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The Dynamics of Equity Risk Premium

The case of France, Germany, Sweden, United Kingdom and USA

Master's thesis within finance

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Abstract

Equity risk premium is a financial variable that is surrounded by mystery. Starting from the almost 30 year old equity premium puzzle caused by considerations that equity premium values which are observable in past data imply an implausibly high risk aversion to more recent statements that equity premium does not exist anymore.

The purpose of this paper is to find out more about the traits and characteristics of equity risk premium, its current status and interactions of its values across international markets by conducting data analysis on mature equity markets using optimal methods as suggested in academic literature.

This paper attempts to clear some of the confusion regarding equity premiums by analyzing equity excess returns in the mature equity markets of France, Germany, Sweden, United Kingdom and USA from 1970 to 2012. It is concluded that equity premium follows a mean reverting process however in short-term and mid-term its values can be volatile and in March 2000 there might have been a structural break. The obtained current equity premium values are significantly higher than zero. At the same time they are lower than popularly used values that are based on longer periods of past data. The paper also finds out that equity premiums in different countries are highly correlated not only due to shared global influence but also due to some direct causality relationships between them, most of which are positive. A panel data analysis is conducted as well to test the explanatory power of some macroeconomic and financial variables on the equity risk premium values and it is concluded that risk-free rate and unemployment rate have some explanatory power for equity risk premium values. This paper manages to clear a part of the mystery that surrounds the equity risk premium.

Contents

Figures

Tables

1 Introduction

The equity risk premium is an important financial variable that reflects the price that is being attached to the extra riskiness of equity markets. In other words it is an excess return over a riskless asset that is provided by the equity market. Exploring the process behind equity premium is an especially interesting topic due to the general confusion that surrounds it and arbitrary way how it frequently is treated in financial calculations. Damodaran (2011) writes that considering the importance of equity risk premium it is amazing how careless the estimation of equity premium is usually treated.

A good example of problems regarding equity premium estimation is mentioned in O'Hanlon and Steele (2000) - in the middle of 90s the question about the size of equity risk premium caused some confusion in the policy arena of United Kingdom. Monopolies and Merger Commission tried to estimate the cost of capital for regulated gas companies. The estimates differed each from other by as much as 6% due to disagreements about the estimated values of equity risk premium which obviously is a huge difference. The value of equity premium was crucial to determine a fair value of return for regulated monopolies and implying reasonable regulations and restrictions.

Equity risk premium is an important variable in theoretical finance both as a result of investor risk aversion in general equilibrium models and as a key determinant in financial valuation theory. Therefore equity risk premium is also empirically important since it is used to make investment allocation decisions (including the decisions whether to invest in pension funds and also the investment allocation of the pension fund). It is a crucial part of the cost of capital and therefore it also affects the results of all valuation estimates. It is used in calculations for expected cash flows, cost of equity, cost of capital, present value of cash flows and also Free Cash Flow to Firm (FCFF) and Free Cash Flow to Equity (FCFE) based estimations of company equity value and firm value. So it is an essential variable in every analyst's calculations. Equity premium is important not only for investors but also for the corporations since it determines their cost of capital and therefore affects some of their decisions regarding amount of necessary to meet future pension fund and heath care requirements and also regarding investing in new ventures (Damodaran (2011)). And as it was already mentioned, it also necessary for regulatory commissions to impose fair restrictions on regulated companies.

There is a historical equity premium puzzle which implies that the historical equity premium value (in the origin of the puzzle it was estimated to be 6.18%) is too high as no microeconomic model or utility function with reasonable parameter values requires individuals to demand such a high risk premium on equity (Mehra and Prescott (1985)). Such a value of the equity premium implies an unrealistically high risk aversion among individuals. Many other authors have looked at this puzzle yet a definite solution has not been presented. The failure of solving this puzzle puts the general equilibrium models and the whole financial valuation theory under a question mark. Even after more than 25 years this puzzle still is a pending matter.

While some economists are still wondering about the equity premium puzzle, after poor stock performance in recent years when they have been outperformed by bonds for some periods (see Kearns and Campbell (2009)), others are starting the question whether the equity risk premium even still exists.

Schrager (2010) writes even after recent developments in stock markets the equity risk premium is still often assumed to be higher than 5% and risk managers avoid answering the question how they come up with such a value. He also mentions that some state pension plans (since the article was published in a British journal, it is reasonable to assume that mainly United Kingdom is being considered) are still assuming equity premium to be over 8% as they have not adjusted the values and are intending to ignore the recent years when stocks have had a relatively poor performance. So there are 2 frequently observable extremes of belief – that equity premium is and will be over 5% high (which seems unreasonable when considered from the perspective of equity premium puzzle) and that there will be no equity premium in foreseeable future (which is unreasonable from the perspective of modern portfolio theory if majority of investors are assumed to be risk-averse).

Those that expect high values of equity premium usually estimate it basing on historical equity return data that dates back as far as 80 years or even more e.g. using the Ibbotson Associates database which is the most frequently used data source and includes data starting from 1926 (Damodaran (2011)). Also several academic papers examine equity returns and premiums for very long periods, for example, Jorion and Goetzmann (1999), Goetzmann, Ibbotson and Peng (2001), Siegel (2005) and Dimson, Marsh and Staunton (2008). However in times of changing global and local economic and financial environment it seems logical to assume that investor preferences are also changing and the equity risk premium is most likely varying over time.

Therefore it is crucial to find out more about the traits of equity premium and what kind of process it follows. If it indeed is varying over time, shorter historical estimate periods or even the use of other possible equity premium estimation methods should be considered to determine the value of more up-to-date market equilibrium premium. Also finding out determinants and relationships that affect the risk premium would be helpful in this matter. That would subsequently help to make better assumptions about the expected equity risk premium in the future and improve the results of forecasts and valuation calculations.

The purpose of this thesis is to find out more about the traits and characteristics of equity risk premium, its current status and relations of its values across international markets by conducting data analysis on mature equity markets using optimal methods as suggested in academic literature. That would allow to at least partially clear up the apparent theoretical and empirical confusion that is surrounding the value of equity premium.

The purpose will be reached by exploring previous research done on equity premium estimation methods and employing the findings (mainly focusing on optimal adjustments of historical approach) in estimating current and also historical equity premium. Afterwards the obtained historical premium values will be used to investigate the behavior of equity premium as a process and to inspect equity premium relationships across international markets. That will allow assessing whether investors might be able to benefit from differences in premium levels across mature equity markets.

Research questions:

- What is the current equity premium in mature markets?

By finding this out it would be possible to see whether the equity premium puzzle is still in effect or whether now its magnitude has diminished and the equity premium has reached a less puzzling level below 5%. Also it would give an answer to the question whether equity premium actually still exists.

- Has the equity premium been stationary over the past 40 years?

A lot of economists believe that equity premium now is different from what it was 100 or more years ago. But a different question is whether there have been significant shifts in equity premium in the last 40 years and whether all data from this period can be used for determining the current and forward looking equity premium.

- Can short period rolling historical equity premium estimates outperform longer period historical estimates?

If the fluctuations in equity premium values are substantial, shorter period rolling historical estimates should be more precise than full sample historical estimates. The best way to assess this is to conduct out-of-sample analysis.

- How are the changes in equity risk premium in different countries related? Are they always in equilibrium? What is more significant in their relations – shared global factors or actual interdependency between the premium values.

This is an important question from investor perspective. Obviously equity premiums should be jointly affected by some global factors. But additionally there should be some direct connections between the premium values in different countries. If the expected risk premium in one country is consistently lower than the expected premium in another country, then there are possibilities for investors who have slightly lower risk aversion to gain extra benefit. Investors from country with a lower expected equity premium can invest in the other country's market in similar stocks at a lower price and by entering that market they should slightly decrease the premium of it. Thus shifts in equity premiums of one market can make some investors to relocate, effectively affecting equity premium also in other markets.

- Can other economic variables help to explain changes in equity premium?

Acknowledging relationship of equity risk premium to other economic variables would help to swiftly adjust the assumed equity risk premium value according to changes in these other variables.

To fulfill the purpose of this paper, chapter 2 focuses on the background of equity risk premium and literature review both regarding the characteristics of equity risk premium and the equity risk premium puzzle and also regarding the equity premium estimation methods. Chapter 3 is devoted to empirical analysis with data description, methodology, estimation results and the result analysis.

2 Theory and previous research

2.1 Short theoretical background

Before turning attention to the problems related to equity premium and its estimation, it is important to take a look at theoretical basis that justifies the existence of equity risk premium. It is necessary to examine it in order to more comprehensively analyze its dynamics.

For example, Goetzmann and Ibbotson (2006) define equity risk premium as the expected return of the stock market minus the expected return of a riskless bond. This obviously raises the question why should equities earn higher returns than bonds. Elton, Gruber, Brown and Goetzmann (2011) explain that stocks are significantly riskier than bonds. Mehra (2003) writes that historically the standard deviation of stock returns has been 20% while for treasury bills it has been only 4%. Moreover dividend payments of stocks can vary a lot over time while the bond coupon payments are usually predictable. Therefore equity risk premium has to be sufficiently high in order to make stocks appealing to risk-averse investors. According to Elton et al. (2011) one of the main pillars of modern portfolio theory is the axiom that most investors are risk-averse and like high returns but do not like high risk. Therefore over long period of time riskier financial instruments must produce higher returns than less risky instruments. And historically it has been so. Goetzmann and Ibbotson (2006) write that 1 USD invested in U.S. large cap stocks in December 1925 would be worth 2658 USD by December 2005. While if it had been invested in U.S. government bonds, it would be worth only 71 USD.

Elton et al. (2011) continue that the equity risk premium is the extra return that the investors expect to earn from investments in equities. The equity premium is not guaranteed, it is only an expectation or average excess return. The volatility of returns is the cause of the premium in the first place. The volatility also makes the estimation of equity risk premium more difficult.

A risk-averse investor will always prefer more return to less and less risk to more (a risk-loving investor might choose more risky asset while a risk-neutral investor will be indifferent). Therefore, by finding a set of assets or portfolios that either offer a bigger return for the same risk or offer a lower risk for the same return, one will have identified all the assets or portfolios that a risk-averse investor would consider holding. And all other assets and portfolios can be ignored. The efficient set of assets and portfolios is called the efficient frontier. A diagram can be created by plotting all investment possibilities in risk and return dimensions. The efficient frontier is the curve consisting of all vertically highest located portfolios of each horizontal point that lie between the minimum variance portfolio and the maximum return portfolio. Due to previously described characteristics it must be a concave function.

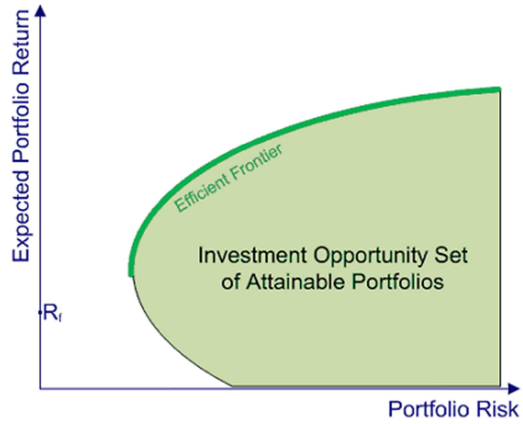

Figure 2.1 Opportunity set of attainable portfolios and the efficient frontier.

Source: thismatter.com

Figure 2.1 shows an area of possibly obtainable portfolios and the efficient frontier. Additionally, if a risk-free investment is available, its risk is considered to be 0 and therefore it is located on the vertical axis and R_f is the risk-free return guaranteed by the risk-free investment.

Damodaran (2002) writes that there still is a disagreement on how to measure the risk of an asset and how to convert the risk measure into the expected return that compensates for the risk. However, most models define risk in terms of variance in actual returns around an expected return and the risk should be considered from a perspective of a marginal investor who already has a diversified portfolio. Therefore the risk is broken into two components. The firm component is specific for each investment while the market component affects the whole subset of investments and therefore is not diversifiable and needs to be rewarded.

Elton et al. (2011) write that the formula for variance of an asset is equal to:

$$\sigma_i^2 = \sum_{j=1}^{M} \left[P_{ij} \left(R_{ij} - \bar{R}_i \right)^2 \right]$$

Where: σ_i^2– variance of asset i; P_{ij} – probability of outcome j for asset i; R_{ij}– return of asset i in outcome j; $\bar{R}_i$– expected return of asset i.

Additionally, the variance for a portfolio consisting of several assets and thus combining the different risk and return properties can be written as:

$$\sigma_P^2 = \sum_{j=1}^{N} \left(X_j^2 \sigma_j^2 \right) + \sum_{j=1}^{N} \sum_{\substack{k=1 \\ k \neq j}}^{N} \left(X_j X_k \sigma_{jk} \right)$$

Where: σ_P^2– variance of portfolio; X_j– fraction of funds invested in asset j; σ_j^2– variance of asset j; σ_{jk}– covariance between assets j and k.

Elton et al. (2011) mention that occasionally it is more convenient to employ an alternative measure of risk called standard deviation σ_i. Standard deviation is equal to square root of variance.

The efficient frontier and risk-free rate leads to the next question – how can investors decide between all these levels of risk and returns? It depends on the investor individual preference or utility functions. A key factor in the utility functions is risk aversion.

Elton et al. (2011) write that there are many ways how the utility functions can be expressed. However most of them belong to just a few groups of models – risk tolerance functions, safety first approach (with popular criterions as Roy's, Kataoka's and Telser's criterion) and value at risk (VaR).

The group in which the role of equity premium can be observed most easily is the group of "risk tolerance functions". In these models the portfolio problem is expressed as a choice between average return and standard deviation of it, investors want to maximize the following function:

$$f_i = \overline{\mathrm{R}}_i - \frac{\sigma_i^2}{\mathrm{T}}$$

Where: T - risk tolerance. T shows investor's trade-off between expected return and its variance. More risk-tolerant investors have higher T, while more risk-averse investors have a low value of T.

This is the moment where the equity premium steps in – since stocks are generally more risky than bonds (and especially risk-free bonds) and the variance of their returns σ^2 is higher, there has to be a return premium in form of a higher $\overline{\mathrm{R}}$ that rewards investors for taking up the risk of investing in equities. The expected equity premium of the market (and consequently also the current stock prices) is determined by the weighted average of each investor's individual expectations (based on the individual's utility function) and the weights are determined by the amount of funds the investor is willing to invest.

As Damodaran (2002) points out, despite different assumptions behind the models, the expected return on any investment can be written in the same way for three of the most popular return model types – capital asset pricing model (CAPM), arbitrage pricing model (APM) and multifactor models:

$$\mathrm{E(R)} = \mathrm{R_f} + \sum_{\mathrm{j=1}}^{\mathrm{j=k}} \beta_\mathrm{j}\,(\mathrm{RP_j})$$

Where: E(R) is the expected return; R_f is the risk-free rate; β_j is the Beta of investment relative to factor j; RP_j is the Risk premium for factor j.

One of the RP_j is the equity premium accounting for higher risk of equities as financial instruments. This thesis will focus on equity risk premium from the perspective of CAPM, since it still seems to be the most popular return model. In the case of CAPM there is only one factor and since the author is considering the equity risk premium of the whole market, the value of β_j is equal to 1.

According to Damodaran (2002), usually the yields from government securities are used as a substitute for the risk-free rate, however there is also some room for discussion as it is possible to use short-term treasury bills or long term treasury bonds. But there is a rule of thumb - the time of maturity for the security used should be consistent with the time period for which the equity risk premium is being estimated (Siegel (2005), Damodaran (2011)). Also it is important to consider that the default possibility of some countries is not so close to zero and the bonds emitted by these countries cannot be directly used to obtain risk-free rate since they also have an additional default premium.

2.2 Equity Risk Premium Puzzle

As it was already mentioned in the introduction, equity premium puzzle is a term that is quite frequently mentioned in connection with the equity premium. This term was forged in the famous paper by Mehra and Prescott (1985) in which they concluded that the historical equity premium in the U.S. market over the period 1889-1978 was 6.18% (with a standard error of 1.76%). According to them, this value is too high as no microeconomic model or utility function with reasonable parameter values requires individuals to demand such a high risk premium on equity. This value of the equity premium implies an unrealistically high risk aversion among individuals. Mehra (2003) emphasizes that it is a quantitative puzzle since in quantitative terms theory provides substantially different values for the equity premium than those that have been historically observed.

Mehra and Prescott (1985) considered that by using realistic values in the utility models the equity premium should be around 1% instead of 6%. They mention a possibility that the mystery might not be the high equity return but the low risk-free rate (in the period they investigated, the average real return on riskless security was 0.8%, for some decades it was negative). Kurz, Jin and Motolese (2005) also mention that one of the reasons behind the equity premium puzzle might be the low risk-free rate. However it is not generally accepted as the reason behind the premium puzzle.

Mehra (2003) writes that one of the reasons why the puzzle cannot be solved is because most of the economic theory is based on the same class models which fail to predict equity premium values that would be similar to their actual values. The failure of financial and economic model paradigms puts the whole class of models under a question mark.

Many other authors have tried to find solutions to this problem and even after more than 25 years this puzzle is still quite a pending matter. Elton et al. (2011) write that all the solutions to equity premium puzzle that have been presented until the present day can be separated in 2 classes: empirical solutions and theoretical solutions.

2.2.1 Empirical solutions to the puzzle

The empirical approach questions the methods of the equity risk premium estimation. Most frequently the historical premium estimates are criticized based on the argument that investor beliefs and attitude towards stocks have changed over time and at the start of the 20th century investing in stocks was perceived as a more risky action than it is now (Elton et al. (2011)).

Another argument according to Elton et al. (2011) and Damodaran (2011) is that investors might have sensibly predicted several market crashes which in the end did not occur, but the lack of signs of these crashes in past data does not mean that they could not have happened. The volatility that can be observed in the equity market does not adequately represent the potential volatility in case of disasters that might significantly reduce consumption and wealth. One of the most notable papers that presents a model of this type is Rietz (1988) in which the model provides equity premium values around 6% - 6.5% after implementing a probability of a huge economic crash between 0.0001 and 0.001. Nevertheless, Mehra (2003) dismisses this model as a possible solution by arguing that during the cold war the possibility of an atomic war would have represented the possibility of a huge disaster. However the real interest rates did not increase during the Cuban crisis when the probability of an atomic war was the highest, thus Mehra believes that this model does not represent reality and does not provide a solution to the equity premium puzzle.

Another argument is that the U.S. market cannot be regarded as a representative market. Looking over the 20th century it is clear that in general it has been a highly successful market, it is affected by survivorship bias and estimates based just on data from this market probably are biased upwards (Damodaran (2011), Elton et al. (2011)). However it is unlikely that his factor alone could have caused the equity premium puzzle. A more in-depth view of survivorship bias is presented in section 2.3.1 Some papers have also found similar equity premium values in other countries (e.g. Salomons and Grootveld (2003), Shackman (2006), Dimson et al. (2008)).

Another factor that might make the historical equity premium appear higher is the decrease in marginal tax rates after World War 2 (Mehra (2003), Damodaran (2011)). Yet this factor alone is not strong enough to account for the premium puzzle alone by itself. Mehra (2003) looks closely at a model created by McGrattan and Prescott which attempts to determine the effect of changing taxes on equity premium. The model shows that in years after World War 2 the equity premium could have been around 8% due to decreasing taxes and in future assuming no changes in tax-rates, the equity premium should be around 4%.

A notable paper about equity risk premium estimations done by Fama and French (2002) concludes that the average equity premium from 1872 to 2000, based on S&P 500 index is 5.57%. However by using an alternative dividend growth model method they estimate that the expected real annual equity premium from 1872 to 2000 was 3.54%. They consider that to be a more realistic result. Equity premium estimated with this approach is similar to the historical equity risk premium for period from 1872 to 1950. Nevertheless for period from 1951 to 2000 this approach estimates a 2.55% equity risk premium while the historical average annual excess return was 7.43%.This result suggests that equity premium has decreased after 1950 and data before this point in time should not be used.

Arnott and Bernstein (2002) also focus on estimating the forward-looking risk premium instead of using the historical excess returns. Their results show that in the past 200 years the equity risk premium has rarely been above 5% and had an average value of 2.4%. They insist that the value of 2.4% should be considered to be a "normal" equity premium instead of the popular value of 5% or even higher. The use of a higher equity premium value is caused by a good stock performance in the previous decades which was caused by non-recurring events and no one should expect the streak of high excess returns to continue.

Fama and French (2002) argue that fundamental methods are more precise than the historical averages and one should not rely on the latter equity premium estimation method. The standard error of this estimate is more than 2 times smaller. Also in their paper they consider that the changing premium helps to keep aggregate risk aversion measured by the Sharpe ratio constant. At the same time the Sharpe ratio for historical average stock returns is almost twice as high for period from 1951 to 2000, compared to the 50 years before. Fama and French (2002) point out that the fundamental estimations fit in with the valuation theory and the model connects with other fundamentals in the way how it is predicted by valuation theory. The average stock return for the years from 1951 to 2000 exceeds average income return on book equity and that would imply that investment during the period was unprofitable on average. But a decrease of expected equity premium results in a growth in stock price and would help to explain some movements in the market.

Another step forward is done by Donaldson, Kamstra and Kramer (2010) who create a complex system of consistent conditional models for estimating the equity premium. They use financial statistics as the growth rate of dividends, interest rates, Sharpe ratios, price – dividend ratios, volatilities and excess returns. Using their approach they estimate that equity risk premium in USA is between 3% and 4%. The standard deviation of their estimate is much lower than that of any other approaches. It is worth noting that they conclude that most likely equity premium is conditionally varying.

Most of the empirical solutions that have been provided managed to get halfway between the equity premium estimated by Mehra and Prescott (1985) and the equity premium values provided by the asset pricing models, therefore these solutions are not sufficient to fully solve the equity risk premium puzzle.

Another viewpoint is that equity premium puzzle no longer is a problem since the equity premium has disappeared. Mehra (2003) points out that for a very short period of time the ex-ante equity premium can be close to zero, however in long investment horizons it has to revert back to its mean. Hence arguments that at the moment there is no equity premium cannot be used for arguing that equity premium or the puzzle no longer exists.

2.2.2 Theoretical solutions to the puzzle

Elton et al. (2011) write that the possible theoretical solutions to the equity premium puzzle mostly have been in the form of development of more sophisticated models of investor utility functions and the way how they perceive risk.

One subset of the theoretical solutions is based on the statement that investors are very averse to drops in their wealth, even if it has recently increased. This behavior is called "habit-formation" or "ratcheting of consumption" (Elton et al. (2011), Siegel (2005)). Therefore the investor will always be extremely averse to a drop in his wealth or to a drop in his wealth level relatively to the wealth of the rest of the society, regardless of the actual level of his current wealth. However these types of models still are flawed and fail to precisely explain the average level of stock market participation. They usually overstate the stock market participation levels among young people (Elton et al. (2011)).

Damodaran (2011) states that models which are assuming the risk aversion to varying consumption over time to be much higher than the aversion to consumption variations at a specific point of time are also quite popular. He also mentions the idea that individuals perceive more risk in equities because they receive updates on equity values so frequently that they get confused by the intensive flow of information. Elton et al. (2011) write that this factor can be described as a part of investor irrationality or inconsistency – they might be too focused on short-term market performances and worried about suffering losses over a year or other short period of time, instead of worrying only about potential losses over long term e.g. 15 years. Focusing on short term performance might make the equity volatility appear higher than it is in the long run, so investors would demand higher equity premium. And considering this higher premium in relation to long term stock returns would consequently lead to unrealistically high estimates of investor risk aversion.

Another shortcoming of current models is mentioned by Kurz et al. (2005) - utility models might not properly assess the volatility of individual consumption levels since in reality it should be higher than the volatility of aggregate consumption level.

Campbell and Cochrane (1999) create a model which changes the perspective on equity risk premium – according to it investors are not afraid of the higher risk attached to stocks, they are afraid of the poor performance of stocks in times of recessions when investor consumption also drops significantly. Their model manages to match the historically observed equity premium values, nevertheless it fails on some other fronts and is not considered as solution to the equity premium puzzle.

Guvenen (2009) is another one of the few examples who manage to come up with an asset pricing model that estimates equity premium values that are similar to the ones observed in historical data. He does so by implementing two key properties of the model – restricted participation in the equity market and heterogeneity in the elasticity of intertemporal substitution in consumption. He notices that even though he uses a different approach, his model has a lot similar with the model created by Campbell and Cochrane (1999). Guvenen (2009) presents a model which produces an equity premium of 5.45% with a volatility of 21.9%. Both of these values are comparable to historical data and are a huge step forward towards solving equity premium puzzle. Nevertheless he points out that the model has its shortcomings, namely it is abstracting from long-run growth as that would crucially complicate the already complex model. Doing that is left as a goal for further research. The model also overstates the volatility of consumption and understates the volatility of investment.

It is evident the search for equity premium puzzle solutions has widened the research and inspired researchers to consider new perspectives. However a model of investor utility that would work reasonably well with the actual observed excess return of stocks over bonds still has not been created. Elton et al. (2011) conclude that before the divergence between data and theory is better understood, utility analysis should be used with caution as we lack understanding about the real level of aggregate investor risk aversion.

2.3 Estimating equity premium

To fulfill the purpose of this paper, it is necessary to examine literature and previous research devoted to the estimation of equity premium. According to Damodaran (2011) there are three broad approaches for estimating the equity risk premium. The most popular one is calculating a historical equity premium. It is also possible to estimate implied equity premium (which is sometimes called supply-side approach, e.g. see Goetzmann and Ibbotson (2006)). And the last approach is to survey investors and obtain a "survey" equity premium. Goetzmann and Ibbotson (2006) also mention a fourth possibility - the "demand approach" – obtaining equity risk premium from investor utility models. However, as it was discussed in previous section, fully reliable models of this type have not been created. Additionally it is complicated to extract the equity premium from these models, so this approach is not convenient for practical use. This thesis will focus on historical equity premium approach since it is the most popular approach. Also the simplest versions of implied equity premium estimation will be considered to later obtain an alternative benchmark result which would be more representative of the actual expected equity premiums in the market since historical equity premium estimations are backwards-looking.

2.3.1 Historical equity premium

First and most popular approach is the estimation of historical premiums using past data. The actual returns earned on stocks over a long time period are estimated and then they are compared to the returns earned on a default-free asset, usually a government security.

Historical equity premium estimations can significantly differ between each other. Before comparing different estimations, one has to consider several factors about them. Derrig and Orr (2003) point out seven factors:

1. Geometric or arithmetic averaging;

2. Short or long investment horizon. Based on Ibbotson yearbook definitions, short-horizon expected equity risk premium is the return of the stock market over 1 month Treasury bills, intermediate-horizon expected equity risk premium is the return of the stock market over 5 year government bonds and long-term horizon equity risk premium is the excess return of stocks over 20 year government bonds.
3. Short-run or long-run expectations. Whether the goal is to estimate the current equity risk premium or the future equity risk premium, e.g. for next 10 years.
4. Unconditional or conditional on some related variable. Conditional estimates usually are short-term forecasts.
5. USA or international market data.
6. Data sources and periods.
7. Real or nominal returns. Although this should not be an issue as long as the equity returns and risk-free asset returns are calculated in the same terms. McCulloch and Leonova (2005) mention that usually the equity premiums calculated using real returns are usually biased downwards by about thirty basis points.

Regarding the first point - geometric averaging usually results in lower equity risk premium estimation than arithmetic averaging, especially if the stock market has had significantly negative returns in some years of the data set. Damodaran (2011) writes that many estimation services and academics support the use of arithmetic average. That would be the best method if annual stock returns were uncorrelated over time. Although some researchers believe that there is long-term negative autocorrelation in equity returns (Damodaran (2011), Campbell and Cochrane (1999)). Therefore the arithmetic average return might overstate the equity risk premium.

Indro and Lee (1997) make a comprehensive comparison between the two methods and also consider a weighted average and an overlapping average that has been suggested by Blume. They conclude that both arithmetic and geometric averages are biased (in long-run the arithmetic average is upwards biased while the geometric average is downwards-biased) and the bias increases with the length of the investment horizons. Same conclusion is made by Jacquier, Kane, and Marcus (2003). Indro and Lee (1997) suggest that the weighted average of arithmetic and geometric averages contains the least bias.

Perhaps the most crucial question regarding historical estimates is about the time period which should be included in the estimation. Due to high stock price volatility the standard error of risk premium estimates is also high. Damodaran (2011) points out that for estimation on U.S. data over a period of 10 years the standard error would be 6.32% but over 80 years it would be "only" 2.23%. So from this perspective the longer the time period, the more precise is the estimate. Therefore there have been some attempts to estimate equity risk premium using data that goes back even to the start of the 19th century (see Goetzmann, Ibbotson and Peng (2001), Siegel (2005)).

The most popular database used for equity premium estimates (according to Damodaran (2011)) is compiled by Ibbotson Associates and published every year in Ibbotson yearbook[1], it is based on data starting from 1926 which is considered to be the starting point of reliable data. Goetzmann and Ibbotson (2006) point out that the whole data set can be used only under the assumption of a stationary equity premium. Gregoriou and Pascalau (2010) also write that a lot of researchers use Ibbotson Associates data from 1926 for estimating equity premium, but at the same time many others use different time periods like 10, 20 or 50 years. Those who use shorter periods believe that average risk aversion of in-

[1] More detailed information about the yearbook can be found on Morningstar website: http://corporate.morningstar.com/ib/asp/subject.aspx?xmlfile=1414.xml

vestors is changing over time. However the cost for using shorter periods is a higher standard deviation. But on the other hand - as economic and financial environment is changing, it seems logical to assume that investor preferences are also changing and the equity risk premium is varying over time. This belief is shared in Chan, Karolyi and Stulz (1992), Brown and Otsuki (1993), Campbell and Cochrane (1999), O'Hanlon and Steele (2000), Arnott and Bernstein (2002), Fama and French (2002), Graham and Harvey (2005, 2012), Lettau, Ludvigson and Wachter (2008), Gameiro (2008) and Donaldson et al. (2010).

Lettau et al. (2008) emphasize that a decrease in equity premium can help to explain the increase in stock prices over the last decades – the future returns are expected to be lower. And lower expectations from the market as a whole lead to an increase in the stock prices.

Donaldson et al. (2010) insist that only models who accept the possibility of time variation, structural breaks and time trends are able to reasonably predict the equity premium. Also Goetzmann and Ibbotson (2006) raise the issue of a changing equity premium, they observe that current price-earnings ratio is much higher than it has been in past and one of the reasons might be a much lower expected equity premium. The other two possibilities are that prices are unreasonably high or that investors are expecting a higher growth of company earnings per share than it has been in past. In a separate section Ibbotson expresses his belief in the last possibility which is why he still believes in long-term full sample historical equity premium estimates.

Salomons and Grootveld (2003) test for possible structural breaks in equity premium but find no signs of them. On the contrary, Kim, Morley and Nelson (2005) conclude that the equity risk premium is stable but sometimes can have structural breaks.

Interestingly, Graham and Harvey (2005) consider the possibility that past excess returns do not affect future equity premium, although they admit that their data set is too small to make a final judgment.

Even though the results and opinions differ, an increasing amount of empirical works suggest that the equity premium is dynamic and varies over time. Hence it would be wrong to use a long period of historical data to estimate the current equity premium. Goetzmann and Ibbotson (2006) warn that historical data always matters but only if it is properly used and correctly interpreted.

One should also avoid narrowing the dataset set too much. Dimson et al. (2008) point out that year-to-year excess return is very broad and it would be wrong to call them risk premiums. Looking over the last 100 years, it is clear that no one could have expected negative premiums in some years or a premium of 57% in 1933, those are simply excess returns of each year. Arnott and Bernstein (2002) mention that the observed excess return and the prospective risk premium are frequently mixed up since both of them are called risk premiums.

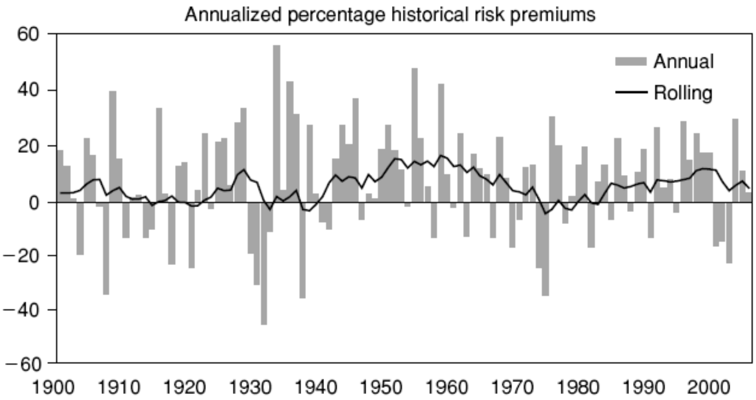

Figure 2.2 Annual and rolling 10-year U.S. equity premiums, 1900-2005.

Source: Dimson et al. (2008)

Figure 2.2. shows the results of calculating a rolling 10 year average premium, which has the potential to capture changes in equity premium over time at the cost of higher standard deviation. It can be seen that a 10 year period for a rolling estimate might not be enough since for some years it still produces negative equity premium estimates which obviously is not a realistic and valid result. Hence one has to consider slightly increasing the time period, because it seems that in times of great volatility 10 years is not a sufficient period to estimate a sensible equity premium. Also this approach increases the weights for some years in the middle of the period so it is also far from being a perfect method.

One also has to be careful with the choice of equity market index when using the historical approach as the index should be market-weighted and it should include as much stocks as possible (Damodaran (2011). Optimally the index should also include stocks that have not survived the whole considered period to avoid survivorship bias. That is a problem in most cases, however the scale of this problem is not clear. Elton et al. (2011), Damodaran (2011), Goetzmann and Ibbotson (2006), Siegel (2005) and many others mention that this factor creates a highly significant upwards bias on equity premium estimations. However in Dimson et al. (2008) it is estimated that the net impact of survivorship bias on the world-wide geometric and/or arithmetic mean equity premium is not more than 0.1%.

Regarding the use of U.S. and international data - according to Elton et al. (2011) and also Goetzmann and Ibbotson (2006) the U.S. market was unexpectedly successful in the last century. USA economy grew impressively and its stock market became the dominant stock market in the world by the late 20th century. These facts alone would suggest that data from U.S. stock market is not a representative sample to measure stock market performance or to measure the equity premium. Jorion and Goetzmann (1999) show that when they analyze equity returns in 39 countries for 1921 to 1996 and find out that while U.S. equities had 4.3% real capital appreciation while the median return of other countries was only 0.8%. So it is important to also look at other markets and not just USA. Shackman (2006) points out that Jorion and Goetzmann research severely lacks in several areas as it does not include dividends and international interest rates. It only calculates the excess return from an American investor perspective. By using data for period from 1970 to 2000, Shackman finds out that USA stock market did not have an unusually high average excess return over this period and excelled with relatively low market volatility. Salomons and Grootveld (2003) also find out that for the period 1988-2001 U.S. equity premium is higher than the world average equity premium (3.7% vs. 1.8%), but it is considerably lower than the average equity premium of emerging markets, which they estimated to be 12.7%.

When comparing the equity premium for markets in different countries, the issue of the existence of a country risk premium should also be raised. Damodaran (2011) explains that if there would be no correlation between the returns in different countries, then the country specific risk could be diversified by a global investor. However empirical research shows that there is a correlation across markets in different countries and in fact it has increased over time and increases in periods of high volatility. That means that not all of the country specific risk can be diversified and it has to be estimated to obtain the equity risk premium for countries that have a significant country risk premium. There are at least three ways to do it – using default spreads on sovereign bond or CDS, using relative equity market standard deviations or using default spread of a bond and relative standard deviation for equity (deviation of equity price against deviation of bond price). Although this mainly is an important issue when comparing developed markets against emerging markets.

2.3.2 Implied equity premiums

The problem with historical equity premium estimations is that these estimates are lagging behind the actual changes in the premium. In case of sudden changes in investor expectations they can provide inaccurate equity premium values. Therefore it is crucial to consider other premium estimation methods to at least get a benchmark whether the historical estimations are credible or whether they do not accurately represent the current situation in the market.

It is possible to obtain an up-to date and current estimation of equity risk premium using what Goetzmann and Ibbotson (2006) refer to as the supply side approach. All of the asset prices represent the expected cash flows from the assets and the required return from them. For example, as shown in Damodaran (2002), the Gordon growth model states that:

$$E_0 = \frac{Div_1}{k_e - g_t}$$

Where: E_0 – current value of equity; Div_1 – expected dividends in next period; K_e – required rate of return for equity investors; g – growth rate in dividends forever.

If the stable growth scenario is assumed then the expected growth rate should be equal to the risk-free rate, therefore the dividend yield on equities would become a measure of the equity risk premium.

$$\frac{Div_1}{E_0} = \text{Dividend Yield} = \text{Equity Risk Premium}$$

Rozeff (1984) writes that this is rule is called "The Golden Rule of Accumulation" – if economy maximizes consumption per capita, the rate of growth of output equals the physical marginal productivity of capital, which in turn equals the rate of interest, hence the real dividend growth approximately equals the real rate of interest. Rozeff (1984) also concludes that this method of using dividend yield as an estimate for equity risk premium is unbiased and has a significant edge over the historical risk premium estimates.

Also Fama and French (2002) argue in favor of calculating equity premiums using this supply-side approach. They write that investor expectations can be judged very well by using fundamental variables (dividends and earnings) to estimate expected stock return. The approaches that they use are based on the statement that average stock return is the average dividend yield plus the average rate of capital gain. Assuming that the dividend-price ratio is stationary (mean reverting) means that in samples which include long time periods the compound rate of the dividend growth approaches the compound rate of capital gain. This leads to the dividend growth model (Fama and French (2002)):

$$A(RD_t) = A\left(\frac{D_t}{P_{t-1}}\right) + A(GD_t),$$

Where: A() – average value; RD_t – stock returns at period t ; D_t – dividend at year t; P_{t-1} – price at the end of year t-1; GD_t is the growth rate of dividends.

This is practically the same model that is put forward by Damodaran (2002) and can be used to obtain the equity premium by subtracting the risk-free rate from the stock returns.

However it is worth emphasizing a point that was made in Fama and French (2002) – this approach only works as a long-term approach. According to Campbell and Cochrane (1999), in short term correlation between dividend growth and consumption growth (and thus the growth of the whole economy) can be as low as 0.05, but in long term it should be 1.0. Also Kurz et al. (2005) confirm that dividend yields have some predicting power on stock returns and the power increases on longer time horizons. Damodaran (2002) writes that after reaching stable growth stage all the variables are expected to grow at the same rate in perpetuity, which makes the estimation using this model easier. But this means that the model can be reasonably well used only in mature markets that are close to stable growth status while the use of it emerging and developing markets is much more complicated. McCulloch and Leonova (2005) write that while the expected earnings growth is often used as proxy for expected dividend growth, it is possible to manipulate the dividend growth model by substituting dividends with earnings minus change in equity book value. Mathematically the model is equal to the dividend discount model, expected earnings growth rates fit in the equation directly and not as proxies for expected dividend growth. These types of models are called residual income models.

Fama and French (2002) conclude that unconditional expected annual simple return estimated using the dividend growth model is downwards biased. However the dividend model is better for long-term expected growth of wealth, while the historical method and an alternative earnings growth model are upwards biased.

However there are some researchers who cast doubt on the predictive power of dividend yields. Goetzmann and Jorion (1993) write that regressions that try to estimate stock prices using dividend yields are subject to many unaccounted biases. Due to these biases statistical tests might show non-existent relationships. Goetzmann and Jorion (1995) find some predictability results for some separate periods in historical U.S. and U.K. data but not for the whole data set. They argue that survivorship bias is affecting the tests which consequently show predictive power of dividend yields when in fact there is none. Goyal and Welch (2003) write that dividend yield ratios ability to estimate equity premium is a mirage and had some efficiency only before the 1990s, but since then it has performed just as well or even worse than the historical equity premium estimate. According to them at the beginning of the 21st century the dividend yield values are only capable of predicting their own values in the next period. But they mention that for period that are greater than about 5 to 10 years the accounting identity that dividend yields have to predict long-run dividend growth of market returns begin to dominate and dividend yields start to have some power to predict equity risk premiums.

Damodaran (2002, 2011) and Fama and French (2002) point out that under the assumption of a constant earnings-price ratio and a stable future growth, the previously described approach can be altered to focus on company earnings instead of dividends, using the equation of sustainable growth and substituting it in the dividend growth model, the implied equity premium can be written as:

$$\text{IERP} = \frac{E}{P} - \text{R}_f$$

Where: IERP – implied equity premium; E – expected earnings in next period, P – value of equity; R_f – risk-free rate.

Models considered in this section can also be extended to include several stages of growth and not just an immediate stable growth period.

The dangers of these methods are that at any time period markets might be mispriced. It is possible to obtain current implied equity premiums, but that does not mean that these premiums are long-term equilibrium premiums (Goetzmann and Ibbotson (2006)).

2.4 Determinants of equity risk premium

To fulfill the purpose of this paper of examining the characteristics and traits of the process behind equity premium it is indispensable to briefly consider the factors that are determining the equity risk premium.

As it was described in the background section, the main determinants of equity risk premium are the additional risk beared by equity market and the utility functions of investors or more specifically – investor risk aversion. Damodaran (2011) mentions that investor risk aversion is usually associated with the age of investors – with age comes higher risk aversion since there are less possibilities for the investor to gain wealth from his working capacity.

Since risk aversion is an important factor, so should be the risk status of the market, since volatility of the stock market is not constant all the time. Kim, Morley and Nelson (2004), Graham and Harvey (2012), Shackman (2006) confirm that there indeed is an empirically observable and substantially positive relationship between volatility of the equity market and equity risk premium. However as straightforward as it sounds, there are some academics who question this relationship. Scruggs and Glabadanidis (2003) write that this relationship is not as clear as it might seem since some research done by economists has also shown it to be insignificant. Scruggs and Glabadanidis (2003) even go as far as suggesting that this might be another puzzle connected to the equity premium.

Another point of view is that the equity premium is not only affected by the risk of equity market itself but also by the volatility of the whole economy. Lettau et al. (2008) write that there is a strong connection between equity risk premium and macroeconomic risk (Damodaran (2011) also mentions this relationship). According to them, macroeconomic risk has noticeably decreased in the last decades. That has also resulted in the decrease of equity premium. The paper was written before the last global financial crisis and as Graham and Harvey (2012) point out, due to the crisis and the decreased stability the equity premium has again increased. That is consistent with Campbell and Cochrane (1999), Scruggs and Glabadanidis (2003), Salomons and Grootveld (2003), Graham and Harvey (2012), Arnott and Bernstein (2002), Guvenen (2009) who write that risk premium is affected by the business cycle. At business cycle peaks the equity premium is lower while at troughs it is higher.

According to Damodaran (2011) some more equity premium determining factors include the availability of information, liquidity of equity market and also irrational behavior of some investors (mismatching inflation and growth rates, viewing the risk of each investment separately rather than looking at it from the portfolio perspective and other aspects of ”mental accounting” etc.). Siegel (2005) also mentions investor ignorance and the fact that older investors are more risk averse because of more limited marketable labor skills so they are worried about maintaining their consumption level.

Kurz et al. (2005) suggest that equity premium is mainly determined by the structure of agent expectations which they call “market state of belief”. Agents either expect the stock returns in next period to be above historical returns, same as historical returns or lower than historical returns.

Chan et al. (1992) also consider the possibility that equity risk premiums are not determined only by domestic factors but also by international factors. After analyzing excess returns of the period from 1978 to 1989 they conclude that U.S. equity premium is affected by international markets (mostly the relationships are observed between the U.S. and Japan’s market and to a lesser degree to other developed country markets). According to them the expected U.S. equity premium is positively related to the covariance of U.S. equity returns to foreign equity returns.

Brown and Otsuki (1993) also consider the idea of a global effect on equity premium of specific countries. They explore some developed markets and the Pacific-Basin markets and conclude that there are global risk factors that affect equity returns all over the world. They observe that Pacific-Basin markets, especially Japanese market, seemed to be more exposed to these global factors and changes in exchange rates than, for example, the U.S. market.

Gameiro (2008) confirms the influence of international factors by finding out that equity premium across major international markets are highly correlated, probably due to a common global influence. Nevertheless a significant part of the equity premiums are country specific.

2.5 Global relations of equity premiums

Finally, before starting the empirical analysis it is necessary to look at the factors that cause the equity premiums to be internationally related from the perspective of financial valuation. The issue of varying equity premiums over countries was touched in 2.4.1. This is also an important factor that needs to be examined to understand changes in equity premium values. In times of increasing cross-border financial flows the equity premium in different countries should be related, otherwise some markets might constantly be more appealing to a fraction of investors than others. Financial valuation theory helps to understand why there should be some direct connections between risk premiums in different countries, not only through common global factors (especially between mature equity markets with a similar degree of risk).

At first it is possible to consider the formula that was first presented in section 2.3.2., which is also known as Gordon Growth Model:

$$E_0 = \frac{Div_1}{k_e - g_t}$$

Where: E_0 – current value of equity; Div_1 – expected dividends in next period; K_e – required rate of return for equity investors; g – growth rate in dividends forever.

As it can be seen, the two variables that positively affect the value of equity are expected dividends in next period and the expected growth rate of the company(assuming that it has entered a stable growth period). While the estimation of these variables is complicated, the idea behind them is quite clear. And the only variable that is negatively affecting the value of equity is the main divisor – required return of equity. There are many different models designated to estimating returns, however as it was already mentioned in the background section, for capital asset pricing model, arbitrage pricing model and multifactor models the formula can be written like this:

$$E(R) = R_f + \sum_{j=1}^{j=k} \beta_j (RP_j)$$

Where: E(R) = expected return; R_f= risk-free rate; β_j = Beta of investment relative to factor j; RP_j = Risk premium for factor j.

Since the equity premium is included in the as one of the risk premiums in the formula and beta for it should be positive (but not necessarily equal to 1 if individual companies are considered), it can be concluded that as long as equity premium is positive, it increases the expected or required return on equity. Hence there is a negative correlation between the equity premium and the value of equity – as equity premium increases, the value of equity decreases and vice versa.

According the Damodaran (2002), two more equity valuation methods are frequently used in valuation – free cash flow to equity (FCFE) and free cash flow to firm (FCFF). And the effect of equity premium on the equity value is the same in both of these approaches as well.

The equity valuation formula using FCFF approach is as follows:

$$E_0 = \frac{FCFF_1}{(r_{WACC} - g_n)} + C_0 - D_0$$

Where: E_0 –current value of equity; $FCFF_1$ = Expected free cash flow to firm next year; r_{WACC} –cost of capital; g_n – growth rate in the FCFF forever; C_0 – value of firm's current cash and marketable securities; D_0 – value of firm's current debt.

The relevant parameter here is r_{WACC}, it can be calculated as follows:

$$r_{WACC} = \frac{E}{(D + E + PS)} k_e + \frac{PS}{(D + E + PS)} k_{ps} + \frac{D}{(D + E + PS)} k_d (1 - T_c)$$

Where: E – market value of equity; PS – market value of preferred stock; D – market value of debt; T_c – corporate tax rate that is applied to the company; K_e–cost of equity; K_{ps}–cost of preferred stocks; K_d –cost of debt.

And cost of equity is essentially the required rate of return on equity which was already considered in Gordon's growth model and is partially determined by the equity premium. So as the equity premium increases, the cost of equity increases, consequently the cost of capital increases and that results in a decrease of current equity value.

The case of free cash flow to equity model is similar:

$$E_0 = \frac{FCFE_1}{k_e - g_n}$$

Where: E_0 –current value of equity; $FCFE_1$ = Expected free cash flow to equity next year; k_e – cost of equity; g_n – growth rate in the FCFE forever.

Therefore it is evident that according to FCFE, as the value of equity premium goes up, it increases the cost of equity and decreases the value of equity. The price of a single stock is equal to the value of company's equity divided by the number of stocks.

Looking at all 3 of these models it is possible to understand the effect that equity premium in different countries has on stock prices. The effect is always the same, it drives the stock prices down. Now let us consider two different countries and assume that country A has a higher equity premium than country B. If all other factors are the same for both countries, country A would consequently have lower stock prices than country B. Of two identical companies with the same future prospects, the one quoted in equity market of country A would be lower. A lower equity premium in country B means that investors in this country require lower returns from stocks than investors in country A. If the financial flows between both countries are not strictly restricted, this means that investors from country B are better off by buying stocks in the market of country A, since from their perspective the stocks are undervalued and they would be ready to pay for them more than the current market price. When investors from country B would become a significant share in equity market of country A, the expected equity premium in country A would decrease as a result of the newly entered investor lower expectations. What would happen further depends on many factors, nevertheless by considering such a situation it is logically clear that the equity premiums are globally related.

Obviously there are numerous other factors that have to be considered since by investing abroad an investor might be facing some fractions of additional risk, especially if the foreign market operates using a different currency because changing exchange rates can quickly transform the situation. Therefore the equity premiums in different countries are not always in a perfect equilibrium. Only a fraction of all investors which consists of investors who have a slightly lower degree of risk-aversion are tempted by the opportunities presented by different premium levels in different countries. That is why the adjustments of equity premiums (that are not affected by jointly shared global determinants but by domestic factors in one of the countries) between countries might be of a low magnitude.

3 Empirical Analysis

3.1 Data

This thesis focuses on mature equity markets which should have no extra risk premiums additionally to the equity premium, therefore 5 countries were chosen for the analysis: France, Germany, Sweden, United Kingdom and United States of America.

Equity returns for the period 1970-2012 were calculated using country level net equity indexes provided by Morgan Stanley Capital International (MSCI). MSCI indices are market-weighted, just like it is necessary, as it was mentioned it 2.4.1. Also the MSCI net indexes include dividend reinvestment after tax payments, so they are appropriate for measuring equity performance. MSCI indexes are calculated both in local currency and also in United States Dollars, therefore it is possible to calculate equity returns both from domestic investor perspective and from American investor perspective. The only problem is that the main MSCI index series include only Large-cap and middle-cap companies and do not include the stocks of small-cap companies, so they do not cover the whole market which would be the optimal case. That is why the main indices were used only for the period from 1970 to 1994. For later dates the MSCI IMI indexes were used since those also include small-cap company stocks. The MSCI indexes are an approved source for equity returns, they are also used for analysis in Salomons and Grootveld (2003) and Shackman (2006).

As it was previously mentioned, government bond yields are usually used as substitutes for the risk-free rate, however their maturity should be similar to the time horizon of equity premium estimates. Therefore the 10 year government bonds were chosen in an attempt to estimate 10 year forward looking equity premiums. The yields of these bonds were collected from different sources, mainly from each country's central bank websites, but data for some additional earlier years was also obtained from the free economic research website Gecodia and Swedish government bond yields from earlier years were obtained from Waldenström (2007) database which was published by Riksbank.

Other necessary data for panel data analysis was obtained from the International Monetary Fund World Economic Outlook Database April 2012. It includes inflation rates (yearly average consumer price change), unemployment rates and country real GDP growth (calculated from yearly GDP values that are based on purchasing-power-parity) for period 1985-2011. The VIX volatility index values (based on S&P 500) are obtained from Yahoo! Finance database.

3.2 Methodology

All of the calculations in this thesis are done using either MS Excel or EViews 7 software. The equity returns necessary for obtaining excess returns are calculated using the discrete returns approach since only monthly and yearly index values are considered and the changes in the values are very high over some of the periods. Continuous or log-returns are appropriate for small changes and treat decrease in the index values more precisely. Nevertheless for larger scale increases, which are more frequent in equity total return index values, they can be imprecise.

For example, if the index value increases from 100 to 150, the return calculated using discrete return approach is 50% while the approximation using log returns would result in only 40.55% return.

This paper uses the CAPM as the benchmark model, therefore the excess returns used for obtaining the equity premium are calculated simply as:

$$ERP_t = R_{e,t} - R_{f,t}$$

Where: ERP_t – equity risk premium in period t; $R_{e,t}$ – equity return in period t; $R_{f,t}$ – risk-free rate in period t.

The equity premiums for each country are estimated using equity returns in local currency and local risk-free rate since that shows the actual premium of each market more precisely. Nonetheless everything is recalculated in USA dollars and the yields of U.S. bonds are used as substitutes for risk-free rate in order to obtain the premiums for testing the relationships between markets. That way all of the premiums can be viewed from a U.S. investor's perspective and the effect of changing exchange rates is removed. The latter approach is consistent with the approach used by Salomons and Grootveld (2003).

In compliance with method description in 2.3.1 a historical average is calculated from excess returns over the years. In that section it was pointed out that historical estimates calculated by using arithmetic average are upwards biased while the geometric average is downwards biased. Therefore a weighted average of these both approaches is used to minimize this bias factor. Since Morgan Stanley does not reveal how much stocks were included in their index calculations for each year, it is not possible to use the weighted average put forward by Indro and Lee (1997). An alternative weighting approach is suggested by Jacquier et al. (2003) in which the weight for geometric average is equal to the ratio of the forward looking horizon of the estimate and sample estimation period. Therefore the weighted average is calculated like this:

$$E_w = (1 - \frac{H}{N})E_A + \frac{H}{N}E_G$$

Where: N-number of periods in sample; H– forward looking horizon; E_w – weighted average equity premium; E_A – arithmetic average equity premium; E_G – geometric average equity premium.

Expected equity risk premium is expected to follow business cycle (Campbell and Cochrane (1999), Scruggs and Glabadanidis (2003), Salomons and Grootveld (2003), Graham and Harvey (2012), Arnott and Bernstein (2002)). However the historical excess returns used for obtaining the premium will obviously drop during crisis while the expected equity premium should in fact increase, thus in order for historical estimates to properly work as equity premium estimators, they should cover the full length of shorter business cycles. According to Dimson et al. (2008) a 10 year historical period is not enough to properly estimate equity premium. Therefore several slightly longer periods are tested – a historical estimation period of 15, 20 and 25 years. Since such rolling periods are shorter than the dataset (which is full 42 years), it is possible to conduct out-of-sample testing. Rolling estimate performance and also the performance of a historical estimation which uses the full sample of data are compared to determine which period provides the best equity premium estimates. Three measures are used in out-of-sample testing: Mean squared error, mean absolute error and mean error.

$$MSE = \frac{1}{N}\sum_{t=1}^{N}(y_{t+s} - f_{t+s})^2$$

$$MAE = \frac{1}{N}\sum_{t=1}^{N}|y_{t+s} - f_{t+s}|$$

$$MSD = \frac{1}{N}\sum_{t=1}^{N}(y_{t+s} - f_{t+s})$$

where MSE – mean squared error; MAE – mean absolute error; MSD – mean error; N – number of observations; y_{t+s} – fitted value respective to out-of-sample observation at time t+s ;f_{t+s} – actual observed value at time t+s.

The results from these 3 measures are combined to determine the optimal historical period for the equity premium estimation. Subsequently the best estimation period is used for obtaining equity premium time series for each of the countries which is then used for further analysis. The nature of the time series is analyzed according to strategies put forward in Elder and Kennedy (2001).

The Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test with Barlett kernel spectral estimation method is for determining whether processes are stationary or non-stationary (and have a unit root). This test is chosen for its convenience since the null hypothesis of it is that the variable is stationary which is the expected result since it should be possible to make reasonable equity premium forecasts. The bandwidth is selected by using the Andrews automatic bandwidth selection since it has proven to be efficient in increasing the power of the Phillips-Perron unit root test[2]. Exogenous variables in the test are chosen according to Elder and Kennedy (2001) strategies.

The Schwarz's information criterion (SIC) is used for determining the optimal lag length in Granger Causality tests and VAR models. It is also known as Bayesian information criterion (SBC). Despite being inefficient, it is chosen for its property to be parsimonious and also to be asymptotically consistent (Gujarati and Porter (2009)) since the number of observations exceeds several hundred in most regressions. When comparing different models and lag lengths, the one with the lowest SIC value is chosen as optimal. The criterion is calculated as follows:

$$SIC = n^{\frac{k}{n}}\frac{RSS}{n}$$

Where: n – number of observations; k – number of regressors; RSS – residual sum of squares.

The relationships between the equity premium series of different countries are also considered. In this analysis section only the equity premium values from American investor perspective are considered. The analysis is done by simply obtaining correlation coefficients between the risk premiums in different countries and also by conducting Granger causality tests and investigating any found causality relationships. Correlation coefficients between the equity premiums in different countries show relations between the premiums however they do not indicate whether the equity premium changes in one of the countries might be directly affecting the changes in other countries or whether they are similarly affected by

[2] More details regarding this matter can be read at http://www.calstatela.edu/faculty/klai/KLPaper/ET_97Oct.pdf

some outside factors. Granger causality test is useful for detecting a possible causality between variables (Gujarati and Porter (2009)). Hence a pair wise Granger causality test is used to determine whether there is any causality between some specific markets.

The equations included in this test are:

$$ERP1_t = \sum_{i=1}^{n} \alpha_i \, ERP\,1_{t-i} + \sum_{j=1}^{n} \beta_j \, ERP\,2_{t-j} + u_{1t}$$

$$ERP2_t = \sum_{i=1}^{n} \alpha_i \, ERP\,2_{t-i} + \sum_{j=1}^{n} \beta_j \, ERP\,1_{t-j} + u_{2t}$$

Where: ERP 1 – equity risk premium in country 1; ERP 2 – equity risk premium in country 2.

Using the F-test this approach determines whether the lagged ERP 2 terms belong in the first equation and whether the lagged ERP 1 terms belong in the second equation. In cases where Granger test shows existing causality a simple model including the lags of the two premiums is estimated to determine the nature of the causality. In cases where a heteroscedasticity or ARCH-effects problem is present, a GARCH(1,1) model is estimated to correct for it. In cases when bidirectional causality is found, the equations that were used in the Granger causality test are estimated using vector autoregressive (VAR) models.

Furthermore, the possibilities to predict changes in equity premium from changes in other variables are assessed using panel data analysis. According to Gujarati and Porter (2009), panel data analysis provides more data which results in more degrees of freedom, higher estimation efficiency and sometimes helps to prevent multicollinearity problems. For this analysis yearly data of obtained equity premiums and several economic variables are considered and the equation estimation can be written as this:

$$ERP_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \varphi_1 ERP_{it-1} + u_{it}$$

Where: i=1,2,3,4,5; t=1,2…26 ; β – factor ; X – variable ; ERP_{it-1} – equity premium value in the previous period.

Obviously time or cross-section fixed constants and coefficients have to be considered and a coefficient can only set to be equal for all cross-sections and time periods if it does not significantly vary over them. The best model will be chosen according to the lowest SIC information criterion value.

Additionally the implied premiums are considered to provide a current estimation of the equity premium for comparison to historical estimates since the latter ones might be lagging behind the actual changes in equity premium. The implied equity premiums are calculated according to the dividend growth models considered in section 2.4.2. However a three stage growth model (in the case of USA - four stage) is used instead of using the simple stable growth model. It is done because a several stage growth model can more accurately describe the current investor expectations of growth. Still the dividend payout ratio is assumed to be constant for simplicity because it is very hard to predict how and if it might change over the next years. Using a two-stage growth model the following formula can be obtained (according to Damodaran (2011)):

$$I_t = \frac{Div_t(1+g_1)}{(1+r)} + \frac{Div_{t+1}(1+g_2)}{(1+r)^2} + \frac{Div_{t+2}(1+g_s)}{(r-g_s)(1+r)^2}$$

Where: I_t – value of stock index at time t; Div – dividends paid out on the index in the respective period; g_1 and g_2 – expected growth rates in stage 1 and stage 2; g_s – expected stable growth rate in perpetuity; r – required return on equity.

Subsequently the "implied" equity risk premium is obtained by subtracting the risk-free rate from the obtained required return on equity value.

3.3 Historical estimation approach

3.3.1 Determining the optimal length of historical sample

At first it is necessary to estimate the effectiveness of rolling estimates and whether they can outperform a full sample historical estimate. It is done using local currencies since the focus at this point is on the estimation of premium and changes in exchange rates can create an additional bias if everything is calculated in USA dollars. The arithmetic average is used for obtaining the out-of sample actual values since there is no forward looking horizon.

Four different historical estimation approaches were assessed – a 15 year rolling average, a 20 year rolling average, a 25 year rolling average and a full sample average. Assessment was done using the mean squared error, mean absolute error and the mean error, data from each country was considered separately, so for each forward looking horizon there are 15 error measure results.

Table 3.1 Accuracy score for out-of-sample testing on data from 1995-2011

Historical period	Perspective		
	1 year	5 years	10 years
15 year rolling	4	2	0
20 year rolling	2	2	0
25 year rolling	3	1	1
Full sample	6	10	14

Source: Own calculations

Table 3.1 shows the number of times that each method was shown to be the most precise one by one of the error measures(for full results see table A.1 in appendix 1). The full sample average outperformed other methods in estimating all perspective equity premiums. However the rolling average methods frequently performed better for estimating a 1 year forward looking premium and among the rolling average methods the 15 year rolling average can be marked as the best. It is evident that the 25 year rolling average does not perform much better than other rolling averages, therefore it can be dropped. That allows the use of data from 5 more years for out-of-sample testing.

Table 3.2 Accuracy score for out-of-sample testing on data from 1990-2011

Historical period	Perspective		
	1 year	5 years	10 years
15 year rolling	1	2	7
20 year rolling	3	7	3
Full sample	11	6	5

Source: Own calculations

According to table 3.2, if the out-of-sample period is increased by 5 years, the performance full sample average is the best only for predicting the 1 year forward looking equity premium (full results can be seen in table A.2 in appendix 1). Possibly due to some substantial changes of the premium levels in this out of sample at a long perspective the rolling averages perform better. The 20 year rolling average performs slightly better in estimating a 5 year forward looking equity premium while the 15 year rolling average is the best at estimating 10 year forward looking equity premium. Since the main goal is to estimate a 10 year forward looking premium (consistently with the use of 10 year government bond yields as substitutes for the risk-free rate), the 15 year rolling average is preferred to the 20 year rolling average. By choosing to drop the 20 year rolling average it is possible to use 5 more years of data for out-of-sample testing.

Table 3.3 Accuracy score for out-of-sample testing on data from 1985-2011

Historical period	Perspective		
	1 year	5 years	10 years
15 year rolling	4	6	10
Full sample	11	9	5

Source: Own calculations

As shown in table 3.3, by increasing the out-of-sample period by 5 more years the results are quite similar to those shown in table 3.2. (for full results see table A.3 in appendix 1).The full sample average still is much better at estimating 1 year forward looking premium and slightly better at estimating 5 year forward looking premium. However 15 year rolling average performed better at estimating the 10 year forward looking premium.

As these last 2 test results that are shown in table 3.2 and table 3.3 suggest, a 15 year rolling premium might be better at estimating 10 year forward looking premium while the full sample average performs better at estimating equity premium for the next year.

3.3.2 Full sample historical equity premium estimation

The full sample equity premium estimate sometimes showed better results than the rolling historical averages, especially for out-of-sample period from 1995 to 2011.It is clear that this method should not be completely discarded and its results should still be considered.

Table 3.4 Equity risk premium based on historical 1970-2011 excess returns, domestic investor perspective, 10 year horizon

	France	Germany	Sweden	United Kingdom	USA
Equity Premium	2.715%	1.707%	7.973%	4.733%	2.628%
Standard error	4.045%	4.012%	4.576%	4.340%	2.687%

Source: Own calculations

Table 3.4 shows the equity risk premiums obtained using only yearly excess returns calculated from domestic perspective – local currency and local government bond yields. The equity premium for France, Germany and USA appears to be reasonably low. The premium is lowest in the equity market of Germany, it is about 1 percentage point higher in the markets of France and USA. The equity premium in U.S. market with a 10 year perspective is estimated to be 2.628% which is much lower than the 6.18% reported in Mehra and Prescott (1985) that originally started the discussion about equity premium puzzle. However the 10 year horizon premium of 4.733% for the United Kingdom already is noticeably closer to this questioned premium value. Furthermore the high result for Sweden's equity premium of 7.97% is much higher than the results for the rest of the countries and even higher than the questioned 6.18%. Lately Sweden's government bonds have had the lowest yields however it has not always been the case historically and cannot have caused this difference. According to the World Federation of Exchanges (2012), the market capitalization and value of trading in Sweden's (and also in Nordic market as a whole) equity market is slightly lower than in other considered markets. Thus it can be argued that the liquidity level is slightly lower in this market which is a valid reason why investors might demand a higher equity premium. However if that would be the only affecting factor, the difference should not be several percent points, it should only be marginal.

Table 3.5 Equity risk premium based on historical 1970-2011 excess returns, global (U.S.) investor perspective, 10 year horizon

	France	Germany	Sweden	United Kingdom	USA
Equity premium	4.321%	4.085%	8.532%	5.534%	2.628%
Standard error	4.372%	4.608%	4.58%	4.360%	2.687%

Source: Own calculations

The equity premiums from an American investor perspective can be seen in table 3.5. They were obtained by calculating all of the returns in United States dollars and using the U.S. government bond yields as the risk-free rates. Mostly due to varying exchange rates, the European equity premiums from an American investor perspective appear significantly higher. It especially is the case for equity market of Germany and France where the equity premium increases by roughly 2.4 and 1.6 percent points compared to the premiums from a local investor perspective. As a result of this data transformation USA now appear to have the lowest premium from the considered countries. The Pound sterling has also been relatively strong against the United States Dollar and the equity premium in United Kingdom increased by 0.8 percent points to 5.53%. Sweden still has the highest equity premium of all the considered countries. That should make Sweden's equity market much more appealing for international investors that have low or no risk aversion. An interesting observation can be made that due to the high standard deviations of excess returns and the consequently high standard error of the estimated equity premiums, the equity premium of Sweden is the only one that is statistically significantly higher than zero (for more details see t-test result table A.4 in appendix 2). So these results actually do not confirm the existence of equity premium. However this problem can be solved by using monthly data instead of yearly data. That vastly increases the amount of observations while the changes in standard errors are negligible, just like it was suggested in Damodaran (2011).

3.3.3 Rolling Historical equity Premium estimates

In section 3.3.1 it was concluded that a 15 year historical estimate might be better for obtaining equity premiums with a 10 year forward looking horizon. Therefore it is essential to also consider values obtained by using this method.

Table 3.6 Equity risk premium based on historical 1997-2011 excess returns, global (U.S.) investor perspective, 10 year horizon

	France	Germany	Sweden	United Kingdom	USA
Equity premium	1.297%	0.823%	4.906%	1.535%	1.465%
Standard error	7.316%	7.711%	7.666%	7.296%	4.496%

Source: Own calculations

This method produces much lower equity premium values. All of them are within 0.8% and 1.55% except for Sweden's equity premium which still is the highest. However even Sweden's equity premium obtained by this method has a more sensible value of 4.91%. The close premium values of France, Germany, UK and USA might be a result of an increased amount of financial flows between these countries that is leveling out the premiums in these countries due to factors considered in section 2.6.

The difference of these premium values from zero is not statistically significant. However if the premiums are calculated using monthly data, all of the values are statistically significantly higher than zero at 10% significance level (equity premium of Germany is the only one that fails the t-test at 5% significance level, see table A.4 in appendix 2).

To gain a better understanding of the relationships and to determine whether there is a causality between some of the risk premiums, it is necessary to split the yearly data into months (fortunately, the dataset includes monthly data for equity returns calculated in U.S. dollars and the U.S.10 year bond yield). That allows creating a time series of equity premiums for each of the countries that has 327 observations.

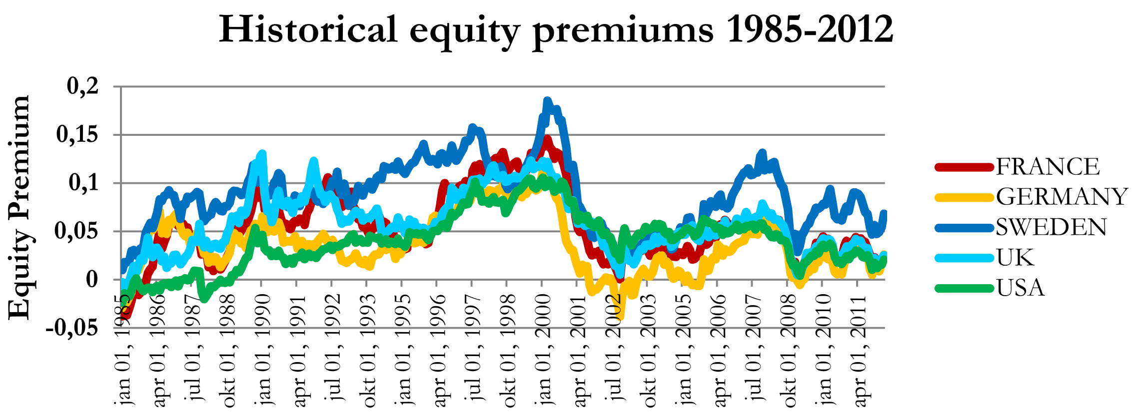

Figure 3.1 Equity premiums obtained using rolling average (15 year) weighted for 10 year forward looking perspective, January 1985 – March 2012.

Source: Own calculations

Figure 3.1 shows how the premiums have changed over the last 27 years. It can be observed that for most of the period Sweden has had the highest equity premium. Over the years it has briefly been exceeded by the equity premium in United Kingdom, France and also USA. Equity premiums of other country markets have changed their relative positions quite frequently. However it also observable that since the beginning of 90s the equity premium in Germany has consistently been slightly lower compared to other European countries. Starting from 1992-1993 the premiums in France, Germany, United Kingdom, USA and to a lesser degree also in Sweden seem to show an increasing tendency to converge to a common value.

The KPSS stationarity tests show that the series are stationarity and therefore reject the presence of a unit root. Also any trend coefficients are insignificant or negligible. Hence it can be concluded that equity premiums follow a mean reverting process or in other words a stationary process around a non-zero mean. The mean values of the equity premium series are as follows: France: 5.54%; Germany: 3.67%; Sweden: 8.7%; United Kingdom: 5.8%; USA: 4.04%. Full descriptive statistics of the series can be seen in table A.7 in appendix 3. The premium value distribution is close to normal distribution, however only premium values for USA pass the Jarque-Bera normality test at 5% significance level. That probably is due to some factors influencing the equity premiums, their values are not just randomly drawn from the normal distribution. From figure 3.1 it is evident that while the mean values of the series are different, the series are closely correlated, most likely the changes in equity values have a common global source.

However after closely inspecting figure 3.1, it does seem like there might have been a structural break in 2000, most likely connected to the Dot-com bubble which burst on March 2000. Therefore Chow breakpoint tests are conducted on the equity premium series (table A. 14), the tests reject the null hypothesis of no structural break on March 2000. Hence it is worth to split the series to consider possible changes in the nature of the process behind equity premiums. The equity premium changes from March 2000 until the middle of 2001 seem to be quite hectic, possibly as a result of the structural break. Accordingly the period from January 1985 to February 2000 is considered as the first section of the series and the period from June 2001 to March 2012 to be the second section of the series.

After inspecting the graphs, both the intercept and trend were included in the KPSS stationarity tests for the first series section and the tests showed stationarity (table A.15 in appendix 4). Afterwards, according to the strategy presented by Elder and Kennedy (2001) the series were tested for a possible time trend. The time trend coefficient was positive for all of the series. However it was significant only for equity premium in USA and equity premium in Sweden. The trend coefficient for equity premium in France and United Kingdom just barely missed the 10% significance level (see table A.16). Thus it can be concluded that over the period from 1985 to 2000 equity premium in USA and Sweden followed a trend-stationary process while equity premium in France, Germany and United Kingdom followed a stationary process with a mean value of 6.52%, 4.89% and 6.79%, respectively.

For the second part of the series only intercept was included in the stationarity test since after inspecting the graph it is clear that the premiums are not growing in this period. The KPSS test showed no unit root also for this period (table A.20). Tests for trend confirmed the initial observation that there is no time trend (table A.21). So for the period from June 2001 to March 2012 equity premium in all of the considered countries followed a stationary process. With the exception of USA, the mean values for this period are lower than the mean values of the whole period: France: 3.58%; Germany: 1.7%; Sweden: 6.59%; United Kingdom: 4.1%; USA: 4.11% (for full descriptive stats of the series see table A.25 in appendix 5).

3.3.4 Relationships between premiums across countries

As it was observed in figure 3.1, equity risk premium (ERP) values seem to be changing simultaneously. That is confirmed by the correlation coefficients between the series.

Table 3.7 Correlation coefficients between the risk premiums

	ERP FRANCE	ERP GERMANY	ERP SWEDEN	ERP UK	ERP USA
ERP FRANCE		0.840343	0.799335	0.894136	0.732239
ERP GERMANY	0.840343		0.823003	0.747973	0.501333
ERP SWEDEN	0.799335	0.823003		0.742523	0.582416
ERP UK	0.894136	0.747973	0.742523		0.698411
ERP USA	0.732239	0.501333	0.582416	0.698411	

Source: Own calculations

Table 3.7 shows that there is a very high correlation between the equity premiums in different countries. So there either are strong relationships between them or there is a strong shared dependency on some global factors. Not a single correlation coefficient below 0.5, with the lowest being between equity risk premium estimates of Germany and equity risk premium estimates of USA. The highest correlation of 0.894 can be observed between equity premiums in France and United Kingdom. These values are similarly high to those presented in Gameiro (2008).

The Granger causality test is used to investigate whether there is direct causality between the premiums or they just react similarly to other exogenous factors. At first Granger causality test is used on the monthly data to examine relationships of equity premiums across countries. Even though there has been a structural break in 2000, Pairwise Granger Causality test with 1 included lag (table A.8 in appendix 3) shows bidirectional causality relationships over period from 1985 to 2012 between equity premiums in France and Germany (if 10% significance level is considered, at 5% level test shows only causality from Germany to France). Also, at 5% significance, level equity risk premium in Germany Granger causes equity premium in Sweden. And at 10% significance level United Kingdom's equity premium Granger causes equity premium of France.

The bidirectional causality between equity premiums in France and Germany allows creating a bivariate VAR(1) model(Table A.9 in appendix 3), the lag length was chosen according to SIC information criterion. White's heteroscedasticity test showed heteroscedasticity problems for the model. That means that while the coefficient estimates are still unbiased, their standard errors are biased and consequently t-tests for their significance are distorted. To account for this, the regression was re-estimated using weighted least squares (table A.10 in appendix 3). All of the coefficients were still found to be significant, even though the coefficient for first lag of equity premium of France in the equation for equity premium in Germany only pass the significance test at 10% significance level. A stability test (table A.11) shows that this VAR model is stable.

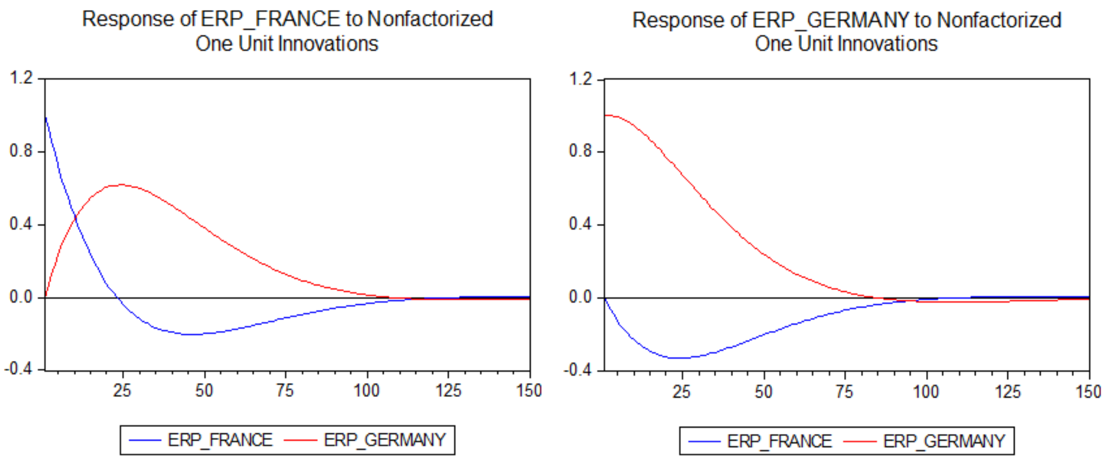

Figure 3.2 One unit residual impulse responses in the bivariate VAR(1) model.

Source: Own calculations

As the left part of figure 3.2 shows, a 1 unit increase in the equity premium of France has a lasting positive effect on its future values for about 2 years. However for the 4 following years it has a smaller yet still significant negative effect, possibly due to over adjustment bias in the investor expectations. Interestingly, the effect of an equity risk premium increase in Germany on equity risk premium in France reaches its peak only after 2 years and after 6-7 years it disappears.

For the equity risk premium in Germany the situation is different – an increase in the equity risk premium of France has a negative effect on equity premium in Germany for about 6 years. This observation is hard to interpret, it might be caused by investors moving their investments from the German equity market to French equity market, however it does not explain why would the investors with the highest requirements for equity premium be the first ones to change their primary choice of equity market and not those who have lower requirements for equity premium. However, considering that Germany has historically had a lower equity premium (see figure 3.1) than other countries, it is possible that investors who demand higher equity premium in the German market are actually international investors. And they might also be the first ones who notice changes in other equity markets and adjust their expectations (hence the initial increase in the equity premium of Germany's market). These international investors would then also be the first ones to choose another market in case of equity premium changes. And as they would leave the market of Germany, the expected equity premium of the market decreases. At the same time the domestic investors who are used to relatively lower equity premiums and are satisfied with them do not bother to move their funds to other markets. After several years when the equity premium in France is decreasing and actually dips below the initial value for a while, the fraction of international investors who left the market of Germany might be returning and thus eventually bringing the equity premium of the market back to the initial value.

The effect of an earlier increase in Germany's equity premium to its current value is more straightforward, at first the effect is quite persistent, however after 2 years it starts to decrease and eventually after 6 six years it becomes insignificant.

As table A.12 and A.13 in appendix 3 show, the other causality relationships that were indicated by the Granger causality test are positive. Thus an increase of equity premium in Germany results in a small increase of equity premium in Sweden in the next period and the equity premium in United Kingdom seems to have a similar effect on equity premium in France. However, models including these variables failed to pass Jarque-Bera normality test, therefore the significance of these relationships can be questioned. The coefficients should be unbiased, however the t-tests for their significance are unreliable.

Since in the previous section it was concluded that on March 2000 there was a structural break in the process that equity premiums were following, it is also worth to consider the split series.

Firstly, for the period from January 1985 to February 2000 Granger causality test (table A.17 in appendix 4) shows causality from Germany to France. A 1% increase in the equity premium of Germany resulted in an increase of equity risk premium in France by 0.065% in the period up to February 2000 (see table A.19 in appendix 4).The analysis of this period is hampered by the fact that previous tests shown a significant trend only for equity premiums in Sweden and USA. However the premiums in other countries showed similar developments in this period even though the tests for trends in these cases were marginally insignificant. It is possible that instead of having a similar time trend, the premium processes were similarly affected by common global factors and in that case by detrending just 2 out of 5 series the analysis is distorted. Due to that also the correlation coefficients are much lower between the detrended premium series and the rest of the premium series.

In case the trend test results are assumed to be imprecise and all of the premium values are detrended, the causality between premiums in France and Germany becomes bidirectional and is very similar to the one already analyzed earlier in this section. Also there is a positive causality connection from equity premium in USA to equity premium in Germany.

Secondly, for the period from June 2001 to March 2012 the Granger causality test with 1 included lag (table A.22 in appendix 5) show causality from Sweden's equity premium to Germany's equity premium and at 10% significance level also from Germany's equity premium to equity premium of USA. So after the structural break the causality between equity premiums of Germany and USA has changed its direction.

Examining the causality relationships shows that the effect of a 1% increase in Sweden's equity risk premium in results in a 0.15% increase in equity risk premium of Germany in the next period (table A.23 in appendix 4). This obviously is surprising and it is hard to find a particular reason why would premium value changes have causality relationships from Sweden to Germany and not vice-versa, considering the mere size of the markets. It is possible that a large fraction of German investors are investing in the Swedish stock market and through them the changes in that market carries over to the German market, while

Swedish investors either stay focused on their own market or evenly scatter over international markets. However those are just speculations.

Interestingly, the effect of an increase in the equity risk premium of Germany appears to have a slight negative effect on equity risk premium in USA (table A.24 in appendix 4). That might be caused by American or international investors shifting away from the German market after an increase of equity premium in the American equity market.

Table 3.8 Correlation coefficients between the risk premium estimates 2001M06-2012M03

	ERP FRANCE	ERP GERMANY	ERP SWEDEN	ERP UK	ERP USA
ERP FRANCE		0.862049	0.860945	0.845815	0.546617
ERP GERMANY	0.862049		0.919422	0.656388	0.198267
ERP SWEDEN	0.860945	0.919422		0.735530	0.251291
ERP UK	0.845815	0.656388	0.735530		0.765766
ERP USA	0.546617	0.198267	0.251291	0.765766	

Source: Own calculations

After comparing the results in table 3.8. to table 3.7 and also to table A.18 in appendix 4 it is clear that in recent years the correlation between equity premiums in France, Germany and Sweden has increased even further. Now it is above 0.86 in all cases. That can be explained with the increasing integration of European financial markets within the European Union. However, interestingly the correlation of equity premium in United Kingdom with other European countries has slightly decreased. At the same time the correlation of equity premium in United Kingdom and USA has increased and now equity market of United Kingdom seems to act as a "bridge" between European equity markets and U.S. equity market since it is correlated to all of them at a similar level.

Equity premium in USA is also noticeably correlated with equity premium in France, yet to lesser degree than in earlier years. However the correlation of equity premium in USA to equity premium in Germany and Sweden has critically plummeted and now can be considered to be low.

So an interesting tendency can be observed – the relationships between equity premiums of countries in Continental Europe are becoming stronger. At the same time their link to other markets is becoming weaker. United Kingdom's equity market is slightly distancing from other European markets and closing to the equity market of USA. And the market of USA is noticeably distancing from equity markets in Continental Europe.

3.3.5 Equity premium and other economic variables

Another perspective how to look at equity premium is examining how it is related to other economic variables which is also one of the research questions for this thesis. For this purpose a panel data analysis was conducted on the yearly data from 1985 to 2012, considering variables like government 10 year bond yields, inflation rates, real GDP growth rates, unemployment rates and VIX volatility index of S&P500. To avoid multicolinearity problems caused by some of the variables which were highly correlated each to other, inflation rates and real GDP growth rate were dropped since they appeared to have a less significant effect on equity premiums than the bond yields. The VIX volatility index had no explanatory power even on the equity premium of USA, therefore it was also dropped. Unemployment rate appeared to have a similar negative effect on equity premium values. If the coefficient of unemployment is considered separately for each country, it can be seen that the effect is relatively lower for Sweden and relatively higher for United Kingdom, however the test for redundant fixed effects showed that the cross-section effects are redundant and the coefficient should not be determined separately for each cross-section. The result for redundant cross-sectionally fixed bond yield coefficients was the same. However the test result for cross-sectionally fixed constants was right on the borderline of rejecting the redundancy at 10% significance level. Considering the results presented in section 3.3.3, cross-sectionally fixed constants make sense due to different mean values for each premium in each country, therefore they were included in the equation.

Table 3.9 Panel data regression analysis

Dependent Variable: ERP_?
Method: Pooled Least Squares
Sample (adjusted): 1986 2011
Included observations: 26 after adjustments
Cross-sections included: 5
Total pool (balanced) observations: 130
Convergence achieved after 12 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.433092	2.323277	3.199400	0.0018
BOND_?	0.372067	0.202414	1.838149	0.0685
UNEMP_?	-0.444232	0.224826	-1.975895	0.0504
AR(1)	0.605700	0.059927	10.10726	0.0000
Fixed Effects (Cross)				
FRANCE--C	1.155462			
GERMANY--C	-1.343396			
SWEDEN--C	2.386091			
UK--C	-0.034161			
USA--C	-2.163996			

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.559651	Mean dependent var	5.911538
Adjusted R-squared	0.534385	S.D. dependent var	3.530392
S.E. of regression	2.408996	Akaike info criterion	4.655861
Sum squared resid	707.9981	Schwarz criterion	4.832325
Log likelihood	-294.6310	Hannan-Quinn criter.	4.727564
F-statistic	22.15046	Durbin-Watson stat	1.819240
Prob(F-statistic)	0.000000		

Source: Own calculations

As the results shown in table 3.9 suggest, the 10 year government bond yields ("BOND") have a strong connection to equity risk premium. A 1% increase in government bond yields result in a 0.37% increase in equity risk premium. These bond yields are already involved in estimating the equity premium values, however in the calculations they were distracted from the equity returns, hence if that would be their only effect on equity premium values, the coefficient should be negative but it is positive instead, showing that the effect of bond yields on equity premiums are more complex. It does make some sense since higher bond yields might be a result of a general increase in the risk of the whole economy. In a state of generally higher riskiness investors might be more willing to choose the "risk-free" rate over equity returns, hence they would demand a higher equity premium. Bond yields also represent the changes in inflation and growth expectations. This result suggests that the value of equity premium might not be a constant difference between the risk-free rate and equity returns but rather a relative ratio to the risk-free rate. Looking at the effect of the bond yields on premiums in each country it can be seen that the bond yields seem to have a lower effect on equity premiums in USA while their effect was a bit higher than average in United Kingdom.

Parallels can be drawn to Damodaran (2011) who found out that government bond yields had a positive effect on historical implied equity premium values in USA. The coefficient estimated in this paper is 2.5 times higher than the one obtained by Damodaran, he estimated it to be 0.15. Damodaran (2011) also considered the ratio of equity premium value to risk-free rate and concluded that in recent years it had a tendency to slightly increase until reaching its maximum in 2008 after which followed a slight decrease in the ratio.

The unemployment coefficient ("UNEMP") shows that a 1% increase in unemployment is followed by a 0.444% decrease in the equity premium. This also is an interesting result. On one hand an increasing unemployment might result in lower growth perspectives, lower return expectations and sensible investors might also lower their equity premium demands. But on the other hand a rising unemployment should increase the risk status of the whole economy and would indicate a slump in the business cycle which should consequently increase the equity premium rather than decrease it. Several papers have mentioned that equity premium is countercyclical to business cycle (Campbell and Cochrane (1999), Arnott and Bernstein (2002), Scruggs and Glabadanidis (2003), Salomons and Grootveld (2003), Guvenen (2009), Graham and Harvey (2012)), but according to them in troughs instead of decreasing, equity premium should increase. This also raises the question of the equity premium estimation method that was used for obtaining the series. A value of premium obtained using the historical approach might be lagging behind the actual premium.

The AR(1) term simply shows that about two thirds of the equity premium in previous period carries over to the next period irrespective of the changes in bond yields and unemployment rates.

3.4 Implied equity premiums

Implied equity premiums are calculated to obtain a current up-to-date expected equity premium as a benchmark for result comparison to the equity premium values estimated using the historical approach. The implied equity premiums are calculated through the dividend yield approach, using the stock index values, dividend yields of the indexes and expected growth rates of the respective countries. The stock indexes are all benchmark indexes that are calculated based on the most liquid and frequently traded stocks. Therefore an assumption is made that the companies which stocks are included in the indexes are mature - their dividend payout policy will not significantly change in the future and their earnings growth will be consistent with the growth of the whole economy. An exception is made with S&P500 index of the USA market, since it includes more companies – the expected earnings growth of included companies for the next 3 years is obtained from a publication on Bloomberg by Soong (2012) that focuses on the perspectives of S&P500 index since it is more likely to be closer to the actual investor expectations.

To maintain some consistency with the historical estimations and forecasts and also the growth rate expectations, the December 2011 closing values are used for all of the stock indexes. The expected growth rates for 2012 and 2013 are obtained after considering IMF World Economic outlook, World Bank real GDP growth forecast, and outlook by Organization for Economic co-operation and Development (OECD). It is assumed that after 2013 all of the countries will enter a stable growth rate. Damodaran (2011) suggests that the current risk-free rate should be used as a stable growth rate. Considering that and also the fact that all of the countries, especially the European ones, should grow at a similar rate, it is assumed that the stable growth in perpetuity will be 2.5% per year for all of the considered countries.

So, for example, in the case of USA the S&P500 index had a closing value of 1257.6 in December 2011. With dividend yield of 2.2%, and the expected growth rates of 4.2%, 5% and 4.5% for 2012, 2013 and 2014 respectively, the equation for the index value looks like this:

$$1257.6 = \frac{28.829}{(1+r)} + \frac{30.271}{(1+r)^2} + \frac{31.633}{(1+r)^3} + \frac{32.424}{(r-0.025)(1+r)^3}$$

Where r – required equity return.

Solving the equation for r, the value of 0.04891 or 4.891% is obtained. However this only is the required return of equities, the implied equity risk premium is obtained by subtracting the risk-free rate from this value. For December 2011 the risk-free rate in USA was 1.89%, therefore the estimated implied equity risk premium for USA as of December 31 2011 is 3.001%. The implied equity premiums for other countries are obtained in a similar manner.

Table 3.10 Variables used for estimating the implied equity premiums

Country	France	Germany	Sweden	UK
Expected growth 2012	1.65%	1.75%	3.2%	2.65%
Expected growth 2013	2.1%	2.4%	3.5%	3.2%
Index used	CAC 40	DAX	OMX Stockholm 30	FTSE 100
Index value	3159.81	5898.35	987.85	5572.3
Dividend yield of the index	4.5%	2.5%	5.49%	3.61%
Obtained required equity return	**7.057%**	**5.041%**	**8.218%**	**6.241%**

Source: Yahoo! Finance; Dax-indices; Financial times; own calculations.

To double check the accuracy of this method the required equity return in United Kingdom was also calculated using FTSE all share index (dividend yield 3.48% and closing price of December 2857.88). In that case the required equity return was obtained to be 6.106% which is quite close to the value of 6.241% obtained from the FTSE 100 index. That is quite close and shows that this method can be used to quite accurately obtain up-to date implied equity premiums. Probably the values are not exactly the same because the assumptions and expectations made by the investors and those that were made in this paper slightly differ. But a small difference like that can also be caused by different groups of investors that are interested in the FTSE all share index instead of only the FTSE 100. And investor inconsistency and irrationality might also play a factor here.

Table 3.11 Implied equity premiums as of January 1st 2012

	France	Germany	Sweden	United Kingdom	USA
Domestic equity premium	4.103%	3.051%	6.394%	3.859%	2.661%
Equity premium, international (U.S.) investor perspective	4.827%	2.811%	5.988%	4.001%	2.661%

Source: Own calculations

The results of this approach are in a way similar to those of the historical averages – the highest premium is in Sweden, followed by France and United Kingdom. And the lowest premium values are in the markets of Germany and USA. Also the values of equity premium are somewhat similar to those estimated by the full sample historical average.

3.5 Summary of equity risk premium estimations

The results for equity premium estimations are noticeably different for each estimation method. The full sample historical average has the highest values, followed by implied equity premiums and lastly the values of 15 year rolling historical average. However that is consistent with the conclusion that there was a structural break in 2000. As a result of that in recent years full sample historical average should tend to overstate the actual equity premium while the rolling 15 year estimate might understate it. Thus the actual premium value should be somewhere between these two values. The implied equity premiums are in between the historical average values, although for France and USA they are higher than the full sample averages. That might be explained with the help of observation made in section 3.3 that historical averages might be slightly lagging behind the actual equity premiums and thus the implied equity premiums might provide a more up-to date equity premium values. This would mean that the equity premium values have recently increased which seems plausible considering the high concerns about global economic stability, especially in Eurozone. Yet it is important to keep in mind that the growth rate assumptions and the assumptions of a constant dividend-payout ratio that were made in estimating the implied equity premiums are questionable and they might not accurately describe the assumptions that are made in the market. Therefore it seems reasonable to consider the average value of the 3 estimation methods which yields similar equity risk premium values in all of the countries with the exception of Sweden.

Table 3.12 Estimated equity risk premium values as of January 1, 2012

	France	Germany	Sweden	United Kingdom	USA
Domestic investor perspective	**2.69%**	**1.82%**	**6.33%**	**3.40%**	**2.25%**
American investor perspective	**3.48%**	**2.57%**	**6.48%**	**3.69%**	**2.25%**
Estimated mean reversion level*	3.58%	1.7%	6.59%	4.1%	4.11%

* Assuming there has been a structural break in March 2000, obtained in section 3.3.3
Source: Own calculations

The obtained equity premium for USA almost coincides with the value of 2.55% that was estimated in Fama and French (2002) using the dividend growth model on data after 1951, which they was deemed to be the most precise method. It is much lower than the 6.18% presented in Mehra and Prescott (1985) which spurred the research into equity premium puzzle. It is similar to results provided in Damodaran (2011) and it is even slightly lower than the 2.4% which was presented as "normal" value of equity premium in Arnott and Bernstein (2002) or the 3% - 4% estimated in Donaldson et al. (2010).

The higher equity premium of Sweden compared to the other considered countries is consistent with results in Shackman (2006) where for period from 1970 to 2000 the equity premium of Sweden in USD was estimated to be 13.25% while for other mature markets the estimation was between 7% and 10%. The ranking of countries sorted by equity premium that was estimated in this thesis also coincides with the results in Solomons and Grootveld (2003), Shackman (2006). Interestingly, in papers that use a bigger data sample like Jorion and Goetzmann (1999) and Dimson et al. (2008) the equity returns in Sweden do not appear to be so much higher compared to other mature markets. It is possible that the excess returns have only been so relatively high in Sweden over the past 4 decades or that some detail in MSCI index calculation methodology makes the equity returns in Sweden appear too high.

The confusion can be cleared by comparing the MSCI total return index of Sweden against data in the Waldenström (2007) database which also includes a total return index for stocks. Of course, the index values had to be transformed to have the same starting value at the beginning of the considered period.

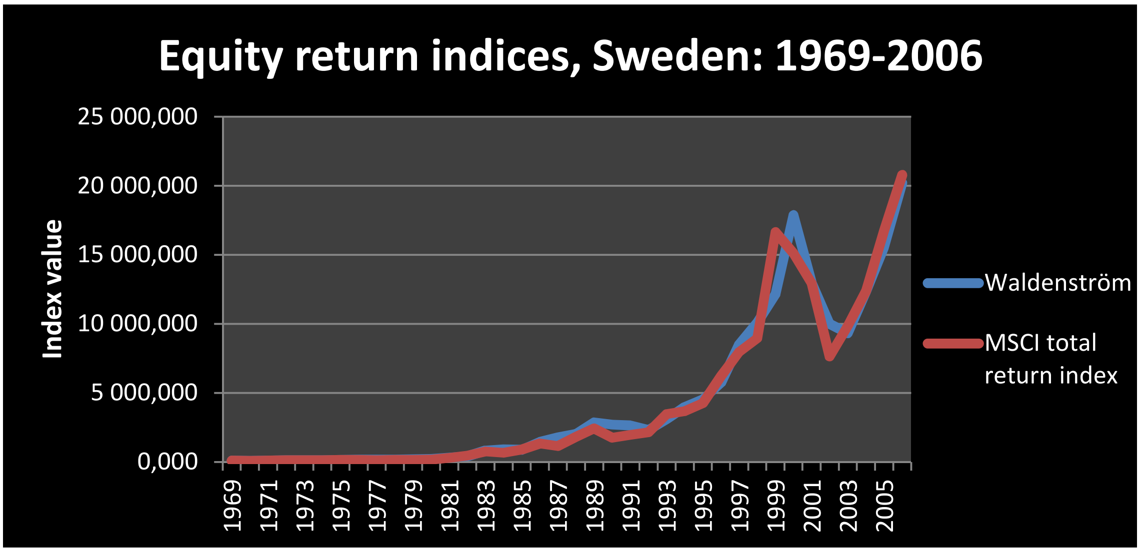

Figure 3.3 Comparison of total return indices for Swedish equity market 1969-2006

Source: MSCI Global equity indices; Waldenström (2007)

As figure 3.3 shows, the values of both indices are quite similar, therefore the problem should not be related to MSCI methodology. So it can be concluded that the high results for equity risk premium in Sweden are not related to the data source. By comparing MSCI total return index values it can be seen that over the last 3 decades equity market of Sweden has performed relatively better than other mature equity markets. Therefore investors with lower risk-aversion can benefit from investing in equity market of Sweden due to higher expected equity risk premium in this market.

4 Conclusion

According to the suggestions made in the literature this paper implemented some adjustments to the typical historical equity premium estimation method. A weighted average equity premium calculation method was used to avoid the upwards bias of arithmetic average and downwards bias of the geometric average, with the weights varying in accordance to the forward-looking horizon. Optimal length of historical estimation period was determined with the help of out-of-sample testing and the results showed that 15-year rolling average performs better than the other period rolling averages and the full sample average at estimating 10 year forward looking equity premiums. Thus the answer to the research question whether shorter period rolling averages can outperform full sample historical estimations is positive. However this method is still far from perfect as for a few years it produced negative equity risk premium values which can be considered as unrealistic.

Furthermore it has to be considered that equity premium series appeared to have a structural break in March 2000. With the out-of-sample period being only from 1985 to 2011 the structural break had an important part in determining the results (although it actually improved the relative performance of the full sample since it made the rolling average to predict too high premium values due to the high premium values at the end of 90s). Thus the obtained results do not mean that a 15 year rolling historical average will also perform so well in the future in case of future structural breaks, the high weight (6.67%) that each included year has in this type of method is possibly its main flaw.

After examining the obtained historical equity premium series it was concluded that over the whole period they have been stationary. Therefore data starting from 1970 can be used in historical equity premium estimations. But it has to be considered that even though in long term the equity premium values appear to be stationary, in short-term and even in mid-term they can vary a lot. Also if the sudden drop in equity premium values in March 2000 is considered to be a structural break and the series are split in two parts, the first part up to the structural break appears to have a positive time trend and is trend-stationary while the second part still is stationary. It might be the case that what happened in March 2000 was a part of the equity premium process when its value increased too much and hit the "ceiling" of premium values that are allowed by equity market mechanisms. If there will not be a serious change in equity premium traits in any of the countries, the mean reverting nature which premiums seem to have, in long term the equity premiums should converge to the following values - France: 5.54%; Germany: 3.67%; Sweden: 8.7%; United Kingdom: 5.8%; USA: 4.04%. Although if the drop in premium values in March 2000 will be more persistent, the new long-term mean equity premium values might be around these values - France: 3.58%; Germany: 1.7%; Sweden: 6.59%; United Kingdom: 4.1%; USA: 4.11%. All of these values seem to be reasonable considering the results of recent researches, with the exception for equity risk premium in Sweden which is slightly higher.

Combining the results of 3 equity premium estimation methods it can be concluded that in 2012 the equity risk premium in the considered mature markets are between 2.25% and 3.7% with the exception of Sweden (6.48%). These values are much lower than those that caused so much concern in the equity premium puzzle and according to more recent publications (e.g. Arnott and Bernstein (2002)) can be considered to be normal. They are certainly lower than the interval of 5% - 8% which is still being used by many practitioners (Schrager (2010)). This paper also tried to answer to the question whether equity premium still exists and while the use of yearly data could not confirm it, by using monthly data and increasing the number of observations it was possible to obtain statistical significance which indicated that equity premium values which are significantly higher than zero. So the truth of equity risk premium values lies somewhere between the two extremes considered in the introduction. But it can be said that equity premium puzzle still is in effect. Several models have managed to predict equity premium values at the current estimated equity premium level, so the magnitude of equity premium puzzle has diminished, yet these models have had their limitations and shortcomings and the puzzle is not entirely solved yet.

A noticeable exception among other equity premiums is the equity premium in the equity market of Sweden, where both the current estimated equity premium value and the mean value of historical equity premium is much higher than in other countries. After examining the volatility of equity excess returns in different markets it is clear that in equity market of Sweden it is similar to other mature markets, so from that perspective it should not be viewed as a more risky market. One factor which might be affecting this is the smaller size of Swedish stock market and slightly lower liquidity that might result in a fractionally higher equity premium. Another important factor from international investor perspective is the currency in Swedish equity market – from currencies in all of the considered equity markets, Swedish krona is the only currency which has not been a popular reserve currency. That would justify higher equity premium demands from international investors and their expectations might increase the expected premium of the market even if the domestic investors would have lower expectations. If investors of mature markets are purely interested in profit (and not voting rights etc.), and the exchange rates between currencies would not be expected to undergo significant changes or the investors would have a low level of risk-aversion, they would be better off by investing in Swedish stock market due to the higher expected equity risk premium in this market. This would especially be the case for U.S. and German investors since equity risk premium in these countries is expected to be lower.

Even though the mean values of equity premiums are different, they are very highly correlated. Interestingly in recent years some new tendencies can be observed – ties of equity premiums in Continental European markets are strengthening, at the same time these premiums are becoming more independent from premiums in United Kingdom and USA. Simultaneously the ties between premiums in United Kingdom and USA are also becoming stronger. It is also shown by changing causality relationships. These changes might be a result of financial market integration within the European Union and increased dependency on internal European Union factors. However that does not justify the distancing between equity premium in United Kingdom and equity premium in Continental Europe. United Kingdom has not implemented euro but so has not Sweden so it could not be the only reason. Yet there might be an explanation for it – London Stock Exchange is the largest stock exchange in Europe hence it probably is attracting more American investors than stock exchanges in other countries. A relatively high presence of American investors would explain why equity premium in United Kingdom is closely related to changes in the American market.

Additionally to being closely related through common international factors, there are signs of direct interactions between equity premium values. Granger causality tests showed causality relationships between premiums in several of the markets. When the whole period from 1985 to 2012 was considered, the most noticeable was the bidirectional causality between Germany and France. Causality among equity premiums was also observed from Germany to Sweden and from United Kingdom to France. Furthermore by considering just the last decades there are causality between Germany and Sweden seemed to have changed its direction and equity premium in Germany Granger caused changes in equity premium of USA. Most of these causality relationships are positive, although two of them (France → Germany and Germany → USA) were negative which was not expected at first although as it was argued in section 3.3.4, it can be explained by the movement of investors who demand relatively higher values of equity risk premium. The interpretation of alternating signs of the relationships might demand further research. The main conclusion from this part of analysis is that when explaining equity premium values one should not only look for global factors that generally affect equity premiums but also consider changes in equity premium values in other close equity markets which might be directly affecting the equity premium values in the considered market. However interdependency between equity premium values in different countries have a smaller effect than the shared global factors that affect the values of equity premium.

Changes in equity risk premium can partially be explained with the help of 10 year government bond yields (and more generally: risk-free rates) and unemployment rates. Government bond yields have a positive effect on equity premiums, possibly there is a ratio relationship between bond yields and the equity premiums that could be examined in further research. The unemployment rates appear to have a negative effect on equity premiums which is a confusing result as in the literature that was reviewed the equity risk premium was considered to be countercyclical. It might be the case that historically estimated equity premiums are lagging behind the actual expected market premium values and this part of analysis has been distorted by that.

In overall the purpose of this thesis was fulfilled and all of the research questions were answered however there still is some uncertainty regarding possible future changes in the equity premium values due to the structural break at the start of the new millennium.

Considering the relatively high errors of historical equity premium methods in some periods, it is clear that the development of equity premium estimation using fundamental variables is the future. Optimally the combination of several fundamental variable methods as it was done in Donaldson et al. (2010) should be developed. I believe it would be preferable to direct further research in this direction.

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Appendix 1 Error measures of historical estimation methods

Table A.1 Error measures of historical methods (out-of-sample 1995-2011)

France

	1 year perspective				5 year perspective				10 year perspective			
	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling
MSE	0.0598	0.0637	0.0618	0.0598	0.0117	0.0141	0.0119	0.0130	0.0038	0.0057	0.0056	0.0051
MAE	0.2032	0.2058	0.1997	0.2026	0.0858	0.0990	0.0954	0.0953	0.0523	0.0708	0.0632	0.0608
MSD	0.0012	0.0267	0.0307	0.0285	-0.0077	0.0161	0.0269	0.0199	-0.0006	0.0175	0.0373	0.0345

Germany

	1 year perspective				5 year perspective				10 year perspective			
	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling
MSE	0.0636	0.0643	0.0677	0.0638	0.0095	0.0105	0.0099	0.0113	0.0015	0.0021	0.0026	0.0019
MAE	0.2143	0.2065	0.2172	0.2082	0.0827	0.0848	0.0816	0.0862	0.0274	0.0415	0.0430	0.0308
MSD	-0.0084	0.0146	0.0173	0.0183	-0.0152	0.0063	0.0120	0.0090	-0.0087	0.0082	0.0227	0.0212

United Kingdom

	1 year perspective				5 year perspective				10 year perspective			
	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling
MSE	0.0299	0.0315	0.0304	0.0299	0.0057	0.0077	0.0060	0.0067	0.0021	0.0043	0.0045	0.0038
MAE	0.1364	0.1387	0.1354	0.1365	0.0634	0.0720	0.0627	0.0664	0.0202	0.0494	0.0615	0.0548
MSD	0.0230	0.0281	0.0253	0.0186	0.0341	0.0438	0.0447	0.0374	0.0363	0.0494	0.0615	0.0548

USA

	1 year perspective				5 year perspective				10 year perspective			
	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling
MSE	0.0408	0.0426	0.0418	0.0416	0.0069	0.0083	0.0084	0.0098	0.0024	0.0036	0.0043	0.0060
MAE	0.1686	0.1710	0.1672	0.1629	0.0679	0.0781	0.0813	0.0861	0.0278	0.0510	0.0546	0.0647
MSD	-0.0196	-0.0034	0.0067	0.0121	0.0058	0.0201	0.0337	0.0414	0.0111	0.0204	0.0391	0.0517

Sweden

	1 year perspective				5 year perspective				10 year perspective			
	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling	Full sample	25 year rolling	20 year rolling	15 year rolling
MSE	0.0996	0.1011	0.1060	0.1053	0.0109	0.0128	0.0149	0.0104	0.0023	0.0035	0.0066	0.0026
MAE	0.2659	0.2615	0.2769	0.2750	0.0846	0.0951	0.0953	0.0845	0.0276	0.0505	0.0645	0.0350
MSD	-0.0022	0.0217	0.0243	0.0218	0.0004	0.0273	0.0308	0.0216	0.0073	0.0236	0.0509	0.0350

Source: Own calculations

Table A.2 Error measures of historical methods (out-of-sample 1990-2011)

	1 year perspective			5 year perspective			10 year perspective		
France									
	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling
MSE	0.0582	0.0600	0.0608	0.0092	0.0092	0.0108	0.0039	0.0047	0.0037
MAE	0.2000	0.1981	0.2024	0.0738	0.0792	0.0827	0.0580	0.0568	0.0490
MSD	0.0197	0.0454	0.0528	-0.0064	0.0218	0.0272	-0.0215	0.0056	0.0173
Germany									
	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling
MSE	0.0624	0.0660	0.0644	0.0082	0.0081	0.0094	0.0018	0.0022	0.0015
MAE	0.2121	0.2168	0.2129	0.0747	0.0713	0.0764	0.0366	0.0404	0.0277
MSD	0.0060	0.0295	0.0348	-0.0192	0.0046	0.0071	-0.0208	0.0041	0.0080
United Kingdom									
	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling
MSE	0.0295	0.0303	0.0321	0.0045	0.0047	0.0061	0.0017	0.0033	0.0031
MAE	0.1367	0.1365	0.1407	0.0561	0.0542	0.0602	0.0344	0.0507	0.0490
MSD	0.0310	0.0344	0.0325	0.0202	0.0296	0.0305	0.0183	0.0354	0.0439
USA									
	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling
MSE	0.0347	0.0355	0.0357	0.0078	0.0088	0.0089	0.0038	0.0049	0.0048
MAE	0.1513	0.1507	0.1495	0.0732	0.0825	0.0832	0.0537	0.0609	0.0576
MSD	-0.0150	0.0058	0.0152	-0.0200	0.0006	0.0128	-0.0208	-0.0033	0.0140
Sweden									
	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling	Full sample	20 year rolling	15 year rolling
MSE	0.1000	0.1049	0.1061	0.0105	0.0129	0.0093	0.0033	0.0056	0.0028
MAE	0.2622	0.2726	0.2754	0.0851	0.0895	0.0799	0.0487	0.0614	0.0390
MSD	0.0131	0.0365	0.0432	-0.0152	0.0102	0.0129	-0.0191	0.0119	0.0130

Source: Own calculations

Table A.3 Error measures of historical methods (out-of-sample 1985-2011)

	1 year perspective		5 year perspective		10 year perspective	
	Full sample	15 year rolling	Full sample	15 year rolling	Full sample	15 year rolling
France						
MSE	0.0726	0.0745	0.0097	0.0110	0.0040	0.0037
MAE	0.2285	0.2294	0.0748	0.0823	0.0570	0.0496
MSD	-0.0179	0.0119	-0.0202	0.0092	-0.0307	0.0006
Germany						
MSE	0.0889	0.0903	0.0087	0.0098	0.0028	0.0024
MAE	0.2426	0.2429	0.0756	0.0768	0.0429	0.0365
MSD	-0.0284	-0.0011	-0.0249	0.0000	-0.0290	-0.0029
United Kingdom						
MSE	0.0264	0.0281	0.0038	0.0050	0.0016	0.0026
MAE	0.1300	0.1317	0.0500	0.0527	0.0349	0.0448
MSD	0.0196	0.0226	0.0136	0.0231	0.0032	0.0224
USA						
MSE	0.0322	0.0330	0.0074	0.0083	0.0053	0.0061
MAE	0.1467	0.1451	0.0734	0.0813	0.0648	0.0679
MSD	-0.0313	-0.0066	-0.0317	-0.0062	-0.0410	-0.0162
Sweden						
MSE	0.0957	0.0999	0.0094	0.0087	0.0031	0.0025
MAE	0.2611	0.2697	0.0781	0.0767	0.0470	0.0365
MSD	-0.0114	0.0164	-0.0137	0.0120	-0.0256	0.0020

Source: Own calculations

Appendix 2 T-tests on equity premiums

Table A.4 T-tests for ERP being significantly higher than zero, p-values

		France	Germany	Sweden	United Kingdom	USA
Based on yearly data	Full sample	0.164	0.190	0.035	0.106	0.167
	15 year rolling average	0.431	0.458	0.267	0.418	0.375
Based on monthly data	Full sample	0.000	0.000	0.000	0.000	0.000
	15 year rolling average	0.019	0.079	0.000	0.009	0.001

Source: Own calculations

Hypothesis $ERP_j > 0$

Appendix 3 Tests on equity premium series 1985-2012

Table A.5 Results of KPSS stationarity tests

	ERP France	ERP Germany	ERP Sweden	ERP United Kingdom	ERP USA
Bandwidth*	85	75.7	76.3	77.9	101
Exogenous	Constant	Constant	Constant	Constant	Constant
LM-stat	0.151007	0.161311	0.137840	0.175901	0.209533
Critical value**	0.463	0.463	0.463	0.463	0.463
Conclusion	Stationary	Stationary	Stationary	Stationary	Stationary

* Andrews automatic selection

** at 5% significance level

Source: Own calculations

Table A.6 Results of tests for a time trend

		France		Germany		Sweden		UK		USA	
		Value	p-value	Value	p-value	Value	p-value	Value	p-value	Value	p-value
Coefficient	ERP_?(-1)	-0.028956	0.0067	-0.037193	0.0037	-0.034475	0.0060	-0.034429	0.0082	-0.018324	0.0748
	C	0.003046	0.0022	0.002638	0.0067	0.004269	0.0033	0.003195	0.0056	0.001295	0.0291
	@TREND	-7.63E-06	0.0612	-6.74E-06	0.1007	-6.67E-06	0.1458	-6.74E-06	0.1054	-2.54E-06	0.4223

Source: Own calculations

Dependent Variable: D(ERP_?): Method: Least Squares; Sample (adjusted): 1985M02 2012M03; Included observations: 326 after adjustments

Table A.7 Descriptive statistics of equity premium series

	ERP_FRANCE	ERP_GERMANY	ERP_SWEDEN	ERP_UK	ERP_USA
Mean	0.055399	0.036701	0.086987	0.058203	0.040453
Median	0.052278	0.034596	0.087033	0.055797	0.041616
Maximum	0.145710	0.119076	0.185280	0.130568	0.105649
Minimum	-0.037853	-0.038258	0.005333	-0.011675	-0.023646
Std. Dev.	0.036066	0.030278	0.034562	0.030251	0.029040
Skewness	0.400156	0.383590	0.188214	0.324806	0.125581
Kurtosis	2.903199	2.746168	2.819411	2.409990	2.663575
Jarque-Bera	8.854492	8.897063	2.374978	10.49273	2.401598
Probability	0.011947	0.011696	0.304986	0.005267	0.300954
Observations	327	327	327	327	327

Source: Own calculations

Table A.8 Pairwise Granger Causality Tests

Sample: 1985M01 2012M03
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
ERP_SWEDEN does not Granger Cause ERP_GERMANY	326	0.23310	0.6296
ERP_GERMANY does not Granger Cause ERP_SWEDEN		3.88053	0.0497
ERP_UK does not Granger Cause ERP_GERMANY	326	0.00053	0.9816
ERP_GERMANY does not Granger Cause ERP_UK		1.46332	0.2273

ERP_USA does not Granger Cause ERP_GERMANY	326	0.53190	0.4663
ERP_GERMANY does not Granger Cause ERP_USA		0.22614	0.6347
ERP_FRANCE does not Granger Cause ERP_GERMANY	326	3.16651	0.0761
ERP_GERMANY does not Granger Cause ERP_FRANCE		7.73143	0.0057
ERP_UK does not Granger Cause ERP_SWEDEN	326	0.15179	0.6971
ERP_SWEDEN does not Granger Cause ERP_UK		0.42950	0.5127
ERP_USA does not Granger Cause ERP_SWEDEN	326	0.17861	0.6728
ERP_SWEDEN does not Granger Cause ERP_USA		0.04789	0.8269
ERP_FRANCE does not Granger Cause ERP_SWEDEN	326	0.26419	0.6076
ERP_SWEDEN does not Granger Cause ERP_FRANCE		0.90656	0.3417
ERP_USA does not Granger Cause ERP_UK	326	0.00769	0.9302
ERP_UK does not Granger Cause ERP_USA		0.23372	0.6291
ERP_FRANCE does not Granger Cause ERP_UK	326	1.00980	0.3157
ERP_UK does not Granger Cause ERP_FRANCE		3.18608	0.0752
ERP_FRANCE does not Granger Cause ERP_USA	326	0.97747	0.3236
ERP_USA does not Granger Cause ERP_FRANCE		0.26619	0.6063

Source: Own calculations

Table A.9 Bivariate VAR(1) model: equity risk premium in Germany and France

Vector Autoregression Estimates
Sample (adjusted): 1985M02 2012M03
Included observations: 326 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	ERP_FRANCE	ERP_GERMANY
ERP_FRANCE(-1)	0.926712	-0.034395
	(0.01943)	(0.01933)
	[47.7002]	[-1.77947]
ERP_GERMANY(-1)	0.064286	1.001368
	(0.02312)	(0.02300)
	[2.78055]	[43.5343]
C	0.001897	0.002028
	(0.00070)	(0.00070)
	[2.71444]	[2.91784]
R-squared	0.963546	0.949108
Adj. R-squared	0.963320	0.948793
Sum sq. resids	0.015140	0.014986
S.E. equation	0.006846	0.006811
F-statistic	4268.725	3011.908
Log likelihood	1163.729	1165.398
Akaike AIC	-7.121036	-7.131276
Schwarz SC	-7.086188	-7.096427
Mean dependent	0.055685	0.036904
S.D. dependent	0.035748	0.030100

Determinant resid covariance (dof adj.)	1.10E-09
Determinant resid covariance	1.08E-09
Log likelihood	2439.914
Akaike information criterion	-14.93199
Schwarz criterion	-14.86229

Source: Own calculations

Table A.10 WLS Re-estimation of the VAR model

System: FRANCE_GERMANY_WLS
Estimation Method: Weighted Least Squares
Sample: 1985M02 2012M03
Included observations: 326
Total system (balanced) observations 652
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.926712	0.019338	47.92119	0.0000
C(2)	0.064286	0.023013	2.793428	0.0054
C(3)	0.001897	0.000695	2.727014	0.0066
C(4)	-0.034395	0.019239	-1.787714	0.0743
C(5)	1.001368	0.022896	43.73596	0.0000
C(6)	0.002028	0.000692	2.931354	0.0035
Determinant residual covariance		1.08E-09		

Equation: ERP_FRANCE = C(1)*ERP_FRANCE(-1) + C(2)
*ERP_GERMANY(-1) + C(3)
Observations: 326

R-squared	0.963546	Mean dependent var	0.055685
Adjusted R-squared	0.963320	S.D. dependent var	0.035748
S.E. of regression	0.006846	Sum squared resid	0.015140
Durbin-Watson stat	1.859215		

Equation: ERP_GERMANY = C(4)*ERP_FRANCE(-1) + C(5)
*ERP_GERMANY(-1) + C(6)
Observations: 326

R-squared	0.949108	Mean dependent var	0.036904
Adjusted R-squared	0.948793	S.D. dependent var	0.030100
S.E. of regression	0.006811	Sum squared resid	0.014986
Durbin-Watson stat	1.924981		

Source: Own calculations

Table A.11 Stability test of the VAR model

Roots of Characteristic Polynomial
Endogenous variables: ERP_FRANCE ERP_GERMANY
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
0.964040 - 0.028596i	0.964464
0.964040 + 0.028596i	0.964464

No root lies outside the unit circle.
VAR satisfies the stability condition.

Source: Own calculations

Table A.12 Causality of premium values from United Kingdom to France

Dependent Variable: ERP_FRANCE
Method: Least Squares
Sample (adjusted): 1985M02 2012M03
Included observations: 326 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000896	0.000845	1.060693	0.2896
ERP_UK(-1)	0.050350	0.028208	1.784959	0.0752
ERP_FRANCE(-1)	0.934391	0.023644	39.51877	0.0000

R-squared	0.963038	Mean dependent var	0.055685
Adjusted R-squared	0.962809	S.D. dependent var	0.035748
S.E. of regression	0.006894	Akaike info criterion	-7.107198
Sum squared resid	0.015351	Schwarz criterion	-7.072349
Log likelihood	1161.473	Hannan-Quinn criter.	-7.093291
F-statistic	4207.839	Durbin-Watson stat	1.812432
Prob(F-statistic)	0.000000		

Source: Own calculations

Table A.13 Causality of premium values from Germany to Sweden

Dependent Variable: ERP_SWEDEN
Method: Least Squares
Sample (adjusted): 1985M03 2012M03
Included observations: 325 after adjustments
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.086640	0.012339	7.021694	0.0000
ERP_GERMANY(-1)	0.120459	0.063463	1.898102	0.0586
AR(1)	0.964115	0.013753	70.09997	0.0000

R-squared	0.949331	Mean dependent var	0.087434
Adjusted R-squared	0.949016	S.D. dependent var	0.034190
S.E. of regression	0.007720	Akaike info criterion	-6.880818
Sum squared resid	0.019191	Schwarz criterion	-6.845890
Log likelihood	1121.133	Hannan-Quinn criter.	-6.866878
F-statistic	3016.494	Durbin-Watson stat	1.772689
Prob(F-statistic)	0.000000		

Inverted AR Roots	.96

Source: Own calculations

Regression in Table A.10 and Table A.11 fail to satisfy normality requirements. However with the big sample size the coefficient estimates should be unbiased, only the p-values are unreliable.

Tests for a structural break in the series:

Chow Breakpoint Test: 2000M03; Null Hypothesis: No breaks at specified breakpoints; Varying regressors: All equation variables (constant, ERP_?(-1) And @TREND); Equation Sample: 1985M02 2012M03

Table A.14 Results of Chow Breakpoint tests

Country	France	Germany	Sweden	United Kingdom	USA
F-statistic	3.899082	4.923257	3.865480	2.834681	5.518574
p-value	0.0093	0.0023	0.0097	0.0383	0.0010

Source: Own calculations

Appendix 4 Tests on equity premium series from January 1985 to February 2000

Table A.15 Results of KPSS stationarity tests

	ERP France	ERP Germany	ERP Sweden	ERP United Kingdom	ERP USA
Bandwidth*	44.6	43.4	29.8	38.2	26.7
Exogenous	Constant, linear trend	Constant, linear trend	Constant, linear trend	Constant, linear trend	Constant, linear trend
LM-stat	0.090621	0.119029	0.081519	0.088925	0.108570
Critical value**	0.146	0.146	0.146	0.146	0.146
Conclusion	Stationary	Stationary	Stationary	Stationary	Stationary

* Andrews automatic selection
** at 5% significance level
Source: Own calculations

Table A.16 Tests for time trend

		France		Germany		Sweden		UK		USA	
		Value	p-value	Value	p-value	Value	p-value	Value	p-value	Value	p-value
Coefficient	ERP_?(-1)	-0.053911	0.0139	-0.056023	0.0136	-0.096293	0.0012	-0.067598	0.0102	-0.112803	0.0013
	C	0.002174	0.0466	0.002073	0.0432	0.006704	0.0007	0.002868	0.0347	-0.001564	0.1151
	@TREND	2.52E-05	0.1151	1.55E-05	0.1894	3.84E-05	0.0181	2.59E-05	0.1055	6.88E-05	0.0022

Source: Own calculations

Table A.16: Dependent Variable: D(ERP_?): Method: Least Squares; Sample (adjusted): 1985M02 2000M02; Included observations: 181 after adjustments

Table A.17 Pairwise Granger Causality Tests

Sample: 1985M01 2000M02
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DETR_ERP_SWEDEN does not Granger Cause DETR_ERP_USA	181	1.25772	0.2636
DETR_ERP_USA does not Granger Cause DETR_ERP_SWEDEN		0.00038	0.9845
ERP_GERMANY does not Granger Cause DETR_ERP_USA	181	0.03825	0.8452
DETR_ERP_USA does not Granger Cause ERP_GERMANY		1.34468	0.2478
ERP_FRANCE does not Granger Cause DETR_ERP_USA	181	0.04312	0.8357
DETR_ERP_USA does not Granger Cause ERP_FRANCE		0.06582	0.7978
ERP_UK does not Granger Cause DETR_ERP_USA	181	0.01286	0.9098
DETR_ERP_USA does not Granger Cause ERP_UK		0.00347	0.9531

ERP_GERMANY does not Granger Cause DETR_ERP_SWEDEN	181	0.09539	0.7578
DETR_ERP_SWEDEN does not Granger Cause ERP_GERMANY		1.67164	0.1977
ERP_FRANCE does not Granger Cause DETR_ERP_SWEDEN	181	1.11966	0.2914
DETR_ERP_SWEDEN does not Granger Cause ERP_FRANCE		0.12476	0.7243
ERP_UK does not Granger Cause DETR_ERP_SWEDEN	181	1.79675	0.1818
DETR_ERP_SWEDEN does not Granger Cause ERP_UK		0.24030	0.6246
ERP_FRANCE does not Granger Cause ERP_GERMANY	181	1.00664	0.3171
ERP_GERMANY does not Granger Cause ERP_FRANCE		4.09295	0.0446
ERP_UK does not Granger Cause ERP_GERMANY	181	0.05909	0.8082
ERP_GERMANY does not Granger Cause ERP_UK		0.45460	0.5010
ERP_UK does not Granger Cause ERP_FRANCE	181	1.66294	0.1989
ERP_FRANCE does not Granger Cause ERP_UK		0.91378	0.3404

Source: Own calculations

Table A.18 Correlation between the equity premiums 1985M01-2000M02

	ERP_FRANCE	ERP_GERMANY	DETR_ERP_SWEDEN	ERP_UK	DETR_ERP_USA	DETR_ERP_FRANCE	DETR_ERP_GERMANY	DETR_ERP_UK
ERP_FRANCE		**0.814751**	**0.145016**	**0.870292**	**0.346888**		0.400119	0.438309
ERP_GERMANY	**0.814751**		**0.260144**	**0.672710**	**0.384539**	0.483764		0.282745
DETR_ERP_SWEDEN	**0.145016**	**0.260144**		**0.091954**	**0.176198**	0.232393	0.344807	0.134745
ERP_UK	**0.870292**	**0.672710**	**0.091954**		**0.374088**	0.479339	0.255749	
DETR_ERP_USA	**0.346888**	**0.384539**	**0.176198**	**0.374088**		0.555900	0.509687	0.548175
DETR_ERP_FRANCE		0.483764	0.232393	0.479339	0.555900		0.641204	0.702405
DETR_ERP_GERMANY	0.400119		0.344807	0.255749	0.509687	0.641204		0.374764
DETR_ERP_UK	0.438309	0.282745	0.134745		0.548175	0.702405	0.374764	

Source: Own calculations

* DETR – detrended series. Even though the trend was significant only for equity premiums in Sweden and USA, the possibility of misleading test results was considered since the graphs both from this and from the other period suggested that all of the premiums should be following a similar type of process. Therefore additionally the detrended premium series for France, Germany and United Kingdom were also included in the table.

Table A.19 equity premium causality relationship from Germany to France

Dependent Variable: ERP_FRANCE
Method: Least Squares
Sample (adjusted): 1985M02 2000M02
Included observations: 181 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002003	0.001084	1.848365	0.0662
ERP_GERMANY(-1)	0.065779	0.032514	2.023105	0.0446
ERP_FRANCE(-1)	0.934750	0.023194	40.30061	0.0000

R-squared	0.966496	Mean dependent var	0.065736
Adjusted R-squared	0.966119	S.D. dependent var	0.037988
S.E. of regression	0.006992	Akaike info criterion	-7.071593
Sum squared resid	0.008703	Schwarz criterion	-7.018579
Log likelihood	642.9791	Hannan-Quinn criter.	-7.050100
F-statistic	2567.392	Durbin-Watson stat	1.963684
Prob(F-statistic)	0.000000		

Source: Own calculations

Appendix 5 Tests on equity premium series from June 2001 to March 2012

Table A.20 Results of KPSS stationarity tests

	ERP France	ERP Germany	ERP Sweden	ERP United Kingdom	ERP USA
Bandwidth*	29.9	37.3	44	35.7	39.9
Exogenous	Constant	Constant	Constant	Constant	Constant
LM-stat	0.135354	0.276478	0.237298	0.137344	0.354064
Critical value**	0.463000	0.463000	0.463000	0.463000	0.463000
Conclusion	Stationary	Stationary	Stationary	Stationary	Stationary

* Andrews automatic selection
** at 5% significance level
Source: Own calculations

Table A.21 Tests for time trend

		France		Germany		Sweden		UK		USA	
		Value	p-value	Value	p-value	Value	p-value	Value	p-value	Value	p-value
Coefficient	ERP_?(-1)	-0.084200	0.0160	-0.078786	0.0229	-0.060388	0.0462	-0.063700	0.0387	-0.093954	0.0137
	C	0.002250	0.1529	-8.58E-05	0.9460	0.002544	0.1998	0.002435	0.1588	0.005134	0.0318
	@TREND	8.04E-06	0.5875	2.31E-05	0.2279	2.19E-05	0.3130	-1.72E-06	0.9001	-2.44E-05	0.1101

Source: Own calculation

Table A.21: Dependent Variable: D(ERP_?): Method: Least Squares; Sample (adjusted): 2001M07 2012M03; Included observations: 129 after adjustments

Table A.22 Pairwise Granger Causality Tests

Sample: 2001M06 2012M03
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
ERP_GERMANY does not Granger Cause ERP_FRANCE	129	0.03256	0.8571
ERP_FRANCE does not Granger Cause ERP_GERMANY		0.40219	0.5271
ERP_SWEDEN does not Granger Cause ERP_FRANCE	129	2.17835	0.1425
ERP_FRANCE does not Granger Cause ERP_SWEDEN		0.07180	0.7892
ERP_UK does not Granger Cause ERP_FRANCE	129	0.04145	0.8390
ERP_FRANCE does not Granger Cause ERP_UK		0.65515	0.4198
ERP_USA does not Granger Cause ERP_FRANCE	129	0.01389	0.9064
ERP_FRANCE does not Granger Cause ERP_USA		1.00477	0.3181
ERP_SWEDEN does not Granger Cause ERP_GERMANY	129	6.92375	0.0096
ERP_GERMANY does not Granger Cause ERP_SWEDEN		1.19119	0.2772
ERP_UK does not Granger Cause ERP_GERMANY	129	0.00569	0.9400
ERP_GERMANY does not Granger Cause ERP_UK		0.06735	0.7957

ERP_USA does not Granger Cause ERP_GERMANY	129	0.00448	0.9467
ERP_GERMANY does not Granger Cause ERP_USA		3.59738	0.0602
ERP_UK does not Granger Cause ERP_SWEDEN	129	0.01633	0.8985
ERP_SWEDEN does not Granger Cause ERP_UK		0.08551	0.7704
ERP_USA does not Granger Cause ERP_SWEDEN	129	0.07499	0.7846
ERP_SWEDEN does not Granger Cause ERP_USA		1.78947	0.1834
ERP_USA does not Granger Cause ERP_UK	129	0.36020	0.5495
ERP_UK does not Granger Cause ERP_USA		0.53741	0.4649

Source: Own calculations

Table A.23 Equity premium causality relationship from Sweden to Germany

Dependent Variable: ERP_GERMANY
Method: Least Squares
Sample (adjusted): 2001M07 2012M03
Included observations: 129 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.005959	0.002794	-2.132710	0.0349
ERP_SWEDEN(-1)	0.154052	0.058546	2.631301	0.0096
ERP_GERMANY(-1)	0.757783	0.075520	10.03424	0.0000

R-squared	0.889518	Mean dependent var	0.017038
Adjusted R-squared	0.887764	S.D. dependent var	0.020871
S.E. of regression	0.006992	Akaike info criterion	-7.065119
Sum squared resid	0.006160	Schwarz criterion	-6.998612
Log likelihood	458.7002	Hannan-Quinn criter.	-7.038096
F-statistic	507.2282	Durbin-Watson stat	1.737536
Prob(F-statistic)	0.000000		

Source: Own calculations

Table A.24 Equity premium causality relationship from Germany to USA

Dependent Variable: ERP_USA
Method: ML - ARCH (Marquardt) - Normal distribution
Sample (adjusted): 2001M07 2012M03
Included observations: 129 after adjustments
Convergence achieved after 23 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.003398	0.001303	2.607198	0.0091
ERP_GERMANY(-1)	-0.033224	0.016564	-2.005817	0.0449
ERP_USA(-1)	0.933696	0.027211	34.31272	0.0000
	Variance Equation			
C	9.74E-06	4.17E-06	2.338638	0.0194
RESID(-1)^2	0.397610	0.201383	1.974391	0.0483
GARCH(-1)	0.197889	0.181397	1.090915	0.2753

R-squared	0.900409	Mean dependent var	0.040981
Adjusted R-squared	0.898828	S.D. dependent var	0.015035
S.E. of regression	0.004782	Akaike info criterion	-7.883148
Sum squared resid	0.002882	Schwarz criterion	-7.750134
Log likelihood	514.4630	Hannan-Quinn criter.	-7.829102
Durbin-Watson stat	1.747868		

Source: Own calculations

Table A.25 Descriptive statistics of equity premium series 2001-2012

	ERP_FRANCE	ERP_GERMANY	ERP_SWEDEN	ERP_UK	ERP_USA
Mean	0.035807	0.017025	0.065888	0.041044	0.041156
Median	0.033711	0.014637	0.062353	0.040492	0.046112
Maximum	0.069629	0.069011	0.131354	0.078908	0.066207
Minimum	0.000458	-0.038258	0.005333	0.004435	0.003917
Std. Dev.	0.016004	0.020790	0.026799	0.016707	0.015109
Skewness	0.254495	0.338554	0.437061	-0.058375	-0.548271
Kurtosis	2.236001	2.730565	2.507785	2.229467	2.111846
Jarque-Bera	4.564975	2.876628	5.451150	3.289822	10.78579
Probability	0.102030	0.237328	0.065509	0.193030	0.004549
Sum	4.654922	2.213193	8.565473	5.335692	5.350286
Sum Sq. Dev.	0.033040	0.055758	0.092649	0.036005	0.029449
Observations	130	130	130	130	130

Source: Own calculations