ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
MSc Economics & Business
Master Specialisation Financial Economics

Explaining Equity Prices using a variable Equity Risk Premium in a Three-Stage Dividend Discount Model

Author: C.R.J.M. Tilman
Student number: 315207
Thesis supervisor: Dr. D.J.C. Smant
Finish date: October 2009

Abstract

This thesis uses analysts' long-term equity growth forecasts to explain the level of equity prices for the S&P 500, the FTSE 100 and the AEX Index for the years 1989-2007. For the analysis, this thesis compares a one-stage and three-stage dividend discount model. The significant effect of analysts' forecasts on equity valuation in the three-stage dividend discount model breaks down after the millennium. This might be contributed to the height of the equity risk premium assumed. Therefore, the equity risk premium, assumed to be a constant factor in the model, is made variable. Using regression analysis, this thesis finds several factors that explain variation in the equity risk premium. By substituting the equity risk premium in the model with its determinants, the explanatory power of the three-stage dividend discount model is greatly augmented, especially after the millennium.

Acknowledgements

Foremost, I would like to thank Dhr Dr. D.J.C. Smant under whose supervision I chose this topic and wrote the thesis. His helpful comments on all the draft versions provided me with essential feedback, whilst allowing me to work in my own way.

Furthermore, I am very much indebted to Yaela van Raalte, Rolf Toole and George Raven from Insinger de Beaufort, who helped me effortlessly with questions regarding this thesis. Without their help, this thesis would not have seen the light of day.

Also, I would like to thank my fellow students and friends, Hans and Stijn, for their insightful comments and stimulating discussions, but foremost for their ability to provide essential distraction when the writing proved tough.

I would like to thank Eline van Arkel for her love and support, especially at times when she had to live with this thesis as much as with me.

Finally, I would like to thank my father for his continuing support. Without his help and limitless faith in my academic abilities, this thesis would not have been completed.

JEL Classification: G17, C22, B23

Keywords:
Valuation, Dividend Discount Model, Long-term Forecasts, Equity Risk Premium

Table of Contents

List of Figures

List of Tables

Chapter 1 Introduction

Equity valuation is often deemed to be the central concept of active financial management[1] and the heart of finance.[2] It is used in corporate finance, portfolio management and can even provide information for monetary policy makers.

The essence of traditional equity valuation methods lies in the fact that they relate stock prices to the fundamental value of corporations.[3] By using these fundamental economic criteria, equity valuation attempts to calculate the fair value for a company or index and explain the volatility of its stock prices.

Many valuation methods have been used to explain and forecast stock prices, using different assumptions concerning the fundamentals that determine valuation. Some methods compare common variables, or multiples, such as earnings or book value from comparable firms to value a business. A second method uses option-pricing models to value an asset. A final method values an asset through the present value of the future expected cash flows on the particular asset.

Up till this moment, however, no single valuation method has found universal support.

This thesis builds on the extensive literature that assumes that the discounted value of future cash flows (represented by dividends) can provide an accurate measure of the fundamental value of equity in the long run and can therefore help to explain the level in observed stock values.

The research specifically extends the work done by Panigirtzoglou and Scammell (2002). In their work they find that long-term earnings forecasts used within a three-stage dividend discount model help to explain the level of equity prices for the S&P 500 index and the FTSE 100 index. This could imply that the inclusion of professional forecasts in a discounted cash flow model might prove to be a first step towards a better understanding of the valuation of indices.

This thesis adds to their work by expanding the dataset from Panigirtzoglou and Scammell (2002) for the United States and the United Kingdom, the S&P 500 and the FTSE 100, as well as including the AEX index of the Netherlands. The research covers the period 1989-2007.

By including this longer and broader dataset, the conclusions drawn from the abovementioned work could be strengthened. Furthermore, it could provide an extension to the empirical equity valuation research, which focuses on the interaction between fundamental economic factors and observed actual prices.

[1] Grinold and Kahn (2000)
[2] Damodaran (2007)
[3] Nasseh and Strauss (2004)

By using the formulas as introduced by Panigirtzoglou and Scammell (2002), the results found in this thesis partly correspond with the data previously found. The three-stage model adopted in this thesis can help explain the level of equity prices for all three above-named indices up till the year 2000. Furthermore, adding long-term earnings forecasts to the three-stage model causes a significant improvement to the explanatory power when compared to the original one-stage dividend discount model up till the same year.
After the year 2000, the relation between the model and the observed index values for all three countries breaks down. This result might question the generality of the model, since the relation between the model and the observed index values only holds for a specific period of time.

To explain this break in explanatory power of the model, this thesis specifically discusses one of the variables used in the original formulas: the Equity Risk Premium. Because this variable is originally assumed constant throughout the dataset and theory would suggest a more variating premium, this variable might explain the break in explanatory power. Including possible determinants of the equity risk premium in the original model and making it variable throughout the dataset might therefore augment its explanatory power.
Through multiple regression analysis, this thesis locates possible determinants of the equity risk premium. By subsequently substituting the equity risk premium in the model with these variable determinants, the explanatory power of the three-stage dividend discount model is greatly augmented, especially for the period following the millennium.

The chapters of this thesis are the following: Chapter 2 reviews the theory behind different valuation methods, while also providing a short literary review that discusses the dividend discount model. This chapter furthermore briefly discusses the hypothesis of rational expectations and also gives a short overview of the theory and research surrounding the equity risk premium. are reported in Chapter 3 reports, while Chapter 4 presents the results. In the final chapter the conclusions are stated.

Chapter 2 Theory

Literature on equity valuation is extensive and differentiated, encompassing a wide variety of valuation models, ranging from simple to more sophisticated methods. Sector 2.1 briefly reviews the most commonly used equity valuation methods. Sector 2.2 firstly discusses one of the most discussed subjects regarding the dividend discount model; the variance bounds framework. Sectors 2.2.2 and 2.2.3 both provide further background for the research in this thesis by briefly discussing the hypothesis of rational expectations and the equity risk premium.

The following sector briefly discusses various equity valuation models. These valuation methods, for firms and for indices, can be broadly categorized into 3 different approaches.[4]

2.1 Valuation models

2.1.1 Relative Valuation

A first valuation method concerns 'relative valuation', where the value of an asset is determined in relation to the market value of comparable assets. In equity valuation, this valuation technique can be divided into two approaches: one concerning individual firms and one that compares equity indices.

The comparison between individual equities often involves the use of financial ratios or 'multiples' that standardize the values of different companies to a single variable. These ratios and multiples are then used to compare a business to other companies in the same industry, because firms in the same industry are thought to face similar growth rates, risk and cash flows.

Since it is very difficult to group equity indices into peer groups, the approach that concerns equity indices uses other financial ratios. It compares the performance of an individual index with regard to economic and market fundamentals of its related economy, such as inflation forecasts, interest rates and GDP growth. Since there exists, however, no consensus methodology concerning the use of these comparisons, the relative valuation approach is therefore not often used when valuing indices.[5]

[4] As distinguished in Damodaran (2007)

[5] Cohen (2005)

2.1.2 Contingent Claim Valuation[6]

A second method to value a business concerns contingent claim- or real option valuation. This approach has found increasing interest among researchers and practioners in the last decades.[7]
Real option valuation uses the work on option pricing as founded by Black and Scholes (1973) and Merton (1973). When this theory is used to value non-financial assets, such as firms, the term 'real options' is used.[8] This approach considers firms to be a set of investment opportunities, since most firms have the option to, for example, expand or contract production, or to invest or sell parts of the firm.
Real option valuation uses the traditional option pricing techniques used for financial assets to evaluate these investments, especially when the outcomes of these investments are uncertain. The more uncertain the outcome and the higher the risk of an investment, the more valuable the option. Real option theory especially values the fact that managers can learn, adapt and revise their investment decisions in response to market developments.[9] Projects that have a negative Net Present Value (the present value of the series of cash flows derived from that project) at a certain point in time, but feature considerable options, might therefore still prove profitable in the long run.

Real option valuation has been used, for example, in the valuation of mining opportunities (Brennan and Schwarz (1985)), petroleum leases (Paddock et. al (1988)), research and development (Nichols (1994)) and strategic acquisitions (Smith and Triantis (1994).
In practice, this approach is most often used in industries that feature uncertain demand and require constant technological innovation (such as electronics, information technology and biotechnology). [10]

There exist, however, a few difficulties with this approach to valuation. The first difficulty stems from the fact that the inputs needed to value a real option are often difficult to obtain and when obtained, they are often noisy. Also, many of these inputs can easily be manipulated. [11]
On top of this, not all investment opportunities carry options, and not all options are valuable.
This makes the real option valuation approach a difficult project when used for the valuation of businesses or indices, since it might not capture all possible opportunities.

---

6 For a complete review of Real Option Valuation, see Smit and Trigeorgis (2004)
7 In 2001, 27% of all CFO's questioned by Graham and Harvey (2001) used real option theory in practice.
8 The term 'real option' was first used by Myers (1977)
9 Smit and Trigeorgis (2004)
10 Smit and Trigeorgis (2004)
11 Damodaran (2005)

The final difficulty with this approach lies in its complexity. The understanding of the investment itself and the theory of option pricing must be extremely thorough. Combined with the vast amount of data needed to implement this valuation method, it makes it a difficult venture on its own.

2.1.3 Present Value Valuation

The final valuation method, present value valuation, is the oldest model for valuing the equity of a firm and is most often used in research and practise.[12,13]This model is based on the idea that the basis of an assets value lies in the present value of the (uncertain) cash flows an investor can obtain from holding this asset.[14] These cash flows are then discounted for the amount of risk, where a higher discount rate implies a higher risk factor. This valuation approach can, in turn, also be used to valuate firms and indices.

2.1.3.1 Dividend Discount Models

The dividend discount model assumes that the only cash flows obtained when holding equity are represented by dividends. To value the stock, the expected future dividends are discounted by an appropriate discount rate that can vary during the holding period. These discount rates can be adjusted for possible risks involving the payout of the dividends. To calculate the value of the firm it suffices to simply multiply the value of the stock with the amount of stocks listed. In turn, the value of an index can be calculated.

Throughout the last decades the dividend discount model has seen many alterations, all based upon different assumptions concerning dividend growth. [15]

The traditional model, as described above, was first altered by Gordon (1962) to account for a constant growth in future dividends. He posed that both the growth rate of the dividends (and earnings) should be taken as a constant stable growth rate. Because of this assumption, dividends could be forecasted into infinity. This model, the Gordon growth model, therefore, does not account for any flexibility in growth rates.

For this reason, the two-stage dividend discount model was developed. This approach assumes two different dividend growth phases: an initial (higher) growth rate corresponding with start-up companies and a lower, stable growth rate when firms reach their maturity state.

This model, however, features a sharp division between the two growth rates.

[12] Foerster and Sapp (2007)
[13] Damodaran (2007)
[14] Grinold and Kahn (2000)
[15] It is recognized that there are other ways to return value to shareholders. Studies such as Brav et. al (2005) discuss this extensively. However, paying out dividends remains the most prominent way to return value to shareholders. (See for example Foerster and Sapp (2005))

The ‘H’ model, as developed by Fuller and Hsia (1984), therefore employs a two-stage dividend discount model, where the initial (high) growth rate is not constant, but declines at a constant rate until it reaches the steady growth rate.

This insight helped to develop one of the later additions to the dividend discount models: the three-stage dividend discount model. This model combines the concept of the traditional two stage model and the aforementioned ‘H’ model because it includes an initial period of high growth, followed by a period of declining growth rates, and a final stage featuring stable growth.[16]

Many studies have tested the validity of the dividend discount model using observed equity prices, with mixed results. Influential studies by, for example, Schiller (1979 and 1981) and LeRoy and Porter (1981) conclude that changes in equity prices are too volatile to be explained by the variance in dividends.

Sorensen and Williamson (1985), Foerster and Sapp (2005), Esterer and Schröder (2006), among others, however, do conclude favorably on the explanatory power of the different variations of the dividend discount model. A more thorough review of the existing literature on the dividend discount model can be found in sector 2.2.

The power of the dividend discount model lies in the fact that other present value models can all be remodeled to present the dividend discount model.

Book value based models that use the book value of assets together with expected earnings, for example, can easily be reformulated to present the dividend discount model.[17]

Also, certainty equivalence models, which adjust for risk through the expected cash flows instead of through the discount rate and excess return models, that separate cash flows into excess return cash flows and normal return cash flows, can all be remodeled to represent the dividend discount model.[18]

The above review of existing valuation models shows the dispersion that exists among these approaches. All models have been found to provide viable results in different settings. This thesis, however, makes use of the dividend discount approach. This model is chosen because of its simplicity, intuitive logic and the fact that all the common valuation techniques can be recast as the dividend discount model.[19] This makes the dividend discount model the ‘umbrella model’ over all other present value models.[20]

---

[16] A more extensive review of the three-stage dividend discount model can be found in Cornell (1999)

[17] See for example Lundholm and O’Keefe (2001)

[18] For the certainty equivalent model and the dividend discount model, see for example Stapleton (1971). For excess return models and the dividend discount model see for example Hartman (2000) or Shrieves and Wachowicz (2000)

[19] Damodaran (2007)

[20] Penman (1998)

2.2 Review of Literature

As stated in sector 2.1, this thesis makes use of the dividend discount approach to equity valuation. The following sectors first give a brief description of one of the most discussed subject regarding the dividend discount model: The variance bounds framework. Sectors 2.2.2 and 2.2.3 give a brief review of two other important topics that surround the dividend discount model: the hypothesis of rational expectations and the equity risk premium.

2.2.1 The Dividend Discount Model and the Variance Bounds Framework

Many studies have set out to find a long run relation between variations in (expected) dividends and stock prices, because a relation between dividends and stock prices is an implicit requirement for any dividend discount model.[21]

Two of the earliest and most cited papers concerning this topic were published by Leroy and Porter (1981) and Shiller (1981). Both papers pioneer the use of a variance bounds framework to investigate the relation between the volatility in stock prices and the dividend discount model. The assumption underlying this framework concerns the fact that, following the efficient market hypothesis, there should exist an upper limit to the explanatory power of the dividend discount model (explained through the volatility in corporate dividends) when explaining the volatility in stock prices. Both works, independently, test for this relation for the S&P 500 and conclude that there does indeed exist a bound on the explanatory power of the dividend discount model and that there exists excess volatility, where the variation in dividends cannot explain the volatility in stock prices. Shiller (1981), for example, found the volatility of stock prices to be 6-12 times its upper limit.

The research following this conclusion has been twofold. Firstly, much research has been done that accept the results from the variance bounds framework and set out to explain the excess volatility found. Most other research following the findings focused on the viability of the variance bounds framework as adopted by Shiller (1981) and LeRoy and Porter (1981).

The research that set out to explain the observed excess volatility in stock prices found many different causes for this phenomenon.[22] Some papers attribute it to rational bubbles (DeBondt and Thaler (1985), West (1987)), regime-switching in the dividend process (Gutierrez and Vazquez (2004)) or to the presence of noise traders in the market (DeLong et. al (1990), Campbell and Kyle (1993)).

[21] Nasseh and Strauss (2004)

[22] For a complete review of the studies on stock price volatility see West (1988)

None of these explanations, however, has led to a valuation model that explains the data better than the dividend discount model.[23]

The other strand of research has focused on the validity of the use of the variance bounds framework to test for the aforementioned relation, since the frameworks used in both Shiller's (1981) and Leroy and Porter's (1981) work have econometric problems which are considered serious enough to invalidate the results.[24]

By altering the variance bounds framework, Kleidon (1986b) and Akdeniz et. al (2007) explicitly reject the framework used by Shiller (1981) that employs a time-series variance bounds test. By replacing this framework by a cross-sectional variance bounds test, they find that the validity of the traditional dividend discount model cannot be rejected.

Flavin (1983) adopts a different point of criticism on the variance bounds framework. She argues that the sample volatility adopted in Shillers (1981) work are obtained by taking the variation from the sample mean instead of the much larger population variance. This leads her to conclude that the excess volatility can be contributed to the 'sampling properties of the volatility measures'.

Following the criticism on the original variance bounds framework, new tests were developed that incorporated all the objections described. Cochrane (1992), for example, finds that by controlling for the issues mentioned the variance bound is satisfied when using data for the New York Stock Exchange. Ackert and Smith (1993), furthermore, come to similar conclusions when analyzing the Toronto Stock Exchange.

Since the models following the criticism on the variance bounds literature conclude much more favorably on the relation between the variation in stock prices and dividends, it strengthens the validity of the traditional dividend discount model.

[23] Akdeniz et. al (2007)

[24] See for example Flavin (1983) and Kleidon (1986a, 1986b) for a discussion on the framework used in Shiller (1981) and Marsh and Merton (1984) for a discussion on the framework used in LeRoy and Porter (1981)

The dividend discount model itself has many versions, as mentioned in the sector 2.1.3.1.
Much empirical research has been done to validate the use of these different versions with regard to the valuation of firms.
Foerster and Sapp (2007), for example, use the Gordon Growth Model and the S&P 500 to compare the fundamental value obtained through the Gordon Growth model with the actual prices. They find that this simple dividend-based valuation method performs relatively well in explaining the actual prices, especially since 1945.
Rozeff (1990) furthermore uses a three-stage dividend discount model to explain stock prices when he concludes "it (the three-stage dividend discount model) provides significant explanatory power for market prices."

One of the recurring issues in dividend discount models is the fact that it uses expectations to determine equity prices. To validate the use of such expectations, the hypothesis of rational expectations is expected to hold. The following sector offers a brief discussion regarding this hypothesis.

2.2.2 The Rational Expectations Hypothesis

Dividend discount models often make use of expectations to determine equity prices. These expectations often concern the growth rate of the dividends paid out to the owner of the equity. The expectations of these growth rates can be formed by economic agents through the use of naïve econometric models or through, for example, survey data. The use of survey data in economic models has been accompanied by much debate concerning the rationality of this data.

The hypothesis of rational expectations was originally proposed by Muth (1961) and relies on the assumption that processes that can be monitored and understood by economic agents determine economic variables. In time, these agents learn the underlying pattern of this process and form expectations on the development of these economic variables.
In an economic model, the rational expectations hypothesis is generally explained through the premise that the value of an economic variable is, *on average*, equal to the value predicted by the economic agent. The hypothesis does not state that expectations are always correct but that the expectation errors that occur are due to unexpected, unpredictable changes in the economic process. Since these errors exhibit no pattern and exhibit a mean of zero, the forecasts are assumed to be correct on average.

The assumption that economic agents make rational forecasts and the forecasts are assumed to be correct on average has become essential for economic theory, since many theoretical models make use of forecasts based on survey data in their approach. Following this assumption, the validity of the rational expectation hypothesis has been questioned on different accounts.

Arrow (1978) states that the rational expectations hypothesis would require all economic agents to be able to forecast general equilibriums in the economy and that all information regarding the processes that determine these equilibriums must be understood correctly. This would disqualify each economic agent in his ability to perform these features.

It must be understood, however, that the rational expectations hypothesis requires all economic agents, on average, to arrive at the same forecasts, without stating that an identical method is used to conclude on these expectations. The hypothesis simply requires that economic agents can make reasonable predictions, using all available information and their ability to determine the underlying processes that generate an economic variable.[25]

The notion that not all these processes that generate economic variables can easily be determined, rendering the rational expectations hypothesis difficult to hold, comprises a second criticism on the rational expectations hypothesis. Attfield et. al (1985), however, refute this argument and find that a rational forecast can still be made, even though the process underlying an economic variable might be more difficult to determine.

The criticism concerning the rational expectations hypothesis not only touches upon the theoretical framework of the hypothesis. Many empirical tests have been implemented to prove or disprove the validity of the rational expectations hypothesis.

Some of the academic papers state that analysts tend to be too optimistic and over-react to certain information while under-reacting to other information, so that unbiasedness can be rejected.[26]

Other research concludes that the forecast errors are predictable, insinuating that the forecasts are not made rationally.[27]

By using unrevised data on prices and by assuming that errors made by individual forecasters are correlated with the errors of other forecasters, Keane and Runkle (1998), however, oppose these conclusions and find strong evidence that price forecasts are indeed rational.

[25] Shaw (1984)
[26] See for example Stickel (1990), Abarbanell (1991) and Dechow et. al (2000) among others
[27] See for example Abarbanell (1991)

The difference between the use of naïve econometric models and survey data to obtain economic forecasts, mentioned at the start of this sector, has also seen much debate.
Fried and Givoly (1982), Brown et al. (1987) and O'Brien (1988) all conclude that forecasts issued by analysts are more accurate than those issued by econometric models, following the belief that analysts can include variables in their forecasts that econometric models cannot, such as variables concerning psychological factors.

Much research has followed this conclusion to discern if any survey database of expectations can be considered superior than other databases in terms of their accuracy and rationality. Since most studies that use expectations obtained through the use of survey data to calculate equity prices use either the Value Line database or the database of the International Brokerage Estimate System (IBES), Ramnath et. al (2001) compare the under/overreaction of both databases by regressing the forecasts errors. [28] They also compare both the bias and accuracy of the long-term analysts' forecasts in the two databases. While they find that Value Line forecasts and IBES forecasts do not differ significantly in their under/overreaction, the long-term forecasts obtained through the IBES database are more rational and more accurate than those obtained through Value Line. They conclude "(the) IBES is likely the better database choice for researchers seeking long-horizon forecasts to estimate equity valuation models."

A different topic of interest when discussing dividend discount models is the equity risk premium. The next sector briefly introduces the theory behind this variable used in almost all dividend discount models. This variable is specifically discussed, not only to provide some background information, but also because much of the research conducted in this thesis concerns the use of this equity risk premium.

[28] Studies that use the Value Line database are, for example, Abarbanell and Bernard (1992) and Shane and Brous (2001). Kang et. al (1994) and Frankel and Lee (1998), for example, employ the IBES database.

2.2.3 The Equity Risk Premium

The calculation of the equity risk premium (ERP) has been 'arguable one of the most debated issues in finance'.[29] Because this premium is one of the main variables used in dividend discount models and also plays an important role in the research conducted in this thesis, the ERP is briefly discussed in this chapter.

One of the basic assumptions in asset pricing theory concerns the fact that there exists a difference in returns required by investors on the assets they are holding. Assets that carry higher risks are required to have a higher pay off than assets bearing a lower risk.
It is, for example, naturally assumed that stocks feature higher returns when compared to bonds. Not only are stocks more volatile over time, they are also a secondary call on the resources of the company, where bondholders have the first call.[30]
The difference between the average expected rate of return on risky investments, such as stocks, demanded by economic agents over the risk-free interest rate is called the equity risk premium.

The height of this equity risk premium has seen much discussion over the last decades ever since a paper by Mehra and Prescott (1985). Their research used additively separable utility functions and constant relative risk aversion to calculate the ERP for the United States in the period 1926-1985.[31,32] Mehra and Prescott set out to see what level of risk aversion, concerning a possible drop in consumption, would justify the observed level of equity risk premium. They concluded that the ERP for the United States was in excess of 6% for the period 1926-1985, implying an 'unnaturally' high level of risk aversion for investors. Following this conclusion, much research has been done to explain this so-called 'equity premium puzzle'.

The research has focused on explaining the excessive high risk premium through either remodeling the formulas used in Mehra and Prescott (1985) to lower the risk premium to a more 'acceptable' level or by explaining the high risk premium through a series of external historical 'accidents', such as rising valuation multiples and survivorship bias, rendering the phenomenon itself 'wrong' and finding that the high risk premium in the past does not at all imply a high ERP for the future.

[29] Koller et.al (2005)
[30] Arnott and Bernstein (2002)
[31] This model leaves the coefficient of the relative risk aversion as the only parameter.
[32] Additively separable utility functions imply that the utility of consumption in year 1 does not depend on consumption in other years.

Some researchers have altered the utility function offered in Mehra and Prescott (1985), making current consumption depend on a benchmark, represented by, for example, the level of earlier consumption, instead of leaving the utility functions separated.[33] This model, however, only explains about a third of the equity risk premium.

Current consumption might also be compared to a different benchmark, such as the consumption of others, an approach adopted by Abel (1990). This model can explain the observed equity risk premium for a somewhat lower level of risk aversion, without, however completely solving the puzzle.

A different approach is taken by researchers who accept the height of the equity risk premium as found in Mehra and Prescott (1985), but ascribe it to some external phenomena. One of the most persistent of these views focuses on the so-called 'survivorship bias'. This viewpoint implies that the United States stock market must be seen as a 'survivor' in a world where more then half of the 36 stock exchanges that operated at the turn of the century have either seen severe disruptions or have been shut down entirely. This small chance of a economic catastrophe would have led investors to require a higher risk premium for risky investments such as stocks. Since the US has been spared irreparable damage to its stock exchange, this could also explain a part of the high equity risk premium.[34]

Another strand of research believes that the high ERP in the United States can be contributed to the rise in valuation multiples. Between 1926 and 2001, stocks rose from being valued at 18 times dividend to almost 70 times dividend in the United States, explaining one-third of the calculated risk premium in that particular period.[35]

Finally, some researchers conclude that there exists no equity premium puzzle as sketched by Mehra and Prescott (1985), but that investors simply have an exceptionally high level of risk aversion.[36] They argue that the observed high level of risk aversion does not necessarily lead to unreasonable behavior among investors, when small changes in wealth are concerned. Because not all investments concern a small portion of an investor's wealth, however, this assumption has not found too much endorsement among researchers.

[33] See, for example, Constantinides (1990)
[34] See, for example, Siegel and Thaler (1997)
[35] See, for example, Arnott and Bernstein (2002)
[36] See, for example, Kandel and Stambaugh (1991)

The discussion surrounding the equity risk premium has also presented itself through the manner in which the ERP is calculated.

Broadly speaking, three different methods to calculate the equity risk premium can be discerned: The first method calculates the equity risk premium through the use of survey data. *Ex post* calculation of the equity risk premium, where the historical equity risk premium is used as a measure of the future premium, is considered a second option, while *ex ante* calculation of the ERP, where current market prices and interest rates are used to calculate a forward-looking premium, comprise the final method of calculation.

The use of survey data is often used to discern the equity risk premium employed by practioners.[37] Economic agents are asked to fill out a survey containing different questions regarding the height of the ERP and the anticipated development of the premium. This method often shows the lack of consensus on the height of the equity risk premium used in the professional field.[38]

The calculation of the *ex post* ERP is most commonly used. It estimates returns on equities over a long period of time compared to the returns on risk-free investments over the same length of time.[39]The difference in returns presents the excess premium obtained through the holding of risky investments. There exists, however, no single universal accepted method to calculate this historical ERP. The main differences lie in the divergence in the time period measured, the differences in risk-free rate used and the manner in which the returns are averaged over time (geometric, arithmetic).[40] Therefore, even when researchers agree on the components of the equity risk premium, the length and data used to calculate the premium, they could end up with different equity risk premium estimates.[41] The historical equity risk premium for the United States, for example, has been calculated to lie between 7.78% and 4.79% using different calculation methods for the same period of time.[42]

[37] See, for example, Welch (2000), Fisher and Statman (2000) and Graham and Harvey (2008)
[38] Welch (2000), for example, found a range of 1-15% in his survey held among 226 financial economists
[39] Damodaran (2008)
[40] Damodaran (2008)
[41] Welch (2000)
[42] Damodaran (2008)

The trouble with the *ex* post calculation approach lies in the fact that it implicitly assumes that the historical ERP can also be considered to apply to the expected premium in the future. Therefore, when calculating the *ex ante* ERP, the valuation models, such as the dividend discount models, are often rewritten to calculate the risk premium as implied by the current market value, the expected dividends next period and the dividend and earnings long-term growth rate.[43]

However, since there exists no uniform agreement on the model used for this calculation, the equity risk premia implied by the *ex ante* approach also offers many different results.

The difference between the last two measurements can be easily pointed out when looking at the equity risk premium after a bull market. The ex post equity risk premium will be high, but the ex ante equity risk premium will be much lower, anticipating a drop in stock values compared to fundamentals.[44]

The difference in the calculation approaches explained above has led to a large range of databases that feature different equity risk premia over different periods of time that can be used by financial practioners.[45]

To explain the height and volatility, many different variables have been linked to the equity risk premium. The following variables are all described extensively in the literature and are mentioned in this sector since they are all used for the research in the following chapters.

One of the variables most frequently used to describe possible changes in the equity risk premium is the spread between corporate and government bonds.[46] An increase in this variable would indicate a rise in equity risk, which would result in a higher equity risk premium.

When calculating this corporate spread**,** the long-term yield on government bonds is subtracted from the long-term yield on corporate bonds.

Different variables are discussed by Lettau et. al (2007) who link changes in the equity risk premium of the United States to shifts in volatility in the real economy. They specifically attribute these changes in the ERP to reduced volatility in consumption growth and GDP growth. The reduced volatility would lead to a decline in macro-economic risk, implying a lower equity risk premium.

[43] This method of calculating the ERP uses the Gordon Growth model as stated in the next chapter.

[44] Mehra and Prescott (2004)

[45] The database most often used in financial research is the Ibbotson equity risk premia database that features equity premia from 1926 till present over different periods often time. A different databaset is used by Shiller (1986) to obtain equity risk premia from 1870-1998.

[46] See for example Panigirtzoglou and Scammell (2002) and Harris and Marston (1999)

Another factor that might create additional risk is the illiquidity of equity. If investors have to pay high costs to sell their stocks, they will demand a higher equity risk premium. Most of the research on this topic has been done on cross-sectional variation on individual stocks. Some papers, however, have tried to extend this question to overall market risk premia. Gibson and Mougeot (2004) find liquidity to be a significant component of the equity risk premium for the US stock market from 1973-1997. Baekart et al. (2006) on their part conclude that differences in liquidity across markets explain differences in equity risk premia across emerging markets.
A final variable that has been found to contain information regarding the equity risk premium is the book-to-market ratio.[47] This ratio is said to contain information about expected cash flows, which are linked to future expected returns.

This sector has given a brief introduction into the discussion surrounding the equity risk premium, considered to be "perhaps the most important number in financial economics".[48] It has also shown that no uniform accepted equity risk premium is adopted by practioners in research.
The following chapter gives an overview of the methodology employed and the data used in this thesis.

[47] See for example Fama and French (1992), Kothari and Shanken (1997), Pontiff and Schall (1998)
[48] Welch (2000)

Chapter 3 Methodology and Data Description

The dividend discount model features many different versions, as presented in sector 2.1.3.1 This thesis specifically follows the model as introduced by Panigirtzoglou and Scammell (2002). They find that a three-stage dividend discount model that incorporates long-term growth forecasts made by professional analysts can better help to explain the level of equity prices for the United States and the United Kingdom than a simple one-stage dividend discount model.

3.1 The one-stage Gordon growth model

The basic dividend discount model is represented by the Gordon growth model, as mentioned in sector 2.1.3.1. This model assumes a constant dividend growth over time through infinity and relates the value of a stock to the dividend obtained in the next time period, the cost of equity and the expected growth rate of dividends through infinity. The cost of equity is divided into an equity risk premium and a risk-free rate to ensure proper compensation for the time value of money and the risk associated with the stock's future cash flows.

The basic one-stage Gordon growth model is formulated in the following way:

$$P_t = \frac{D_{t+1}}{(ERP_t + Rf_t) - g_t} \qquad (1)$$

Where:	Po	=	Price of Stock at year 0
	D1	=	Expected Dividends at year 1
	ERP	=	Equity Risk Premium
	Rf	=	Risk-free rate
	G	=	Growth rate of Dividends through eternity
	T	=	Time period t

As can be perceived by formula **(1)**, the use of this model is limited to firms that have a stable growth rate of dividends through infinity. This implies that all the other performance measures (such as the earnings growth rate) must grow at that same rate. (For example: if the dividend growth rate exceeds the earnings growth rate, dividends will exceed earnings in the long run. If the earnings growth rate exceeds the growth rate of dividends, the payout ratio in the long run will converge to zero, also rendering the model unstable).

3.2 The three-stage dividend discount model

The three-stage dividend discount model used in Panigirtzoglou and Scammell (2002) combines the features of the classical two-stage model and the H-model, as mentioned in sector 2.1.3.1. It includes an initial period of high growth, followed by a period of declining growth rates and a final stage featuring a stable growth rate. It also includes long-term growth forecasts.

Forecast data in economic models is typically obtained either through use of survey data or through data obtained by the use of naïve econometric models. This thesis follows the conclusions by, for example, Fried and Givoly (1982), Brown et al. (1987) and O'Brien (1988), also mentioned in sector 2.2.3, who favour survey data because of its ability to include variables in its dataset that econometric models cannot, such as variables that concern psychological factors. For this purpose this thesis uses survey forecast data collected in the International Brokerage Estimates System (IBES) following the conclusions drawn in sector 2.2.3.[49]

The three-stage dividend discount model used in this thesis can be formulated in the following fashion:

$$P_t = \frac{D_t}{(ROE_t - g_t)}\left[(1 + g_t) + n_t * (g_{IBES\,t} - g_t)\right] \qquad (2)$$

Where:	Pt	=	Price of Stock
	Dt	=	Dividend
	ROE	=	Return on Equity
	G	=	Long Run Real Growth Rate
	Gibes	=	Real Growth Rate from IBES Forecasts
	N	=	Number of years assumed for the transition period
	T	=	Time Period t

[49] Sector 3.3.1.1 will further clarify the choice for this particular database

The Long Run Real Growth Rate (g) can further be divided into:

$$g_t = ROE_t * (1 - b_t) \qquad (3)^{50}$$

Where: ROE = Return on Equity. It is assumed that in the long run, the ROE will become equal to the Cost of Equity (ROE = ERP+r), where ERP represents the Equity Risk Premium investors expect for their (risky) investments and r stands for the long-term interest rates. This will exclude any possible abnormal earnings in the maturity stage.

B = Pay-out ratio, the fraction of earnings paid out as dividends ($\left(\frac{D_t}{E_t}\right)$)

The formulas mentioned above are used to extend the research done by Panigirtzoglou and Scammell (2002). By using monthly time-series data, formulas **(1), (2)** and **(3)** can be solved to obtain monthly equity prices implied by the one-stage and three-stage dividend discount model. These implied equity prices are then compared to the observed equity prices for all three countries for the period 1989-2007 to see whether the three-stage dividend discount model does a better job at explaining the level of observed equity prices than the simple one-stage Gordon growth model.

Chapter 4, which discusses the first results of the research, shows that the three-stage model adopted in this thesis can help explain the level of equity prices for all indices when compared to the simple one-stage model up till the year 2000. To account for the break in explanatory power after the millennium, this thesis examines the role of one of the variables used in the formula: The equity risk premium. Since the equity risk premium is assumed to be constant throughout the entire dataset and chapter 4 shows that the observed equity prices do not support this assumption, this variable might (partially) explain the mentioned drop in explanatory power after the year 2000.

[50] Bodie et al (2005)

It is therefore interesting to see if changes in the implied risk premium correspond to changes in other economic variables. This information can, in turn, be used to construct a variable equity risk premium for the three-stage dividend discount model using these economic variables.

Firstly, the monthly implied equity risk premium is calculated by inversing formulas **(2)** and **(3)** using the observed equity prices for all three countries.

To locate possible determinants of this implied equity risk premium, a multiple regression analysis is then run for all three countries featuring different sets of explanatory variables often cited in literature and described in sector 2.2.4. These regression analyses show that the chosen explanatory variables explain a large portion of the variation in the implied equity risk premium.

Finally, the results of the regression analyses are used to substitute the constant equity risk premium in formulas **(2)** and **(3)** with an equity risk premium that variates throughout the dataset to see if this might heighten the explanatory power of the three-stage dividend discount model.

The description of the data used for formulas **(1)**, **(2)**, and **(3),** the regression analysis and the manner in which the data is obtained can be found in the following section.

3.3 Data Description

3.3.1 Data description one-stage and three-stage dividend discount model

Because of the difference in availability of all the data, the range in the dataset used for the research in this thesis of both dividend discount models differs among the three countries.

The dataset for the United States starts in December 1991 due to the absence of earlier long-term inflation forecasts, while the dataset for the United Kingdom starts in June 1993 since no earlier earnings data could be found. The dataset for the Netherlands commences in May 1989 since no earlier IBES forecasts for this country were made.

The dataset for all three countries, however, end in April 2007, together with the available IBES forecasts and are presented in months.

3.3.1.1 The return on equity

The return on equity used in equation **(3)** is divided into an Equity Risk Premium and a risk-free rate. The risk-free rate represents the interest rate paid by financial instruments that carry no default risk. Other risks, such as liquidity risk (where one faces the risk of being unable to sell the instrument on short notice, without having to pay large cost), or inflation risk (the risk that the real value of your instrument might drop due to high inflation), however, might still be present in the risk-free rate.

The risk-free rate differs between the United Kingdom, the United States and the Netherlands.

In case of the United Kingdom, the monthly yield on long-term (ten-year) zero coupon Inflation Linked Gilts (ILG's) is used as a proxy for the risk-free rate.

These long-term, liquid government bonds are often considered to carry (almost) no default risk. Since the principal on these particular bonds is indexed to the inflation rate there is, furthermore, no inflation risk present. The yields are obtained through the Bank of England and cover the period of January 1985-January 2009. The yields are presented in percentages.

Since neither the United States nor the Netherlands feature similar liquid inflation linked bonds, these risk-free rates have to be calculated.[51]

The risk-free rate for the United States is calculated by subtracting the quarterly long-term (ten years) inflation expectations collected by the Survey of Professional Forecasters from the monthly yield on 10 year zero coupon US government bonds.[52] Since the Survey of Professional Forecasters did not start collecting these forecasts until December 1991, no earlier inflation expectations are used in this thesis. The forecasts end in October 2008. The yields on the long-term bonds are obtained through Thomson Datastream and range from January 1989-October 2008. Both the inflation expectations and the yields are presented in percentages.

The risk-free rate for the Netherlands is calculated in a different manner.

The monthly yields on ten-year zero coupon government bonds are reduced by semi-annual long-term inflation expectations issued by Consensus Economics in the monthly issue of their paper on Economic Forecasts. These inflation expectations are obtained through a survey of more than 200 prominent forecasters in Western Europe and are issued each April and October. The surveyed are asked to give a forecast for the inflation rate for each year for the coming 5 years, as well as an average forecast of the inflation rate for the subsequent 5 years. To calculate the expected long-term inflation rate, an average of all these forecasted rates is taken and assumed for the 6 months including and following the date of issue of the forecasts.

---

[51] The United States Treasury does issue inflation-indexed securities (TIPS), but these have only traded since 1997 and are relatively illiquid. This makes the risk-free rate calculated in this thesis more useful.

[52] http://www.phil.frb.org/research-and-data/real-time-center/survey-of-professional-forecasters/historical-data/inflation.xls

The forecasts for April and October 2000 and October 2001 are not available. These rates are calculated by averaging the forecasts before and after these dates.

Also, since the long-term inflation forecasts are not available prior to 1996, the one-year ahead expected inflation rates for the years preceding 1996 are used, since these rates are the only expected inflation rates available for the Netherlands. These inflation rates are issued by the Central Planning Bureau (CPB) of the Netherlands and are also used for the period following April 2007, since these rates were not available either.[53] The inflation expectations for the Netherlands end in October 2008.

The monthly yields on the long-term bonds are obtained through Thomson Datastream and cover the period of January 1989-October 2008. Both the inflation expectations and the yields data are presented in percentages.

Since all yields and inflation forecasts used for the calculation of the risk-free rate are presented in percentages, the risk-free rate is also presented in percentages.

3.3.1.2 The equity risk premium

Sector 2.2.4 has shown that there exists no universal accepted rate for the equity risk premium. This thesis adopts an equity risk premium rate for all three countries of 4% to calculate the equity prices as implied by both dividend discount models. This is close to the annual average risk premium for all three countries since the 1960's and corresponds to the risk premium used in Panigirtzoglou and Scammell (2002).[54]

3.3.1.3 The long run real growth rate

The long run real growth rate is calculated using equation **(3)**, where the return on equity is calculated in the fashion put forth in sector 3.3.1. All long run real growth rates are presented in percentages.

3.3.1.4 The payout ratio

The payout ratio is calculated on a monthly basis by dividing the dividends for each index by its earnings. Since neither dividends nor earnings are directly available for indices, they are recalculated each month using dividend yields and price/earnings ratios respectively. [55]

These monthly dividend yields and price/earnings ratios are obtained through Thomson Datastream for all three indices.

[53] CPB (1988-1996, 2007-2008)

[54] The assumption of a 4% ERP is also supported by Damodaran (2008), who calculates the equity risk premium using 8 different approaches. The average of all these approaches lies around the mentioned 4%.

[55] Dividends are calculated by multiplying the dividend yield with the price and dividing the answer by 100, while earnings are calculated by dividing the price of an index by its price/earnings ratio.

The length of the period covered by the earnings and dividends differ among the three countries. While dividend and earnings data for the United States and the Netherlands are available from January 1983, dividends for the United Kingdom are only available from January 1986 onwards and earnings are not even available until June 1993. All earnings and dividend data end in October 2008.

3.3.1.5 IBES forecasts

The Three-Stage Dividend Discount Model used in this thesis (equation **(2)**) specifically incorporates long-term analysts' forecasts. Since, according to financial theory, long-term expected earnings growth drives the valuation of the overall stock market and individual stocks, these long-term EPS growth forecasts are essential for valuation models.[56]

The long-term earnings growth forecasts used in this thesis are published by the International Brokerage Estimates System (IBES). This database is used because it features a more comprehensive coverage of brokerage firms and financial analysts than any other commonly used service, and includes many analysts from smaller brokerage firms.[57,58]

Also, as mentioned in sector 2.2.3, the IBES database is considered to be more rational and more accurate than other frequently used databases.

The IBES analysts' projections include corporate earnings (not dividends) and are consensus forecasts by sell-side analysts of the EPS growth of an index, sector or company over a specific period of time, excluding all non-operating items.[59]

The 'long-term' forecasts for the FTSE 100, the S&P 500 and the AEX index cover three to five years. This thesis uses these forecasts as a 4-year average.[60]

The IBES forecasts used in this thesis start in December 1987, November 1988 and May 1989 for the United States, the United Kingdom and the Netherlands respectively. All three sets end in April 2007 and are presented in percentages.

3.3.1.6 The length of the high growth and transition periods

The high growth period is set at four years. The length of the transition period is set at eight years ('N' in formula **(2)**). This follows the length of the transition period adopted in other research.[61]

---

[56] Cusatis and Woolridge (2008)
[57] Cusatis and Woolridge (2008)
[58] Other databases commonly used include Zack's Investment Research, Value Line and Thomson First Call Research
[59] Panigirtzoglou and Scammell (2002)
[60] This follows for example: Ramnath et al. (2001) and Cusatis and Woolridge (2008)
[61] See for example: Lee et al. (1999) and Reimer et al. (2001)

3.3.2 Data description regression analysis

The variables used for the regression analysis are the variables as discussed at the end of sector 2.2.4.

For the corporate spread, the yields for long-term government bonds used earlier in this thesis were employed, while the yields for long-term corporate bonds were obtained through Moody's Rating Agency, using the yields on long-term AAA corporate bonds. All yields are presented in percentages.

Consumption growth is measured as the growth in total personal consumption expenditures. For the United States, the data that corresponds to Personal Consumption Expenditures (PCE) is used and obtained through the Bureau of Economic Analysis of the US Department of Commerce. The data for the United Kingdom are obtained through the Office of National Statistics, while the consumption growth rates for the Netherlands are obtained through the CBS database.

Since both the data for the United Kingdom and the Netherlands are measured by quarterly growth rates, these rates are interpolated to represent monthly rates. Consumption growth is measured in percentages.

GDP growth is measured by the quarterly growth in the Gross Domestic Product. The data for all three countries was obtained through Bloomberg and interpolated to represent a monthly percentage change in the GDP.

As a proxy for market liquidity, the monthly changes in the number of shares traded on each index are used, following the approach taken by Gibson and Mougeot (2004). The data for trading volume for the United States are obtained through data 360, a website that features datasets for the economy of the United States.[62] This dataset ends in August 2006. The data for the UK are obtained through Thomson Datastream and also end in August 2006. The data for the Netherlands are obtained through Bloomberg and start in February 1993.

The variable for market liquidity is measured in percentages.

Finally, the Book-To-Market ratio uses book values obtained through Bloomberg, using the index-weighted book values. All market values are obtained through Thomson Datastream. The data on the book-to-market ratio for the United States commences in January 1995, while the dataset on this ratio for The United Kingdom and the Netherlands start in July 1993. All ratios are measured in percentages.

The data used for the regression analysis cover the monthly values for the period December 1991-April 2007 for the United States, June 1993-April 2007 for the United Kingdom and May 1989-April 2007 for the Netherlands unless specifically mentioned otherwise.

[62] http://www.data360.org/dataset.aspx?Data_Set_Id=398

Chapter 4 Results

When comparing the results in this chapter to those found in Panigirtzoglou and Scammell (2002) for the periods covered in both papers, small differences can be noted. These can be attributed to a possible difference in the data used, since it is not clear which sources were used for the Panigirtzoglou and Scammell paper. This thesis, for example, uses earnings data issued by Thomson Datastream, while Panigirtzoglou and Scammell used the realised earnings data issued by IBES. The trends, however, exhibit the same patterns as found in the aforementioned paper.

4.1 IBES earnings forecasts versus outturns

Figure 1 shows the monthly analysts' forecasts and their respective outturns for the US, UK and Dutch stock market. The figure compares the IBES long-term earnings forecasts with the actual annualised four-year-ahead earnings growth.

Because long-term forecasts are often only revised by a small amount because these forecasts tend to lie around a long-term mean value, the graph displaying the forecasts shows less variability when compared to the actual outcomes.

INSERT FIGURE 1 HERE

4.2 Observed Index Prices versus Dividend Discount Models

Figure 2 compares the individual index prices with the index prices implied by both the one-stage dividend discount model (formula **(1)**) and the three-stage dividend discount model (formula **(2)**).

INSERT FIGURE 2 HERE

The graph shows that the index values implied by the three-stage dividend discount model in general follow the observed index values until approximately the year 2000. Then larger deviations occur.

The three-stage model used in this thesis provides a better explanation for the observed index values than the one-stage model, since the values implied by the three-stage dividend discount model track the observed index values more closely. After the year 2000 the larger explanatory power of the three-stage model decreases.

To possibly heighten the explanatory power of this particular three-stage dividend discount model, particular attention will be given to the equity risk premium.

4.3 Equity Risk Premium

Figure 2 clearly shows the drop in explanatory power of the three-stage dividend discount model after the millennium. A possible explanation for this reduction might lie in the assumption of a constant equity risk premium as described in sector 3.3.1.2.[63] However, since many researchers find the equity risk premium to vary considerably over time, a more variable equity risk premium might augment the explanatory power of the three-stage dividend discount model used in this thesis.[64]

The equity risk premium (ERP) needed to calculate the different index values for both dividend discount models, was initially presumed to be 4%. Reversing the calculations and using the observed index values as the Price (Pt) in formula **(2)** makes it possible to calculate the corresponding equity risk premia. Figure 3 shows the different levels for these premia for the United States, the United Kingdom and the Netherlands.

INSERT FIGURE 3 HERE

The graph shows the risk premia for all three countries to be highly variable with the premium for the United States and the United Kingdom moving around the mentioned 4%. The premium for the Netherlands, however, moves around a higher level. This could imply that the expected ERP of 4% for the Netherlands, presumed at the start of this thesis, was set too low.

Since the deviation, however, is not so large to warrant significant changes in the results, the assumed equity risk premium of 4% is adopted.

[63] Since the length of the transition period in this thesis was assumed to be 8 years, a change in this period might also result in smaller deviations from the observed index values. Changing the length of the transition period, however, does not have a significant effect, as can be see in figures A2 and A2 in Appendix A. These figures compare the implied equity prices to the observed equity prices, using transition periods of 6 and 10 years.

Because figure 3 shows that the equity risk premium for all three countries exhibit variation throughout the dataset, a change to a more variable equity risk premium in the three-stage model might lead to smaller deviations from the observed index values. It is therefore interesting to see if changes in the implied risk premium as seen in Figure 3 correspond to changes in other economic variables.

This information can, in turn, be used to construct a variable equity risk premium for the three-stage dividend discount model using these economic variables as determinants of the equity risk premium. To locate possible determinants of the equity risk premium, a regression analysis is run using the data described in sector 3.3.2.

4.4 Regression analysis

After possible outliers have been excluded from the dataset and the variables have been checked for normality and multicollinearity, it becomes possible to run a regression analysis to locate possible determinants of the equity risk premium.[65]

To locate the possible determinants of the equity risk premium, this thesis uses Ordinary Least Square (OLS) regression analysis. To calculate how well the set of variables described in section 3.4.1 explains the variation in the implied risk premium, this thesis employs the following regression analysis:

$$ERP_t = a + b_{1*} ConsGr_{t-i} + b_2 * GDPGr_{t-i} + b_3 * Liq_{t-i} + b_4 * CorpSpr_{t-i} + b_5 * BTM_{t-i} + \in \quad (4)$$

Where: ERP = (Implied) Equity Risk Premium

ConsGr =Monthly National Personal Consumption Growth

GDP Growth =Monthly National GDP Growth

Liq =Monthly liquidity

CorpSpr =Monthly Corporate Spread

BMT =Monthly Book-To-Market Ratio

T-i =Time period T-I, where T-3 = 3 months, T-6 = 6 months etc

The explanatory variables in this regression analysis are stated as lagged predictors of the equity risk premium to discern the possible forecasting powers of these explanatory variables. Since not all explanatory variables are issued at a monthly basis the explanatory variables are lagged for a period of 3 months at a time. This implies, for example, that T-3 concerns the value of the explanatory variable three months before the calculation of the equity risk premium and T-6 concerns the value of the variable 6 months before the calculation of the equity risk premium.

[65] 6 observations have been excluded from the analysis because they are considered outliers. Appendices B and C give a complete description of the tests concerning possible outliers, the normality assumption and multicollinearity

This analysis, however, does not use lagged predictors that go back more then 12 months. Therefore, 5 different regression analyses are run, reflecting T=t and T-3, T-6, T-9 and T-12.

To see if the variables discussed in sector 3.3.2 can help to explain the variation in the implied risk premia for the United States, the United Kingdom and the Netherlands, the R squared variable can be consulted. This variable shows the amount of variance in the dependent variable (the implied equity risk premium) that can be explained by the model. To see which of the 5 possible set of variables (T=T, T-3, T-6, T-9, T-12) explains the variation in the equity risk premium the fullest, Table 1 shows the different sets of R squared variables for all 5 sets of predictors for all three countries.

INSERT TABLE 1 HERE

While the regression analyses used for all 5 sets each roughly explains 50 percent of the variation in the equity risk premium for all three countries, the regression analysis that uses the lagged predictors of T-6 does the best job. For this reason, this regression analysis is used for all further research.[66]

The complete results of the multiple regression analysis for all three countries with the lagged predictor variables of T-6 are shown in table 2.

INSERT TABLE 2 HERE

Following Table 1, the R squared variable shows values of 0.58, 0.53 and 0.61 for the United States, the United Kingdom and the Netherlands respectively. This implied that 58% of the variance in the implied equity risk premium for the United States and 53% for the United Kingdom can be explained be their models, while the model for the Netherlands even explains 61% of the variation in its implied risk premium.

For these results to be statistical significant at a 5% level, it is required for the significance to lie below 0.05. Since all three tables in Table 2 show a significance of 0.000, all R squared values can be considered statistical significant at a 5% level.

[66] The descriptive statistics of the observations used for this regression analysis can be found in Appendix D.

One objection might be put forth against these results, however. Since the variability of the book-to-market ratio is often primarily derived from variation in the market value, and the models used in this thesis try to calculate the market value, the high explanatory power of the model might be solely attributed to the inclusion of the book-to-market ratios.

To conclude on the explanatory power of the model as presented above a, regression analysis is run for all three countries, excluding the book-to-market ratios. These regression results can be found in Table 3 in and show that, although the exclusion of the book-to-market ratio does have a negative effect on the explanatory power of the model for two countries (the R squared variable for all countries and all sets of (lagged) predictors, especially for the United States, drops), these results continue to be statistically significant.

INSERT TABLE 3 HERE

Also, because the observed book values used to calculate the book-to-market ratios display a normal variability, it is less likely that the variation in the book-to-market ratio can exclusively be ascribed to the change in market values.
Because the regression results stay significant and the book values used for the regression analysis show a normal variability, the model that includes the book-to-market ratios is used for the subsequent research.

4.5 Implementation of the results

The multiple regression analysis implemented in the previous chapter has enabled the stable equity risk premium, assumed to be 4% in the three-stage dividend discount model, to become variable.

The regression analysis has shown that the equity risk premium can, partially, be explained by consumption growth, GDP growth, market liquidity, corporate spread and the book-to-market ratio. Using the betas in table 2, the following equations can be discerned:

For the United States:

$$ERP = 0.016 + 0.348 * ConsGr_{T-6} + 0.216 * GDPGr_{T-6} + 0.003 * Liq_{T-6} - 0.159 * CorpSpr_{T-6} + 0.074 * BTM_{T-6} \quad (5)$$

For the United Kingdom:

$$ERP = 0.042 - 0.729 * ConsGr_{T-6} - 0.008 * GDPGr_{T-6} + 0.0001 * Liq_{T-6} - 0.453 * CorpSpr_{T-6} + 0.042 * BTM_{T-6} \quad (6)$$

For the Netherlands:

$$ERP = 0.082 - 0.757 * ConsGr_{T-6} - 0.373 * GDPGr_{T-6} - 0.002 * Liq_{T-6} - 0.755 * CorpSpr_{T-6} - 0.007 * BTM_{T-6} \quad (7)$$

Each coefficient shows the amount of change in the dependent variable, when the concerning explanatory variable rises with 1, whilst holding all other explanatory variables constant;

If consumption growth for the United States, for example, rises with 1 percent, the equity risk premium is expected to rise with 0.348%.

To see if a variable equity risk premium, explained by the numerous variables mentioned in the regression analyses, strengthens the explanatory power of the three-stage dividend discount model, equations **(5), (6)** and **(7)** are added to equation **(2)**. In this way, the static equity risk premium of 4% is substituted by an equity risk premium that variates throughout the dataset.

Figure 4 therefore compares the individual index prices with the index prices implied by both the one-stage dividend discount model (formula **(1)**) and the three-stage dividend discount model (formulas **(2)** and **(3)**) using a variable equity risk premium.

INSERT FIGURE 4 HERE

Figure 4 clearly shows the positive effect of the implementation of a variable equity risk premium. Compared to figure 3, the three-stage dividend discount model does a much better job in explaining the variation in observed equity prices for all three indices, especially after the millennium. After the year 2000, the drop in explanatory power of the three-stage dividend discount model, as noted earlier in this thesis, has now virtually diminished.

Table 4, furthermore, shows the correlation between the observed equity prices and the equity prices implied by the one-stage and three-stage dividend discount model as well as the three-stage dividend discount model that includes a variable equity risk premium. Even though the correlation coefficient does not give any information about the level of equity prices, a rise in the correlation coefficient indicates a rise in the degree that both variables move in the same manner throughout the sample period.

INSERT TABLE 4 HERE

The table clearly shows that the correlation between the observed and implied equity prices has risen significantly when substituting the constant equity risk premium by its variable determinant, indicating a rise in co-movement between the observed and implied equity prices. The correlation coefficients might therefore also support the notion that by employing a variable equity risk premium, the three-stage dividend discount model does a significantly better job in explaining the variation in equity prices, when compared to a one-stage model.
This applies to all three countries, throughout the entire dataset.

Chapter 5 Conclusion

The explanatory power of the dividend discount model regarding the variation in equity prices has seen much debate. This thesis follows the results of Panigirtzoglou and Scammell (2002), who find that the inclusion of long-term analysts' forecasts in a three-stage dividend discount model helps to explain the level of equity prices for the S&P 500 of the United States and the FTSE 100 of the United Kingdom.

By expanding the dataset to include the AEX index for the Netherlands and by lengthening the analysis by adding the period 2001-2007, this thesis finds that a three-stage dividend discount model that includes long-term forecasts and uses a constant equity risk premium, helps to explain observed equity prices until the year 2000. It does, however, lose its explanatory power in the period following the millennium.

Because the three-stage dividend discount model used in this thesis assumes a constant equity risk premium throughout the period tested, the break in explanatory power after the millennium might be ascribed to the rigidity of this variable. In order to identify possible determinants of the equity risk premium implied by the model, several multiple regression analyses are run. Four of these analyses implore lagged predictors (T-3, T-6, T-9, T-12), while 1 regression analysis does not make use of a lagged predictor (T=t).

While all the models explain the variation in the equity risk premium to a certain extent, the model that uses data available 6 months before the observation fares the best. The analysis shows that by including variables such as corporate spread, consumption growth, GDP growth, liquidity and book-to-market ratio, 53-61% of the variation in the implied equity risk premium can be forecasted 6 months in advance by the mentioned explanatory variables.

When these variables are included in the three-stage dividend discount model to replace the constant equity risk premium, the explanatory power of the three-stage dividend discount model is augmented. The noted break in explanatory power, present after the millennium, is made undone.

It can therefore be concluded that, by using a variable equity risk premium, the three-stage dividend discount model does a much better job in helping to explain the variation in equity prices for the United States, the United Kingdom and the Netherlands than a one-stage dividend discount model for the years 1989-2007.

References

Literature

- Abarbanell, J., S., "Do Analysts' Earnings Forecasts Incorporate Information in Prior Stock Price Changes?", *Journal of Accounting and Economics*, Volume 14, 1991, Page 147-165

- Abarbanell, J., S., Bernard, V., "Test of Analysts' Overreaction/Underreaction to Earnings Information as an Explanation for Anomalous Stock Price Behavior", *Journal of Finance*, Volume 47, 1992, Page 1181-1207

- Abel, A., B., "Asset Prices under Habit Formations and catching up with the Joneses", *America Economic Review*, Volume 80, 1990, Page 38-42

- Ackert, L., F., Smith, B., F., "Stock Price Volatility, Ordinary Dividends and other Cash Flows to Shareholder", *Journal of Finance*, Volume 48, 1993, Page 1147-1160

- Akdeniz, L., Salih, A., A., Ok, S., T., "Are Stock Prices Too volatile to be Justified by the Dividend Discount Model?", *Physica A*, Volume 376, 2007, Page 433-444

- Arnott, R., D., Bernstein, P., L., "What Risk Premium is Normal", *Financial Analsysts Journal*, 2002, Page 64-85

- Arrow, K., J., "The Future and the Present in Economic Life", *The Economic Enquiry*, Volume 16, Number 2, 1978, Page 157-169

- Attfield, C., L., F., Demery, D., Duck, N., W., *Rational Expectations in Macroeconomics*, Blackwell, Oxford, 1985

- Bekaert, G., Harvey, C., R., Lundblad, C., "Liquidity and Expected Returns: Lessons from Emerging Markets", *The Review of Financial Studies*, Volume 20, Number 6, 2006, Page 1783-1831

- Black, F., Scholes, M., "The Pricing of Options and Corporate Liabilities", *Journal of Political Economy*, Volume 81, 1973, Page 637-654

- Bodie, Z., Kane, A., Marcus, A., J., *Investments*, McGraw-Hill/Irwin, New York, 2005

- Brav, A., J., R., G., Campbell, R., H., Roni, M., "Payout Policy in the 21st Century", *Tuck Contemporary Corporate Finance Issues III Conference Paper*, 2005

- Brennan, M., Schwartz, E., "Evaluating Natural Resource Investments", *Journal of Business*, Volume 58, Number 2, 1985, Page 135-157

- Brown, L., D., Griffin, P., A., Hagerman, R., L., Zmijewski, M., E., "Security Analyst Superiority Relative to Univariate Time-Series Models in Forecasting Quarterly Earnings", *Journal of Accounting and Economics*, Volume 9, Number 1, 1987, Page 61-87

- Campbell, J., Y., Kyle, A., S., "Smart Money, Noise Trading and Stock Price Behavior", *Review of Economical Studies*, Volume 60, 1993, Page 237-261

- Cochrane, J., H., “Explaining the Variance of Price-Dividend Ratios”, *Review of Financial Studies*, Volume 5, Number 2, 1992, Page 243-280

- Cohen, R., D., The Relative Valuation of an Equity Price Index, *The Best of Wilmott*, Volume 2, 2005, Page 99-132

- Constantinides, G., M., “Habit Formation: A Resolution of the Equity Risk Premium Puzzle”, *Journal of Political Economy*, Volume 98, Number 3, Page 519-543

- Cornell, B., *The Equity Risk Premium: The Long-run Future of the Stock Market,* John Wiley & Sons, New York, 1999

- CPB, *Macro-Economische Voorspellingen*, SDU Publisher, The Hague, 1988-2007

- Cusatis, P., Woolridge, J.R., “The Accuracy of Analysts’ Long-Term Earnings per Share Growth Rate Forecasts”*, Working Paper*, Pennsylvania State University*,* 2008

- Damodaran, A., *The Promise and Peril of Real Options*, Working Paper, New York University, 2005

- Damodaran, A., *Valuation approaches and Metrics: A Survey of the Theory and Evidence*, Now Publishers Inc., New York, 2007

- Damodaran, A., “Equity Risk Premiums: Determinants, Estimation and Implication”*, Working Paper*, 2008

- DeBondt, W., F., M., Thaler, R., “Does the Stock Market Overreact?”, *Journal of Finance*, Volume 40, 1985, Page 793-805

- Dechow, P., M., Hutton, A., P., Sloan, R., G., “The Relation between Analysts’ Forecasts of Long-Term Earnings Growth and Stock Price Performance Following Equity Offerings”, *Contemporary Accounting Research*, Volume 17, 2000, Page 1-32

- Delong, J., B., Schliefer, A., Summers, L., H., Waldmann, R., J., “The Economic Consequences of Noise Traders”, *Journal of Political Economy*, Volume 98, 1990, Page 703-738

- Esterer, F., Schröder, D., “Implied Cost of Capital Based Investment Strategies”, *Working Paper*, 2006

- Fama, E., F., French, K., “The Cross-Section of Expected Stock Returns”, *Journal of Financial Economics*, Volume 33, 1992, Page 3-56

- Fisher, K., L., Statman, M., “Investor Sentiment and Stock Returns”, *Financial Analysts Journal*, Volume 56, Page 16-23

- Flavin, M., “Excess Volatility in Financial Markets: A Reassessment of the Empirical Evidence”, *Journal of Political Economy*, Volume 91, 1983, Page 929-956

- Foerster, S., R., Sapp, S., G, “The Dividend Discount Model in the Long-Run: A Clinical Study”, *Journal of Applied Finance*, Volume 15, Number 2, 2005, Page 55-75

- Foerster, S., R., Sapp, S., G., *"Dividends and Stock Valuation: A Study from the Nineteenth to the Twenty-First Century",* 2007

- Frankel, R., Lee., C., "Accounting Valuation, Market Expectations and Cross-sectional Stock Returns", *Journal of Accounting and Economics,* Volume 24, 1998, Page 283-319

- Fried, D., Givoly, D., "Financial Analysts' Forecasts of Earnings: A Better Surrogate for Market Expectations", *Journal of Accounting and Economics*, Volume 4, Number 2, 1982, Page 85-107

- Fuller, R., J., Hsia, C., "A Simplified Common Stock Valuation Model"*, Financial Analysts Journal*, Volume 40, 1984, Page 49-56

- Gibson, R., Mougeot, N., "The Pricing of Systematic Liquidity Risk: Empirical Evidence from the US Stock Market"*, Journal of Banking and Finance*, Volume 28, 2004, Page 157-178

- Gordon, M., J., *The Investment, Financing, and Valuation of the Corporation*, R. Irwin, Homewood III, 1962

- Graham, J., R., Harvey, C., R., "The Theory and Practise of Corporate Finance: Evidence from the Field", *Journal of Financial Economics*, Volume 60, 2001, Page 187-243

- Graham, J., R., Harvey, C., R., "The Equity Risk Premium in 2008: Evidence form the Global CFO Outlook Survey", Working Paper, 2008

- Grinold, R., C., Kahn, R., N., *Active Portfolio Management*, McGraw-Hill, New York, 2000

- Gutierez, M., J., Vazquez, J., "Switching Equilibria: The Present Value Model for Stock Prices revisited", *Journal of Economic Dynamics and Control*, Volume 28, 2004, Page 2297-2325

- Harris, R., S., Marston, F., C., "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts", *Working Paper No 99-08*, University of Virginia, 1999

- Hartman, J., C., "On the Equivalence of Net Present Value and Economic Value Added as Measures of a Project's Economic Worth", *The Engineering Economist*, Volume 45, 2000, Page 158-165

- Kandel, S., Stambaugh, R., F., "Asset Returns and Intertemporal Preferences", *Journal of Monetary Economics*, Volume 27, 1991, Page 39-71

- Kang, S., O'Brien, J., Sivaramakrishnan, K., "Analysts' Interim Earnings Forecasts: Evidence on the Forecasting Process", *Journal of Accounting Research*, Volume 32, 1994, Page 103-112

- Keane, M., P., Runkle, D., E., "Are Financial Analysts' Forecasts of Corporate Profits Rational?", *Journal of Political Economy*, Volume 6, Number 4, 1998, Page 768-805

- Kleidon, A., W., "Bias in Small-Sample Tests of Stock Price Rationality", *Journal of Business*, Volume 59, 1986a, Page 237-261

- Kleidon, A., W., "Variance Bounds Tests and Stock Price Valuation Models", *Journal of Political Economy*, Volume 94, 1986b, Page 953-1001

- Koller, T., Goedhart, M., Wessels, D., *Valuation: Measuring and Managing the Value of Companies*, John Wiley and Sons, New Jersey, 2005

- Kothari, S., P., Shanken, J., "Book-To-Market, Dividend Yield and Expected Market Returns: A Time-Series Analysis", *Journal of Financial Economics*, Volume 44, 1997, Page 169-203

- Lee, C., M., C., Meyers, J., Swaminathan, A.P., "What is the intrinsic value of the Dow?", *Journal of Finance*, Volume 54, Number 5, 1999, Page 1693-1740

- LeRoy, S., Porter, R., "The Present Value-Relation: Tests Based on Implied Variance Bounds", *Econometrica*, Volume 49, 1981, Page 555-574

- Lettau, M., Ludwigson, S., C., Wachter, J., A., "The Declining Equity Risk Premium: What Role does Macroeconomic Risk play?", *Review of Financial Studies*, Volume 21, 2007, Page 1653-1687

- Lundholm, R., J., O'Keefe, T., "On Comparing Residual Income and Cash Flow Models of Equity Valuation: A Response to Penman 2001", *Working Paper*, University of Michigan Business School, 2001

- Marsh, T., A., Merton, R., C., "Dividend Variability and Variance Bounds Tests for the Rationality of Stock Market Prices", *Working Paper*, Massachusetts Institute of Technology, 1984

- Mehra, R., Prescott, E., "The Equity Risk Premium: A Puzzle", *Journal of Monetary Economics*, Volume 15, 1985, Page 145-161

- Mehra, R., Prescott, E., "The Equity Risk Premium in Retrospect", *Handbook of the Economics of Finance*, Elsevier BV, Amsterdam, 2003

- Merton, R., C., "Theory of Rational Option Pricing", *Bell Journal of Economics and Management Science*, Volume 4, 1973, Page 141-183

- Muth, J., F., "Rational Expectations and the Theory of Price Movements", *Econometrica*, 1961, Page 315-335

- Myers, S., C., "Determinants of Corporate Borrowing", *Journal of Financial Economics*, Volume 5, Number 1, 1977, Page 6-13

- Nasseh, A., Strauss, J., "Stock Prices and the Dividend Discount Model: Did Their Relation Break Down in the 1990's?", *The Quarterly Review of Economics and Finance*, Volume 44, 2004, Page 191-207

- Nichols, N., A., "Scientific Management at Merck: An Interview with CFO Judy Lewent", *Harvard Business Review*, Volume 72, Number 1, 1994, Page 88-99

- O'Brien, P., C., "Analysts' Forecasts as Earnings Expectations", *Journal of Accounting and Economics*, Volume 10, Number 1, 1988, Page 53-83

- Paddock, J., Siegel, D., Smith, J., "Option Valuation of Claims on Physical Assets: The Case of Offshore Petroleum Leases", *Quarterly Journal of Economics*, Number 103, 1988, Page 479-508

- Pallant, J., *SPSS: Survival Manual*, Open University Press, New York, 2007

- Panigirtzoglou, N., Scammell, R., "Analysts' Forecasts and Equity Valuations", *Bank of England Quarterly Bulletin*, Spring, 2002

- Penman, S., H., "A Synthesis of Equity Valuation Techniques and the Terminal Value Calculation for the Dividend Discount Model", *Review of Accounting Studies*, Volume 2, Number 4, 1998, Page 303-323

- Pontiff, J., Schall, L., D., "Book-To-Market Ratios as Predictors of Market Returns", *Journal of Financial Economics*, 1998, Volume 49, Page 141-160

- Ramnath, S., Rock, S., Shane, P., "Value Line and I/B/E/S Earnings Forecasts", *International Journal of Forecasting*, Volume 21, Number 1, 2001, Page 185-198

- Reimer, K., Zanker., A., Nawroth, A., P., "Risk Premia on European Sectors", *Pan European Alpha Generation*, Commerzbank, 2001

- Rozeff, M., S., "The Three-Phase Dividend Discount Model and the ROPE Model", *Journal of Portfolio Management*, 1990, Page 36-42

- Shane, P., Brous, P., "Investor and (Value Line) Analyst Underreaction to Information about Future Earnings: The Corrective Role of Non-Earnings-Surprise Information", *Journal of Accounting Research,* Volume 30, 2001, Page 387-404

- Shaw, M., K., *Rational Expectations: An Elementary Introduction*, Wheatsheaf Books, Brighton, 1984

- Shiller, R., J., "The Volatility of Long-Term Interest Rates and Expectations Models of the Term Structure", *Journal of Political Economy*, Volume 87, 1979, Page 1190-1219

- Shiller, R., J., "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?", *American Economic Review*, Volume 71, 1981, Page 421-436

- Shrieves, R., E., Wachowicz, J., M., "Free Cash Flow, Economic Value Added and Net Present Value: A Reconciliation of Variations of Discounted Cash Flow Valuation", *Working Paper*, University of Tennessee, 2000

- Siegel, J., J., Thaler, R., H., "Anomalies: The Equity Risk Premium Puzzle", *The Journal of Economic Perspectives*, Volume 11, Number 1, 1997, Page 191-200

- Smit, H., J., Trigeorgis, L., *Strategic Investments: Real Options and Game Theory*, Princeton University Press, Princeton and Oxford, 2004

- Smith, K., W., Triantis, A., "The Value of Options in Strategic Acquisitions", *Real Options in Capital Investment: Models, Strategies and Applications, ed. Trigeorgis,* Praeger, Westport, 1994

- Sorensen, E., H., Williamson, D., A., "Some Evidence on the Value of the Dividend Discount Model", *Financial Analysts Journal*, Volume 41, 1985, Page 60-69

- Stapleton, R., C., “Portfolio Analysis, Stock Valuation and Capital Budgeting Decision Rules for Risky Projects” Journal of Finance, Volume 26, 1971, Page 95-117

- Stickel, S., “Predicting Individual Analyst Earnings Forecasts”, *Journal of Accounting Research*, Volume 28, 1990, Page 409-417

- Tabachnick, B., G., Fidell, L., S., *Using Multivariate Statistics*, Allyn & Bacon, New York, 2001

- Welch, I., “Views of Financial Economists on the Equity Risk Premium and on Professional Controversies”, *Journal of Business*, Volume 73, Number 4, 2000, Page 501-537

- West, K., D., *“*A Specification Test for Speculative Bubbles” , *Quarterly Journal of Economics*, Volume 102, 1987, Page 553-580

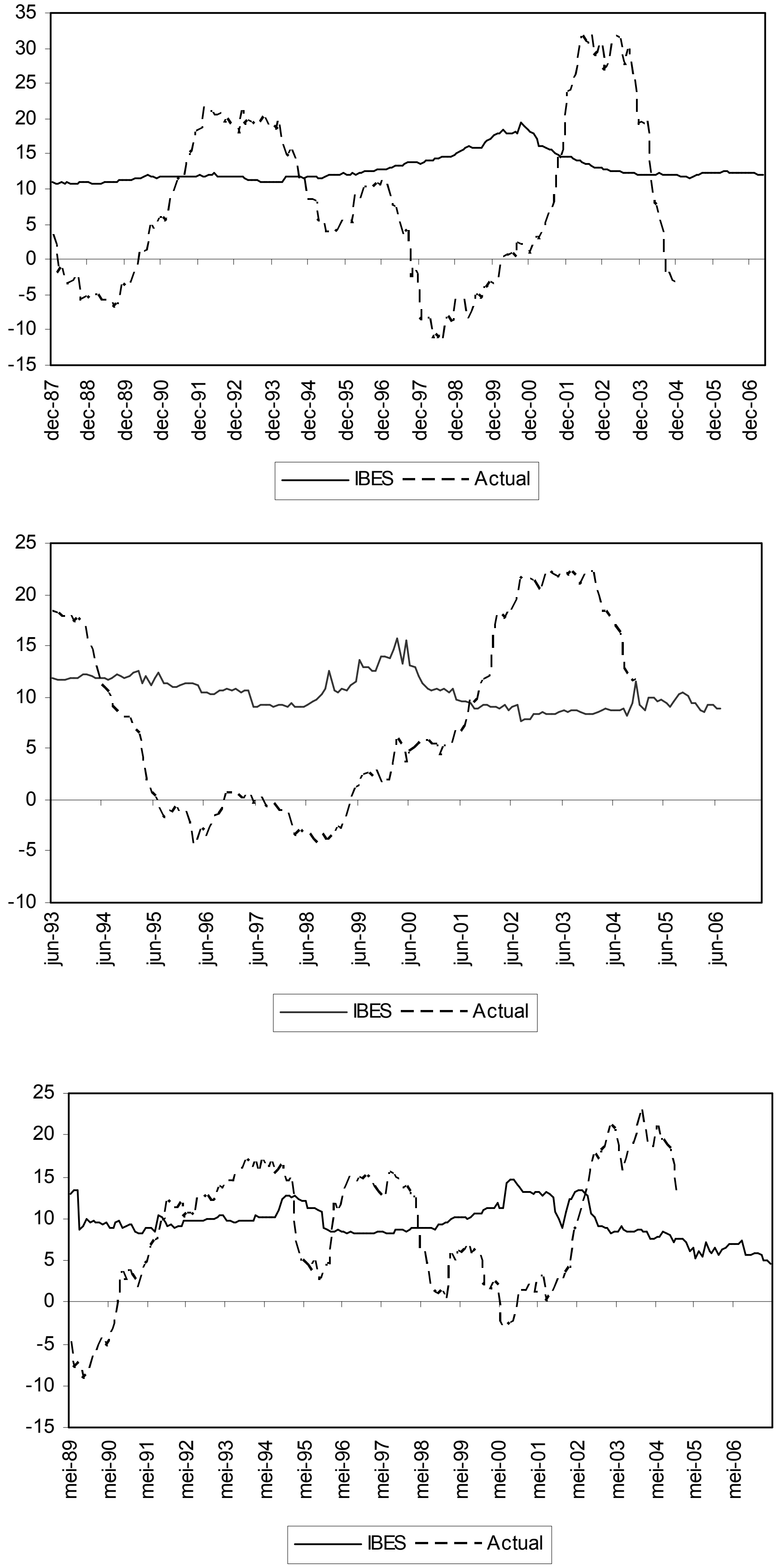
- West, K., D., “Bubbles, Fads and Stock Price Volatility Tests: A Partial Evaluation”, *Journal of Finance*, Volume 43, 1988, Page 639-655

Internet Sources

- http://www.data360.org/dataset.aspx?Data_Set_Id=398 as seen on July 21st, 2009
- http://www.phil.frb.org/research-and-data/real-time-center/survey-of-professional-forecasters/historical-data/inflation.xls as seen on July 21st, 2009

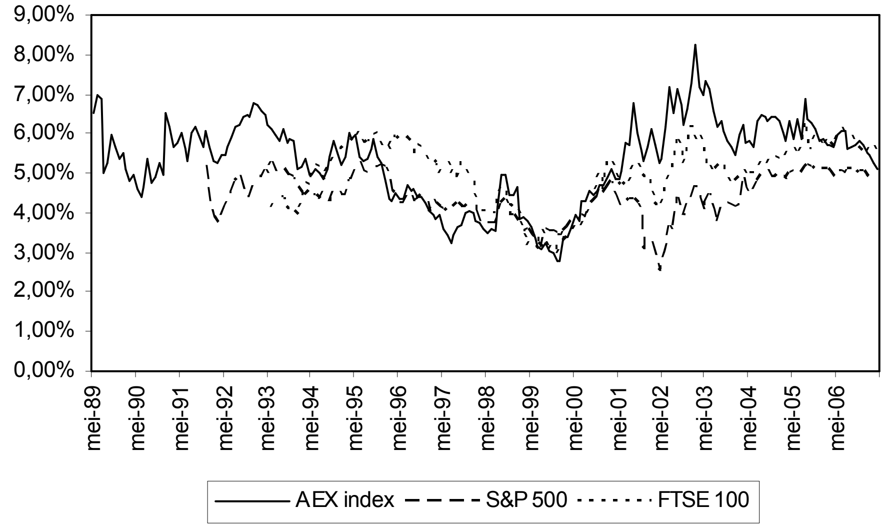
Figures

Figure 1 IBES earnings forecasts versus outturns for the US, UK and NL



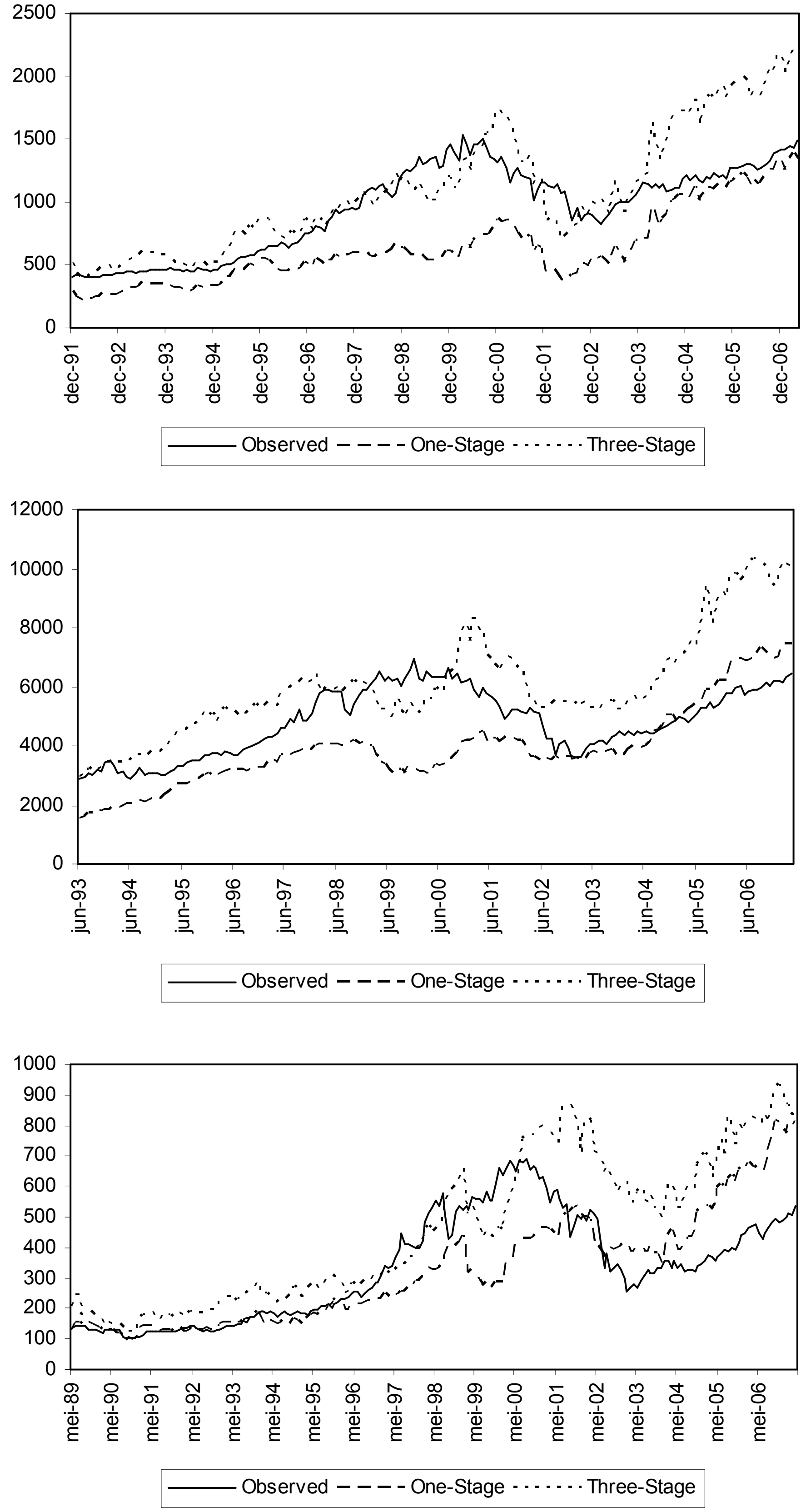
IBES	=	IBES EPS Long-term earnings growth
Actual	=	Actual annualised four-year-ahead earnings growth

Figure 2 Equity risk premium implied by the three-stage dividend discount model for the US, UK, NL



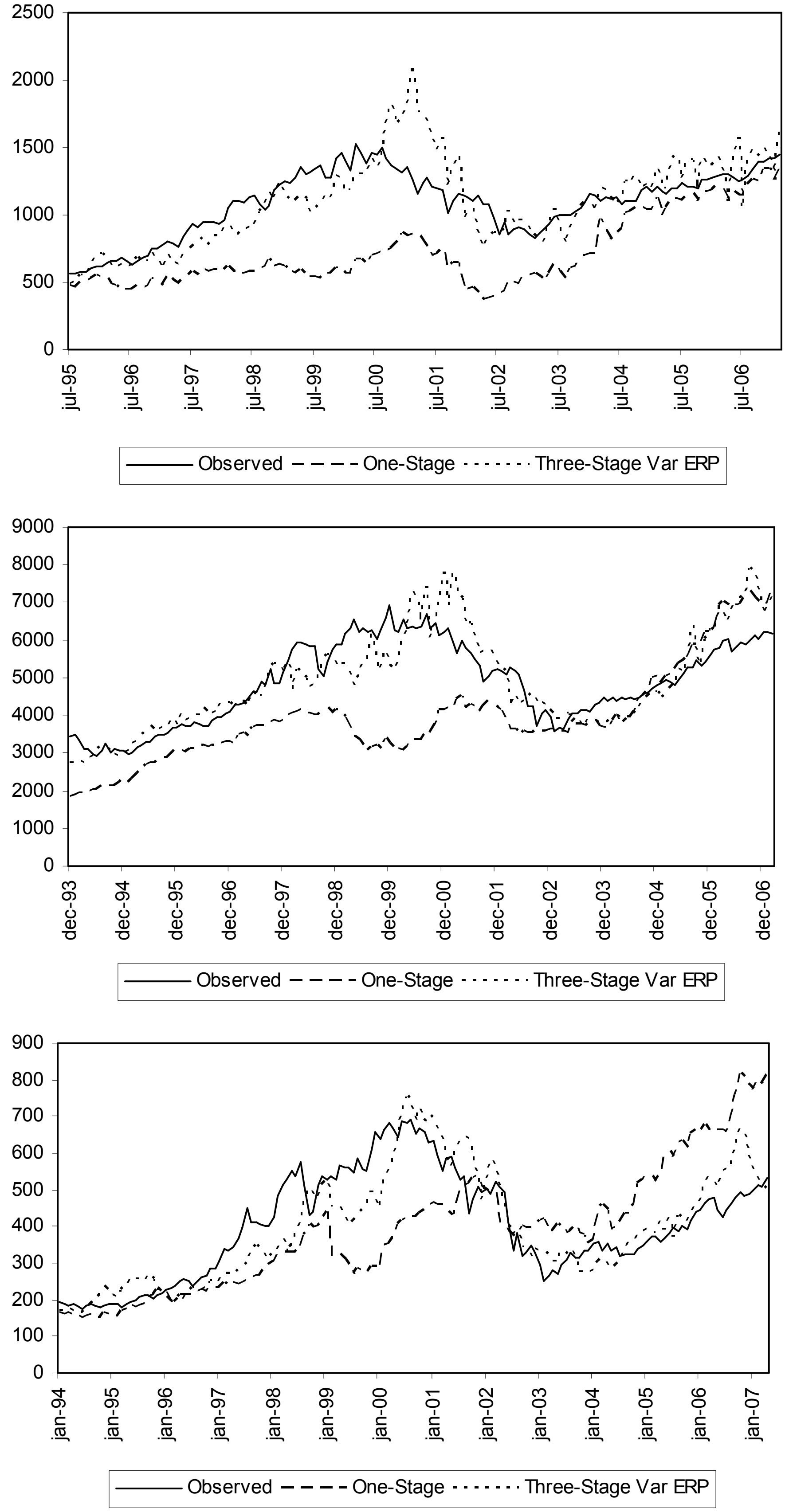
AEX = AEX Equity Risk Premium implied by three-stage dividend discount model
S&P 500 = S&P 500 Equity Risk Premium implied by three-stage dividend discount model
FTSE 100 = FTSE 100 Equity Risk Premium implied by three-stage dividend discount model

Figure 3 **One-stage and three-stage dividend discount model versus observed index values for the US, UK and NL**



Observed	=	Observed equity price
One-Stage	=	Equity price implied by the one-stage dividend discount model
Three-Stage	=	Equity price implied by the three-stage dividend discount model

Figure 4 One-stage and three-stage dividend discount model versus observed index values with a variable ERP for the US, UK and NL



Observed = Observed equity price
One-Stage = Equity price implied by the one-stage dividend discount model
Three-Stage Var ERP = Equity price implied by the three-stage dividend discount model with variable ERP

Tables

Table 1 R squared for all five sets of (lagged) explanatory variables

	US	UK	NL
T	53.30%	57.30%	54.00%
T-3	58.60%	52.50%	60.70%
T-6	58.40%	52.90%	60.70%
T-9	52.90%	52.80%	57.60%
T-12	43.90%	44.40%	51.90%

Note: All R square variables are statistically significant for the 5% level

Table 2 Regression results for the US, UK and NL

Results			
	B	Standard Error	Significance*
(Constant)	0.016	0.004	0.000
Consumption Growth	0.348	0.224	0.123
GDP Growth	0.216	0.040	0.000
Liquidity	0.000	0.002	0.939
Corporate Spread	-0.159	0.083	0.058
Book-To-Market Ratio	0.074	0.007	0.000
R Square Regression	0.584		
Significance Regression*	0.000		

*On a 5% level

Results			
	B	Standard Error	Significance*
(Constant)	0.042	0.005	0.000
Consumption Growth	-0.729	0.290	0.013
GDP Growth	-0.008	0.084	0.923
Liquidity	0.000	0.002	0.902
Corporate Spread	-0.453	0.049	0.000
Book-To-Market Ratio	0.042	0.006	0.000
R Square Regression	0.529		
Significance Regression*	0.000		

*On a 5% level

Results			
	B	Standard Error	Significance*
(Constant)	0.082	0.002	0.000
Consumption Growth	-0.757	0.333	0.024
GDP Growth	-0.373	0.040	0.000
Liquidity	-0.002	0.002	0.456
Corporate Spread	-0.755	0.112	0.000
Book-To-Market Ratio	-0.007	0.001	0.000
R Square Regression	0.607		
Significance Regression*	0.000		

*On a 5% level

Table 3 R squared for all five sets of (lagged) explanatory variables without the Book-To-Market Ratio

	US	UK	NL
T	19,20%	45,10%	53,00%
T-3	22,90%	40,60%	54,90%
T-6	23,00%	39,30%	50,10%
T-9	21,80%	37,80%	43,20%
T-12	14,70%	29,50%	35,80%

Note: All R square variables are statistically significant for the 5% level

Table 4 Correlation coefficients between observed and implied equity prices

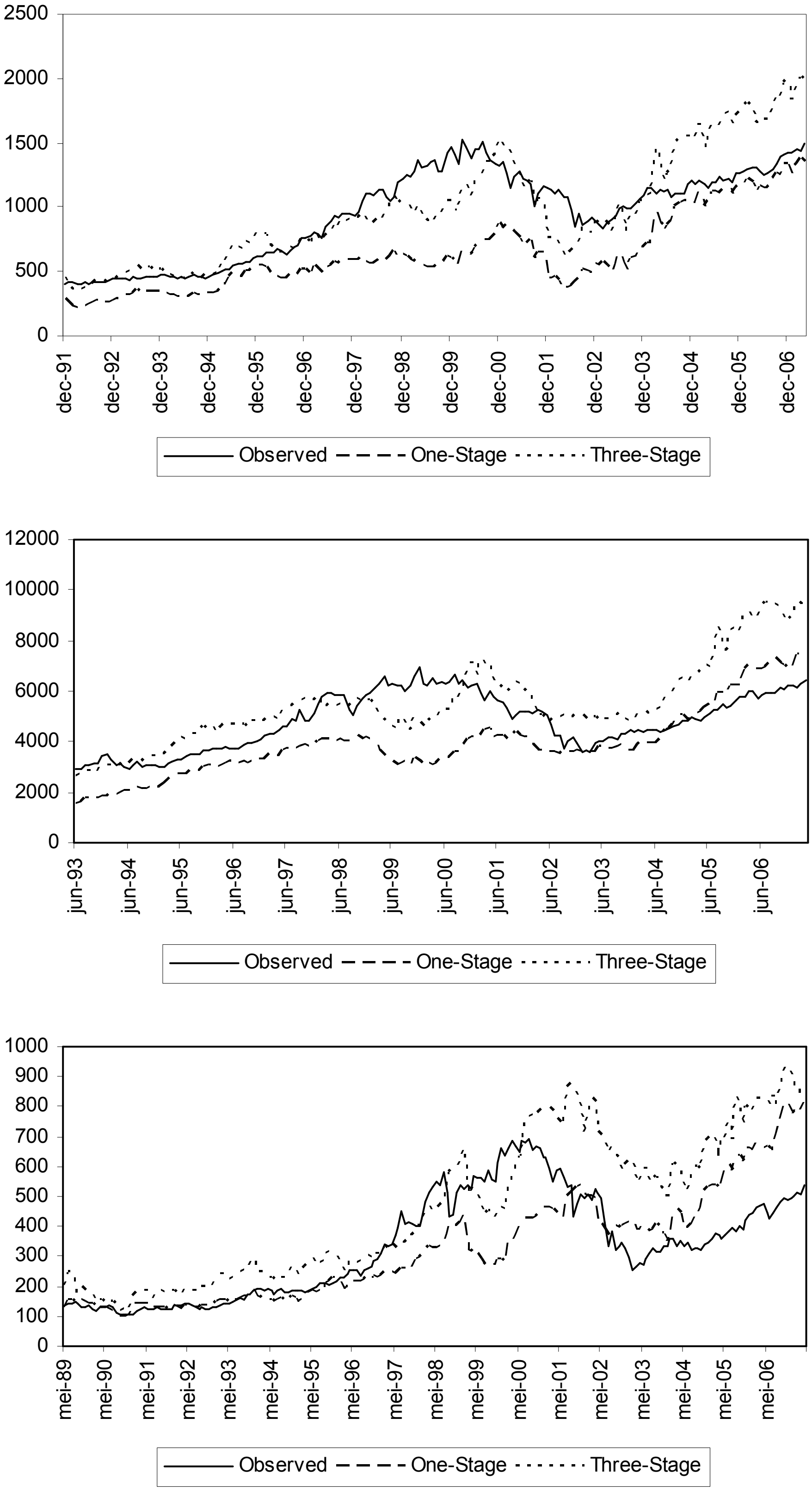
Correlation with observed equity prices			
	US	UK	NL
One-stage DDM	0.574471105	0.553877318	0.464243814
Three-stage DDM	0.803627789	0.628586578	0.624044835
Three-stage DDM incl var. ERP	0.819048622	0.859663088	0.868925469

List of Figures Appendix

List of Tables Appendix

Appendix A. Variation in Transition Periods

Figure A1 One-stage and three-stage dividend discount model versus observed index values, transition period 6 years for the US, UK and NL

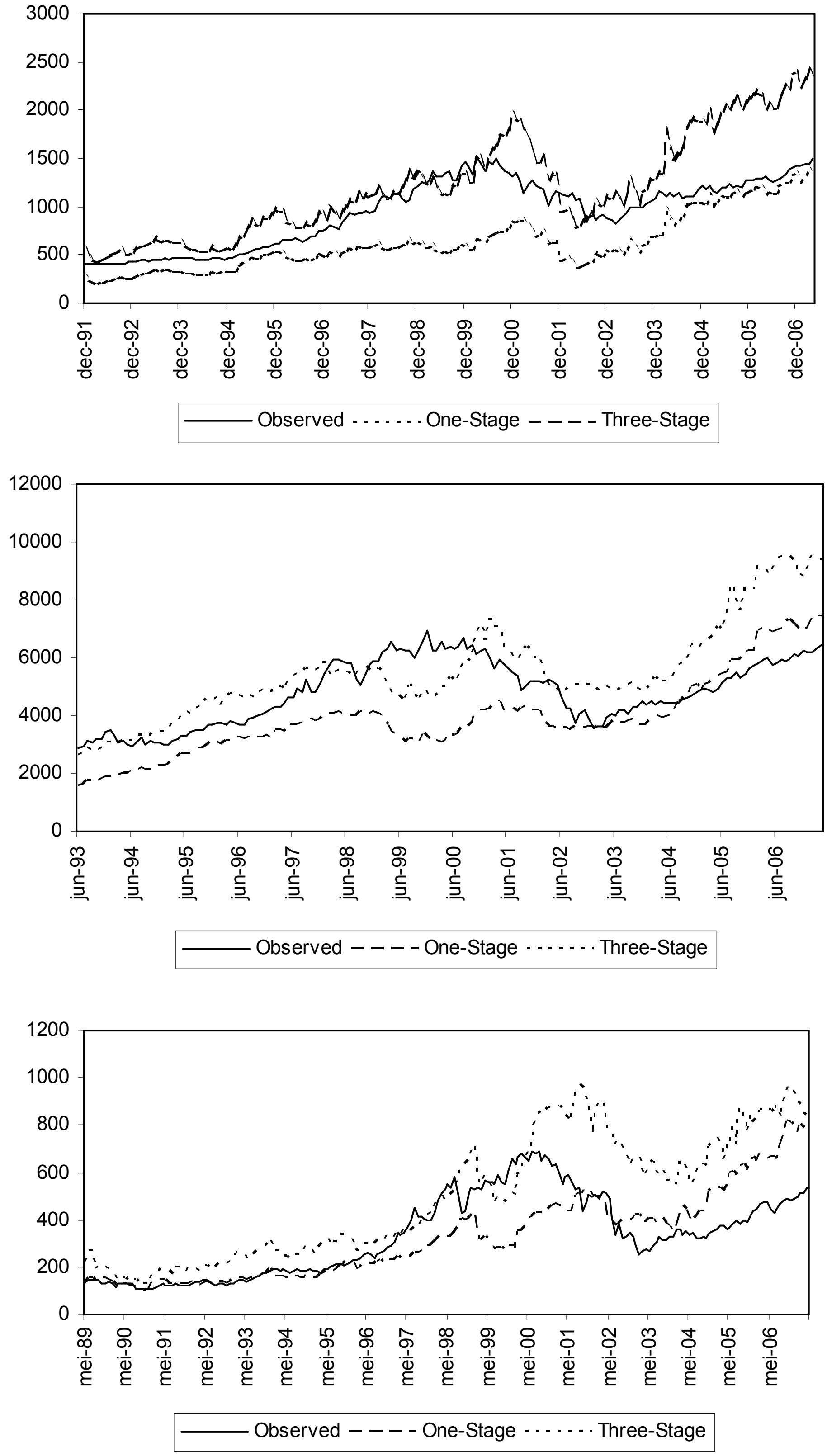


Observed = Observed equity price

One-Stage = Equity price implied by the one-stage dividend discount model

Three-Stage = Equity price implied by the three-stage dividend discount model with a transition period of six years

Figure A2 One-stage and three-stage dividend discount model versus observed index values, transition period 10 years for the US, UK and NL



Observed	=	Observed equity price
One-Stage	=	Equity price implied by the one-stage dividend discount model
Three-Stage	=	Equity price implied by the three-stage dividend discount model with a transition period of ten years

Appendix B. Outliers, the Normality Assumption and Multicollinearity

B1. Outliers

Outliers can be categorized as variables that have such an extreme value that they distort statistics.[67] In order to locate possible outliers, different approaches can be taken. One of these methods concerns the inspection of the maximum Mahalanobis distance that is produced after running a multiple regression analysis. To determine possible outliers, the critical Chi-square value for the explanatory variables has to be compared to the maximum Mahalanobis distance for these variables.[68]

The critical Chi-square value can be found in Table C1, which uses the number of explanatoryvariables in the regression to compute the critical value for the Mahalanobis distances.[69]

INSERT TABLE C1 HERE

If the maximum Mahalanobis distance value exceeds the critical value corresponding to the number of explanatory variable in table C1, it can be assumed that outliers are present in the dataset of explanatory variables.

The maximum Mahalanobis distance values for all three countries can be seen in Table C2.

INSERT TABLE C2 HERE

The United States and the United Kingdom show a maximum Mahalanobis distance that exceeds the critical Chi-square value (77,388 and 36,985 over 20,52), which implies the existence of outliers in those sets of explanatory variables.

Because, as mentioned, outliers can distort the statistics of the regression analysis, these outliers are removed from the dataset. Since this involves the deletion of only six observations (August 2002, October 2005, December 2005, January 2006, and August 2006 for the variable liquidity, September 2005 for Consumption growth) for the United States and only 1 observation for the United Kingdom (February 2000, also for the liquidity variable) it is unlikely that the expulsion of these cases will negatively effect the results of the regression analysis.

[67] Tabachnick and Fidell (2001), Page 66
[68] Pallant (2007), Page 157
[69] As found in Tabachnick and Fidell (2001), Page 933

The Mahalanobis Distance for all three countries after the exclusion of outliers can be found in table C3. All three maximum Mahalanobis distances have dropped to reasonable levels after the exclusion of the outliers.

INSERT TABLE C3 HERE

A different approach in the search for outliers makes use of Cook's Distance. This value measures the influence each of the cases has if the specific case is deleted. Cases that feature a Cook's Distance score higher than 1 are considered outliers. [70]

Table C2 and C3 also show Cook's distance for all three countries before and after the exclusion of outliers. Since all three countries have a Cook's Distance score lower than 1 even before the exclusion of the outliers, this specific measure does not imply the possible existence of outliers.

B2. The Normality Assumption

Many statistical tests assume that the variables used for the analysis are normally distributed, which implies that the biggest frequency of values are concentrated around the mean value and smaller frequencies exist toward the extreme values. Running a multiple regression analysis also requires this normality assumption to hold. To test for the existence of normality in the sets of variables, Normal P-P Plots and Scatterplots are created.[71]

For the normality assumption to hold, the Normal P-P plots should show the variables to lie in a reasonably straight line from bottom left to top right. The scatterplot should show no clear pattern while most of the scores should be concentrated in the centre of the plot.

Table C4 shows the different plots for all three countries for all predictors (T=t to T-12). Since none of the plots show any significant deviation from the criteria, it can be assumed that the variables used for the multiple regression analysis are roughly normally distributed and therefore render themselves qualified for regression analysis.

INSERT TABLE C4 HERE

----

[70] Tabachnick and Fidell (2001), Page 69

[71] This follows Pallant (2007), Page 58. These plots use the databases that exclude the outliers found in the previous sector.

B3. Multicollinearity
In order to run a valid multiple regression analysis, the explanatory variables of the regression left after the exclusion of possible outliers, should be tested for multicollinearity. If multicollinearity exists among these explanatory variables it could cause unstable, matrix inversions. This may result in excessively large error terms, rendering none of the coefficients significant. [72]
To check for the possible existence of multicollinearity a collinearity statistics table must be generated. [73]

Table C5 shows the collinearity statistics tables for all three countries.

INSERT TABLE C5 HERE

The two values utilised to check for the existence of multicollinearity are 'Tolerance' and 'VIF'. Tolerance indicates the level of variability of each explanatory variable that is not explained by the existence of the other explanatory variables in the regression analysis. If the height of this value is less than 0.1 it might indicate multicollinearity.
The Variance Inflation Factor (VIF) concerns the opposite of the Tolerance value. If the height of this value is larger than 10, possible multicollinearity can exist.

It can be concluded that none of the three datasets show multicollinearity, since none of the 'Tolerance' levels lie below 0.1 and none of the 'VIF' levels lie above 10.

[72] Tabachnick and Fidell (2001), Page 84
[73] Pallant (2007)

Appendix C. Outliers, the Normality Assumption and Multicollinearity

Table C1. Critical Values for Evaluating Mahalanobis Distances.

No. of Independent Variables	Critical Value	No. of Independent Variables	Critical Value
1	10.83	6	22.46
2	13.82	7	24.32
3	16.27	8	26.13
4	18.47	9	27.88
5	20.52	10	29.59

Table C2 Maximum Mahalanobis en Cook's Distances before the exclusion of outliers

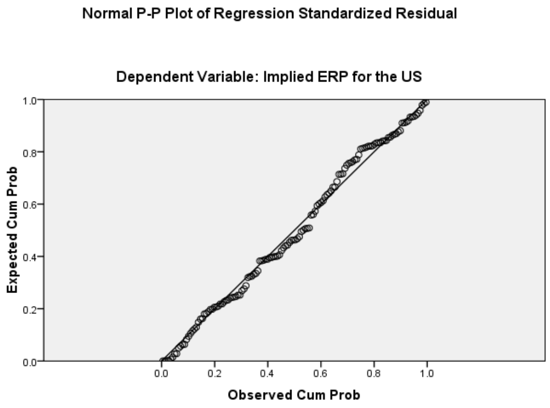
Country	Maximum Mahalanobis Distance					Cook's Distance				
	T-12	T-9	T-6	T-3	T	T-12	T-9	T-6	T-3	T
United States	78,649	77,283	77,388	77,303	77.294	0,076	0,097	0,138	0,144	0.194
United Kingdom	36,879	36,377	36,985	36,712	35.507	0,417	0,240	0,069	0,065	0.097
The Netherlands	20.598	19.975	20.188	20,165	19,628	0.159	0.100	0.142	0,056	0.046

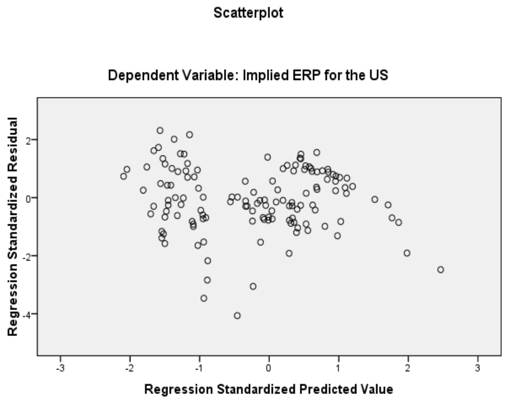
Table C3 Maximum Mahalanobis and Cook's Distances after the exclusion of outliers

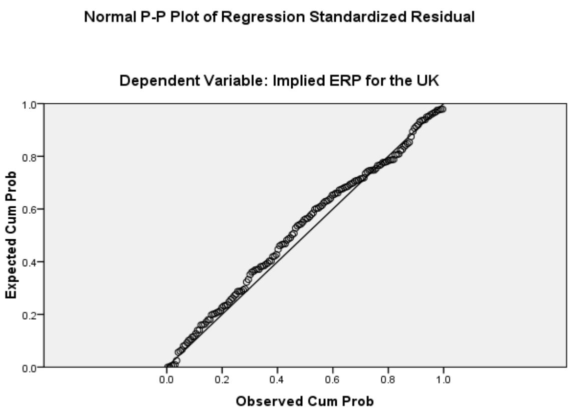
Country	Maximum Mahalanobis Distance					Cook's Distance				
	T-12	T-9	T-6	T-3	T	T-12	T-9	T-6	T-3	T
United States	20.125	20.495	20.037	20.799	20.009	0.081	0.112	0.154	0.161	0.183
United Kingdom	15.386	16.353	16.711	15.824	16.835	0.113	0.037	0.070	0.065	0.099
The Netherlands	20.598	19.975	20.188	20.165	19.628	0.159	0.100	0.142	0.056	0.049

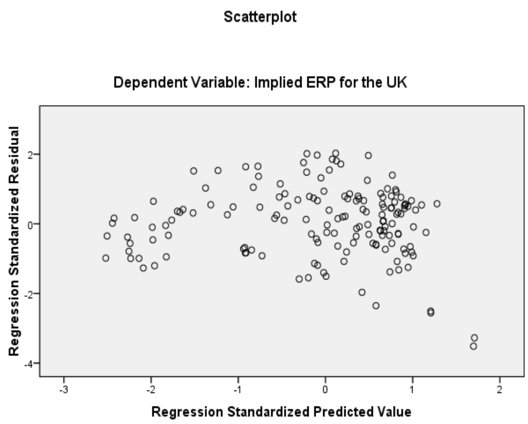
Table C4 Normal P-P plots and Scatter plots for the US, UK and NL for T=T to T-12

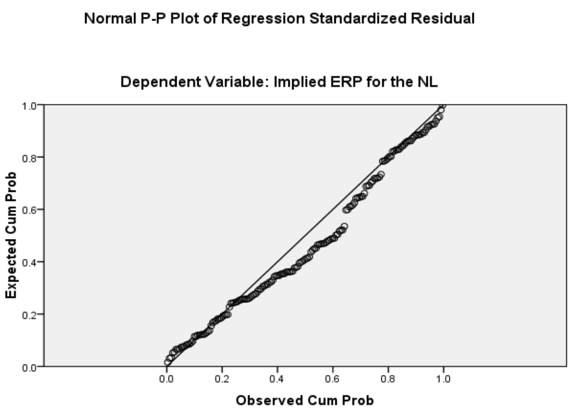
C4.1 Normal P-P plots and Scatter plots for the US, UK and NL for T=T

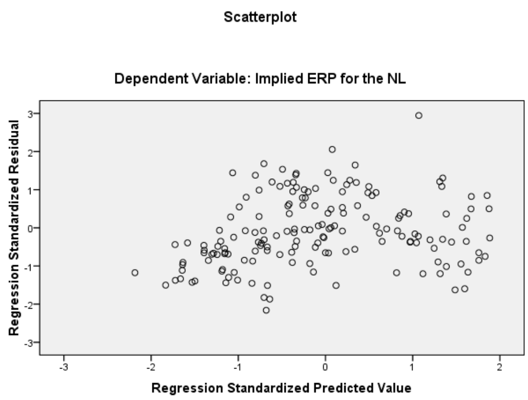




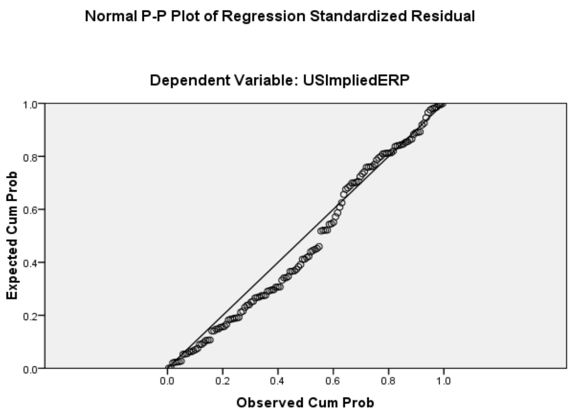


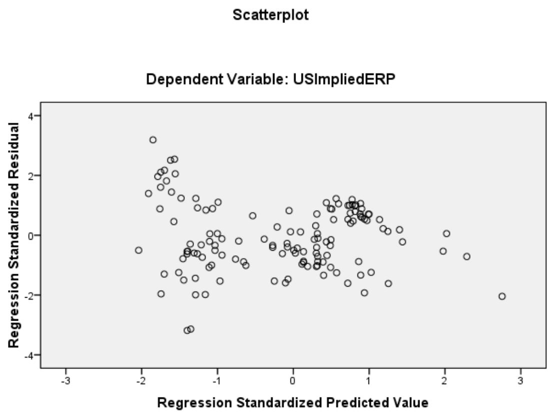


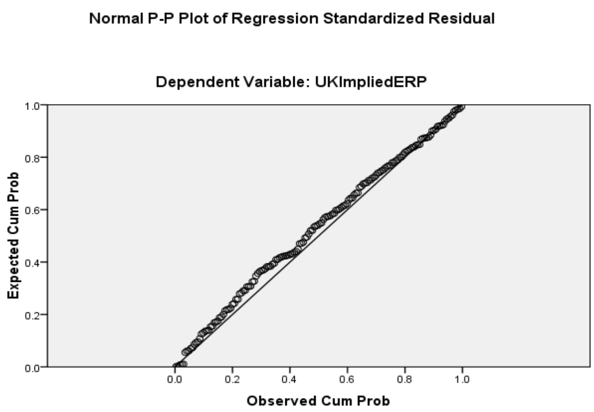


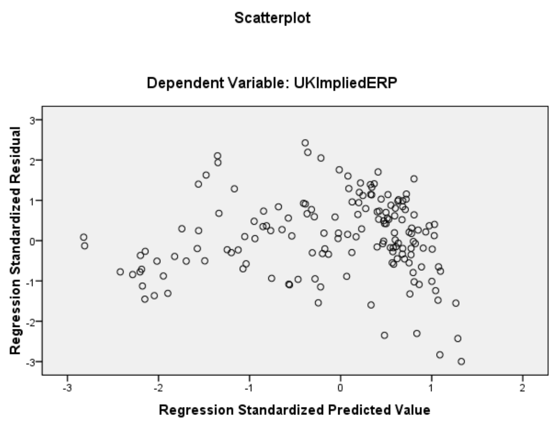


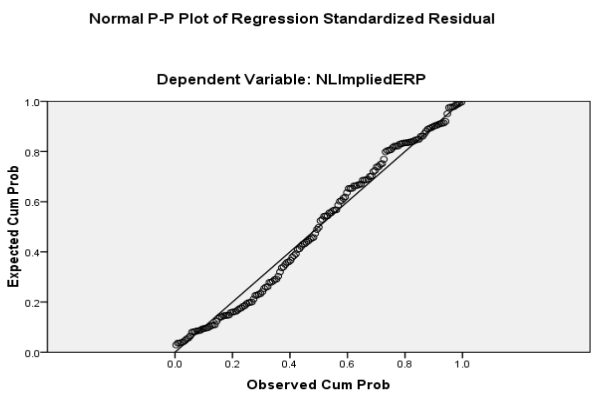
C4.2 Normal P-P plots and Scatter plots for the US, UK and NL for T-3

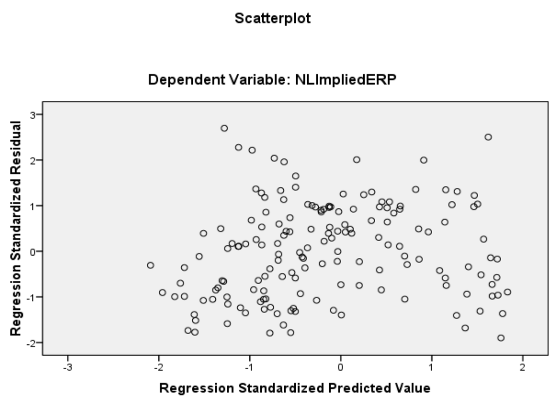




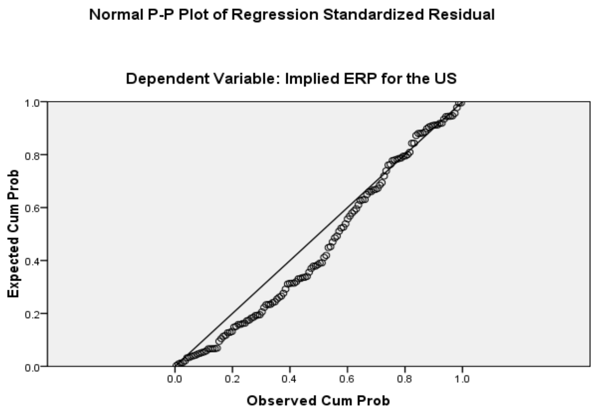


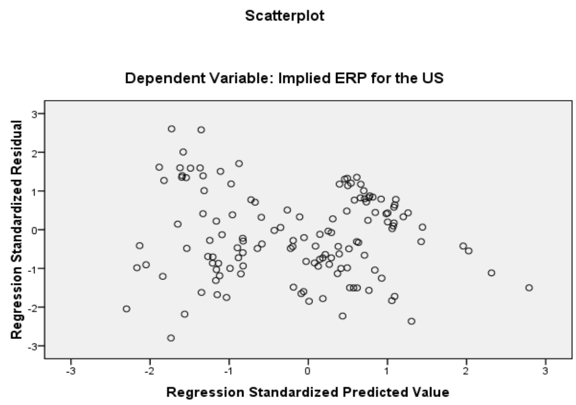


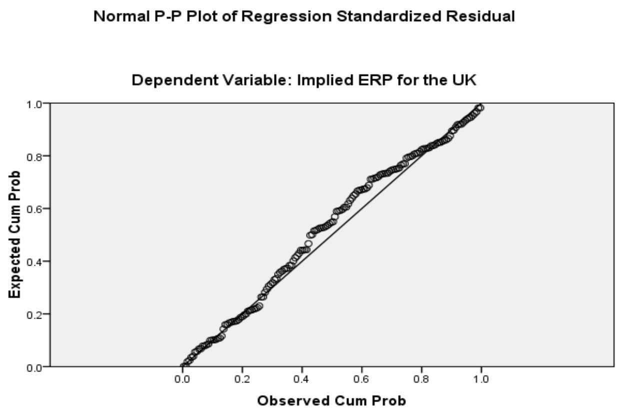


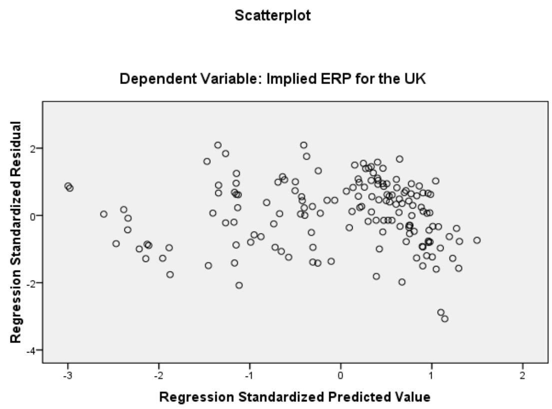


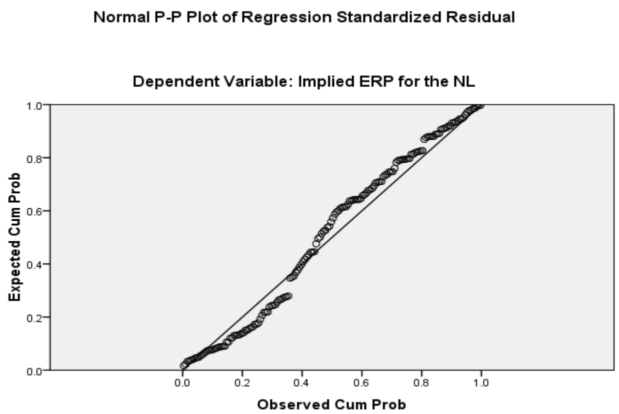
C4.3 Normal P-P plots and Scatter plots for the US, UK and NL for T-6

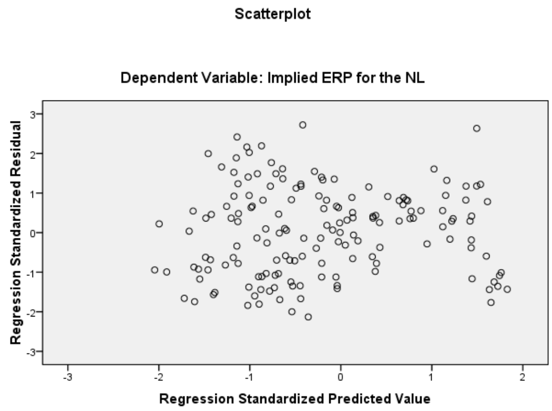




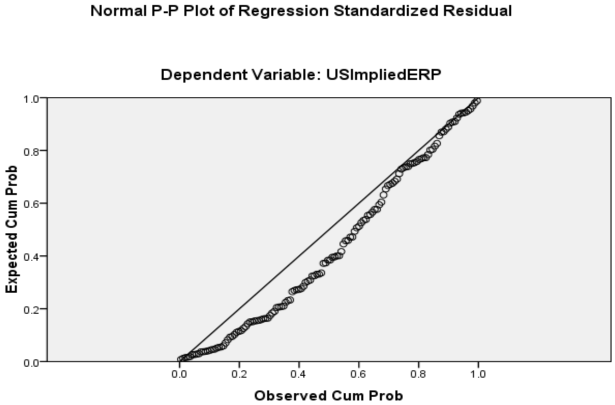


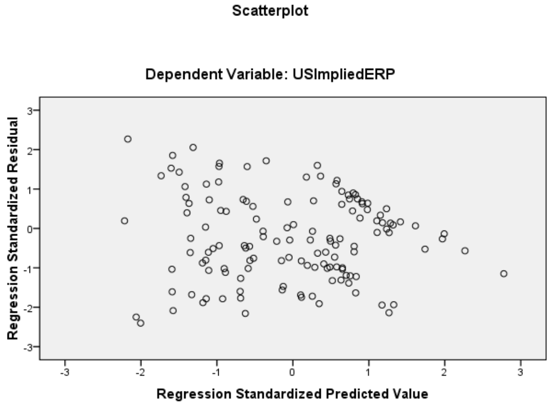


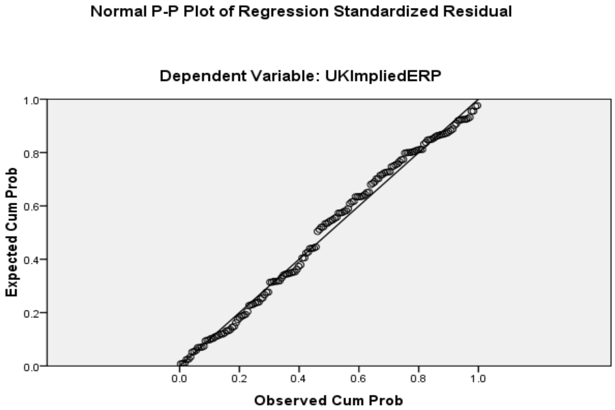


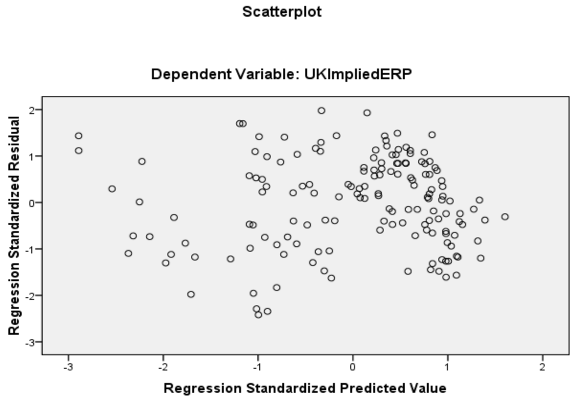


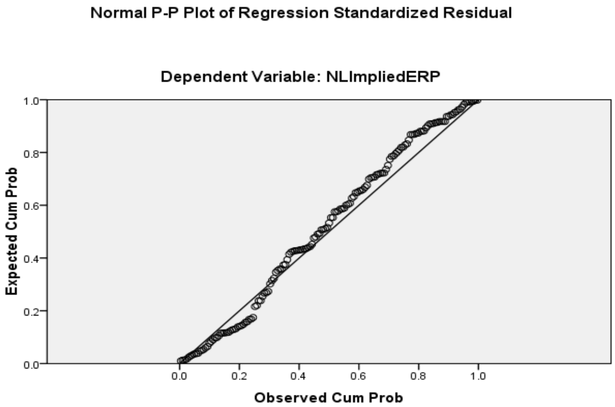
C4.4 Normal P-P plots and Scatter plots for the US, UK and NL for T-9

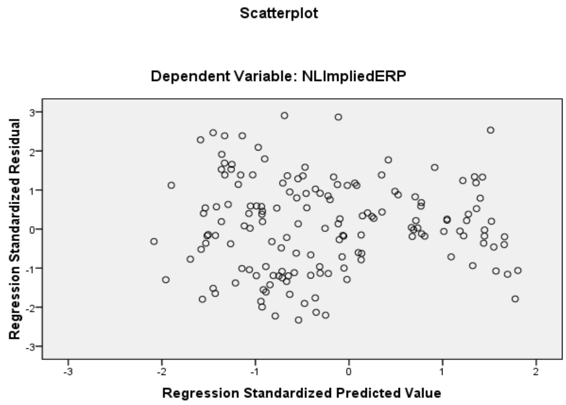




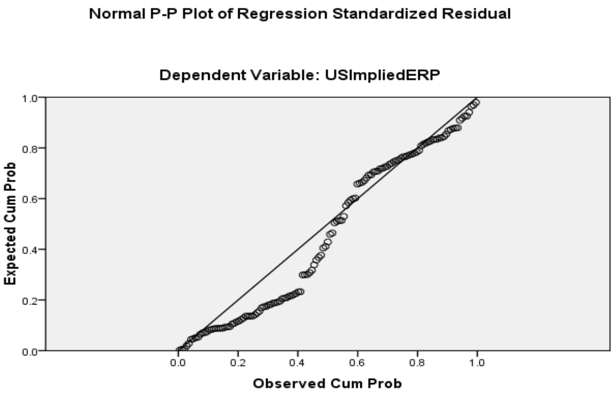


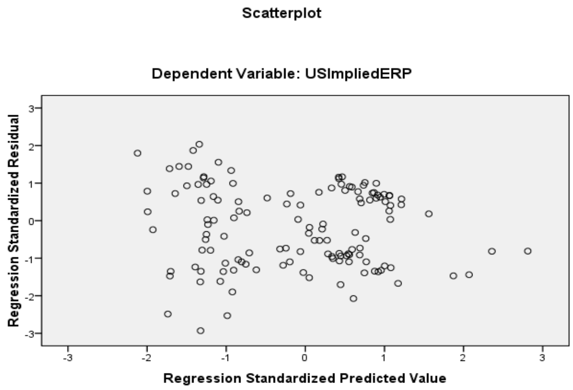


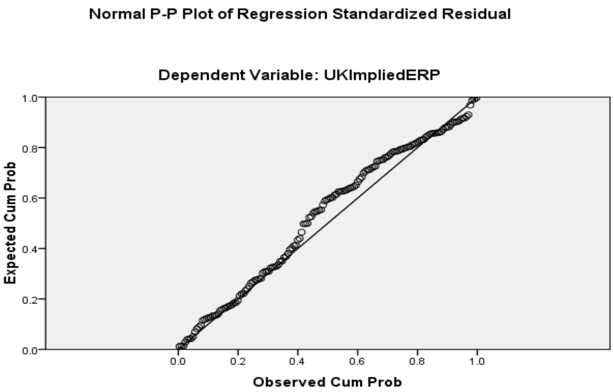


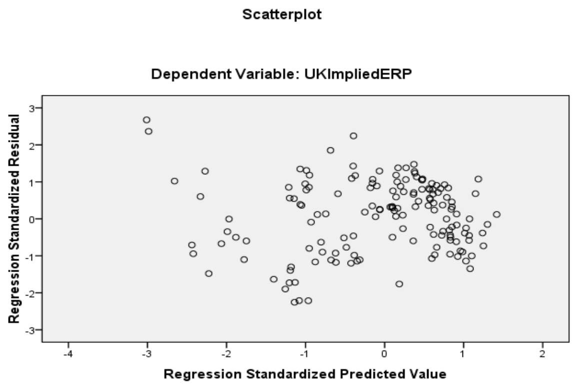


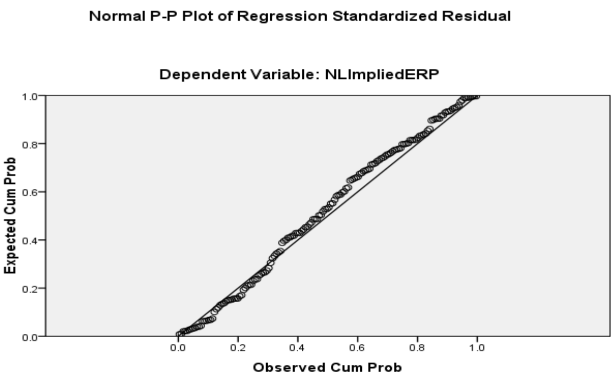
C4.5 Normal P-P plots and Scatter plots for the US, UK and NL for T-12











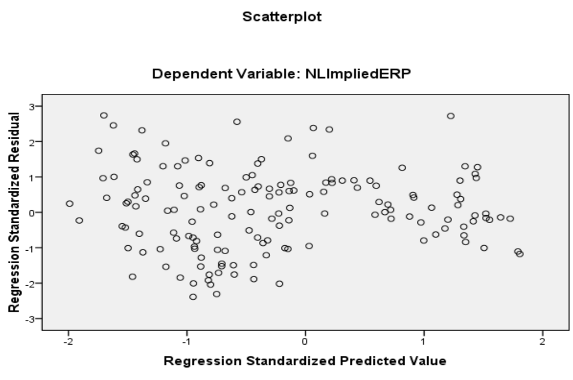


Table C5 Collinearity Statistics table for the US, UK and NL

			Collinearity Statistics							
	T-12		T-9		T-6		T-3		T	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
(Constant)										
Consumption Growth	0.969	1.032	0.977	1.024	0.961	1.041	0.945	1.058	0.985	1.015
GDP Growth	0.547	1.829	0.597	1.675	0.561	1.782	0.547	1.828	0.520	1.921
Liquidity	0.997	1.003	0.995	1.005	0.995	1.005	0.995	1.005	0.996	1.004
Corporate Spread	0.639	1.565	0.0688	1.453	0.678	1.476	0.678	1.474	0.711	1.406
Book-To-Market Ratio	0.581	1.720	0.652	1.533	0.616	1.622	0.604	1.656	0.63	1.587

			Collinearity Statistics							
	T-12		T-9		T-6		T-3		T	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
(Constant)										
Consumption Growth	0.826	1.211	0.820	1.220	0.823	1.215	0.823	1.215	0.770	1.298
GDP Growth	0.609	1.641	0.602	1.662	0.606	1.651	0.594	1.683	0.555	1.801
Liquidity	0.996	1.004	0.996	1.004	0.996	1.004	0.996	1.004	0.996	1.004
Corporate Spread	0.971	1.030	0.971	1.030	0.971	1.030	0.974	1.027	0.965	1.036
Book-To-Market Ratio	0.544	1.838	0.534	1.872	0.536	1.867	0.520	1.921	0.472	2.116

			Collinearity Statistics							
	T-12		T-9		T-6		T-3		T	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
(Constant)										
Consumption Growth	0.835	1.197	0.838	1.193	0.843	1.187	0.844	1.185	0.844	1.185
GDP Growth	0.778	1.285	0.788	1.269	0.796	1.257	0.801	1.249	0.799	1.251
Liquidity	0.977	1.024	0.974	1.027	0.974	1.027	0.974	1.027	0.973	1.028
Corporate Spread	0.451	2.217	0.464	2.154	0.469	2.134	0.479	2.086	0.488	2.05
Book-To-Market Ratio	0.484	2.067	0.499	2.003	0.503	1.987	0.516	1.939	0.525	1.904

Appendix D. Descriptive Statistics for the US, UK and NL for T-6

D1. Descriptive Statistics for the US

Descriptives					
	N	Minimum	Maximum	Mean	Std Deviation
Implied ERP	185	0.02524869	0.05326382	0.04392700	0.00590100
Consumption Growth	203	-0.01082360	0.00763470	0.00174500	0.00186700
GDP Growth	204	0.00200000	0.04800000	0.02988700	0.01163200
Illiquidity	172	-0.59745205	0.56929111	0.02027900	0.14716000
Corporate Spread	203	0.00662000	0.03034000	0.01485700	0.00507300
Book-To-Market Ratio	167	0.19546303	0.58614004	0.31866900	0.06810200
Valid N (listwise)	134				

Correlations						
	Implied ERP	Consumption Growth	GDP Growth	Illiquidity	Corporate Spread	Book-To-Market Ratio
Implied ERP	1.000	0.077	-0.133	0.086	-0.305	0.654
Consumption Growth	0.077	1.000	0.097	0.051	-0.003	-0.093
GDP Growth	-0.133	0.097	1.000	0.012	-0.419	-0.052
Illiquidity	0.086	0.051	0.012	1.000	-0.340	-0.007
Corporate Spread	-0.305	-0.003	-0.419	-0.340	1.000	-0.680
Book-To-Market Ratio	0.654	-0.093	-0.052	-0.007	-0.680	1.000

D2. Descriptive statistics for the UK

Descriptives					
	N	Minimum	Maximum	Mean	Std Deviation
Implied ERP	167	0.02918373	0.06341070	0.04987000	0.00807800
Consumption Growth	185	-0.00528024	0.00885495	0.00430000	0.00198700
GDP Growth	185	0.00200000	0.04800000	0.02934600	0.00778000
Illiquidity	158	-0.46450341	0.85222742	0.03303300	0.24402300
Corporate Spread	185	-0.01040000	0.02780000	0.00888600	0.00923700
Book-To-Market Ratio	185	0.16761307	0.79075337	0.38185900	0.10246000
Valid N (listwise)	158				

Correlations						
	Implied ERP	Consumption Growth	GDP Growth	Illiquidity	Corporate Spread	Book-To-Market Ratio
Implied ERP	1	-0.070	-0.380	0.009	-0.521	0.471
Consumption Growth	-0.070	1	0.266	-0.008	-0.182	-0.459
GDP Growth	-0.380	0.266	1	-0.052	-0.076	-0.664
Illiquidity	0.009	-0.008	-0.052	1	0.008	0.011
Corporate Spread	-0.521	-0.182	-0.076	0.008	1	0.120
Book-To-Market Ratio	0.471	-0.459	-0.664	0.011	0.120	1

D3. Descriptive statistics for the NL

Descriptives					
	N	Minimum	Maximum	Mean	Std Deviation
Implied ERP	216	0.02767503	0.08264561	0.05306829	0.01051149
Consumption Growth	234	-0.00484431	0.00645889	0.00193439	0.00172555
GDP Growth	232	-0.00200000	0.05500000	0.02755747	0.01461613
Illiquidity	189	-0.45813133	0.82853872	0.04617731	0.24455869
Corporate Spread	234	-0.00206000	0.03114000	0.01444821	0.00686896
Book-To-Market Ratio	184	0.29561004	2.45272055	0.80712066	0.64125219
Valid N (listwise)	166				

Correlations						
	Implied ERP	Consumption Growth	GDP Growth	Illiquidity	Corporate Spread	Book-To-Market Ratio
Implied ERP	1	-0.394	-0.701	-0.042	-0.298	0.036
Consumption Growth	-0.394	1	0.384	0.051	0.145	-0.025
GDP Growth	-0.701	0.384	1	-0.006	0.227	-0.015
Illiquidity	-0.042	0.051	-0.006	1	-0.132	0.044
Corporate Spread	-0.298	0.145	0.227	-0.132	1	-0.672
Book-To-Market Ratio	0.036	-0.025	-0.015	0.044	-0.672	1