University Press, Princeton, New Jersey

other investors than arbitrageurs. Demand shocks push prices away from fundamental values and arbitrageurs are unable to correct prices. These shocks to demand are caused by irrational investors. Limits of arbitrage research focus on the constraints and limitations arbitrageurs face, and why arbitrage fail to bring prices close to fundamental values. (Gromb & Vayanos 2010, 252-3)

There are numerous studies discussing the risks arbitrageurs face and how the risks affect the actions taken by arbitrageurs. Fundamental risk is the risk that arises when arbitrageurs try to find a suitable substitute to hedge their original investment. When buying a mispriced stock arbitrageurs consider all the available information, but that does not edge out the possibility that the stock will receive bad news causing the then-mispricing to be the new “correct” value. Arbitrageurs will hedge their position to cover their investment from industry-wide shocks by buying other stock within the same industry. In practice, there are no perfect substitutes and thus, fundamental risk cannot be totally removed. Further, the substitute security, even if it exists, can be mispriced. (Barberis & Thaler 2003, 1058)

Noise trader risk is an idea that the mispricing exploited by the arbitrageurs worsens in the short run. When buying a mispriced stock, there is a risk that the irrational traders, noise traders, that cause the undervaluation of the stock will further drive the price down. This is called noise trader risk. Noise trader risk can force arbitrageurs to liquidate their position early and cause potentially steep losses. In some cases the noise trader risk is related to the position that is bought for hedging the original position (a short position). Should the original owner of the borrowed security want it back, arbitrageur may be forced to close the position earlier than intended. (Barberis & Thaler 2003, 1058-59)

Transaction costs can also limit the arbitrage possibilities by making arbitrage opportunities less attractive. Transaction costs include commissions and bid-ask spreads, but also the costs associated with the short selling that is often essential to the arbitrage process. D’Avolio (2002) found that these fees are relatively small. In general for most stocks, transaction fees range between 10 and 15 basis points, but in some cases they may be larger. D’Avolio pointed out that in some cases arbitrageurs might not even find stocks to borrow for any price.

In practice arbitrage is limited by these risks, in contrast to the textbook version of arbitrage. As there is no perfect substitute for any mispriced securities, arbitrageurs are exposed to fundamental risk. The presence of fundamental risk means that arbitrage is limited by (i) risk aversion of arbitrageurs and (ii) fundamental risk is systematic, thus it cannot be diversified away. Noise trader risk and transaction costs further add to limits of arbitrage. (Barberis & Thaler 2003, 1060) DeLong, Shleifer, Summers, and Waldman (1990) showed that noise trader risk alone is powerful enough to limit arbitrage. Noise trader risk adds short investment horizon to the limits of arbitrage. The possibility of an early, forced liquidation means that many arbitrageurs have short horizons. This affects

the first point above. Transaction costs affect the second point. If the costs are great, some arbitrageurs might not be able to exploit mispricing even if they wanted to.

Arbitrage is mostly performed by specialized institutions and investment banks. But their actions are limited by trading strategies they implement and the agency frictions that come along. Agency frictions can also cause nonfundamental demand shocks discussed earlier. Crises can be smoothed by government intervention. There is reasonable evidence to support the fact that government intervention can increase liquidity in more peripheral stocks. The financial health of arbitrageurs is crucial for the smooth functioning markets and the provision of liquidity. (Gromb & Vayanos 2010, 253)

### **2.1.2 Investor Sentiment**

Investor sentiment is a belief about future cash flows and investment risks that is not justified by the facts at hand. The first model of investor sentiment was proposed by Shleifer (1998). The model shows how investors form expectations of future earnings. The model is based on psychological assumptions and particularly on the ideas of Griffin and Tversky (1992). When making forecasts, people pay too much attention to the strength of evidence presented to them, rather than the statistical significance. The model yields a prediction that stock prices overreact to consistent patterns of good or bad news. The theory predicts that one-time strong news events should generate an overreaction. Further, there seems to be empirical evidence to support the theory. (Shleifer 1998)

In many behavioral finance models investors are of two kinds. First, assumes that investors are rational and sentiment-free. Second kind consist of irrational investors who are prone to exogenous sentiment. These two kinds compete in the market and set prices and expected returns. The first group, arbitrageurs, are limited in many ways. The limits consists of short horizons or transaction costs and risks. Because of this the prices do not always revert to their fundamental values. Thus, mispricing arises from two different sources. First, the change in sentiment on the part of the irrational traders. Second, the limit to arbitrage from the rational investors. Investor sentiment is especially clear in speculative stocks. Speculative stock can be seen as a set of stock with no clear true value. Such companies include young, currently unprofitable but potentially extremely profitable companies. Because of the combination of no earnings history and highly uncertain futures, both too low and too high valuations are justified. The one that holds is dependent on what befits the prevailing sentiment of market participants. (Baker & Wurgler 2007, 3-5)

Investor sentiment can affect all companies, but a company with long earnings history, tangible assets, and stable payout ratio is much less subjective and thus, less sensitive to sentiment. An exogenous shock might affect investor sentiment and investors' beliefs



could cause demand pressure which in turn might cause some mispricing. This mispricing could be observable from different benchmarks such as book-to-market ratio. Market prices of securities usually reflect the fundamentals, with sentiment playing only a minor role. (Baker & Wurgler 2007, 5; 10-11)

Brown and Cliff (2005) studied the relationship between investor sentiment and asset valuation. It has been long debated whether or not investor sentiment has an effect on asset prices. Traditional finance argue that investor sentiment does not affect asset valuations, as all agents are rational and hold the same beliefs about the future development. However, studies have shown that investor sentiment may cause over- and undervaluation of assets.<sup>2</sup> Brown et al. (2005) hypothesized that excessive optimism leads to periods of overvaluation and this, in turn, causes low cumulative long-run returns as the prices revert to their intrinsic values. They found that irrational investor sentiment do affect price levels. Further, asset pricing models should take investor sentiment into account, as well as regulators and government officials should be concerned by a sudden change in sentiment if it translates into a negative shock.

Investor sentiment can also be affected by media. Tetlock (2007) found a connection between news media and movements in stock market indicators. The key finding was that a high level of pessimism in the media predicts downward pressure on market prices, causing a reversal towards fundamentals. Further, the findings by Tetlock suggest that measures of media content may serve as a proxy for investor sentiment. Statistical tests also showed that media content does not provide new information about fundamental asset values.

### **2.1.3 Anchoring Bias and Belief Perseverance**

The tendency to be influenced by suggestions is called anchoring in psychological literature. The phenomenon is well-known in the field of psychology, and confirmed in a number of studies. Even experts of their own field are prone to suggestions. For example, Northcraft and Neale (1987) studied it in the context of real estate valuation. They found that changing the given asking price and implied price per square foot influenced real estate agents' opinions of the house's appraisal value. The changed asking price swayed the valuation by 11 % to 14 % of the value of the house. They found similar results with amateur subjects. (Shiller 1999, 1314-15)

---

<sup>2</sup> For example, see DeLong and Shleifer (1991), White (1990), and Shiller (2000). Especially Shiller's view on the rise and fall of technology stocks see overly bullish sentiments as a reason behind the dotcom bubble and the subsequent bust of the bubble.

Kahneman, Slovic, and Tversky (1982) argue that when forming estimates, people often start with some initial value and then adjust away from it. Empirical evidence has shown that the adjustment is often too low. In other words, individuals “anchor” on the initial, even arbitrary, value. (Kahneman, Slovic & Tversky 1982) Anchoring bias causes individuals to be too fixed with their initial value, and the tendency is to not change it over time. This is even evident in the stock market. Analysts valuing a company might not accept the fact that the fundamentals have changed so much that the initial value cannot be reached. The phenomenon is even stronger if the analyst and/or investor is affiliated with the company (such as an underwriter analyst). (Barberis & Thaler 2005, 408n)

In a speculative market such as the stock market, values are ambiguous. And as such, there is no way to say the market is at a true value. In this case, the best indicator of current prices is past prices. This notion, however, is not consistent with the random walk theory. Serial correlation of stock prices is assumed to be low and if past prices truly are an indicator of present and future prices, serial correlation should be higher. Nevertheless, models of smart money seeking to exploit any mispricing are consistent with the implications that serial correlation is low and yet anchoring is rather important for stock prices. (Shiller 1999 1315-16)

Lord, Ross, and Lepper (1979) found that people who hold strong opinions are likely to examine relevant empirical evidence in a biased manner. They accept “confirming” evidence. On the other hand they treat “disconfirming” evidence more critically. Even when presented with totally discrediting evidence some beliefs can survive. In everyday life the availability of contradictory evidence is not sufficient enough to cause an abandonment of beliefs or theories. It was also found that while some test subjects do change their prior beliefs, the change is far less significant than it ought to be. (Lord, Ross & Lepper 1979, 2008; 2108) This is due to two effects. First, people are reluctant in searching for information that contradicts their own beliefs. Second, if they find such evidence or information it is treated with skepticism. This phenomenon is called belief perseverance. It can be found in an even stronger form, known as confirmation bias. In this context individual can see even contradicting evidence as being in their favor. (Barberis & Thaler 2005, 15)

Relevant to this study is a psychological phenomenon called conservatism. Conservatism states that individuals are slow to change their beliefs when presented with new information. The studies have found that individual do change their beliefs in the right direction, but the magnitude of change is lower than models of rational investor would predict. Conservatism leans on the under reaction side of evidence. Individual investors might disregard the full information content of public announcements. This might be because they believe this is only a temporary event and cling on their previous estimates. This failure to properly aggregate the information in a new earnings number can also be seen as investor overconfidence about their prior information. (Shleifer 1998) Hirshleifer

(2001) suggested that conservatism might be a consequence of anchoring upon an initial value. Hirshleifer also suggested that conservatism might be caused by the costs of updating beliefs. More cognitively costly information is weighed less and further easily processable information, i.e. scenarios and concrete examples, is weighted more. Conservatism can be also understood through under- versus over-reaction to signals. Individuals reliance on the strength of information signals and underreliance on the weight of information serve as a way to interpret over- and under-reaction signals. Strength of an information realization is how extreme the evidence is, and the weight of evidence is its reliability. But if favorable signal trumps unfavorable, the signal has low strength. In general, different settings can cause same signals to be judged differently. As stated earlier, conservatism leads individuals not to change their beliefs. If the beliefs are not changed according to new information, this indicates that the investor is not acting rationally.

Cognitive resources being limited might cause narrow framing. Narrow framing may lead to analyzing problems in an isolated fashion. In a logically identical decision problems narrow framing leads the individual not to consider all available information, instead they only consider evidence rising from their own frame. Narrow framing may also aid the anchoring phenomenon. By limiting the availability or the willingness to obtain new information, individual may hold on to their initial belief rather than adjust accordingly. Another kind of narrow framing is mental accounting. Mental accounting involves keeping track of losses and gains related to decisions in different mental accounts. These accounts are then re-examined only when taking action. Mental accounting may explain the disposition effect. Disposition effect is a propensity to hold on to securities that have declined in value and to sell the assets that have risen. (Hirshleifer 2001, 10-11) Further, the narrow framing can cause some actions taken by individuals with belief perseverance to be further limited.

#### **2.1.4 Comovement**

The traditional view on return comovement emphasizes the comovement in fundamentals. This is because in a frictionless economy with rational investors, price equals fundamental value. Although some industries are in fact based on the same fundamentals (such as the automotive industry), fundamentals-based view of comovement is incomplete at its best. (Barberis & Thaler 2005, 48-49)

Fama and French (1995) studied the rational view of comovement in small and value stocks by investigating the relationship of common factors between the stocks and earnings news. They found that there are common factors in earnings news and return factors, but the cash-flow factors are weaker than the factors in returns. Further, there is only a little evidence that the return factors are driven by cash-flow factors. Fundamentals can

only explain a part of the return comovement, thus the phenomenon must derive from somewhere else. One behavioral comovement theory is the one proposed by Lee, Shleifer, and Tversky (1991). They observed that investors typically choose to trade only a subset of all available securities. This is naturally based on their preferences as investors. As these preferences, such as risk aversion and sentiment, change, they alter their exposure to the securities they hold. Through these changes they include a common factor in the returns of these securities. (Barberis & Thaler 2005, 49) This theory can also be called as the habitat view. This view predicts that there will be a common factor in the returns of securities that are held and traded by specific subset of investors. (Barberis, Thaler & Wurgler 2005, 284)

A basic feature of human cognition is classification, the grouping of objects into categories based on some sort of a similarity between them. Classification of large numbers of objects into categories is also persuasive in financial markets. When deciding on the portfolio allocation many investors categorize assets in broad classes and then decide how to allocate funds across various asset classes. (Barberis & Shleifer 2003). Shiller (1999) brings up the same kind of an idea. Investors tend to see their assets in mental compartments. These compartments include safe part and riskier part. Individuals also tend to separate their income into three compartments: wage and salary income, asset income, and future income. The spending is different between the categories, for example, individuals are reluctant to spend out of future income even if it is certain to arrive. The mental compartments influence individual's decision making and might explain some anomalies. A tendency to separate out decisions into separate mental compartments might explain why hedgers tend to hedge specific trades rather than their overall position. (Shiller 1999, 1317)

Barberis et al. (2003) argue that investors tend to simplify asset allocation process by grouping stocks into categories, such as value stocks or small-cap stocks. The asset classes investors use are sometimes called styles, and allocating funds among different styles is called style investing. Assets in a class share a characteristic, which can be based in law, markets, or in fundamentals. This view on comovement can be called the category view. (Barberis & Shleifer 2003, 161-162)

There are two main reasons why investors might pursue style investing. First, categorization simplifies the problem of choice and allows processing of vast amounts of information with reasonable efficiency. The decision to allocate money across ten different styles is less intimidating than choosing among the thousands and thousands of securities. Second, asset categories help investors to evaluate the performance of professional fund managers who pursue the same style. The benefits are attractive particularly to institutional investors, who must follow rules or laws of portfolio allocation. The interest in style investing has grown over the years paralleling the growth of institutional investors. The growing interest and importance of style investing calls for the assessment of its

effect on financial markets. If these same categories are adopted by noise traders, they will create price pressure as they move from one category to another. The price pressure will induce common factors in the returns of stocks that happen to be in the same category, even if the cash flows are largely uncorrelated. (Barberis et al. 2003, 162)

Barberis, Shleifer and Wurgler (2005) test this categorizing behavior of investors and found that after inclusion to S&P 500 –index, stock's beta with the S&P beta goes up. The results were generally stronger in more recent data, which suggest that the phenomenon is consistent with the findings in their previous study discussed before. Standard & Poor's have stated that in choosing stocks for inclusion in the S&P 500, they are trying to make their index as representative as possible of the U.S. economy. They take no opinion about the fundamental value of the stock, so the inclusion in the index should not change investors' perception of the correlation of the included stock's fundamental value with other stocks' fundamental value. Under the fundamental view of comovement, the correlation of the included stock's return and other stocks' return should not change. Further, Barberis and Shleifer (2003) found that the comovement of assets in the same style is too correlated and when reclassifying an asset into a new style or category it starts to correlate with that particular style. (Barberis et al. 2003, 162)

Kumar and Lee (2006) aimed to combine investor sentiment and return comovements. Firstly, Kumar et al. found that retail investors' trades are systematically correlated, meaning that individuals tend to buy or sell stocks in a similar manner. The findings mean that there seems to be a common directional component in the trading activities of investors. Further, they found that the common component of retail trades has a mounting power in explaining return comovement. The relation means that when investors grow bullish, the stocks enjoy higher excess returns. Broadly put, the results support a role for investor sentiment in the study of financial markets.

### **2.1.5 Herd Behavior**

The tendency for people who interact with each other and behave similarly is called herd behavior. Herd behavior can be seen as some kind of irrationality, such as a loyalty induced psychological motivation to be in accord with other members of a group. To understand herd behavior, one should consider theories of information. The opinions herd behavior is prominent are not plain facts, but more subtle matters, for which limitations of time and natural intelligence prevent individuals from discovering all relevant information. Within these limitations people have a tendency to acquire information in sequence by observing the actions of other individuals in their group who precede them. In this case the first signal is very important. Those who follow the first signal may rationally

ignore their own signals and rather trust the decisions made by other before them. This is called information cascade. (Shiller 1995, 181-4)

Herd behavior can be caused by various different sources. For example, fund managers may rather copy the actions taken by other fund managers than follow their own strategy or private information. This could be due their concern of their own reputation as managers. Rational investors act on all available information in an efficient manner. The theory and evidence on group behavior and psychology suggests that the link between information and market outcome is weakened by said group psychology. In addition, members of a herd may amplify exogenous shocks. By buying when others are buying, a herd can cause excessive market volatility. (Scharfstein & Stein, 1990) Scharfstein and Stein also suggest that an agency problem plays a part in explaining herd behavior. Agents get a reward for convincing principals that they are right, a problem that arises especially when the market has enjoyed a long period of growth. In this situation the fear of cashing out when the market is heating up and potentially losing out on further profits is greater than crashing with other market participants. Swimming against the current and failing would result in a reputation problem for money managers and thus weakening their future in the job market. This view is different from, for example, Banerjee (1992). The model proposed by Banerjee adopts the idea of information cascade, which was presented earlier. The main difference between the two approaches is the role of incentives. In the case of information cascade incentives play no role, whereas incentive have a clear role in the model proposed by Scharfstein and Stein. Banerjee (1992) noted that in many occasions of herd behavior there is no obvious principal agent problem and that in the case of asset markets, principal-agent problem may be very common (conning people to believe you know something others do not).

Bikhchandani and Sharma (2001) pointed out that herding and herd behavior can cause volatility, destabilize markets, and increase the fragility of the financial system. In the wake of crises the profit-maximizing investors are blamed for sharp downturns. However, it should not be surprising that these investors react similarly and at the same time. Bikhchandani and Sharma also made a difference between “intentional” and “spurious” herding. “Intentional herding” is a result of, as the name suggests, intentional copying of other investors which is not efficient. “Spurious herding” is the outcome when groups of investors are facing similar decision problems and information sets take similar decisions. For example, if interest rates were to rise suddenly any rational investors would make changes in their portfolio(s). This form of herding is efficient in the sense of efficient market hypothesis.

As discussed above, herding can be either efficient or inefficient. “Spurious herding” does not interfere with the efficient market hypothesis, even if it has a significant effect on the market. However, making the difference between these two in empirical data is not necessary in this study. In efficient markets new information will be included in the

market prices instantly and most profit-maximizing investors will react accordingly. In the more transparent markets this effect is the greatest, meaning the prices will follow fundamental values more closely. This, however, does not mean lower price volatility. As mentioned earlier, when groups of investors face the same decision set and react accordingly “spurious herding” might increase volatility. (Bikhchandani et al. 2001)

Going with the flow may also cause troubles. The false consensus effect may make an individual reluctant to consider possibility that he is making a deviant error. False consensus may also result from availability of information as like-minded people tend to associate together. As people’s attention is limited, they tend to pay more attention to ideas of facts that are reinforced by conversation. (Hirshleifer 2001, 19) In previous studies, it has been documented that people have a tendency to overestimate their similarity to others. Williams (2013) found a positive relationship between the likelihood of an analysts’ revised forecast being too close to his earlier forecast. In a similar manner, Welch (2016) concluded that when economists attempt to provide a forecast, it often lies between their personal estimate and their perceived consensus estimate.

## **2.2 Characteristics of Financial Downturns**

Many studies have shown that investors brace themselves for economic downturns and market crashes<sup>3</sup>. This disaster risk plays a significant role for equity risk premium. Also, as shown in previous chapter, exogenous shocks can affect all companies regardless their earnings history or segment.

This chapter presents previous studies concentrating on the effect of business cycles and disasters have on equity risk premium. Uncertainty and changes in beliefs of the future affect the risk premium and are thus, an important part of this study. With the focus on the post financial crisis era, it is a necessity to understand how equity risk premium is affected by crises come true and emerging uncertainty.

### **2.2.1 Equity Risk Premia and Business Cycles**

Fama and French (1989) found that common stocks as well as long-term bonds contain a term that has a clear link to business cycles. Often this term is low near business cycle peaks, and high near the troughs of business cycles. In addition, expected returns contain a risk premium. The risk premium is related to long-term aspects of business conditions. Fama et al. also found that the variation of this premium is stronger for low-grade bonds

---

<sup>3</sup> See for example Rietz (1988), Barro (2006), and Orlik & Veldkamp (2015)

than for high-grade bonds. Also, the effect is stronger for stocks than for bonds. Ferson and Harvey (1991) found similar results. They concluded that the stock market risk premium is the most important for capturing predictable variation of stock portfolios. The predictability is often attributed to market inefficiencies, meanwhile others hold the view that predictability is a cause of changes in the required return. Fama et al. pointed out the same issue.

Backus, Routledge, and Zin (2008) showed that not only do equity returns and equity risk premium vary over time, they also lead the business cycles. This finding suggests that there is a macroeconomic factor in the cyclical behavior of asset returns. The growth rate of equity prices lead business cycles, furthermore high excess returns are associated with high future growth.

The problem is that standard business cycle models such as the real business cycle model, largely fail to replicate the level, the volatility, and the cyclical behavior of risk premia. Gourio (2010) concluded that when disaster risk is held constant, the models implied quantities is the same as implied by a model with no disasters. When the risk of disaster is time-varying it causes a similar preference shock. An increase in the perceived probability of disaster can cause a collapse of investments and a recession. This would cause risk premia to rise, increasing the cost of capital. Further, a recession causes an increase in demand for precautionary savings, leading the yield on less risky assets to fall, while spreads on risky assets increase.

### **2.2.2 Catastrophic Events**

Economic uncertainty can be a powerful force in the modern day economy. Numerous studies have shown that a change in beliefs or uncertainty can trigger business cycles and asset price fluctuations. Uncertainty affects macroeconomics through different shocks. The uncertainty and shocks fluctuate causing business cycles but the reason behind the fluctuations is still an open question. Traditionally, belief shocks are viewed in a way that suddenly every agent knows that future outcomes will be less predictable than in the past. This, in practice, is not possible. Further, certainty can be seen as a precision of beliefs and a rise in uncertainty would imply a loss of information. (Orlik & Veldkamp, 2015)

A catastrophic event, or black swan, is an event that causes dramatic drops in wealth, such as the collapse of Japanese equities in the 1980s or the most recent global financial crisis. These events occur infrequently and their possibility is very low. The events themselves are not well enough understood to be modeled accurately. Moreover, the probabilities of such events cannot be estimated with current models, thus causing a problem in their valuation, i.e. effect on the equity risk premium. (Damodaran 2016; Marsh & Pfleider 2012)



Because these events are rare, there is not enough historical data to make assumptions or models to depict them. Nevertheless, catastrophic events do occur from time to time and investors would want to protect themselves against it. Most of the events are by nature systematic risk and cannot be diversified away. Investors can protect themselves from such an event with a swap or an option, but this means that there has to be a counterparty to bear the additional risk. In general, these events are thus undiversified and seen as market risk. (Marsh & Pfleider 2012)

Mehra and Prescott (1985) noted that, historically, average return on equity has far exceeded the average return on short-term debt. They studied whether the large difference could be explained by taking transaction costs, liquidity constraints, and other frictions into account. They found that it cannot be explained within their framework. Rietz (1988) proposed a solution to the equity premium puzzle by bringing low-probability economic disasters in and thus explaining both high equity risk premia and low risk-free returns without abandoning the Arrow-Debreu paradigm. Rietz' conclusions received a lot of criticism for too high probabilities and the size of economic disasters. Barro (2006) further studied the inclusion of rare economic disasters. The results hold as proposed by Rietz, with few changes but the key result is the same: rare disaster should be taken into account when studying the equity risk premia. Barro (2006) and Rietz (1988) both concluded that disaster risk is time-varying.

Orlik and Veldkamp (2015) modelled the way beliefs are formed. Econometricians assume that agents have precise knowledge of the distribution of outcomes and they are only uncertain of the outcome that will be chosen from this distribution. The skewness of the distribution depicts the probability of extreme events. When the estimated skewness is changed by new information or revision, the probability of extreme events changes as well. Even a slight change in the estimated skewness can increase or decrease the probability of these tail events many-fold. And because these tail events are very far from the mean, changes in their probability have a large effect on variance, which in turn translates into large shocks to uncertainty. Thus, beliefs about black swans are responsible for much of the shock to macroeconomic uncertainty. (Orlik et al. 2015)

Welch (2016) found that the cost of escaping the risk of extreme crashes with put options was 1 % - 2 %. However, the cost is time-varying. At times when the fear of a crash is highest the crash fear accounts more for the equity premium, as much as 6 % per year. In more calmer times, such as 2015, crash fear explained only 0,5 % of equity premium. Even though extreme disasters are unlikely and the thought of a black swan event wiping out the entire stock market is irrational, disaster fears and probabilities are more important in some years than others.

### 2.2.3 Role of Investor Behavior in Crisis

It should be evident from the discussion above, investor behavior has a significant effect on stock market. Studies have shown that investors in general suffer from overconfidence in their own abilities. However, overconfidence itself does not mean that people over- or underreact to certain events or news. Nevertheless, overreaction is a widely studied phenomenon and has empirical support. It has been challenged by the supporters of efficient market hypothesis as a chance result. Shiller (1999) proposed that overconfidence may have more clear implications for the volume of trade rather than for any tendency to overreact. Barberis (2011) proposed that investors' overconfidence in their ability to forecast and the precision of the forecasts can cause bubbles to form. When estimating an asset's fundamental value, investors become overconfident about the usefulness of information, causing them to push the price of the asset up.

Another form of overconfidence appears to be believe that history is irrelevant. This includes the belief that future should be judged afresh now using only factors we see now, not from past statistics. Lack of learning from historical lessons regarding financial and economic uncertainties might explain why investors often disregard diversification and why most investors appear not to be interested in the correlation between their investments and labor income. (Shiller 1999, 1319-20; 1325-26) On the other hand, Barberis (2011) pointed out that belief-based overvaluation can cause bubbles. This is due to the fact that investors extrapolate past outcomes too far into the future. The idea is based on Kahneman and Tversky's representativeness heuristic. According to representativeness heuristic, people expect even small samples of data to reflect the properties of the population. As a result, investors draw too strong inferences from these small samples, leading to overextrapolation.

People also have a tendency to gamble, or play games with unnecessary risk. This provides a puzzle as at same time investors need to accommodate both risk-avoiding behavior and risk-loving behavior. Speculators need to be understood to fully understand bubbles. Speculators might have very rational expectations about the future. Further, they might be very emotional about the future of stock market and yet, make very sensible and rational quantitative expectations. (Shiller 1999, 1325) The tendency to gamble is evident in stocks related to new technology. Investors view these stocks as lottery, should the new technology deliver, some of the stocks might experience a huge increase in value. This was the case during the dotcom-bubble of late 1990s. While some investors do have a tendency to gamble, it can argued that the disagreement over future prospects of the stock market can cause bubbles to form. In most cases, one group of investors are bullish while others are bearish. In the presence of short-sale constraints, the price of assets will only reflect the views of the bullish. Because of the constraints, bearish investors will stay out of the market, causing the asset(s) to be overvalued. (Barberis 2011, 3)

Psychology of tail events, events that are of low-probability but have a significant impact, can be understood by using a two-step framework. In the first step, an individual assesses the probability of a tail event. In the second step, individual makes a decision based on the first step. The first step is about each individual own beliefs of the future, while the second step is about individual preferences. Studies have shown that people tend to overestimate the probability of tail events and being aware of the potential tail event, he will overweight this potential outcome in his decision making. Recent studies emphasize the fact that loss aversion is less significant than previously thought and probability weighting is now empirically more supported. In case of stock market this means that investor is willing to pay more for a stock that is positively skewed in return for a lower average return. Positively skewed stock will be overvalued as investors see that it has the potential to become the next big thing. However, the probability of this potential is estimated to be too high, leading to overvaluation and lower average return. (Barberis 2013, 611-3)

Hoffman, Post and Jennings (2013) hypothesized that crises depresses individual investors' perceptions. This means that their return expectations and risk tolerance decrease while their risk aversion increases. During the recent financial crisis of 2008-2009, investors suffered from information overload, meaning that they received unusually high volume of dramatic and unexpected news. Information overload might cause uncertainty in investors' decision making, thus reducing trading activity. Alternatively, large amount of information may cause frequent changes in perceptions and cause a large divergence between such perceptions. These changes in turn might lead to higher trading activity: changes in perceptions give investors' reasons to trade and divergence of perceptions make it easier to find a counterpart for trading. In the same study Hoffman et al. (2013) concluded that investors' risk tolerance is time-varying and related to risk-taking behavior. However, investors' portfolio risk moves in parallel with market risk, meaning the change in risk tolerance had no impact on portfolio level. Instead of de-risking their portfolio in favor for cash, investors use the time of crisis as a change to enter the market. The definition of risk is a complicated task. The nature of risk includes subjective probability, utility, and state preferences. This means that there is no true risk, only perception of risk. Risk is dependent on the individual investor, thus it is nearly impossible to pin down. (Holton 2004, 24) Because risk is such sensitive matter that depends on individual perceptions it is important to remember that one group might perceive risk in a totally different manner than some other group.

During the financial crisis of 2008-2009 many risky assets experienced dramatic price declines. Institutional amplification mechanism was thought to explain the large drops. Institutional amplification mechanism is quite straightforward. When bank's holding of a risky asset decline in value, then in order to deleverage, the banks has to sell some other holdings. This will push down the value of other banks' risky assets, further forcing them

into sales of their own, thereby pushing the prices even further down. Loss spirals and margin spiral are important mechanisms in transforming relatively small losses into larger price declines over a variety of risky assets. However, psychological amplification mechanisms possibly had an important role as well. Specifically mechanisms related to loss aversion and ambiguity aversion are considered to be in a key role. The idea is that institutional and individual investors experience increase in loss aversion and ambiguity aversion after suffering losses in their risky asset holdings. This leads investors to reduce their holdings and further drive prices of these assets down. In this case ambiguity aversion arises from the “competence hypothesis” by Heath and Tversky. According to Heath et al. individual can be either ambiguity averse or ambiguity seeking, the role depends on how competent the individual feels at analyzing the situation at hand. In the case of stock market, when an investor suffers losses in their holdings of risky assets they feel less competent in analyzing these assets. This makes them ambiguity averse and leads them to reduce holdings of risky assets, pushing the prices down. Loss aversion, on the other hand, is the observation that people are more sensitive to losses than to gains of the same magnitude. The same effect as with ambiguity aversion is evident from empirical studies on loss aversion. Investors who suffer subsequent losses become more loss averse as a result. (Barberis 2011, 10-13)

Investors, both individual and institutional, can continue business model that poses serious to the firm or to the individual. Usually, if a venture or investment poses risk to investor, he should limit the scale of his activities, even if there was more money to be made. However, by manipulating their own beliefs they could delude themselves into thinking that their business model is not risky, but rather worth pursuing. This would indicate that the investors are aware of the risks included in their endeavors, at least vaguely. The psychology behind this is based on cognitive dissonance. Cognitive dissonance is the discomfort one feels when taking an action that conflicts with one’s typically positive self-image. By manipulating one’s beliefs, the trader/investors can remove dissonance and continue exploiting the risky business model and/or strategy. (Barberis 2011, 8-10) The belief manipulation hypothesis traders/investors are unaware of the risks they are taking, the view tries to explain why they are unaware. The simple answer is that they are unaware because they choose to be.

### **3 EFFICIENT MARKETS, EQUITY RISK PREMIUM, AND BANKING INDUSTRY**

Efficient market hypothesis has long been the most empirically tested financial theories. This study, in part, takes on the assumption that markets truly are efficient. However, this is not the aim of this study. The aim of this study is to get on answer to a simple relationship between banks placement in stress tests conducted by the European Banking Authority and its respective equity risk premium. If the markets are efficient there should be correlation between the two.

#### **3.1 Theory of Efficient Equity Markets**

##### **3.1.1 Efficient Market Hypothesis**

The theory of efficient capital markets, or efficient market hypothesis (EMH henceforward), was proposed by Fama in 1970. Since then EMH has had a great influence on practical finance as well as financial theory. The theory states that, under certain conditions, all new information is instantly reflected in the price of the stock. Because of this statement EMH rejects trading strategies with excessive expected returns. This means that an investor cannot gain greater returns by actively trading than a passive investment portfolio (Shleifer 2000, 1). Efficient financial markets can also be explained by stating that in efficient financial markets do not allow investors to earn above-average returns without accepting above-average risks (Malkiel 2003, 60).

The strong-form of market efficiency states that security prices fully reflect all available information. For the strong-form to hold certain assumptions are needed: there are no transaction costs in trading securities; all the market participants have costless access to all available information, and all agree on the implications of current information for the current price and distributions future prices. (Fama 1970, 387-388; Fama 1991, 1575) But since there are trading costs, not all information is available to everyone, and not all market participants agree on the implications of said information, this extreme version of market efficiency is false. Nevertheless, market efficiency holds as long as transactors take account of all available information. Similarly, large transaction costs do not themselves imply that prices will not fully reflect available information. (Fama 1970, 388)

A weaker and more sensible version of the EMH was presented by Jensen (1978). This version of the efficiency hypothesis states that prices reflect information to the point where the marginal costs do not exceed the marginal benefits of acting on information. The semi-strong form of market efficiency states that all publicly available information

(e.g. stock splits, public announcements, and annual reports) is reflected on the share prices. The available semi-strong form evidence is consistent with the efficient market model. Moreover, the evidence is consistent throughout different tests on different types of public information. (Fama 1970)

In traditional finance, models depicting financial markets and/or investors' decision making, the key assumption is the rationality of market participants. Like all other models, the theoretical foundations of the EMH rests on three key arguments about investor rationality. First, investors are assumed to be rational and value securities rationally. Second, in the case of not rational investors, their trades are random and cancel each other out without affecting prices, and third, rational arbitrageurs eliminate the influence on prices of similarly behaving irrational investors. (Shleifer 2000)

For markets to be efficient, day-to-day price changes should not be related (nor during any other historical time period), they follow so called random walk theory. Random walk theory is based on two different hypotheses, economic and statistical. The economic hypothesis is based on the EMH and it states that past prices cannot reliably predict future prices. Market efficiency means that no investor can earn systematically superior returns. This further indicates that "beating the market" is, in the long term, impossible. The statistical hypothesis states that price changes are independent random variables. (Cheng & Deets 1971) Random walk theory and the EMH go seemingly hand in hand, and random walk theory is an extension to the general expected return model of efficient markets (Fama 1970). When put together, these two models form the basis of classical finance. The assumption of markets where prices move independently from day-to-day and all available information is reflected on the share prices is fundamental in today's practical and theoretical finance.

Nevertheless, the assumption of efficient markets does not mean that certain anomalies cannot be present (Fama 1998, 284). In an efficient market overreaction to information can occur, if under-reaction are about as frequent as overreaction. For EMH to hold anomalies should be randomly split between overreaction and under-reaction. Fama (1998) also noted that large long-term return anomalies that cannot be attributed to chance are likely to be caused by methodology and tend to disappear when different statistical approaches are used. Market efficiency does not mean that markets do not make errors in valuation. Markets can be efficient even if market participants are irrational or even if stock prices exhibit greater volatility than changes in fundamentals can explain. As a result of irrational market participants, pricing irregularities and predictable patterns can appear and even persist for short periods. (Malkiel 2003, 60)

### 3.1.2 Criticism to Efficient Market Hypothesis

The critique towards EMH has steadily risen since the inception of behavioural finance. Jensen (1968) called EMH the best empirically established economic fact. However, there are studies both for and against efficient markets, thus there is no consensus regarding the matter. The vast amount of studies made to debunk EMH is impossible to cover in this section and only a handful of critique is presented. The evidence from banking sector and other aspects important for this study is emphasized in this overview.

Malkiel (2003) pointed out that if the market was perfectly efficient, there would no need for professionals to uncover information. If all the information is reflected in the prices, it would be futile to try and discover undervalued assets as there would be none. Malkiel concluded that while there has been discoveries of irrational pricing of individual stock in historical experience, they are unlikely to persist due to arbitrageurs. Naseer and Tariq (2015) observed in their study that although markets may often be efficient, they are not always efficient. Market efficiency contradictions like calendar effects, momentum effect, and size effect are attributed to psychological theories and cognitive biases. Another point made by Malkiel was those of uncertain future forecasts, especially during bubbles. All equity valuations depend on future forecasts, which are inaccurate by nature. During the internet bubble of the late 1990s the projections and durations of growth rates were unsustainable for internet and telecommunication companies. Even independent analysts and investors thought the projections were accurate. In this case the whole market saw the valuations to be correct. In hindsight we can say that they were inaccurate. But during the events there was no arbitrage opportunity available.

Summers (1986) studied the methods and models used in market valuations. He concluded that certain types of inefficiency cannot be detected using standard methods and models. The hypothesis that market valuations include large errors is consistent with the available empirical evidence. Nevertheless, Summers pointed out that earning abnormal returns based on the use of publicly available information is difficult. The efficient market view that market prices represent fundamental values calls for caution. Treating the changes in stock prices as rational reflections of fundamental values can lead to erroneous conclusions. When explaining the behaviour of speculative prices a more conservative approach may be needed.

The evidence from the efficiency of banking sector is vast. The results are often inconclusive and conflicting. Borges (2010) studied the weak-form market efficiency of European stock market indexes, namely UK, France, Germany, Spain, Greece and Portugal, from January 1993 to December 2007. She found mixed evidence on the EMH: the hypothesis is rejected on daily data in Portugal and Greece, data from France and the UK rejects EMH, and data from Germany and Spain do not allow the rejection of EMH (EMH holds). However, in Portugal and Greece, the data from 2003 onwards shows a martingale

behavior. This suggests that the two markets are changing and are more in line with EMH. On the contrary, weekly data from France and the UK shows a strengthening mean reversion, which means partition from efficient markets. The tests provided somewhat mixed evidence on the level of efficiency.

In another study Narayan, Narayan, Popp, and Ahmed (2015) found that banks listed on the New York Stock Exchange (NYSE) are efficient but day-of-the-week dependent. Overall the hypothesis states that EMH is day-of-the-week-dependent and it is rejected for only 62 % of firms on all trading days. This means that for 38 % of the firms considered market efficiency depends on the trading day. Narayan et al. also tested for the economic significance of the results. They concluded that when investors do not account for this information, they obtain incorrect information of economic significance. In other words, investors understate or overstate the expected gains. In line with the hypothesis, expected gains are also day-of-the-week-dependent.

## **3.2 Equity Risk Premium**

Given the purpose of the study, it is quite clear that equity risk premium needs to be covered in detail. In this chapter are presented some of the factors affecting risk premium. Also, as we know in hindsight, central banks had an important role in stabilizing the market. Because of this, the effect of government and more importantly monetary policy are covered in their own subchapter. The various unconventional methods done by the European Central Bank and the Fed stabilized the markets. The actual results and effect on equity risk are covered fully in chapter 5 in the discussion of results based on the empirical data.

In practice, equity risk premium is often considered to be stable over time, which numerous studies have shown to be an incorrect assumption<sup>4</sup>. It is clear that an inaccurate discount rate, which equity risk premium is part of, has significant effects on the final result of calculations. Because of this effect the time-varying nature of risk premia is covered.

### **3.2.1 Investor Preferences**

Determinants of ERP are varied and they include psychological as well as economic factors. Investors' preferences vary and naturally, this will also affect ERP. ERP should not only reflect the risk but also the price of that risk.

---

<sup>4</sup> For example see Cochrane and Piazzesi (2001), Backus, Routledge, and Zin (2007), and Fama and French (1989).



The most critical factor is the risk aversion of investors. As the market becomes outright more risk averse, equity risk premium will climb higher. On the other hand, when risk aversion declines, ERP will decline as well. The collective risk aversion determines ERP and changes in this collective will change ERP. (Damodaran, 2016) Bakshi and Chen (1994) examined risk premiums in the United States and found that as investors age, their risk aversion rises. This would suggest that individuals become more risk averse as they age.

The consumption preferences also impact ERP. In net saving markets ERP should be lower than in net consuming markets. When individuals prefer current consumption over future consumption, ERP increases. (Damodaran 2016) The relationship consuming preferences and expected ERP is easy to make. But the reasons behind are more complicated. Understanding the motives for consuming or saving calls for examination of individual's utility function. Expected utility framework (EU henceforward) tries to explain investor behavior. EU is based on the work of von Neumann and Morgenstern (1944), but it has since been shown in studies that when it comes to risky gambles, investors do not act as the theory predicts. Prospect theory by Kahneman and Tversky (1979) is the most promising for financial applications. The theory tries to capture people's attitudes towards risky gambles as parsimoniously as possible. The theory is based on two non-zero outcomes, where the subject has to choose in between two different outcomes with two different probabilities. The most important finding is that utility is defined over gains and losses rather than overall final wealth positions. (Barberis & Thaler, 2003)

### **3.2.2 Information and Liquidity**

Another important factor is the available information. Information about changes in earnings and cash flows as well as the underlying economy is transmitted to markets. The quality and quantity of information available to investors influence the decision making. More accessible information about investment possibilities lead to higher confidence and as a result lower risk premiums. On the other hand too much information may lead to information overload, a situation when investors cannot handle all the available information and, simultaneously, the reliability of the information may vary. Nevertheless, low level of information may be the reason why investors demand higher risk premium in emerging markets. (Damodaran 2016)

In some cases illiquidity of an asset may also impact the ERP. Current argument is that, on aggregate, the net effect of illiquidity on ERP is relatively small and does not play an important role. However, in case of smaller cap stocks illiquidity might play significant role. The effect can be seen in the buy-sell spread more concretely. The cost of illiquidity

increases when economies slow down, thus funds are withdrawn out of equities. This should be seen as a rise in ERP. (Damodaran 2016)

### **3.2.3 Government and Monetary Policies**

Until the global financial crisis of 2008, government policies were not thought to impact equity risk premium in developed countries, only in emerging markets. But the actions taken by the US and European governments in the turmoil of the financial crisis have calmed the markets and possibly affecting the equity risk premium. Pastor and Veronesi (2012) found that uncertainty about government policy can cause higher equity risk premiums. There has also been discussion about the effect of monetary policy on equity risk premium.

Traditionally, central banks influence has been through macroeconomic variables such as inflation and real growth. Through these variables, changes in monetary policy effect equity risk premium. However, the effect of these changes is highly debated. The common thought is that the lowering of interest rates do not affect equity risk premium and thus, such action should result in higher prices in financial assets. Controversially, pushing interest rates low the central bank sends signals about its thoughts on future growth, health of economy, and inflation. (Damodaran 2016) Controversially, Peng and Zervou (2015) found that monetary policy rules and changes in it, can have a significant effect on equity risk premiums and that inflation targeting policy is likely to create volatility in equity risk premiums. They also found that optimal monetary policy minimizes the effect on equity premium compared to other objectives that the central banks might have. The object of optimal monetary policy is to divide the risk among all the agents in the economy. Given the risk sharing, the return on equity is low under optimal monetary policy. Overall, the optimal monetary policy can lower the equity premium, while following suboptimal monetary policy, such as focusing on inflation stability, might cause high equity premium. Inflation targeting policy implies lower short term bond return which, in turn, produces a higher equity premium.

Thorbecke (1997) found evidence that positive monetary shocks increase stock returns. Expansionary monetary policy causes real effects by either increasing future cash flows or by decreasing the discount factors. These results mean that monetary policy has, at least in the short run, real and quantitatively important effects on real variables. However, the evidence that monetary policy is a common factor does not explain why it affects stock returns. These results directly contradict the belief that monetary policy is neutral.

### 3.2.4 Other Factors

As we can see from the discussion above, there are many factors affecting ERP and their contribution on the total is difficult to estimate. There are also behavioral components that affect ERP that are not covered here. There are several studies that suggest that human behavior at least partially determines ERPs. The most famous theory must be the one of money illusion. This theory states that the investors inconsistent dealing with inflation causes volatility in ERP. More specifically, equity risk premiums rise in periods when inflation is higher than expected and drops when inflation is lower than expected.

A part of the risk in equities comes from the health of overall economy. When inflation, economic growth, and interest rates are predictable and stable, the ERP should be relatively low. The result is logical. When the overall economic situation is good, individuals will have more certainty over their own financial situation and thus, consume and save for the future. When the saving increases, ERP will decline and vice versa. (Lettau, Ludwigson & Wachter 2008)

The country risk classifications in this study are sovereign risk classifications published by Moody's. Country risk classifications provided by, for example, OECD is composed of transfer and convertibility risk and cases of force majeure (e.g. war, floods, and civil disturbance). (OECD 2015) The credit risk classes conducted by private rating agencies reflect the frequency of default events, and thus indicate the probability of default by bond issuers. A study by Canuto, dos Santos, and de Sá Porto (2012) found that certain macroeconomic indicators explain the changes in the classes of sovereign risk. They also found that high sovereign risk can be battled by improving i.e. the level of public debt, external debt, and foreign trade flow. In another study by Cosset and Roy (1991) they found that GDP per capita and propensity to invest are highly correlated with high credit ratings. Meanwhile, foreign debt to exports ratio is negatively associated with ratings. Credit ratings are important factor in ERP as the overall risk in an economy increases ERP. But as country risks are naturally country dependent and the aim of this study is to provide company-specific ERPs, credit ratings are deducted from total ERP. The following formula is to clarify how the ERP is calculated.

$$\text{Company Specific ERP} = \text{ERP}_{\text{Total}} - \text{Country Risk}$$

### 3.2.5 Bank Sector Specific Risks

Equity premium is influenced by default risk in two ways. First, investors do not hold perfectly diversified portfolios. Second, the default risk is systematic. Because of default risk investors charge a spread over the risk-free rate, the higher the risk, the higher the

required rate of return. Fiordelisi and Marqués-Ibañez (2013) found that bank default risk is systematic, thus it cannot be diversified away. By using several measures of individual bank risk they showed that these measures have an impact on European banking stock market risk. In the banking sector default risk can become systematic when a failure of a single bank affects other institutions. Some institutions are more likely to create such a cascade of failures. Before the 2008 financial crisis size was thought to be the key factor impacting systemic risk. Since, it has been accepted that also other factors are at play.

Kole, Koedijk, and Verbeek (2006) concluded that by incorporating systemic crises has a significant impact on asset allocation decisions and ignoring the impact of crises cause substantial costs. The consequences for international equity markets are due to the deteriorating trade-off of risk-return. This means that, for a relatively long period, higher risk does not translate into higher returns. In contrary, Das and Uppal (2004) found that the implications for equity portfolios in a crisis is limited. They also noted that for highly levered portfolio there is positive probability of losing one's entire wealth in a case of a large negative systemic shock. However, they assumed that systemic crisis are short-lived, which is not consistent with the real economy. This point was also noted in the study by Kole et al. (2006)

Fiordelisi et al. (2013) pointed out that there are banks whose failure does not only affect its own stock holders but on all stocks. In this case, the bank's default risk would also affect the overall risk in financial markets. The implication of this result is clear. By identifying banks with stronger systemic risks, regulators should impose more strict regulatory requirements on these institutions. So far regulators have applied capital requirements which are calculated according to the risk positions of individual banks. Thus, the banks with highest potential to cause market-wide rise in risk levels, do not necessary have the highest capital requirements. The logic, and its flaws, behind the current model of capital requirements has been highlighted especially after the recent financial crisis.

### **3.2.6 Time-Varying Risk Premia**

Campbell and Shiller (1988) stated that dividend-price ratio can be used to reflect the rate at which future dividends are discounted to today's price. Further, when discount rates are high, the dividend-price ratio is high. By using dividend expectations to correct share prices, it is possible to obtain a better estimate of long-term discount rate. They used a constant risk premium in their models but nevertheless the discount rate varies over time as the riskless real rate of interest varies. But as we know risk-free rate is an important factor in the total risk premium, so it is safe to assume that the equity risk premium is affected by the interest rates.

Ferson and Harvey (1991) concluded that rates of return for common stocks and bonds are to some extent predictable over time. However, the source of the predictability is not agreed upon. It has been contributed to both market inefficiencies and as result of changes in the required return. They found that the most predictable variation in returns may be attributed to changes in the market price of beta risk. Time variation of beta coefficients is greater in individual stocks than for a portfolio of common stocks. Nevertheless, estimates of portfolio betas fluctuate over time. The link between firm size and beta fluctuation is also evident. The smallest firms have highest volatility in beta coefficient and for largest firms it is negative. However, most of the predictable variation can be attributed to time-varying risk premiums.

Gourio (2010) pointed out that assuming a constant disaster risk has as much of an effect as assuming there is no disaster risk. He also pointed out that risk premia are driven by a small, exogenously time-varying risk of economic disaster. The variation of disaster risk accounts for a significant fraction of business cycle, especially during sharp downturns in investments and output. Joouini and Napp (2008) concluded that subjective beliefs, such as pessimism and optimism, affect the overall market price of risk. Thus, the disaster risk is time-varying, which in turn affects the equity risk premium. Pessimism and optimism vary in cycles, as does business cycles.

### **3.3 Financial Institutions**

This chapter provides insight on the role of debt within financial institutions. As debt's role is different in financial institutions compared to other industries, this has clear implications on the valuation of financial institutions, such as banks and insurance companies. The aim of this chapter is to show how the role of debt affects the valuation methods and how, in general, value is created in financial institutions.

#### **3.3.1 Valuation of Financial Institutions**

Financial institutions differ from non-financial institutions greatly. Whereas in general valuation interest income and expenses are taken out of equation, they are important components of financial institutions' income. Also, financing decision are at the core of how banks generate earnings. Thus, to value financial institutions (or banks) the "normal" discounted cash flow method cannot be used. Instead, equity cash flows have to be used. (Koller, Goedhart & Wessels 2005)

To be able to forecast equity cash flows, some key drivers of value needs to be identified. For industrial companies these are drivers for value are growth and return on capital,

whereas financial institutions the most important drivers are growth and return on equity. Equity cash flows are typically forecasted in relation to some other balance sheet item, such as total assets. (Koller et al. 2005) Bank's equity value might also be difficult to obtain. This is because bank's debt is not traded in the capital markets. For example, savings and current account deposits have no interest rate and unknown maturity. Thus, it is very difficult to determine a fair overall market value of debt because of practical inability to determine the appropriate cost of capital for these liabilities. Additionally, banks can use deposits also to generate value and this has to be taken into account in the used valuation method. (Schroeck 2002, 15)

When estimating equity cash flows for a financial institution some simplifications need to be made. For instance, mismatch profit (or expense) contribution to net income cannot be truly understood or estimated. Also, we cannot accurately estimate the quality of the loan portfolio, or whether the bank has excess equity. Nevertheless, it is still possible to use equity cash flow model to understand bank's economics and future prospects. (Koller et al. 2005)

Despite the obvious differences, the same mathematical method applies when evaluating financial institutions. Instead of free cash flow to firm, free cash flow to equity has to be used. Other than that the method and reasoning behind it stays the same. The net present value (NPV) of future cash flows tells the value of the firm. The bank management strives to maximize the NPV equation and tries to keep the perceived riskiness of the bank relatively unchanged. (Schroeck 2002, 14)

### **3.3.2 Value Creation in Financial Institutions**

It is universally recognized that a firm's general objective is to create value for its shareholders by maximizing the firm's value. Many studies have shown that cash flow based measures seem to have higher correlation with stock price performance and shareholder value than more traditional accounting measures. It is assumed that all firms, including financial institutions, should maximize their end of period wealth, and hence, maximize the value to shareholders. But the problem is that it is not certain that maximizing shareholder value translates to maximizing stock prices. If the market is not perfect, stock prices may not reflect the long-term value of the firm, but rather a biased opinion of the market participants or poor information. (Schroeck 2002, 10-13) Of course in this case, the market efficiency is addressed. Also, the field of behavioral finance might help us understand why the stock prices are not maximized.

The most important income categories for banks are net interest income and fee income. Net interest come is simply the difference between the interest income a bank earns

from lending and the interest expense it pays to borrow funds. This contains two separate components. First is the true customer spread, the difference between lending and borrowing interest rates. This difference creates value. Second is the maturity mismatch income. Banks' assets have a different duration than its liabilities have, and banks earn a spread from being in different parts of the yield curve. However, mismatch income is difficult to maintain and rarely create value. Mismatch income is difficult to remove from profits, thus we have to accept that there might be some instability year-on-year. (Koller et al. 2005)

Fee income is a form of revenue from services provided customer. These include retail banking, private banking services, and asset management. Fee income is usually easier to estimate, as it is independent from financing decisions. Banks may also derive income from other activities, such as capital gains on their securities portfolio, but these are often highly volatile. (Koller et al. 2005)

On the cost side also two categories are significant, the major one being loan losses. This means that banks' loans are repaid in time. If customers are unable to pay their debt either on time or not at all, the result is the same: lower income. Estimating loan losses is difficult for outsiders, as they rarely have access to banks loan portfolio. The other important cost category is noninterest expenses. These include selling, general, and administrative expenses. (Koller et al. 2005)

Risk and risk management can also be way to create value in a financial institution. The means to an end depend on how risk is defined and what are the goals of risk management. Value maximization also affects stakeholders' value and interests. Different risk management methods may affect the value of company and thus making more or less desirable in the eyes of investors and other stakeholders. Before setting on goals of risk management, the effects of risk management goals on stakeholders' interests need to be clear. (Schroeck 2002, 32-34)

### **3.3.3 Risk Management in Banks**

Almost all bank transactions are associated with some level of uncertainty and thus contributes to the overall risk level of a bank. The term risk is usually used to describe specific uncertainty, which have objective or subjective probabilities and can be quantified. The variability of this probability is called volatility in finance. Further, risk is often related to potential losses, whereas positive deviations are seen as opportunities. Nevertheless both views are included when talking about risk or riskiness of an asset. Other views of risk are firm risk, a risk that is specific for a company or an industry, market-wide risk, also called systematic risk which cannot be diversified away. Risks can also be seen as a

continuous risk, source of risk that changes continuously, or as an event risk, risk that is associated or created by a specific event. (Schroeck 2002, 24-25)

Risk management on the other hand can be seen as a separate unit within a company that works independently and reports to the board of directors. It can also be seen as defined set of activities. However, companies usually do not manage risk as a whole but rather manage single risk exposures. In a more centralized manner companies should be able to manage risk as a net position, which is more efficient and should lead to better managed risk. (Schroeck 2002, 25-26)

Banks basically function as an intermediary by taking deposits from savers and lending them to borrowers with risky businesses. Institutions can exploit the effects of diversification of individual credit and term risks. Further, they are able to transfer risks and distribute it to different market participants. By creating different financial contracts, they have the ability to allocate risk and create relatively stable return distributions. These contracts, in turn, can be sold to other market participants. Through these contracts banks also manage their risk and hence, risk management can create value. However, the most important role for risk management is to prevent bankruptcy of a bank. This is also evident from the regulators point of view. But only preventing losses will not maximize the shareholders' value. Because of this the framework of just maximizing value needs to be expanded to take the risk-management orientation into account. (Schroeck 2002, 28-30)

The objective of risk management should be the same as any other function within a company, maximizing value. The goal of risk management determines the method and ways to conduct risk management. In nonfinancial companies reduction of the volatility of the company's cash flows and earnings is seen as the primary goal of risk management, whereas in banks and other financial institutions risk management instruments are used primarily used for hedging. Banks' choice of risk management way depends on two different choices. First, they have to choose the desired approach. Second, depending on the previous choice, banks need to choose the instrument(s) to achieve the goal of risk management. If the bank decides to eliminate or avoid certain risks that are not desirable, bank can protect itself by hedging or by diversifying its portfolio. Other nonfinancial methods include setting corporate policies or getting an insurance against undesired outcome. Contrary to decision to avoid some risks, it can use financial agreements or contracts to transfer the risk to other market participants. This includes selling in the spot market and hedging via derivative instruments. As long as the risks of the created asset are understood in the market, bank should be able to sell them for a fair value in the market place. The final option is to absorb or manage some risks. These are often the kind of risks that cannot be traded or hedged, they are complex, illiquid, and difficult to reveal to others (an asset cannot be created. Absorbed risks may often be a business necessity and might play a role in the bank's purpose. In all of the circumstances, banks must actively use three different instruments. First, they need to diversify their credit and asset portfolios. Diversification



reduces the frequency of both worst-case and best-case scenarios, which reduces bank's probability of failure. Second, because banks have superior risk pooling skills, it is cheaper for some risks to hold a pool of risk internally than to buy external insurance. Third, because all risk cannot be diversified away or insured internally, banks need to make sure they hold sufficient amount of capital to ensure its functionality in a worst case scenario. The decision to absorb risks should be based on competitive advantages rather than avoiding costs, in the case of maximizing value. (Schroeck 2002, 31-33; 39-43)

There is empirical evidence that banks do not use derivatives to speculate. However, according to surveys, firms do have open or unhedged positions when they have a market view. In addition, banks almost never hedge 100 % of their risk exposure. This is due to transaction costs, possible errors in risk measurement, and opportunistic speculation. Even though the main target of risk management is value creation, there is no direct empirical evidence of value creation. (Schroeck 2002, 46-47)

### **3.3.4 Capital Structure in Banks**

According to the Miller & Modigliani propositions, bank's capital structure does not play a role in value creation. Further, there is no connection between the risk management actions of a bank and the amount of equity capital it needs to hold. However, empirical evidence suggests that banks violate the M&M propositions and that capital structure is relevant can be used to create value. In addition, the value of a bank can be seen as a function of its financial leverage. There are several different factors that affect the capital requirements, such as tax benefits and government regulation, and these factors make it difficult to determine the net value effect of changes in bank leverage, (Schroeck 2002, 138-140)

Capital can be seen as a substitute for risk management, such methods as hedging and selling risks. Smaller banks tend to prefer more risk management to less. This might be because they have limited access to risk management, they need to hold more capital. In addition, small banks have more operating risk, a lack of fee-based income, and a lack of diversification of their credit portfolios. Because of attributes mentioned above, seem that the capital structure of a bank is closely related to the underlying risk in bank's balance sheet. The role of capital functions as a substitute for transferring risk and it works as a buffer against costly shocks. (Schroeck 2002, 140-141)

For the above mentioned reason, regulators require banks to hold a certain amount of capital. Since the introduction of Basel accords I, II, and III, the capital ratios have started to rise globally. Before that the capital ratios had been falling for over 150 years. Regulators felt it to be necessary to require banks to hold a minimum amount of capital to protect the economy from negative externalities. Usually the capital requirement is higher

than it should, because banks are generally opaque in their operations, making it nearly impossible to outsiders to determine the exact capital requirements. (Schroeck 2002, 143-144) In Europe there has been some development in the opaqueness of banks since the introduction of EU wide stress test beginning in 2009. These test allow regulators with some insight of banks' operations and they are better informed when making capital requirement decisions.

When discussing about capital there is a difference between actual capital, required capital, and available capital. Actual capital is the capital in a bank's balance sheet. That should be equal to the required regulatory capital. This however is not always the case as not all book capital qualifies as regulatory capital. From regulatory point of view the so called Tier 1 and Tier 2 capital is accepted. Tier 1 capital is, in broad terms, equity capital and disclosed reserves, whereas Tier 2 capital is often reserves, hybrid debt capital instruments or subordinated debt. The issue is that equity capital is not easy measure, as it depends on how the bank's assets and liabilities are valued. Thus, the book value of equity it is measured on a historical basis rather than fair actual market value. (Schroeck 2002, 147-149)

Risk capital of a bank is the minimum amount of capital that has to be invested to buy insurance that fully protects the value of a bank's net assets against a decline in value. There is a connection between risk capital and regulatory capital as regulatory capital tries to measure risk capital according to a particular accounting standard. Risk capital is completely determined by the shape of the distribution of the changes in value of net assets. When liabilities of a bank are fixed and not related to the payoff of the bank's assets, gross assets show the same fluctuations as net assets. Thus, it is sufficient to know the distribution of the value changes in the gross assets to determine the required amount of risk capital in the bank. In reality, however, some of the liabilities are fixed and some are contingent. (Schroeck 2002, 153-155)

### **3.3.5 Stress Tests in General**

European Banking Authority (EBA) is responsible for ensuring the orderly functioning and integrity and the stability of the financial system in European Union. EBA is mandate to monitor and assess market developments and to identify trends, potential risks, and vulnerabilities. The primary tool of supervision to conduct these analyses is the EU-wide stress test exercise. The aim of the test is to assess the resilience of financial institutions to adverse market developments and to contribute to the overall assessment of systematic risk in the European Union's financial system. (EBA 2016)

Since 2011, the EBA has collected statistical information on a quarterly basis. This is done in order to calculate KRI (key risk indicator) ratios that provide early warning signs

of trends and potential risks and vulnerabilities in the banking sector. KRIs are the minimum feasible set of metrics which the analysis is based on. KRIs are also used to build a meaningful risk dashboard and reports. Moreover, the EBA has placed emphasis on uniform reporting requirements to ensure data availability and comparability. (EBA 2016)

There are eight different risk categories while each category consists of numerous risk indicators. The categories are liquidity, funding, asset quality, profitability, concentration, solvency, operational, and market risk. These are presented shortly below. However, the EBA methodology guide might change over time as a result of experience or changes in the EU supervisory reporting.

*Liquidity risk* refers to the risk of a firm being unable to fund its increases in assets or to meet its financial obligations as they fall due. Liquidity risk can be caused by bank's failure to recognize or address changes in market conditions that may affect the institutions ability to liquidate assets quickly and with minimal loss in value. This result may also rise from financial institutions inability to manage unplanned decreases and changes in funding sources. Liquidity risk is especially important for financial institutions as credit institutions fulfil a maturity transformation role in the financial system. Liquidity is also considered to be a systemic risk. This means that realization of liquidity risk can cause contagion effect, which in turn have historically caused bank runs.

*Funding risk* refers to the risk taken by a firm in accessing sufficient funds to meet its obligations when they fall due. A bank's poor financial performance may lead to its reduced creditworthiness and to a failure to access sufficient funds over a specific horizon, making it unable to settle its obligations. Firm's funding risk profile is a key indicator when assessing the risk firm holds in its balance sheet.

*Asset quality* reflects the quantity of existing and potential credit risk associated with loan and investment portfolios and other assets. Asset quality can be also seen as credit risk, which is, simply put, the potential risk that a bank borrower or counterparty will fail to meet its obligations in accordance with pre-agreed terms. The goal of credit risk management is to maximize a bank's risk-adjusted rate of return by maintaining an acceptable credit risk exposure. Credit risk is a major risk in bank sector and banks need to be in a position to react to worsening conditions.

*Profitability risk* is important as economic development and can be only ensured if banks are profitable. The risk of low profitability can materialize through several channels. A direct consequence is the problem when banks seek refinancing, deteriorating profitability may cause other banks and investors to be less willing to invest in the bank or lend it money. In the case of asset price bubbles, many banks may increase their investments in the same asset class causing structural problems for banks.

*Concentration risk* refers to the risk of a financial institutions suffering heavy losses due to the default of a single counterparty with high probability of default. While concentration is more relevant at a micro level, for the whole banking system is important as it can be used to detect contagion effect.

*Solvency risk* is institutions lack of ability to absorb losses or decrease in earnings. Measures for solvency, such as regulatory capital requirements, are the most traditional measures that supervisors have used to control bank failures.

*Operational risks* are the risk of loss from inadequate or failed internal process, systems and people intervention, or from external events. Operational risk is unavoidable and it is neither willingly incurred nor revenue drive. In addition, it is not diversifiable and cannot be fully eliminated. However, it can be transferred by insurance.

*Market risk* is a risk associated with the risk of losses in on balance sheet, positions arising from adverse movements in market prices. Market risk stems from all the positions included in banks' trading book, but also from commodity and foreign exchange positions. Market risk has a wider impact than only on liquid trading book positions, so the need for a more comprehensive view has increased.

### **3.3.6 European Banking Environment**

Banking in Europe mixes “traditional” and “capital markets banking” and this mix interacts with sovereign debt in a dangerous way. Institutions with large exposure to the sovereign debt of larger, and potentially more dubious, economies in European Union are more susceptible to sharp changes in the price of these securities. Concerns about solvency may transform into a liquidity crisis. Some securities, prime broking, and OTC derivatives especially need quality collateral. Collaterals are needed as these calls are triggered periodically by significant price shifts. When banks cannot meet the collateral calls, liquidity crises emerges. If banks cannot recapitalize, small and medium sized enterprises will not receive funding as easily as their funding depends on banks. Deleveraging as a consequence of the recapitalizing pressure and reinforces downward pressure on the real economy. (Blundell-Wignall 2011, 203)

The European Monetary Union (EMU) has resulted in high levels of debt in households and corporates in the worst competitive positions. This is problematic as when governments have to raise savings to stabilize the level of debt, other sectors in the economy should run down savings to offset the impact on overall growth of the economy. Banking crisis is particularly troubling as the cross-border exposure of banks in Europe is very large, particularly in sovereign debt. The special nature of European special brand of in-

stitutional arrangements has the ability to exacerbate the financial crisis. Because exchange rates cannot be adjusted, the pressure caused by asymmetric real shocks are forced into labor markets and result in unemployment. (Blundell-Wignall 2011, 203)

At its core, the sovereign debt crisis was caused by too much leverage and increased dealing in high risk products, for the given leverage. Recently banks have begun to practice risk-weighted asset optimization and this has caused the Basel rules to become redundant. The Tier 1 ratio provides no meaningful constraint in either form of the risk mentioned, thus it controls very little at all. Banks are permitted to use their own internal models and alternatives to alter the characteristics of risky assets, to which the capital weighting rules apply. (Blundell-Wignall 2011, 207) Further, Blundell-Wignall and Atkinson (2010) showed that high Tier 1 ratio does not correlate with low writedowns and losses to total assets, i.e. high level of writedowns and losses are associated with a high Tier 1 ratio.

### **3.4 Forming the Hypothesis**

The information provided in previous chapters serves as base for the hypothesis of this study. In line with the efficient market hypothesis, an investor is only able to achieve higher returns by taking higher risk. The equity risk premium varies depending on changes in market risk as well as on the level of risk of a current asset or a basket of assets. As stated earlier, the financial institutions covered in this study are from around Europe and based on different market conditions. However, all of the institutions have not concentrated to one particular country, but they conduct business Europe wide. This in mind, it is safe to say that the market conditions are similar for all the institutions, but they do differ slightly from one another.

The hypothesis is as follows: better placing in the stress tests should be compensated by a lower equity risk premium. Lower placement in the stress test indicates that the institution holds more risky assets in their balance sheet that will suffer in a down turn, and to compensate the riskier investment equity risk premium should be higher.

## 4 ANALYSIS OF EMPIRICAL EVIDENCE

### 4.1 Estimation of Historical Equity Risk Premium

#### 4.1.1 Discounted Cash Flow Model

It is commonly known that the value of a company is its future earnings discounted to today. To be able to study ERPs for specific firms, calculation of these free cash flows is needed. This is done by using discounted cash flow model (DCF henceforward). As discussed earlier in chapter 1, free cash flow to equity best captures company's potential dividends. For financial institutions FCFE is calculated by subtracting regulatory capital changes from net income. Regulatory capital change is considered to be the change in common equity tier 1, the same capital used in the stress tests conducted by EBA.

Two methods of DCF can be applied to calculation of ERP. The first is Gordon growth model, which assumes a constant growth rate. The second, also used in this study, is a multiple-stage model. This method allows the growth rate to change over time and thus, gives a more realistic result. (Damodaran 2006) The analysis begins with the actual historical growth. The length of this period depends on the year examined. After 2016, Institutional Broker's Estimate System's (I/B/E/S) one-year, two-year, and three-year growth estimates are used as proxies for future growth. These are considered to be stages 1 and 2 in this analysis. Stage three is the so-called reversion to long term growth. This stage is chosen to be 10 years. In this last stage the growth rate will linearly decay to the long-term growth rate, which is the average of the forecasted GDP growth rates from 2032 to 2046.

When calculating the terminal value, the most important thing to consider is the terminal growth. The terminal growth is not considered static in this study, rather it changes over time. For this purpose a 10-year forward GDP is applied to each respective year, starting at the end of the forecast period. The terminal growth rate cannot be higher than the growth overall economy in which the company operates, even though some companies can maintain a higher growth rate for an extended period of time. Nevertheless, the growth rate will drift towards "stable growth" at some point in time. (Damodaran 2006) In this study, GDP forecast is provided by Oxford Economics via Datastream and considers the whole Europe, as all the banks operate Europe wide.

Change in CET1 is calculated first from actual historical figures and from 2015 to 2030 they are calculated with the use of CET1 ratios reported by the banks. An average of the post eurocrisis (post-2011) CET1 ratios is applied for this purpose. If the average is below Basel III requirement of 7,5%, the minimum required is applied. This is a rather

significant simplification, but we cannot possibly know what kind of events banks will face or policy changes banks are going to make. It is likely that the CET1 ratio will not stay stable over the forecast period but this is a simplification that needs to be made.

#### 4.1.2 Cost of Equity and Equity Risk Premium

After the calculation is done for FCFE, we can solve the equation for  $k_e$ , the cost of equity. For this the market capitalization of each respective institution is used for corresponding year. Cost of equity of course includes the risk-free rate and this is eliminated by subtracting 10-year German government bond (Bund10Y henceforward) value from the each corresponding year. Bund10Y is used as all the banks are European and German government bonds are considered to be the safest bet in Europe at the moment. Using treasury notes might not be as useful as using Bund10Y and might not give us as good of an insight as Bund10Y will. Below is shown the composition of cost of equity,  $k_e$ .

$$\text{Cost of Equity, } k_e = r_f + r_a \quad (3)$$

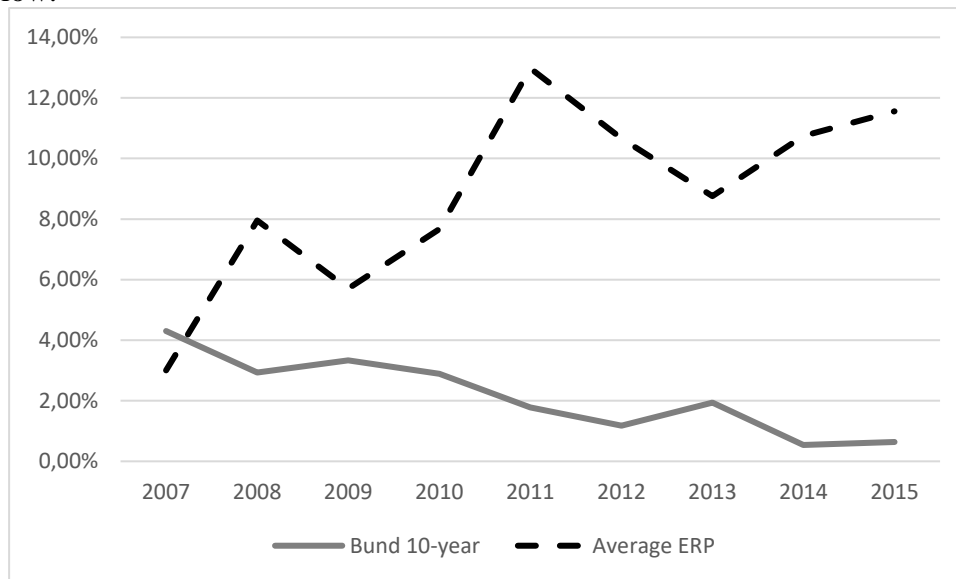
In the formula  $r_f$  stands for the risk-free rate (Bund10Y, as discussed above) and  $r_a$  represents the expected return on asset a, the equity risk premium. This tells us that by subtracting  $r_f$  from  $k_e$  will result in the company specific equity risk premium,  $r_a$ .

It is worth noting that Bund10Y has been declining ever since the 2007 financial crisis, the development is pictured below in Figure 1.



**Figure 1** Development of German 10-year Government Bond

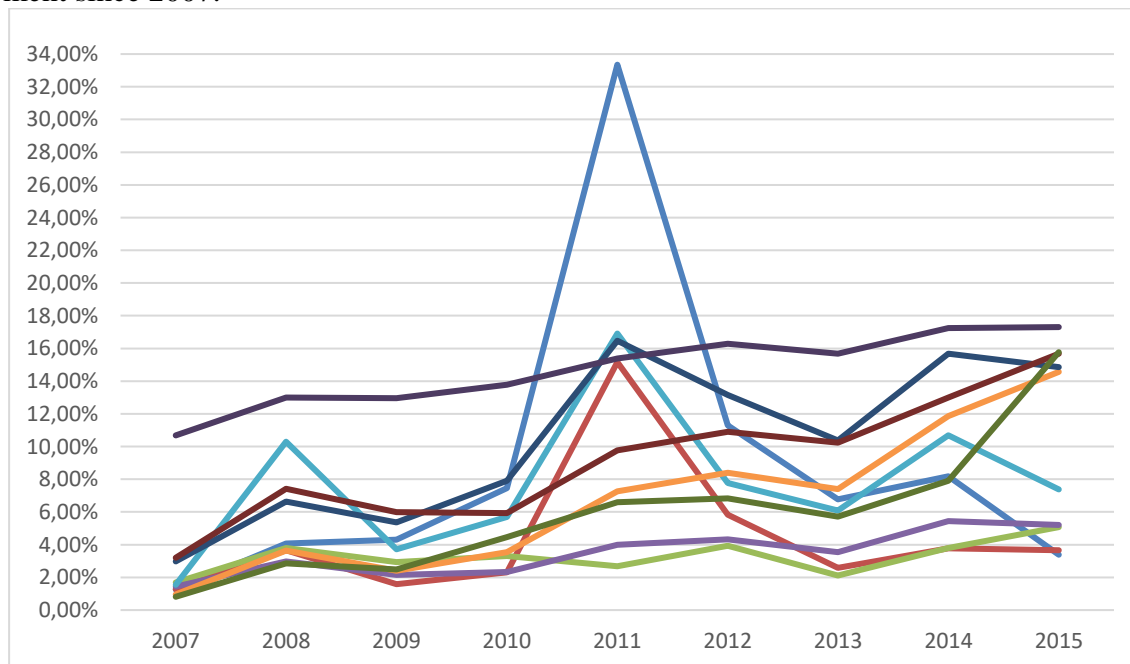
As mentioned above, ERP is calculated by subtracting risk-free rate from the cost of equity. The decline of Bund10Y has a significant effect on ERP. If cost of equity is unchanged, decline of Bund10Y naturally causes ERP to rise. This is evident in Figure 2 below.



**Figure 2** Development of 10-year German Government Bond and Average Equity Risk Premium

As we can see, the difference between risk-free rate and average ERP is greater than the change in ERP, and the remaining difference is due to the more uncertain future of financial markets.

Figure 3 presents the five banks with the highest and the lowest ERPs and their development since 2007.



**Figure 3** Five highest and five lowest ERPs in 2015 and their development before



It is evident that ERP did not react as strongly during the financial crisis as it did during the Euro crisis of 2011. This would suggest that even though the financial crisis had a significant effect on the market value of banks, the Euro crisis posed a greater risk for European financial institutions. On the other hand, a stable trend in the ERP is observable. Since 2007 ERP has steadily risen from low single digit numbers to higher percentiles.

#### 4.1.3 Country Risk Premium

Country risk is one of the numerous risks that investors need to take into account when making investment decisions. Country risk is the measure of different macroeconomic factors that affect the equity risk premium and investors investment decisions. Country risk premiums can be treated differently based on the assumption of the nature of the country risk. There are several ways to calculate the effect of country risk premium, such as weighted average in the proportion of revenue from different countries. But in the case of financial institutions, the real source of revenue is difficult to obtain, even more difficult since the operations of banks are extremely complicated. In this study, it is assumed that every company in their respective countries are equally exposed to country risk. This approach eliminates the need of historical betas and/or lambdas for the country risk premiums. Country risk premiums are calculated only for 2015 to give more insight of the effect of country risk on ERP. In most cases country risks are relatively small. Country risk is more important in emerging markets where economic and political environment might be more volatile than in mature markets. In this study most of the home countries of banks considered are in mature markets. The data for country risk premiums is by Damodaran and obtained from his website. (Damodaran 2006)

The formula changes slightly when including country risk. The calculation is as follows:

$$k_e = r_f + \text{Country Risk Premium} + r_a \quad (4)$$

This indicates that by subtracting country risk premium and risk-free rate from the cost of equity would give us a more company specific ERP. In Table 2 is listed country premiums by country.

**Table 2 Country Risk Premiums**

<b>Country Risk Premium</b>	
Austria	0,17 %
Belgium	0,45 %
Denmark	0,00 %
France	0,29 %
Germany	0,00 %
Hungary	2,45 %
Ireland	0,57 %
Italy	1,60 %
Netherlands	0,00 %
Norway	0,00 %
Poland	1,16 %
Spain	1,46 %
Sweden	0,00 %
UK	0,04 %

It is evident from Table 2, that country premiums are relatively small. This would indicate that within Europe, country risk premium does not play a significant role on the total ERP. The case would be different if the study would be conducted in developing countries which face more instability, economic and politic wise.

## **4.2 Stress Tests and Previous Results**

EU-wide stress test are conducted to develop a common foundation for national authorities, for them to be able to identify residual areas of uncertainty. Another goal is to strengthen market discipline, through the publication of consistent data on a bank by bank level illustrating how balance sheets are affected by common shocks in the economy. The stress test is initiated and coordinated by the EBA and undertaken in cooperation with the Competent Authorities. (2016 EU Wide Stress Test)

Stress test scenario is based on a general macroeconomic downturn over a 3 year horizon. Any general shock will likely cause a recession which would translate into bank losses, thus stress tests serve as an analytical tool to understand what happens to banks' balance sheets if an economic downturn is preceded by an economic shock. (2016 EU Wide Stress Test)

Stress tests concentrate on the common equity tier 1 ratio (CET1 ratio, henceforward). According to Basel III rule, at all times, banks must fund themselves with 4,5% common equity of risk-weighted assets. If an institution falls under this level, it is considered to be undercapitalized and must act accordingly by either raising common equity or by lowering the amount of risky assets. From 2019 onwards, an additional mandatory buffer will

be placed. This additional buffer is equivalent to 2,5% of risk-weighted assets. Thus, the total capital requirement will rise to 7%. (Basel Committee on Banking Supervision 2010)

The results of the stress test allows the Competent Authorities to assess banks' ability to meet minimum and additional own funds requirements under duress. In addition, the results will guide individual banks to better conduct their financial planning, management and other factors. In practice, the supervisors could respond to poorly succeeded banks by implementing dividend restrictions or by setting capital guidance. (2016 EU Wide Stress Test)

Banks' performance on these test should also tell something about their health to investors. For example, poorly ranking bank is more likely suffer greater losses in an event of an economic shock, if the bank in case doesn't make adequate changes to its operations. Other things remaining equal, investors would require a higher rate of return for their investment for such a bank to compensate for the higher risk.

The result from the most recent stress test indicates that, since 2011, the EU banking sector has become more resilient due to significant rises in capital requirements and thus, capital. However, the impact of the adverse scenario is mostly driven by credit risk losses (-349 billion euros) followed by operational risk (€-105bn) and market risk across all portfolios (€-98bn). (2016 EU Wide Stress Test)

In Table 3 banks are listed by their home country and it presents how the banks have succeeded in EU wide stress tests since 2010. The rise of capital ratios is evident from Table 3. As we can see, most of the banks included in the 2016 stress test have held CET1 ratio above Basel II and III requirements in previous test.

**Table 3 Results of Previous EU Wide Stress Tests**

Name of Institution	2010		2011		2014		2016	
	Actual	adverse scenario	Actual	adverse scenario	Actual	adverse scenario	Actual	adverse scenario
Erste Group Bank AG	9,20 %	8,10 %	8,70 %	8,10 %	10,00 %	7,60 %	12,35 %	8,19 %
KBC Group NV	10,90 %	9,79 %	10,50 %	10,00 %	12,70 %	8,30 %	15,17 %	11,27 %
Danske Bank	11,70 %	10,80 %	10,00 %	11,10 %	13,70 %	11,70 %	16,12 %	14,02 %
Jyske Bank	13,50 %	12,80 %	12,10 %	12,80 %	14,90 %	13,60 %	16,06 %	14,00 %
BNP Paribas	10,10 %	9,70 %	9,20 %	7,90 %	10,50 %	8,10 %	11,05 %	8,59 %
Groupe Cr�dit Agricole	9,70 %	9,20 %	8,20 %	8,50 %	10,80 %	8,80 %	13,52 %	10,49 %
Soci�t� G�n�rale S.A.	10,70 %	10,20 %	8,10 %	6,60 %	10,70 %	8,10 %	11,42 %	8,03 %
Deutsche Bank AG	12,60 %	10,30 %	8,80 %	6,50 %	13,40 %	8,90 %	13,19 %	7,80 %
Commerzbank AG	10,50 %	9,30 %	10,00 %	7,40 %	10,80 %	8,00 %	13,77 %	7,42 %
OTP Bank Nyrt.	13,80 %	16,80 %	12,30 %	13,60 %	15,90 %	11,90 %	13,41 %	9,22 %
Allied Irish Banks plc	7,00 %	7,20 %	3,70 %	-2,80 %	14,60 %	6,90 %	15,89 %	7,39 %
Bank of Ireland	9,20 %	7,60 %	8,40 %	3,40 %	11,80 %	9,30 %	13,30 %	7,69 %
Intesa Sanpaolo S.p.A.	8,30 %	8,80 %	7,90 %	7,40 %	11,70 %	8,30 %	12,98 %	10,24 %
UniCredit S.p.A.	8,60 %	8,10 %	7,80 %	6,60 %	9,60 %	6,80 %	10,59 %	7,12 %
UBI Banca	8,00 %	7,10 %	7,00 %	6,40 %	11,80 %	8,20 %	12,08 %	8,85 %
ING Groep N.V.	10,20 %	9,10 %	9,60 %	8,70 %	10,10 %	8,70 %	12,94 %	9,00 %
ABN AMRO Group N.V.	13,00 %	10,30 %	9,90 %	9,20 %	12,10 %	9,10 %	15,51 %	9,53 %
DNB Bank Group	N/A <sup>1</sup>	N/A <sup>1</sup>	8,30 %	9,00 %	11,30 %	11,30 %	14,31 %	14,30 %
PKO Bank	13,30 %	15,70 %	11,80 %	12,20 %	14,20 %	14,30 %	13,27 %	11,45 %
Banco Santander S.A.	10,00 %	10,20 %	7,10 %	8,40 %	10,40 %	8,90 %	12,71 %	8,69 %
BBVA S.A.	9,40 %	9,60 %	8,00 %	9,20 %	10,50 %	9,00 %	12,04 %	8,29 %
Banco Popular Espa�ol S.A.	9,10 %	7,50 %	7,10 %	5,20 %	10,10 %	7,60 %	13,11 %	7,01 %
Banco de Sabadell S.A.	9,00 %	7,70 %	6,20 %	5,00 %	10,30 %	8,30 %	11,69 %	8,19 %
Nordea Bank	10,20 %	10,20 %	8,90 %	9,50 %	13,60 %	12,00 %	16,45 %	14,09 %
Svenska Handelsbanken	9,10 %	9,10 %	7,70 %	8,60 %	18,70 %	16,90 %	21,25 %	18,55 %
SEB	12,40 %	10,70 %	11,10 %	10,50 %	14,70 %	13,00 %	18,85 %	16,60 %
Swedbank	10,40 %	10,50 %	8,70 %	9,40 %	18,20 %	16,30 %	24,14 %	22,26 %
HSBC Holdings	10,80 %	10,40 %	10,50 %	8,50 %	10,80 %	9,30 %	11,87 %	8,76 %
Barclays Plc	13,00 %	13,90 %	10,00 %	7,30 %	9,10 %	7,10 %	11,42 %	7,30 %
The Royal Bank of Scotland	14,40 %	11,70 %	9,70 %	6,30 %	8,60 %	5,70 %	15,54 %	8,08 %
Lloyds Banking Group Plc	9,60 %	9,40 %	10,20 %	7,70 %	10,20 %	6,20 %	13,05 %	10,14 %
Average	10,59 %	10,06 %	8,95 %	8,01 %	12,12 %	9,62 %	14,16 %	10,41 %

<sup>1</sup> DNB Bank Group was not included in the EU Wide Stress Test of 2010

It is also evident that the capital ratios have been on the rise in almost every situation. What is striking from this table, is that almost all banks in double digits after the adverse scenario in 2016 stress test are from the Nordic countries. All other financial institutions are well under 10 percent, but that is not a significant level. Similarly, none of the banks included were not under the 7% limit that will be implemented in 2019. Two banks are close to this limit: Banco Popular Espa ol (7,01%) and UniCredit (7,12%). It is also worth to note that, in many cases the actual CET1 ratio has improved in past years, but it does not always translate to the ratio after the adverse scenario. This would indicate that the banks do hold more capital as a buffer, but at the same time the corresponding assets are riskier. As a side note, only one bank was not included in the 2010 stress test, the Norwegian DNB Bank Group. Nevertheless, this does not affect the outcome of this comparison.

### 4.3 Statistical Analysis

The intuitive assumption would be that the higher the placement in the stress tests the lower the equity risk premium. This means that the banks with lowest ERP would rank higher in the stress test, given that the market is efficient. Based on this thought we can derive a hypothesis; ERP and placement in stress test are inversely correlated. Thus, the null hypothesis and alternative hypothesis are formed as follows:

$$H_0: \rho_{ERP,placement} > -0,5$$

$$H_1: -1 \leq \rho_{ERP,placement} \leq -0,5$$

This null hypothesis is tested with Pearson's correlation coefficient (correlation, for short henceforward) using SPSS Statistics –program. The results are considered to significant if the p-value less or equal to 0,05. The results from these tests are shown in Tables 4-7 below. All tables include the correlation between the pairs and their respective p-values. It should be noted that in the test for 2010 N is less than in other tests as one bank was not included in the 2010 stress test.

**Table 4 Correlation in 2010**

Correlations <sup>a</sup>			
		ERP2010	P2010
ERP2010	Pearson Correlation	1	-,042
	Sig. (2-tailed)		,829
P2010	Pearson Correlation	-,042	1
	Sig. (2-tailed)	,829	

a. Listwise N=29

**Table 5 Correlation in 2011**

Correlations <sup>a</sup>			
		ERP2011	P2011
ERP2011	Pearson Correlation	1	-,115
	Sig. (2-tailed)		,547
P2011	Pearson Correlation	-,115	1
	Sig. (2-tailed)	,547	

a. Listwise N=30

**Table 6 Correlation in 2014**

Correlations <sup>a</sup>		ERP2014	P2014
ERP2014	Pearson Correlation	1	,041
	Sig. (2-tailed)		,832
P2014	Pearson Correlation	,041	1
	Sig. (2-tailed)	,832	

a. Listwise N=30

**Table 7 Correlation in 2016**

Correlations <sup>a</sup>		ERP2016	P2016
ERP2016	Pearson Correlation	1	,281
	Sig. (2-tailed)		,132
P2016	Pearson Correlation	,281	1
	Sig. (2-tailed)	,132	

a. Listwise N=30

It is evident from the tables above, that there is no statistically significant negative correlation as predicted earlier. Also, all the p-values are higher than the agreed 0,05 which leads to the dismissal of the null hypothesis. The implication is that there is no relationship between ERP and placement in the stress tests.

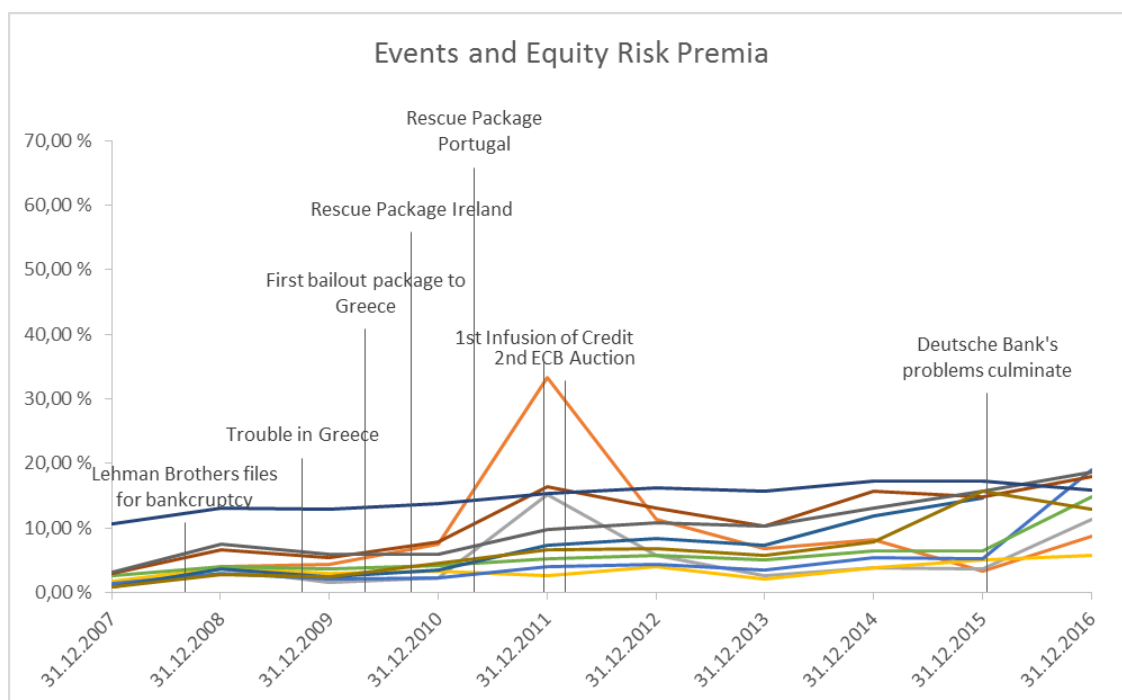
## 5 RESULTS AND DISCUSSION

### 5.1 Timeline of Financial Crisis and the Effects on Equity Risk Premium

The data presented in previous chapter shows a rise in ERP since 2007. More interestingly, the global financial crisis did not have a significant effect on ERP, whereas the Euro bond crisis had a significant and evident effect on ERP.

Figure 4 below shows the top 5 and bottom 5 banks rated by the 2015 equity risk premia. Also, eight most important dates are embedded in the figure. The dates have been selected to represent the changes in the financial markets or they are otherwise considered to be important for the equity risk premium.

**Figure 4 Timeline of important events and equity risk premium**



As we can see from Figure 4, the effect of the financial crisis was relatively small on equity risk premium. On the other hand, the Euro bond crisis had much greater effect. The three bailout package to Greece, Ireland, and Portugal caused an observable rise in ERP. Of course the package itself do not affect the premium but the reasons behind them. The growing concern on the possible losses caused ERP to rise sharply.

The overall trend has been rising, in line with the overall downward trend of interest rates and government bonds. With all things equal, lowering government debt (10-year German government bonds in this study) results to a rising equity risk premium.

On December 8 2011 European Central Bank (ECB) announced its open market operations to ease the markets and bring stability to financial markets and banks. These operations included two rounds of longer-term refinancing operations (LTROs). The aim of LTROs was to enhance credit support measures to support bank lending and liquidity in the euro area money market. The two LTROs had a maturity of 36 months (three years) and the option to early repayment after one year. Also at the same time ECB announced that it will lower the reserve ratio from 2 % to 1 % starting 18 January 2012. The LTROs had a fixed rate of 1 % and the interest will be paid when the operations matured. The allotment dates were 21 December 2011 and 29 February 2012. In the first round ECB handed out about 489 billion euros of which 325 billion euros was tapped by banks in Greece, Ireland, Italy, and Spain. In the second round every bid was allocated in full, totaling 529 billion euros. The second round surpassed the first round by 40 billion euros. (ECB 2011) The effect of LTROs is evident in Figure 4. The two rounds of LTROs dropped the ERP significantly especially in the case of the bottom 5 –banks.

A similar refinancing operations again took place in June 2014 and March 2016. These operations, touted targeted longer-term refinancing operations (TLTRO I and TLTRO II, or TLTROs), were designed to enhance the functioning of monetary policy by supporting bank lending to the real economy. TLTROs are targeted in the sense that banks can borrow the amount that is linked to their loans to non-financial corporations and households. Moreover, in TLTRO II the interest rate is linked to respective bank's lending patterns, thus higher borrowing to non-financial companies and households (excluding loans for house buying) leads to lower interest rate. For TLTRO I the interest rate equals to a fixed rate of Eurozone's main refinancing operations. Further, the banks participating in TLTROs are subjected to additional reporting as an assurance that the money lent actually reaches the real economy. (ECB 2014; 2016) During TLTRO I banks acquired a total amount of 432 billion euros and, taking into account the paybacks from the first round, TLTRO II totaled 352 billion euros. It is worth noting that the last operation in March 2017 was the most popular one of TLTRO II, during which banks applied for a total of 233,5 billion euros. (Tamminen 2017)

## 5.2 Behavior of Equity Risk Premium

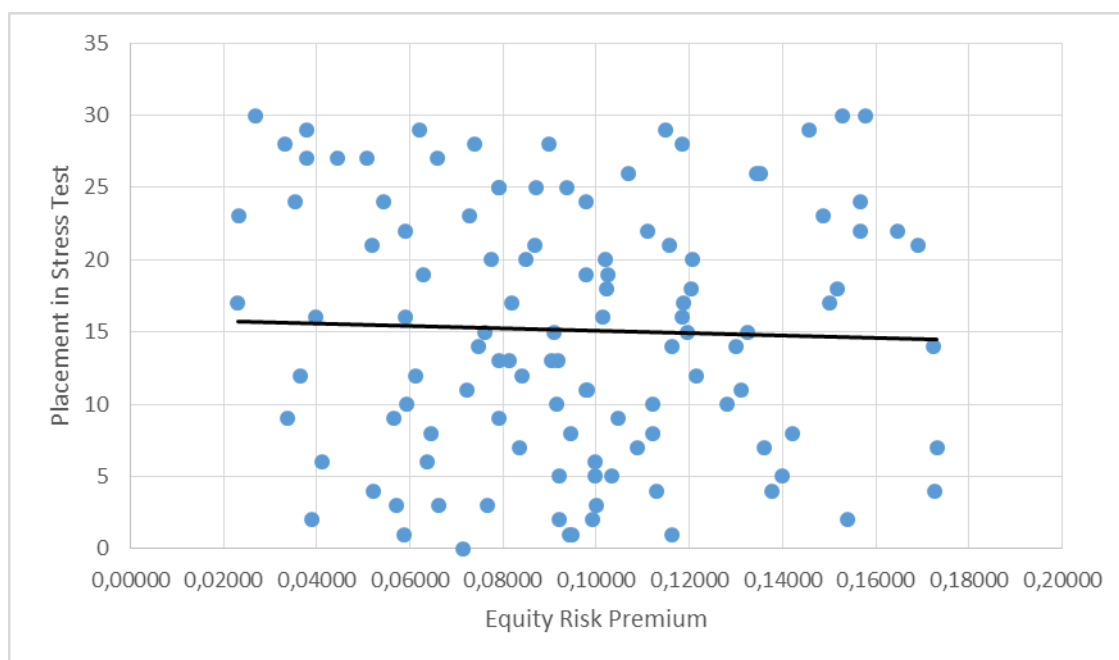
It is an intuitive thought that the stress test results and equity risk premium should walk hand-in-hand. But as it has been shown in previous chapters that is not the case, at least not in this set of data. The initial hypothesis that higher equity risk premium results in a lower placement in the stress tests is rejected for all the years considered. Only the first two test show a negative correlation but it is not statistically significant. It may be a too big of a conclusion to state that the market is not efficient in pricing the risk of European



financial institutions. However having said that, there seems to be evidence to support the claim that, especially the high ranking banks, suffer from market's mispricing.

Figure 5 represents all the financial institutions and their respective equity risk premiums and placements in stress tests from all four stress tests. It should be noted that Commerzbank is excluded from this scatter plot due to the extreme levels of equity risk premium.

**Figure 5 Scatter Plot of Stress Test Placements and Equity Risk Premium**



In Figure 5 shows that all the data is evenly distributed. Had the original hypothesis stood, this scatter plot should show a rising trend line. However, since this is not the case a good look into the possible reasons for this behavior should be taken. In the following subchapters market efficiency in pricing the risk levels is discussed from a theoretical as well as a behavioral aspect.

### 5.2.1 Capital Market Efficiency

Risk is defined as the uncertainty about deviation from expected returns. In the field of finance risk is often associated with downside risk, i.e. the actual returns are lower than originally expected. However, should this be the case rational investors would not invest in risky assets as the only outcome of taking a risky position is potential losses. Hence, it should not be forgotten that risk goes both ways, the riskier the asset the higher the potential deviation from expected outcome. The measurement of risk, however, is difficult. The overall risk of an investment is composed of several different factors and some of them are difficult to quantify in a meaningful way. Perhaps the most commonly used

metric to capture risk in an investment is beta. Many studies have been conducted to capture the importance of beta, and the time-varying nature of it. Even though beta coefficient is not covered in this study, it is worthwhile to note that it plays an important role in capital asset pricing model that is used to calculate the expected return on an asset.

Fama and French (1997) pointed out in their study that the variations in risk loadings cause the estimates of asset pricing models to be imprecise. Another problem is the imprecise estimates of factor risk premiums. The result from the second problem is that the expected premium interval ranges over 10 percent. By combining the two problems it is clear that the estimates of the cost of equity is imprecise. The imprecision is caused mainly by the second point above and standard errors can be more than 3 % per year. As market is mostly made of people who make the calls on investment decisions, this possesses a worrying message to the pricing of risk. However, most of the risk can be diversified away. There still is a possibility of mismanaging the risk if the underlying risk is calculated incorrectly.

A similar notion was made by Rigotti and Shannon (2001). They noted that there are two types of events: events that all agents perceive have a unique probability and events that some perceive do not. This leads to a situation where risky securities are traded but uncertain securities are not. Under uncertainty markets are incomplete as the uncertainty limits the exchange of securities. It is important to understand the difference between risk and uncertainty. As discussed earlier, risk is a two-way street and even if some agents are risk averse, some are always risk takers. Uncertainty, however, has the ability to lower trading volume and hinder the efficiency of markets. Uncertain securities do not have an “agreed” probability but it varies from investors to investor making it more difficult to find counterparty for a trade. An uncertain event can also have unknown probability of occurring. Uncertainty is different from risk also in a way it affects investors. Investor behavior can be different from their behavior under risk, as the probability of uncertain event is unknown or varies between individuals. Even in well-functioning markets it is possible that markets are not able to precisely price contracts that are conditional on uncertain events. As discussed briefly above, indeterminacy in outcomes may cause excess price volatility and predictions are likely to be sensitive to even small measurement errors.

Shiller (2001) pointed out, even though real dividends explain a lot of price movement, price movement is more volatile than dividends. The excess volatility can be contributed to fashion and fads. This means that even the part of prices can be affected by non-fundamental shocks. Positive outlook on the future can affect dividend setting in a similar way it affects investors’ behavior. A positive view of the future development of business may encourage managers to rise dividends. If a manager and the public share their optimism, managers increase dividends at the same time that fashions or fads cause prices to increase.

The purpose of this chapter was to present some evidence on why market might not be efficient in pricing risk. It should be clear that even if markets are efficient they may be incorrect and investor behavior can cause a deviation from the equilibrium. In the next chapter some of the key behavioral finance theories for this study are used to explain why equity risk premium has not developed as thought based on the original hypothesis.

### **5.2.2 Behavioral Finance Aspect**

Investors are known to make errors in their analysis and they often share common misconceptions. Methods of security analysis and simplistic theories of the stock market spread through mass media and word of mouth making them available to all investors. When investors fall for elementary errors they may cause large price movements in stocks. In the United States, interest in stock market reached an all-time high in the 90s, there is no evidence that investor sophistication increased. For example, it was popular to value firms based upon revenue rather than earnings. Though internet and mass media spread information and make information more available to investors, it also enables the spreading of false or incorrect information. But from the point of view of uninformed investors the market is informationally efficient. Rational but uninformed investors may act on the information they have and cause fluctuations in prices. If the volume of trade is high enough, the aggression may intimidate rational investors and thus prevent prices from reverting to their “true” value. (Hirshleifer, Subrahmanyam & Titman 2002)

Shiller 2001 explained speculative bubbles through feedback. As prices increase so does the investor enthusiasm. This in turn increases demand in the stock market further driving the prices up. High demand for stocks is generated by the past high returns and expectation of even higher returns in the future. This feedback process can amplify positive news and forces. If real fundamental growth cannot back up the development the bubble will come to an end at some point as the prices cannot go up forever. For this theory hold, there has to be an inconstancy to investors’ judgement, for example past price changes affect the way investors resolve a conflicting set of information as they judge the market.

Shiller’s theory can be applied to the results of this study. In the years following the global financial crisis and the European sovereign debt crisis news of troubled banks were somewhat regular. Combined with the undiversifiable systemic risk in the banking industry, markets reaction was negative, even the more stable banks, unassociated (directly) to the failing banks, suffered in terms of market value. The Feedback theory can be viewed conversely. Even though the fundamental values indicated that some banks were more profitable, the public lack of demand drove the prices lower, lowered enthusiasm led to further decrease in prices. As is the case during speculative bubbles, investors have to

make allocation decisions, even if the information present is conflicting. Going against the stream is problematic for professionals as well as for individual investors. The potential gains are lower than the advantage of “doing as everyone else is doing”. Especially fund managers are reluctant to make drastically different decisions than their peers.

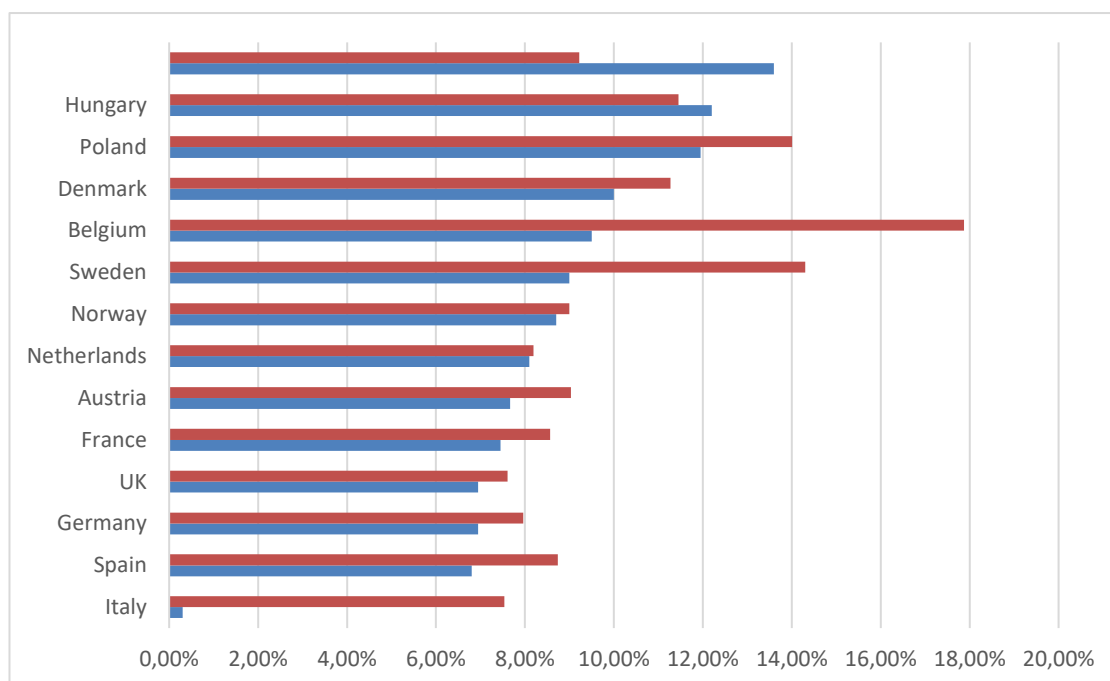
Comovement and herd behavior can explain the indifference in the actions taken by the market in aggregate. In general, investors tend to follow trends or other more famous investors or institutions. During the euro sovereign debt crisis the uncertainty surrounding financial institutions made investors to withdraw their investments from banks. The systemic risk within the industry made all banks vulnerable to failure of one or more banks. Especially in Europe banks hold significant amounts of cross-border debt. Thus, the caution surrounding financial industry was understandable. Having said this, there were, and still is, institutions that are less exposed to the effects of bank failures. The crisis was centered around banks in Spain, Italy, Portugal, and Ireland. But the effects were felt in institutions around Europe. As you can see from table 8, banks based in the Scandinavia have performed significantly better in the stress test compared to other countries.

**Table 8 Results of Stress test, sorted by 2016 results**

Name of Institution	2010		2011		2014		2016	
	Actual	After adverse scenario	Actual	After adverse scenario	Actual	After adverse scenario	Actual	After adverse scenario
Swedbank	10,40 %	10,50 %	8,70 %	9,40 %	18,20 %	16,30 %	24,14 %	22,26 %
Svenska Handelsbanken	9,10 %	9,10 %	7,70 %	8,60 %	18,70 %	16,90 %	21,25 %	18,55 %
SEB	12,40 %	10,70 %	11,10 %	10,50 %	14,70 %	13,00 %	18,85 %	16,60 %
DNB Bank Group	N/A <sup>1</sup>	N/A <sup>1</sup>	8,30 %	9,00 %	11,30 %	11,30 %	14,31 %	14,30 %
Nordea Bank	10,20 %	10,20 %	8,90 %	9,50 %	13,60 %	12,00 %	16,45 %	14,09 %
Danske Bank	11,70 %	10,80 %	10,00 %	11,10 %	13,70 %	11,70 %	16,12 %	14,02 %
Jyske Bank	13,50 %	12,80 %	12,10 %	12,80 %	14,90 %	13,60 %	16,06 %	14,00 %
PKO Bank	13,30 %	15,70 %	11,80 %	12,20 %	14,20 %	14,30 %	13,27 %	11,45 %
KBC Group NV	10,90 %	9,79 %	10,50 %	10,00 %	12,70 %	8,30 %	15,17 %	11,27 %
Groupe Crédit Agricole	9,70 %	9,20 %	8,20 %	8,50 %	10,80 %	8,80 %	13,52 %	10,49 %
<b>Average</b>	<b>10,51 %</b>	<b>10,05 %</b>	<b>8,92 %</b>	<b>7,97 %</b>	<b>12,12 %</b>	<b>9,64 %</b>	<b>14,12 %</b>	<b>10,43 %</b>
Intesa Sanpaolo S.p.A.	8,30 %	8,80 %	7,90 %	7,40 %	11,70 %	8,30 %	12,98 %	10,24 %
Lloyds Banking Group Plc	9,60 %	9,40 %	10,20 %	7,70 %	10,20 %	6,20 %	13,05 %	10,14 %
OTP Bank Nyrt.	13,80 %	16,80 %	12,30 %	13,60 %	15,90 %	11,90 %	13,41 %	9,22 %
ING Groep N.V.	10,20 %	9,10 %	9,60 %	8,70 %	10,10 %	8,70 %	12,94 %	9,00 %
UBI Banca	8,00 %	7,10 %	7,00 %	6,40 %	11,80 %	8,20 %	12,08 %	8,85 %
HSBC Holdings	10,80 %	10,40 %	10,50 %	8,50 %	10,80 %	9,30 %	11,87 %	8,76 %
Banco Santander S.A.	10,00 %	10,20 %	7,10 %	8,40 %	10,40 %	8,90 %	12,71 %	8,69 %
BNP Paribas	10,10 %	9,70 %	9,20 %	7,90 %	10,50 %	8,10 %	11,05 %	8,59 %
BBVA S.A.	9,40 %	9,60 %	8,00 %	9,20 %	10,50 %	9,00 %	12,04 %	8,29 %
Banco de Sabadell S.A.	9,00 %	7,70 %	6,20 %	5,00 %	10,30 %	8,30 %	11,69 %	8,19 %
Erste Group Bank AG	9,20 %	8,10 %	8,70 %	8,10 %	10,00 %	7,60 %	12,35 %	8,19 %
The Royal Bank of Scotland	14,40 %	11,70 %	9,70 %	6,30 %	8,60 %	5,70 %	15,54 %	8,08 %
Société Générale S.A.	10,70 %	10,20 %	8,10 %	6,60 %	10,70 %	8,10 %	11,42 %	8,03 %
Deutsche Bank AG	12,60 %	10,30 %	8,80 %	6,50 %	13,40 %	8,90 %	13,19 %	7,80 %
Bank of Ireland	9,20 %	7,60 %	8,40 %	3,40 %	11,80 %	9,30 %	13,30 %	7,69 %
Commerzbank AG	10,50 %	9,30 %	10,00 %	7,40 %	10,80 %	8,00 %	13,77 %	7,42 %
Allied Irish Banks plc	7,00 %	7,20 %	3,70 %	-2,80 %	14,60 %	6,90 %	15,89 %	7,39 %
Barclays Plc	13,00 %	13,90 %	10,00 %	7,30 %	9,10 %	7,10 %	11,42 %	7,30 %
UniCredit S.p.A.	8,60 %	8,10 %	7,80 %	6,60 %	9,60 %	6,80 %	10,59 %	7,12 %
Banco Popular Español S.A.	9,10 %	7,50 %	7,10 %	5,20 %	10,10 %	7,60 %	13,11 %	7,01 %
1 DNB Bank Group was not included in the EU Wide Stress Test of 2010								

These results show that some institutions are not as heavily influenced by adverse scenarios, so it would be logical that they do not suffer in terms of equity risk premium. But as we know from the previous chapters this is not the case. In figure 6 the geographical differences are even more evident.

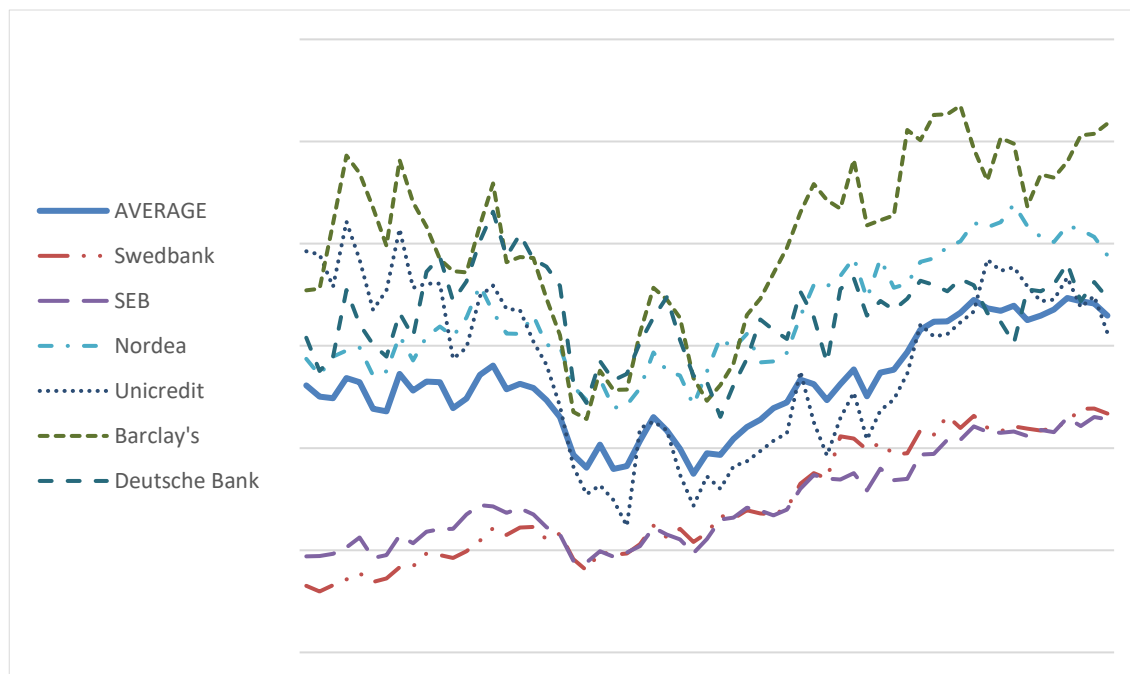
**Figure 6 Breakdown of 2011 and 2016 stress test results by country**



It is clear that, for some reason, institutions based in different countries bounced back from the 2011 crisis better than others. It is worthwhile noting, that the results have improved throughout. The volume of change may indicate that the institutions have either improved their ratio of risky assets in their balance sheet or have limited their exposure to risky assets. The overall improvement may tell us that the actions taken by the ECB has had the desired effect. Despite the obvious difference in the results, the market does not reward the banks with better results in terms of equity risk premium. As mentioned above herd behavior may explain the behavior of investors but the actions of investors do not necessarily explain the whole difference and the similarities of development.

The concept of comovement has been discussed earlier. In a nutshell, it means that when a stock is part of an index, its development will start to follow the development of the index. This, in turn, would suggest that if the development follows an index the stock might not react as heavily to good or bad news. Figure 7 presents the top three and bottom three companies of the 2016 stress test in terms of their market value. From this it can be seen that the market values have developed similarly but it needs to be said that as the overall environment surrounding European banking sector has stabilized so have the volatility of the six stocks. And as the uncertainty has unwound the reaction has been positive overall.

**Figure 7 Selected 6 banks' market values development and overall average 2010-2015**



It is a bit of a reach to say that the development could be contributed to the comovement effect but all the banks included in the figure are also part of the Euro Stoxx Banks –index. Nevertheless, the trend is clear for the institutions considered.

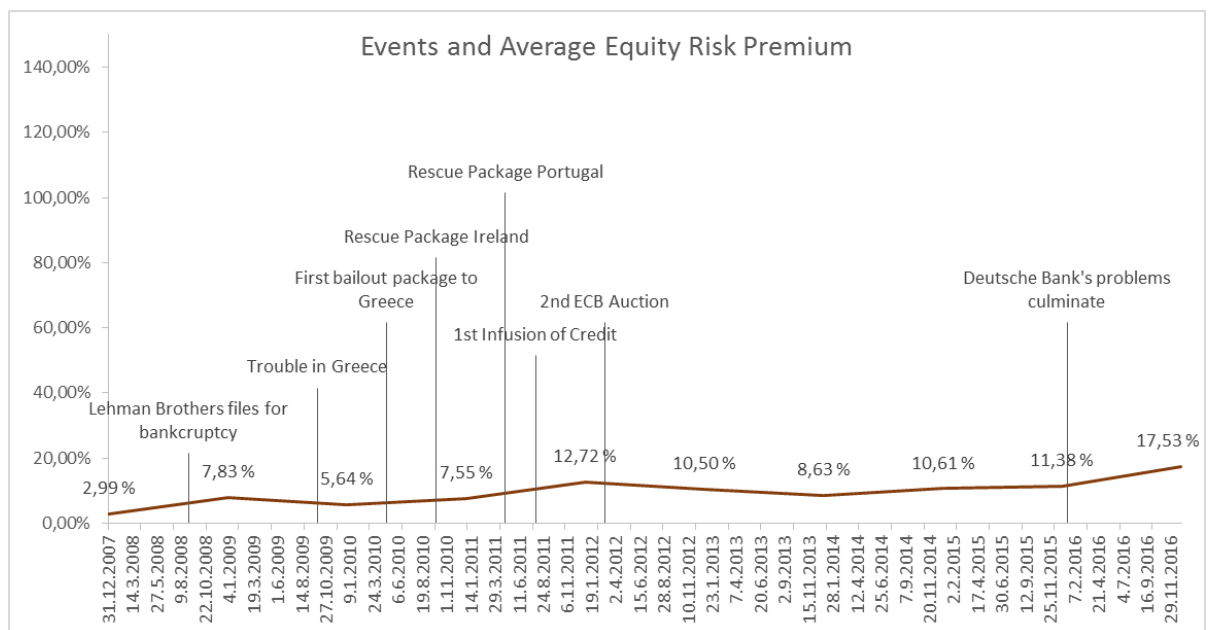
Another important psychological phenomenon to consider is belief perseverance. Investors habit to cling on information they have received before overpowers new information they obtain. So even if the new information is more positive, the uncertainty surrounding decision making may influence the final decision. Hesitation to adapt to the new information causes the market to inefficiently react to new information. In context of this study, belief perseverance causes mispricing of the equity risk premium. As investors were hesitant about the outlook of the financial industry they were unable to recognize that some institutions are better prepared for catastrophic events and down-turns in the global market.

## 6 CONCLUSIONS

The financial industry suffered many setbacks from the global financial crisis to the euro sovereign debt crisis. The euro sovereign debt crisis hit European financial institutions much harder than the global financial crisis of 2007.

In the after wave the ECB was forced to take action in order to stabilize the industry and ease the uncertainty in Europe. (ECB 2011) The actions were successful, in terms of the equity risk premium. The results of the actions are visible in figure 8.

**Figure 8 Important Events and the Average ERP in the Sample**



The ERP lowered in the years after LTROs and TLTROs. Nevertheless, the equity risk premium has steadily risen during the scope of this study. It is worth noting that the equity risk premiums have also stabilized in recent years, meaning the volatility is lower than before. On the other hand the problems in Germany that started in 2016 with Deutsche Bank has once again caused uncertainty in the financial industry, but these events are not included in this study as they fall out of the time range.

As it has been pointed out before, the main hypothesis of this study has been rejected. In other words the equity risk premium and the results of the stress tests do not correlate. This, of course, is against the efficient market hypothesis. So the question is, what has caused the deviation from efficient markets?

As Fama (1998) pointed out the assumption of efficient markets does not mean that certain anomalies cannot be present. In an efficient market overreaction to information

can occur, if under-reaction are about as frequent as overreaction. For EMH to hold anomalies should be randomly split between overreaction and under-reaction. Malkiel (2003) stated that market efficiency does not mean that markets do not make errors in valuation. As a result of irrational investors, pricing irregularities and predictability can persist for short periods. Even if stock prices show greater volatility than changes in fundamentals cause, markets can be efficient if arbitrageurs correct the market prices to reflect the actual change, if arbitrage is not limited. Borges (2010) also found some evidence that some European markets' show different levels of efficiency. Those findings are in line with the findings of this study, as different institutions from different regions do not benefit from their more risk averse behavior or more stable regions, hinting that the market was not totally efficient at that time.

The central behavioral finance concepts used to shed light to the deviation from efficient market hypothesis in this study has been herd behavior, belief perseverance, and feedback theory. Each of these phenomena have their own way in explaining the receding from efficient markets. This study does not take a stand on the efficiency of the markets but rather examines what has caused the brief error in the market's ability to correctly price financial institutions. Belief perseverance explains why investors do not adjust their beliefs when presented new information (Barberis & Thaler 2005). Belief perseverance might explain how the belief against financial institutions remained and markets reluctance to adapt to new information regarding the financial improvement of certain institutions, thus explaining the missing correlation between the stress tests and the level of equity risk premium. The idea by Barberis and Thaler can explain, in part, why the mispricing persisted for a long period of time.

Herd behavior and feedback theory are used to explain how better performing institutions were drawn into the same comparison as the worst institutions in Europe. Only a part of the uncertainty can be attributed to the behavior of investors, as the situation in Europe was unprecedented. European banking industry is unique in terms of cross border investments and not one investor could know how far reaching a failure of one bank could potentially be, meaning the uncertainty was rather rational. Bikhchandani and Sharma (2001) stated that herd behavior can destabilize markets and increase the fragility of the financial system. Indeed, if all investors act similarly the effects multiply. However, it should not be surprising that these investors react similarly and at the same time when presented with similar information.

It is well known that behavioral finance is an important factor in financial markets, but the magnitude is not certain. This study provides some insight how different behavioral finance theories can explain why certain financial institutions suffered in the after shock of the global financial crisis and Euro sovereign debt crisis. By combining different theories it is possible to draw some conclusions on how big of an effect investor behavior can have on the market.



Further research is needed on how long does behaviorally caused mispricing occur in the market and to what extent market inefficiency can be attributed to concepts such as herd behavior and belief perseverance. As we know, behavioral finance and its' concepts have a significant influence over equity markets but real effect is difficult to measure and quantify exactly. It is difficult to even say how long and to what effect did herd behavior, belief perseverance, and feedback theory affect the investors' behavior during the timeline of this study.

## REFERENCES

- Backus, D. – Routledge, B. – Zin, S., (2008) The Cyclical Component of US Asset Returns, Working Paper, Stern School of Business, New York, New York.
- Baker, M – Wurgler, J., (2007) *Investor Sentiment in the Stock Market*. NBER Working Paper Series. (Working Paper 13189)
- Ball, R., (2009) The Global Financial Crisis and the Efficient Market Hypothesis: What have we learnt? *Journal of Applied Corporate Finance*, Vol. 21 (4), 8-16
- Banerjee, A., (1992) A Simple Model of Herd Behaviour, *The Quarterly Journal of Economics*, Vol. 107 (3), 797-817.
- Barberis, N. (2011) Psychology and the Financial Crisis of 2007-2008. Available at SSRN: <https://ssrn.com/abstract=1742463>
- Barberis, N., (2013) The Psychology of Tail Events: Progress and Challenges, *American Economic Review: Papers & Proceedings*, Vol 103 (3), 611-616.
- Barberis, N. - Thaler, R., (2003) A survey of behavioral finance. *Handbook of the Economics of Finance*, 1, 1053–1128.
- Barro, R.J., (2006) Rare Disaster and Asset Markets in the Twentieth Century. *The Quarterly Journal of Economics*, Vol. 121 (3), 823-866.
- Bikchandani, S. – Sharma, S., (2001) Herd Behavior in Financial Markets, *IMF Staff Papers*, Vol. 47 (3)
- Blundell-Wignall, A., (2011) Solving the Financial and Sovereign Debt Crisis in Europe, *OECD Journal: Financial Market Trends*, Vol. 2011(2), 203-224.
- Blundell-Wignall, A. & Atkinson, P., (2010) Thinking Beyond Basel III: Necessary Solutions for Capital and Liquidity, *OECD Journal: Financial Market Trends*, Vol. 2010 (1)
- Borges, M.R., (2010) Efficient market hypothesis in European stock markets. *The European Journal of Finance*, 16 (7), 711–726.
- Brown, G. – Cliff, M., (2005) Investor Sentiment and Asset Valuation, *Journal of Business*, Vol. 78 (2), 405-440
- Brunnermeier, M.K. – Oehmke, M., (2012), *Bubbles, Financial Crises, and Systematic Risk*. NBER Working Paper Series (Working Paper 18398)
- Canuto, O. – Santos, P. dos, – Sá Porto, P. de, (2012) *Macroeconomics and Sovereign Risk Ratings*, Journal of International Commerce, Economics and Policy 3

- Cheng, P.L. & Deets, K.M.. (1971) Portfolio Returns and the Random Walk Theory. *The Journal of Finance*, Vol. 26 (1), 11–30
- Cosset, J-C. – Roy, J. The Determinants of Country Risk Ratings (1991), *Journal of International Business Studies*, Vol. 22 (1)
- Daniel, K. – Hirshleifer, D. – Subrahmanyam, (1997) A. Investor Psychology and Security Market Under- and Overreaction. *Journal of Finance*, Vol 52 (1), 1-33.
- Damodaran, A., (2006) *Damodaran on Valuation* 2nd ed., Hoboken, New Jersey: John Wiley & Sons.
- Damodaran, A., (2012) *Equity Risk Premiums (ERP): Determinants , Estimation and Implications – The 2012 Edition Updated*, New York, N.Y.
- Damodaran, A., (2015) *Equity Risk Premiums (ERP): Determinants , Estimation and Implications – The 2015 Edition Updated*, New York, N.Y
- Das, S.V. – Uppal, R., (2004) Systemic Risk and International Portfolio Choice, *The Journal of Finance*, Vol. 59 (6), 2809-2834
- D’Avolio, G. (2002) The Market for Borrowing Risk, *Journal of Financial Economics*, Vol. 66, 271-306
- De Long, J.B. – Shleifer, A. – Summers, L. – Waldman, R. (1990), Noise Trader Risk in Financial Markets, *Journal of Political Economy*, Vol. 98, 703-738.
- Eaton. J – Gersovitz, M. – Stiglitz, J.E., (1986) The Pure Theory of Country Risk. *European Economic Review*, Vol. 30
- European Central Bank (2011) Press Release, 8 December 2011, ECB announces measures to support bank lending and money market activity. Retrieved 13.3.2017 [https://www.ecb.europa.eu/press/pr/date/2011/html/pr111208\\_1.en.html](https://www.ecb.europa.eu/press/pr/date/2011/html/pr111208_1.en.html)
- European Central Bank (2014) Press Release, 3 July 2014, ECB announces further details of the targeted longer-term refinancing operations. Retrieved 18.4.2017 [https://www.ecb.europa.eu/press/pr/date/2014/html/pr140703\\_2.en.html](https://www.ecb.europa.eu/press/pr/date/2014/html/pr140703_2.en.html)
- European Central Bank (2016) Press Release, 10 March 2016, ECB announces new series of targeted longer-term refinancing operations (TLTRO II), Retrieved 18.4.2017 <[https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310\\_1.en.html](https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310_1.en.html)>
- Fama, E.F., (1970) Efficient Capital Markets: a Review of Theory and Empirical Work. *The Journal of Finance*, Vol. 25 (2), 383–417.
- Fama, E.F., (1991) Efficient Capital Markets: II. *Journal of Finance*, Vol. 46 (5), 1575–1617.

- Fama, E.F., (1998) Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics*, Vol. 49 (3), 283–306.
- Fama, E.F. - French, K.R. (1988) Permanent and Temporary Components of Stock Prices. *Journal of Political Economy*, Vol. 96 (2), 246.
- Fama, E. – French, K. (1989) Business Conditions and Expected Returns on Stocks and Bonds, *Journal of Financial Economics*, Vol. (25), 23-49.
- Fama, E. – French, K., (1997) Industry Costs of Equity, *Journal of Financial Economics*, Vol. 43, 153-193.
- Ferson, W. – Harvey, C., (1991) The Variation of Economic Risk Premiums, *Journal of Political Economy*, Vol. 99 (2), 385-415
- Fiordelisi, F. – Marqués-Ibañez, D., (2013) Is Bank Default Risk Systematic?, *Journal of Banking and Finance*, Vol. 37 (6), 2000-2010.
- Gourio, F., (2010) *Disaster Risk and Business Cycles*, Working Paper, Boston University
- Gromb, D. – Vayanos, D., (2010) Limits of Arbitrage, *Annual Review of Financial Economics*, Vol. 2, 251-75
- Hirshleifer, D., (2001) Investor Psychology and Asset Pricing, *Journal of Finance*, Vol. 56 (4), 1533-1597.
- Hirshleifer, D. – Subrahmanyam, A. – Titman, S., (2006) Feedback and the Success of Irrational Investors, *Journal of Financial Economics*, Vol. 81, 311-338
- Holton, G., (2004) Defining Risk, *Financial Analysts Journal*, Vol. 60 (6), 19-25.
- Hong, H. – Stein, J.C. (1999) A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets. *Journal of Finance*, Vol. 54 (6), 2143-2184
- Jensen, M.C. (1978) Some Anomalous Evidence Regarding Market Efficiency. *Journal of Financial Economics*, Vol. 6(2–3), 95–101.
- Jouini, E. – Napp, C. (2008) On Abeläs Concept of Doubt and Pessimism. *Journal of Economic Dynamics and Control*, Vol. 32, 3682-3694
- Kahneman, D. – Tversky A. (1979) Prospect Theory : an Analysis of Decision Under Risk. *Econometria*, Vol. 47 (2), 263.
- Kole, E. – Koedjik, K. – Verbeek, M. (2006) Portfolio Implications of Systemic Crises, *Journal of Banking and Finance*, Vol. 30 (8), 2347-2369.
- Koller, T. – Goedhart, M. – Wessels, D. (2005) *Valuation: Measuring and Managing the Value of Companies*. John Wiley & Sons, Inc., Hoboken, New Jersey

- Kumar, A. – Lee, C., (2006) Retail Investor Sentiment and Return Comovements, *The Journal of Finance*, Vol. 61 (5), 2451-2486.
- Lo, A.W. - MacKinlay, C. (1988) Stock Market Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test. *The Review of Financial Studies*, Vol. 1(1), 41–66
- Lord, C. – Ross, L. – Lepper, M. (1979) Biased Assimilation and Attitude Polarization: The Effects of Prior Theories on Subsequently Considered Evidence. *Journal of Personality and Social Psychology*, Vol. 37 (11), 2098-2109
- Malkiel, B. (2003) The Efficient Market Hypothesis and Its Critics, *Journal of Economic Perspectives*, Vol. 17 (1), 59-82
- Mehra, R. – Prescott, E.C. (1985) The Equity Premium: A Puzzle, *Journal of Monetary Economics*, Vol 15 (2), 145-161
- Milburn, J.A. (2008) The Relationship between Fair Value, Market Value, and Efficient Markets. *Accounting Perspectives*, Vol. 7 (4), 293-316
- Narayan, P.K. – Narayan, S. – Popp, S. – Ahmed, H. (2015) Is the Efficient Market Hypothesis Day-of-the-Week Dependent? Evidence from the Banking Sector, *Applied Economics*, Vol. 47 (23), 2359-2378
- Naseer, M. – Tariq, Y., (2015) The Efficient Market Hypothesis: A Critical Review of Literature, *IUP Journal of Financial Risk Management*, Vol 12 (4), 48-63
- Orlik, A. - Veldkamp, L., *Understanding Uncertainty Shocks and the Role of Black Swans*, NBER Working Paper Series. (Working Paper 20445)
- OECD (2015) Country Risk Classification 2015, <<http://www.oecd.org/tad/xcred/crc.htm>,> retrieved 2.3.2017
- Peng, Y – Zervou, S.A. (2014) Monetary Policy Rules and the Equity Premium. Available at SSRN: <https://ssrn.com/abstract=2498684> or <http://dx.doi.org/10.2139/ssrn.2498684>
- Rietz, T.A. (1988) The Equity Risk Premium: A Solution. *Journal of Monetary Economics*, Vol 22 (1), 117-131
- Rigotti, L. – Shannon, C., (2001) Uncertainty and Risk in Financial Markets, *Department of Economics, UCB*. UC Berkeley: Department of Economics, UCB. Retrieved from: <https://escholarship.org/uc/item/6m42r5rr>
- Schroeck, G. (2002) *Risk Management and Value Creation in Financial Institutions*. John Wiley & Sons, Inc., Hoboken, New Jersey

- Scharfstein, D. – Stein, J., (1990) Herd Behaviour and Investment, *The American Economic Review*, Vol. 80 (3), 465-479.
- Shiller, R.J. (1990) Market Volatility and Investor Behavior, *The American Economic Review*, Vol. 80 (2), 58-62.
- Shiller, R.J. (1995) Conversation, Information, and Herd Behavior, *The American Economic Review*, Vol. 85 (2), 181-185
- Shleifer, A. Model of Investor Sentiment (1998), *Journal of Financial Economics*, Vol. 49, 307-343
- Shleifer, A., (2000). Inefficient Markets: An Introduction to Behavioral Finance, *Journal of Policy Modeling*, 158(3), 307–318.
- Shleifer, A. – Vishny, R.W. (1997) The Limits of Arbitrage. *Journal of Finance*, Vol. 52 (1), 35-55
- Summers, L. (1986) Does the Stock Market Rationally Reflect Fundamental Values? *The Journal of Finance*, Vol. 41 (3), 591-601
- Tamminen, E., (2017) Pitkät keskuspankkiluotot kelpasivat pankeille, Euro ja Talous – blog post, retrieved 18.4.2017, available at <<http://www.eurojatalous.fi/fi/blogit/2017/pitkat-keskuspankkiluotot-kelpasivat-pankeille/>>
- Tetlock, P., (2007) Giving Content to Investor Sentiment: The Role of Media in the Stock Market, *The Journal of Finance*, Vol. 62 (3), 1139-1168
- Thaler, R. (ed.) (2005) *Advances in behavioural finance, Vol II*. Princeton University Press, Princeton, New Jersey
- Thorbecke, W. (1997) On Stock Market Returns and Monetary Policy. *The Journal of Finance*, Vol.52 (2), 635-655
- Von Neumann, J. - Morgenstern, O. (1944) *Theory of Games and Economic Behavior*, Princeton, New Jersey: Princeton University Press.
- Welch, I., (2016) The (Time-Varying) Importance of Disaster Risk, *Financial Analysts Journal*, Vol. 72 (5), 14-30.
- Welch, I., (2000) Views of financial economists on the equity premium and on professional controversies. *The Journal of Business*, Vol. 73(4), 501-537.
- Williams, J., (2013) Financial Analysts and the False Consensus Effect, *Journal of Accounting Research*, Vol. 51 (4), 855-907.