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„The Equity Premium Puzzle in the U.S., UK, Germany
and Austria during the last two decades“
- An Empirical Study -

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ABSTRACT

The diploma thesis is based on the famous Equity Premium Puzzle posed in Mehra and Prescott 1985. They pointed out that historically the average return on equity has far exceeded the average return on short-term default-free debt.¹ The thesis studies and explains the Equity Premium Puzzle in the U.S., U.K, Germany and Austria during the last decades. It considers the time horizon of 2000 to 2010, almost 10 years, by showing if there is an Equity Premium between those countries during this decade.

The historical data for stock prices, volatility and exchange rates are reliable and are taken monthly average from Bloomberg for the largest stocks most traded: Standard and Poor 500 Index, United Kingdom Index, Deutsche Index and Austrian Index.

The T-Bill prices are also taken from the database of the government department to each country.

The thesis adopts the two basic models: the average stock return and the growth dividend model. Based on these two models I compare and discuss their results. Finally, I try to show some final solutions for the equity premium puzzle.

The result of this study shows that the Equity Premium puzzle for those countries exists and still is extremely low and slightly negative.

¹Mehra and Prescott (1986): The Equity Premium A Puzzle

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This Diploma's thesis is dedicated to my beloved mother Shpresa Topi. **Mom I love you and I will always miss you!**

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LIST OF ABBREVIATIONS

ATX	Austrian Stock Index
Av. Average	
CAPM	Capital Asset Pricing Model
CRSP	Center for Research in Security Prices
DAX	Deutsche Stock Index
ECB	European Central Bank
e.g.	Example
Equity Premium (1)	Equity Risk Premium Based On the Average Stock Return Model
Equity Premium (2)	Equity Risk Premium Based on the Dividend Growth Model
EURIBOR	Euro InterBank Offered Rate
Fig.Figure	
GD	Growth rate of dividends
GP	Growth rates of the stock prices
i.e.	That is
N	Number of Observation
NYSE	New York Stock Exchange
OECD	Organization for Economic Co-operation and Development
pp.	Page
Return(1)	Expected Stock Return Based On The Average Stock Return Model
Return(2)	Expected Stock Return Based On The Dividend Growth Model

s.e.	Standard error
SD	Sharp Ratio for the mean of Equity Premium (2) divided by the standard deviation of Return(1)
SR	Sharp Ratio for the mean of Equity Premium (1) divided by the standard deviation of Return(1)
UK	United Kingdom
UKX	United Kingdom Stock Index
US	United States
Vs.	Versus

CHAPTER 1

1.1 Introduction

What I actually think is that our prey, called the equity risk premium, is extremely elusive.

Stephen A. Ross 2001

Almost twenty-six years ago, Mehra and Prescott posed that historically the average U.S. return on equity has far exceeded the average return on short-term risk-free debt. They found that over the ninety-year period the average real annual yield on the S&P 500 Index was seven percent compared to the average yield on short-term debt, which was less than one percent. This empirical fact refers to *the equity premium puzzle*. Why was the equity premium so high? This effect is due to “risk”. Stocks are riskier than bonds, and for that reason, stockholder will get a higher rate of return than bondholder will.

In contrast to Mehra and Prescott article, McGrattan and Prescott in their paper (2003) found that there was no equity premium puzzle by taking into account taxes, regulations and costs ignored by Mehra and Prescott (1985). The real return on equity is equal to the after-tax real return on capital plus a modest premium for bearing non-diversifiable aggregate risk².

The equity premium puzzle is an illustration of a discrepancy between model prediction and empirical data. This puzzle was observed by numerous empirical studies during the past two decades. Numerous papers paid attention to well-developed countries like USA, United Kingdom., Germany, France and Canada and few to emerging countries like Asia, Africa, South America, the Middle East, and Eastern Europe. However, none of them tried to generate monthly average data for stock and bond in these time horizons.

²McGrattan and Prescott, 2003: “Average debt and Equity returns: Puzzling?”

1.2 The Purpose of the Diploma Thesis

The diploma thesis aims to find out the existence of the equity premium puzzle in United States, United Kingdom, Germany and Austria during the last two decades. In order to get a comprehensive result, the thesis intends to consider the time horizon of 1990 to 2000 and 2000 to 2010, the ten-year time horizon for the large listed markets. Until now, there is no evident empirical study for equity premium puzzle introducing monthly average data for stock and bond returns to those countries in the last decade, my work presents that.

1.3 The Structure of the Diploma Thesis

The thesis is structured into five chapters. The first chapter shows a brief introduction to the equity premium puzzle and the reason of choosing this topic.

Chapter 2 presents a historical overview in the area of equity premium puzzle concentrating on the important evidence. It summarizes the past evidence of the historical equity premium, i.e. before Mehra and Prescott's paper in 1986 and present further other new conjectures based on it.

Chapter 3 concentrates on the data sources and the models testing the existence of the equity premium used in the thesis. The data sources taken into consideration are over the period 1990 to 2010 and are collected over the historical performance of the New York Stock Exchange, United Kingdom stock Index, Deutsche Stock Index and Austrian Stock Index. In Chapter 4, the model presents the results tested.

Finally, Chapter 5 is based upon the main conclusion, which tries to sum up the main goals of the thesis and makes further arguments for future researches.

CHAPTER 2

2.1 The Equity Premium Puzzle: Literature Review

In this section, I will try to give a historical overview to the Equity Premium Puzzle.

The first pioneer of the concept of equity premium was John Stuart Mill in his book *Principles of Political Economy 1848*. Mill pointed out that profit can be divided into three parts³:

- first, the interest for capital borrowed which represents the riskless rate
- second, the value of risk, which is equivalent to the equity risk premium
- third, the profit of stock which is the surplus profit that remains to the capitalist after replacing his capital: and the ratio which that surplus bears to the capital itself, is the rate of profit.⁴

However, his new early concept of equity premium did not widely develop. This was because during that century the economists were focused on the theory of profit and perfect competition rather than risk and return.

In 1921, Frank Knight, a Chicago economist, explained the importance of risk in his famous work *Risk, Uncertainty and Profit* by demonstrating its role before 1921 in the theory of profit. Knight defined risk and later he proposed the distinction between risk and uncertainty sharply. Indeed, his work did not explain the role of risk and uncertainty affecting prices in practical aspect and no explanation of the equity premium.

More, at the beginning of 20th century, there was the need to construct a stock price index by collecting historical equity price data from markets. It was Charles Henry Dow, who created the famous Dow's index of 30 stocks, which was a daily measure of the market. There were also further attempts from a vast number of macroeconomists to construct stock price indices like Mitchell (1911), Persons (1916), Cole and Frickey (1928) for the United States and Smith and Horne (1934), and Bowley, Schwartz, and Smith (1931) for Great Britain.⁵

³Mill, J.S., 1848: "The principles of Political Economy, Book 2, Chapter 16

⁴Mill, J.S., 1845: "Essays on some unsettled questions of political economy, Essay IV, P.90

⁵Goetzmann and Ibbotson, 2005: "The Equity Risk Premium: Essays and Explorations", Book

In 1924, Edgar Smith attempted to explain how to quantify the equity premium in the long run investment.⁶ Smith collected historical price and dividend data during 1866 to 1923 from Boston and New York Stock Exchanges. He created different stock and bond portfolios and for each of them included ten securities. The main goal was to show the performance of these asset classes over four different periods. He found that equities yielded higher income than bonds. His empirical finding was not widely developed at that time, only by scholars.

In his 1925 article: *Stocks vs. Bonds*, Fisher addressed his finding of investing in a diversified portfolio of equity and bonds. He believed that bonds were overvalued and were seen as a safety investment in an uncertain inflation world. Then Smith's finding quickly crossed the Atlantic and was published in the famous journals such as the Journal of the American Statistical Association and the Review of Economic Statistics.⁷

On October 24, 1929, the Great Depression in the United States began. Two days before, Fisher announced in the New York Times that stock prices were low. Many economists and analysts tried to conclude that stocks were overvalued and Fisher's announcement was wrong. The evidence suggested that Fisher was right: stocks were undervalued relative to the predictions of theory.⁸

In 1937, Bowland, a professor at Brown University, based on Smith's book showed the performance of stock investment during the Great Depression. These empirical findings showed that stock investment survived the crash.⁹

In his 1938 study, Alfred Cowles III collected monthly individual stock prices and dividends during the period of 1872 to 1937 for stock on the New York Stock Exchange and capital-weighting them. His model suffered due to the fact of taking the average of high and low prices during the month, which caused a shift in the returns and downward shifting due to the volatility.¹⁰

⁶Smith, Edgar, 1924: "Common Stock as Long Term Investment", Book

⁷ Smith, 1927: "Market Value of Industrial Equities," Review of Economic Statistics and 1931: "Tests Applied to an Index of the Price Level for Industrial Stocks," Journal of the American Statistical Ass.(Suppl. March 1931)

⁸McGrattan and Prescott, 2003: "The 1929 Stock Market: Irving Fisher Was Right"

⁹Bowland, Chelcie, 1937: "The Common Stock Theory of Investment"

¹⁰Goetzmann and Ibbotson, 2005: "The Equity Risk Premium: Essays and Explorations", Book

In 1938, John Burr Williams defined the model to estimate the equity premium. According to his model, i.e. a model based on a dividend discount model, he argued that in order to find the value of a risky security one should add a “risk premium”.¹¹

In 1952, Harry Markowitz proposed creating a portfolio by taking into consideration historical means, variances and covariances of each security and linking investment return and risk. Regarding his model, he defined equity premium as the distinction between the riskless return of an asset and the expected return of the tangency portfolio.

Early 1960s, it was the University of Chicago, which did lots of empirical studies explaining the long run stock return performance. Under the contribution of two economists Fisher and Lorie, The Center for Research in Security Prices (CRSP) collected historical stock price and dividend data for the U.S. stock market.

In 1964 Fisher and Lorie published their evidence on U.S. stock returns in the paper “Rates of Return on Investments in Common Stocks”, updated later in 1965. Ten years later, they also collected data of U.S government securities.

In the 1960s, further empirical estimates of rates of return were done. One of these was also the Capital Asset Pricing Model (CAPM) developed by Sharpe, Lintner and Mossin. The CAPM is used to determine the optimal portfolio of a risky asset based on the Markowitz model. It tries to give an analytical explanation to the equity premium.

In 1970s, there existed two important events to develop the existence of the consumption theory:

- first, Lucas (1976) on rational expectations, who argued that consumption depends on expected income
- second, Hall (1978) on the martingale process, who argued that consumption follows a martingale process if the preference of the consumer is time-separable, the utility is of a quadratic form and the interest rate is constant.¹²

Lucas defined equity premium as the difference between the aggregate consumption data and asset returns.

¹¹ Williams, John Burr, 1938: “The Theory of Investment Value”, Book

¹² Cheng and Tong, 2008: “Asset pricing: a structural theory and its applications “, Book Ch 1, pp. 6

In 1985, Mehra and Prescott tried to explain in their famous paper the equity premium puzzle under individual preferences and historical data.

However, there have been further attempts of a vast number of economists to explain an equity premium puzzle after 1986. Some of the economists try to focus on the famous paper of Mehra and Prescott and provide other new evidence but some expand the equity premium puzzle to new approaches/models.

I have classified them as to five main conjectures and tried to give the following brief explanations:

1. Economic risk

In his 1988 work, Rietz claimed that the economy is riskier and the equity premium may be explained due to the fact of low probability disasters¹³, which was not explained by Mehra and Prescott at that time.

2. Risk preferences

Epstein and Zin (1990) showed that the specification of the first-order risk for risk preferences can help to explain better equity premium puzzle but not completely.¹⁴

3. Market inefficiency

In their paper, Mehra and Prescott assumed the market to be efficient. In reality, there is no efficient market. This can be for two reasons: first, individuals and firms are not able to diversify the perfect risk, second, in the perfect capital market, there are costless transactions, but in reality, individuals face different transactions costs or trading constraints. To have a better understanding of the market inefficiency have a look in the Constantinides, Donaldson and Mehra's paper, "*Junior can't borrow: A new perspective on the equity premium puzzle*" (2005).

4. Behavioral model

The behavioral models try to explain the equity premium puzzle by using prospect theories for example:

¹³Rietz, 1988: "The equity premium: A solution"

¹⁴Epstein and Zien, 1990: "First-order' risk aversion and the equity premium puzzle"

Constantinides (1990) introduced a new concept of “habit formation” as a solution to the equity premium puzzle. The model in his paper generated high variability in the marginal rate of substitution in consumption with relatively low variability in the consumption growth rate through habit persistence in utility and low risk aversion.¹⁵

Benartzi and Thaler (1995): “Myopic Loss Aversion and the Equity Premium Puzzle” offered a new explanation to the equity premium puzzle based on behavioral theory by suggesting that investors were assumed to be loss averse, i.e. they are more sensitive to losses than gains.

5. Liquidity model

Eden (2008) did his finding on price dispersion to the liquidity model. He argued that an asset is more liquid if it is used relatively more in low price transactions and the probability that it will be bought at the low price is relatively high. In equilibrium, government bonds are more liquid than stocks and agents with a relatively stable demand are willing to pay a high “liquidity premium” for holding bonds. The equity premium compensates agents with relatively unstable demand for the “illiquidity” of stocks. The model tries to give another solution to the equity premium.¹⁶

CHAPTER 3: DATA SOURCES AND MODELS

3.1 Data Source

In their *Principles of Corporate Finance* textbook, Brealey and Mayer define the equity premium as “the expected additional return for making a risky investment rather than a safe one”. This means that the equity premium is just the market return (by including dividends and capital gains) over a risk-free return. Their equity premium estimation was around 6 to 8 percent. Is this applicable considering the last two decades?

¹⁵Constantinides, 1990: “Habit Formation: A Resolution of the Equity Premium Puzzle”

¹⁶Eden, 2008: “Liquidity, Equity Premium and Participation”

To estimate the equity premium one should look for seven important types of estimates:¹⁷

- Geometrics vs. arithmetic averaging
- Short vs. long investment horizon
- Short vs. long-run expectations
- Unconditional vs. conditional on capital gains, dividend yield or other assumptions about the future
- Domestic U.S. vs. international market data
- Data sources and periods
- Real vs. nominal returns

The first appropriate difference in the estimate of the equity premium is whether using arithmetical or geometric returns for the historical return data. By definition, an arithmetic mean return is a simple average of the series of returns. A geometric mean return is the compounded rate of return. The arithmetic returns are equal or higher than geometric returns.

This can be expressed by the formula: $Arithmetic.return = Geometric.return + \frac{\sigma^2}{2}$

where σ^2 is the variance of the arithmetic return.

The equity premium can be determined by arithmetic differences: Equity – Risk-Free Rate or by geometric differences: $\left(\frac{(1 + Return - on - Equity)}{(1 + Risk - Free - Return)} \right) - 1$.

Mehra and Prescott (1985) used the arithmetic average returns.

The second difference is the investment horizon, which shows the whole investment period considered. It shows the maturity of the risk-free parameter that is actually used for the equity premium estimation. There exist three different horizons for the determination of the equity premium¹⁸:

- The short-horizon defined as the difference between the total stock returns and the total Treasury bills returns

¹⁷Derrig and Orr, 2003: "Equity Risk Premium: Expectations Great and Small

¹⁸Ibbotson Yearbook, Valuation (2003)

- The intermediate-horizons show the total stock returns minus the total intermediate-term government bond returns
- The long-horizon is the difference between the total stock returns and the long-term government bond returns.

The third difference relates to the expectation of the equity premium. It can be of two types:

- The short-run expectation indicates the current equity premium, i.e. an expectation of up to ten years.
- The long-run expectation refers to an expectation more than ten years, for example fifteen or twenty years.

A further difference is the unconditional or conditional estimate on one or more related variables. In my thesis, I will use conditional ones, for example: capital gains, dividend yield, volatility or other assumptions.

The fifth type is whether using U.S. or international market data. As it is already stated in my topic I will collect U.S. and international market data. Needs to be considered the fact of using the weighted average returns.

The next important difference is the data and period used for the market and for the equity premium variables. Using different historical data, it refers to the length, timing, and source of the underlying data used. The time data for estimating the equity premium can be annual or monthly returns; daily returns are not good estimates for the purpose of the equity premium,

The last type is whether to use nominal or real figures for stock returns and risk-free rate returns. If the stock return and risk-free rate both are nominal, the difference in returns eliminates inflation. If both are real, inflation is removed from the estimation of the equity premium.¹⁹

3.1.1 Bottom-Up Line for Data Sources

In this section, I will summarize the main data sources used in the thesis to estimate the equity premium. The thesis will be focused on the equity premium puzzle in the

¹⁹Derrig and Orr, 2003: "Equity Risk Premium: Expectations Great and Small

United States, United Kingdom, Germany and Austria. The sample period for the study is chosen for the last two decades, i.e. between 1990 to 2000 and 2000 to 2010, in sum 10 years each. Thus, it relates to the short-term expectation discussed above. The historical data are collected from the largest stock market indexes namely U.S. Standard and Poor 50 Stock Market Index (S&P Index), UK Stock Market Index (UKX), Germany Stock Market Index (DAX), and finally Austrian Stock Market Index (ATX). The whole data, thank to Bloomberg, are reliable and careful adopted for estimating the equity premium. Despite the vast papers on the equity premium puzzle, my work concentrates on the short-horizon defined as the largest stock market total returns minus the Treasury bills total returns. I find it more reasonable using arithmetic average return method rather than geometric method. The time series of these data is particularly different from the other articles, which adopted annual data; my work provides monthly average ones. The final remark consists on two important issues. First, the equity premium estimates are unconditional ones, e.g. capital gains, dividend yield, volatility or other assumptions. Second, the historical data collected are expressed in nominal terms for stock returns and risk-free rate returns.

3.1.2 Proxy for Stock Market Return

The thesis includes returns adopted from the largest stock exchange market Index as the proxy for stock market returns. The data adopted may influence the end result for the equity premium puzzle in those countries for the last two decades. They are taken in monthly average and present nominal terms. As discussed above, the four largest market exchange Indexes are the Standard and Poor 500 (S&P500), the United Kingdom Index (UKX), the German Index (DAX) and the Austrian Index (ATX).

The expected stock returns are calculated based on the two basic models that will be discussed in the next section. The figures 1, 2, 3 and 4 below show the expected stock return based on the average stock return model over twenty years. For the UKX the data are provided after 1992, for the DAX from 1996 and for the ATX from 1992. This is due to the dividend price availability.

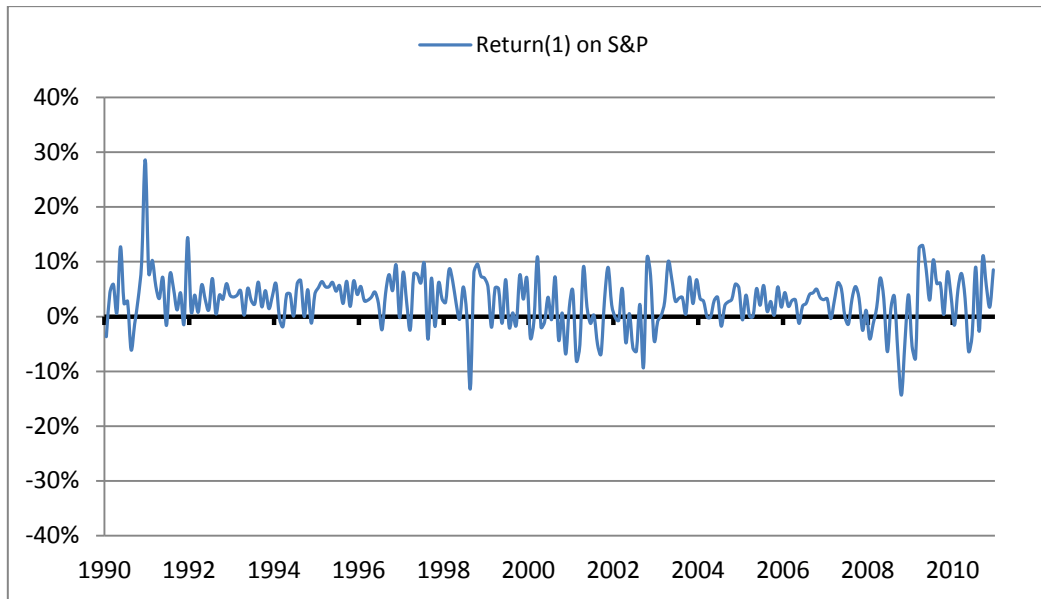


Fig.1: Expected stock returns (1) on S&P from 1990 to 2010²⁰

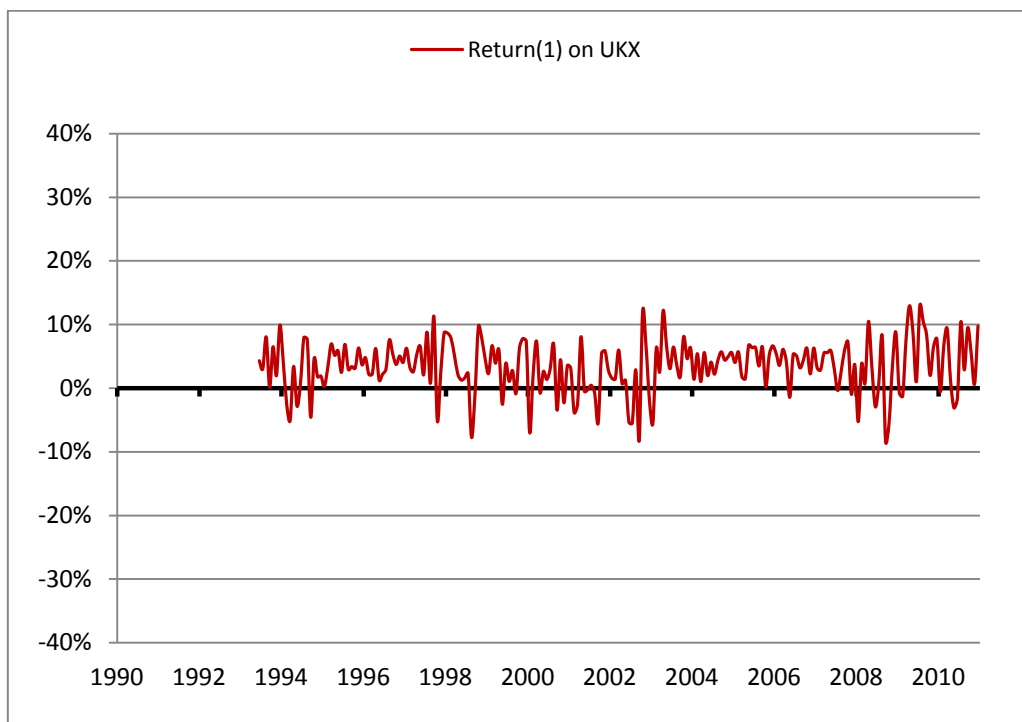


Fig.2: Expected stock returns (1) on UKX from 1990 to 2010

²⁰Expected Stock Returns (1) means the expected stock returns based on the average stock return model

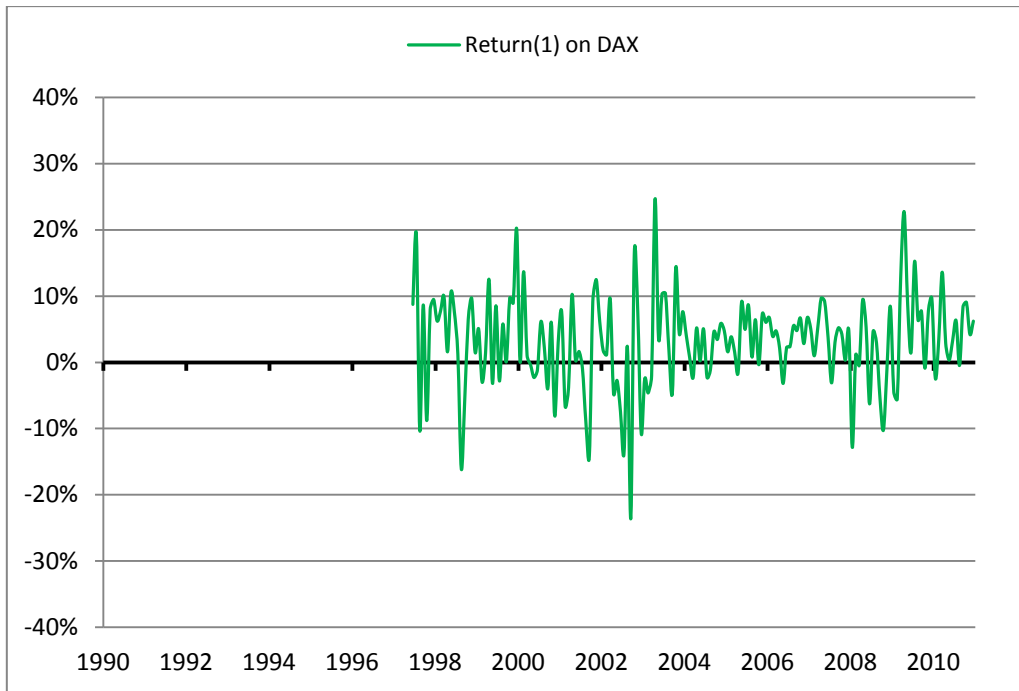


Fig.3: Expected stock returns (1) on DAX from 1990 to 2010

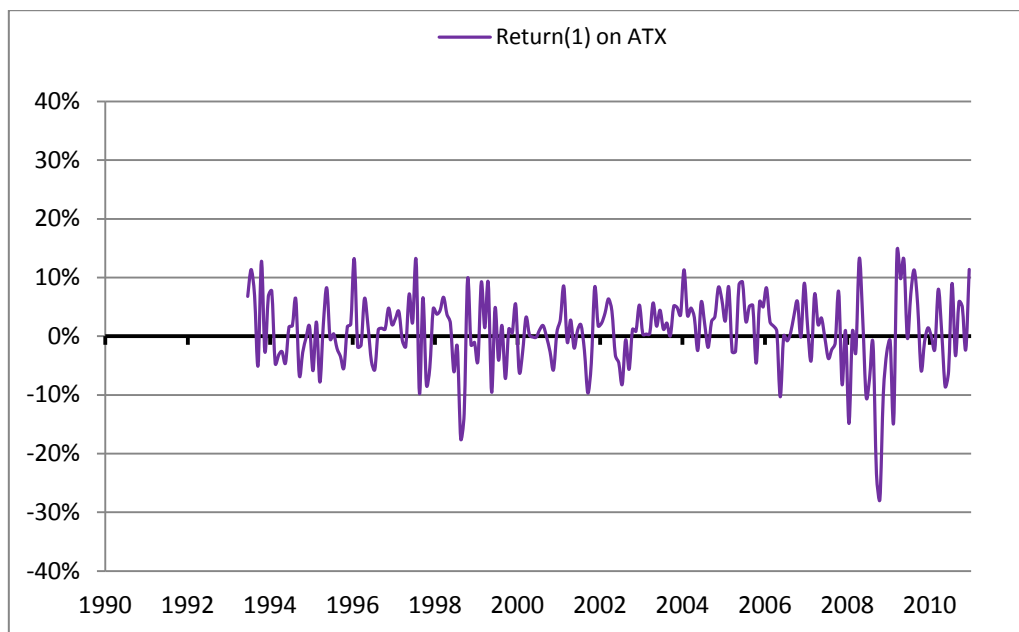


Fig.4: Expected stock returns (1) on ATX from 1990 to 2010

The next figures show the monthly average stock returns based on the growth of dividend model over 1990 to 2010.

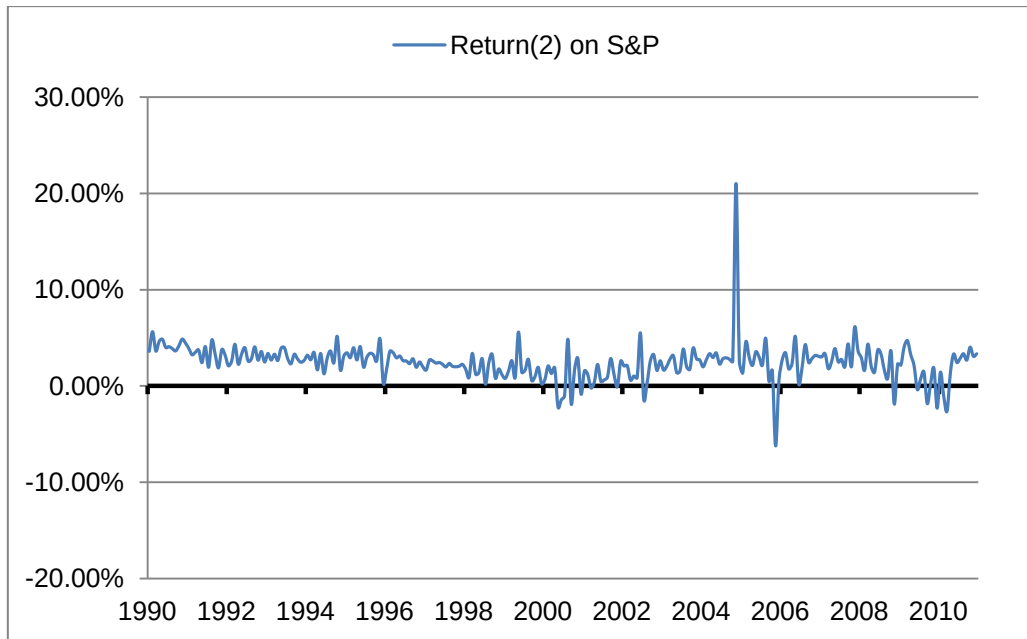


Fig.5: Expected stock returns (2) on S&P from 1990 to 2010²¹

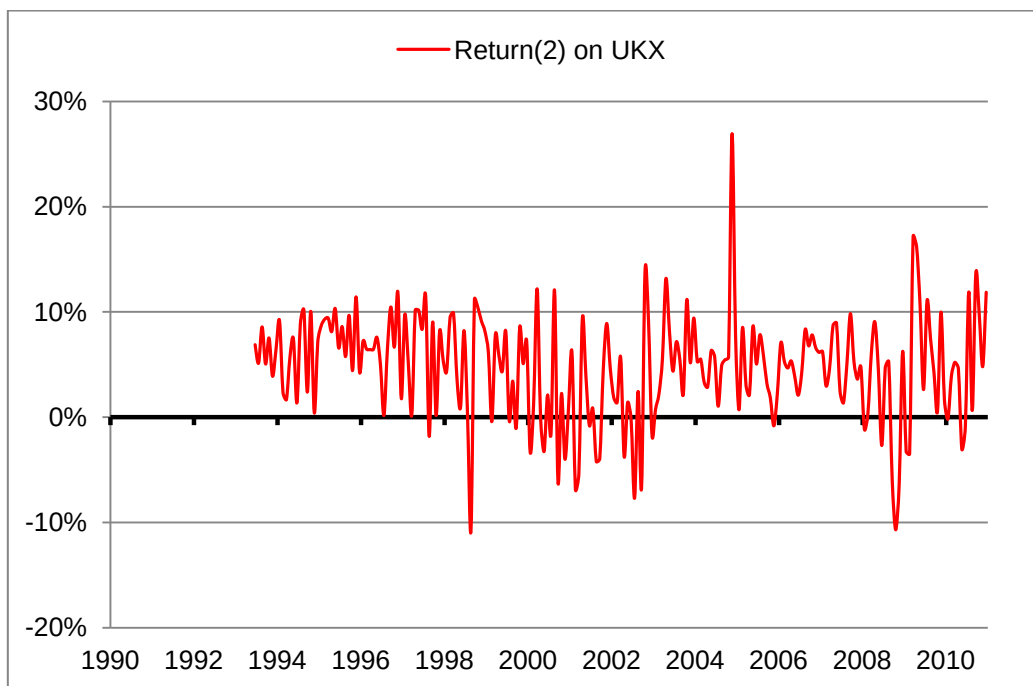


Fig.6: Expected stock returns (2) on UKX from 1990 to 2010

²¹ Expected Stock Returns (2) means the expected stock returns based on the average growth dividend model

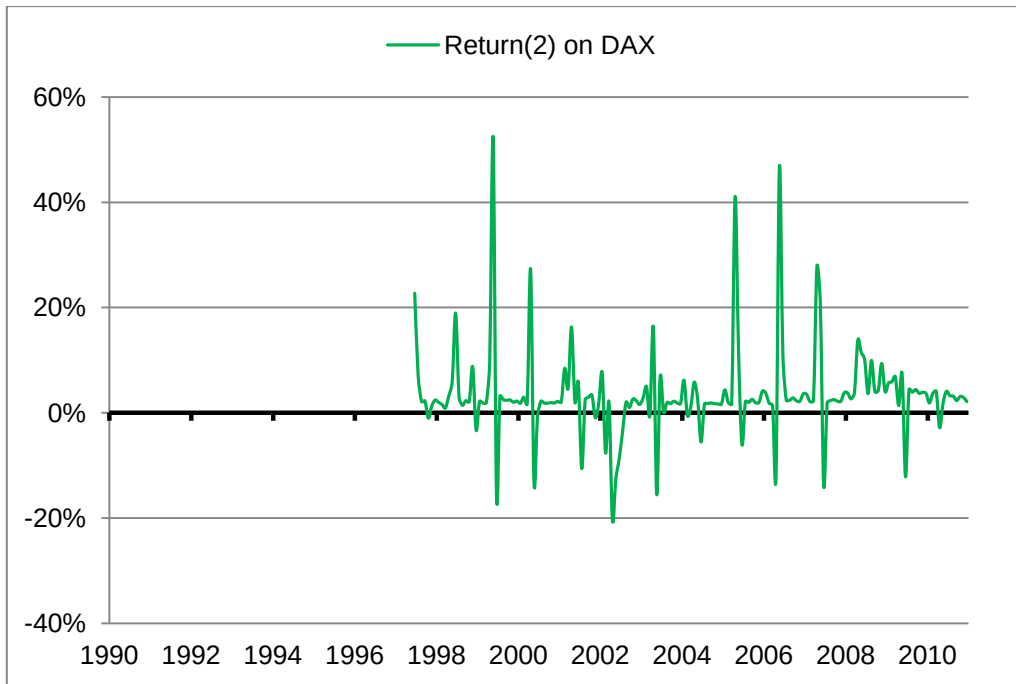


Fig.7: Expected stock returns (2) on DAX from 1990 to 2010

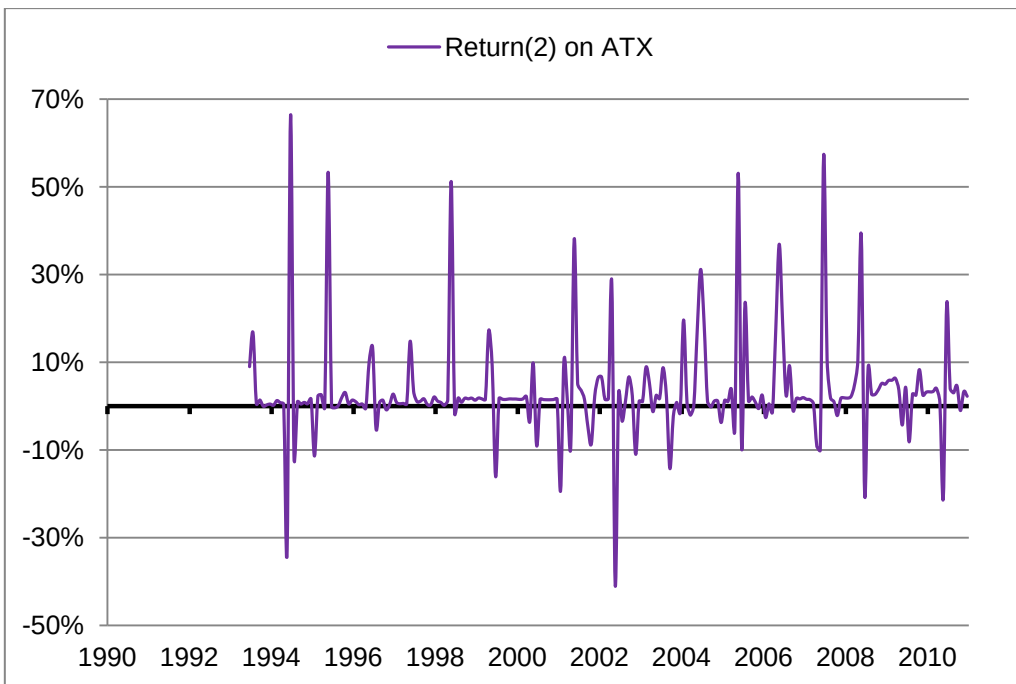


Fig.8: Expected stock returns (2) on ATX from 1990 to 2010

3.1.3 Proxy for Treasury Bill Return

It is standard practice to measure the equity premium using bills, since these most closely approximate risk-free investments²². At the beginning of the twentieth century, there was no Treasury bill market. Therefore, I adopted as a proxy for the short-term risk-free interest rate, the short-term government bonds, in other cases the short-term central bank discount rate. As mentioned above the data for risk-free rate are collected in the short term, i.e. monthly rates over the last two decades. Treasury bills are short-term government bonds. Their maturity is three, six, or twelve months. In most countries, treasury bills are issued by an auction or a tender, but there is usually also a very liquid secondary market in which bills can be bought and sold. Short-term Treasury bills have low inflation risk because one-month bills will expose the investor to only one-month's uncertainty at any time.²³

The figure below shows the short-term Treasury bill rate over the two last decades for the United States, the United Kingdom, Germany and Austria. Remark: I took the interest rates for Germany and Austria from 1990 to 1998 and I adopted the EURIBOR 3-month interest rate from 1999 to 2010. EURIBOR is a daily reference rate based on the averaged interest rates at which Eurozone banks offer to lend unsecured funds to other banks in the euro wholesale money market (or interbank market).²⁴

²²Kyriacou et al. ,2004: "The Equity Premium"

²³Dimson, Marsh and Staunton, 2002: "Triumph of the optimists: 101 years of global investment returns", Book

²⁴http://en.wikipedia.org/wiki/Euro_Interbank_Offered_Rate

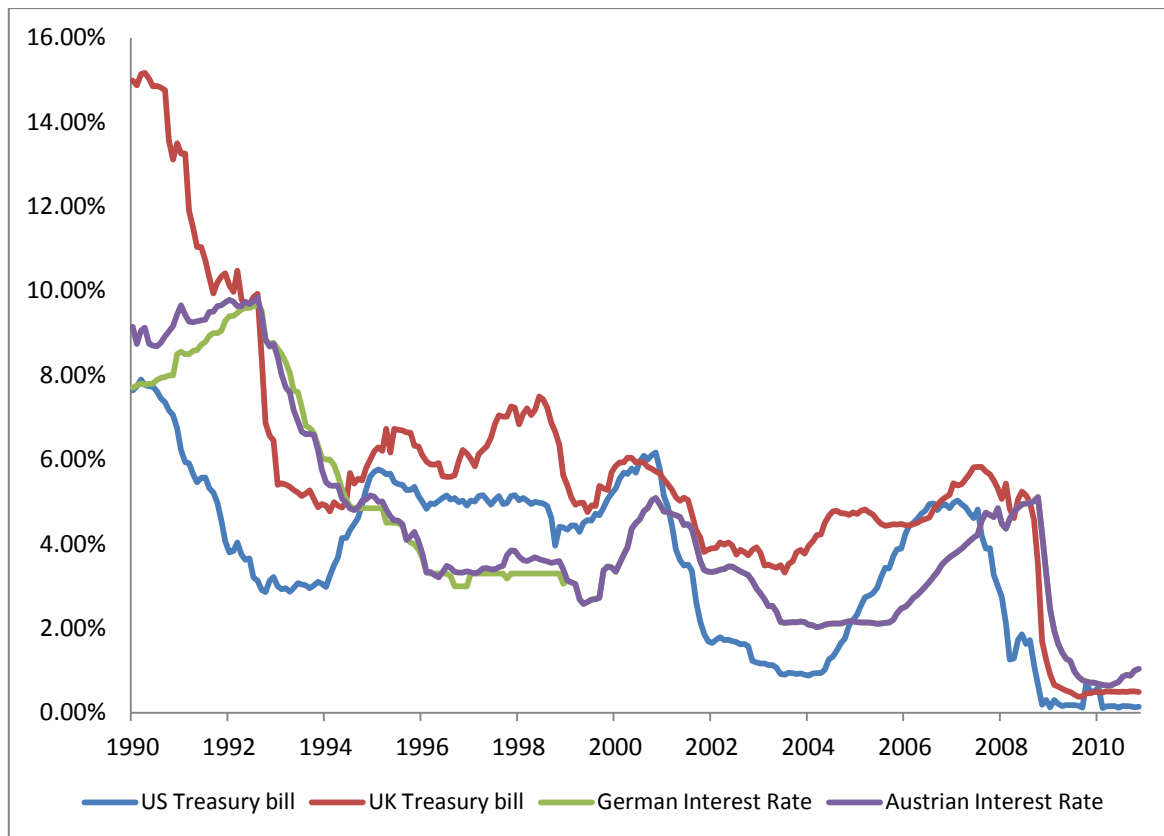


Fig.9: Treasury bill rates of return from 1990 to 2010

3.2 Models

In this section, I will introduce the basic models to estimate the expected stock return. Fama and French (2001) in their paper presented three models: the capital gain model, the dividend growth model, and the earnings growth model to investigate the three periods of historical returns: 1872 to 2000, 1872 to 1950, and 1951 to 2000. I will focus on the first two models for the two periods of historical returns: 1990 to 2000 and 2000 to 2010 and will try to test the equity premium puzzle in these countries. These two models adopted are simple. However, if the assumptions or estimates are made wrong, the result will alter what you are going to estimate.

3.2.1 The Average Stock Return Model

This model shows that the average stock return is the average dividend yield plus the average rate of capital gain:²⁵

$$A(R_t) = A(D_t / P_{t-1}) + A(GP_t) \quad (1)$$

Where D_t is the dividend for year t , P_{t-1} is the stock price at the end of year $t-1$, $A(R_t)$ refers to the average rate of stock return at time t , and $GP_t = \frac{P_t - P_{t-1}}{P_{t-1}}$ is the rate of capital gain. Other two assumptions are: $\frac{D_t}{P_{t-1}}$ is the dividend yield and $\frac{D_t}{P_t}$ presents the dividend-price ratio.

3.2.2 The Dividend Growth Model

Another approach to estimate the expected stock return is the dividend growth model:

$$A(RD_t) = A(D_t / P_{t-1}) + A(GD_t) \quad (2)$$

where $GD_t = \frac{D_t - D_{t-1}}{D_{t-1}}$ is the growth rate of dividends.

A further assumption is that dividend-price ratio D_t/P_t is stationary (mean reverting)²⁶. Stationarity implies that if sample period is long, the compounded rate of dividend growth is comparable to the compounded rate of capital gains. The average return model (1) and growth rate of return models (2) consider the estimates of the unconditional expected stock return.

^{25,26}Fama and French, 2001: "The Equity Premium"

CHAPTER 4: MODELS SOLUTION AND DISCUSSION

4.1 Equity Premium across Four Countries, 1990 to 2010

In this section, I will show and explain the results for the U.S., UK, Germany and Austria equity premium based on the two models discussed above.

Figure 10 presents the U.S., UK, German and Austrian equity premium based on the average stock return model in the period of 1990 to 2010.

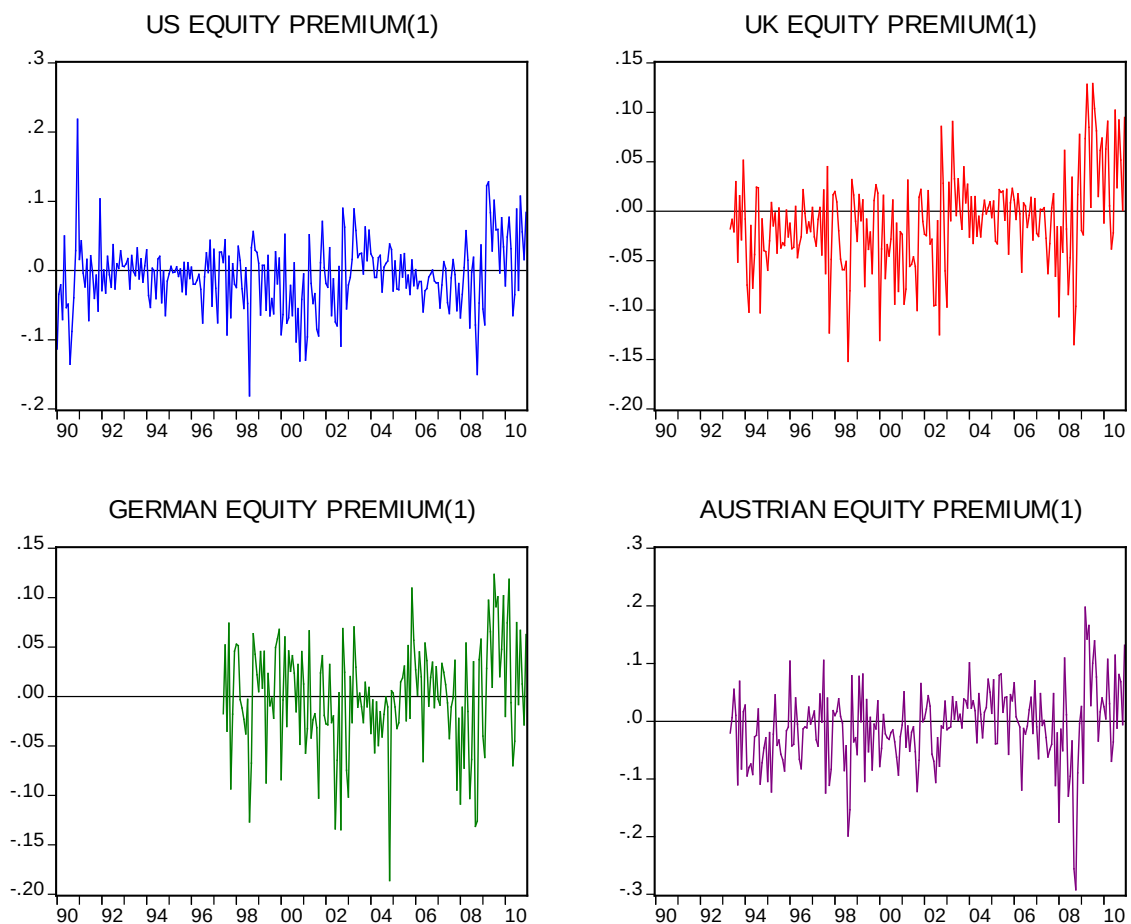


Fig.10²⁷: Equity Premium through the Average Stock Return Model across four countries
Monthly average, 1990-2010

Surprisingly, figure 10 shows that for United Kingdom equity premium based on the average return model seems to have on average a negative value during 1993 until 2000. In contrast, the Austrian equity premium for 1993 to 2000 produced by the

²⁷ Data availability for UK and Austria is from 1993 and for Germany from 1997 and on.

same model seems to have on average a positive value because most of the line is positioned above to the zero line. After 2000, the Austrian equity premium decreases and in 2005 reaches the lowest value, almost - 20 percent.

In figure 11, the difference between the monthly average stock returns calculated from the dividend growth model and the monthly Treasury bill returns, is the average equity premium over twenty years, 1990-2010. Under the dividend growth model, the UK equity premium seems to have on average a negative value and the lowest one compared to the other countries. Most of the equity premium line is shown below the zero line and in higher percentage. Similarly, U.S. equity premium seems to be negative, most of the line is placed down to zero line. During 1999, Austrian equity premium under the dividend growth model reached the lowest value, in contrast to UK and Germany; they reached a higher value of the equity premium. During 2005, U.S., Germany and Austria had a negative value of the equity premium from the dividend growth model given in the figure 11.

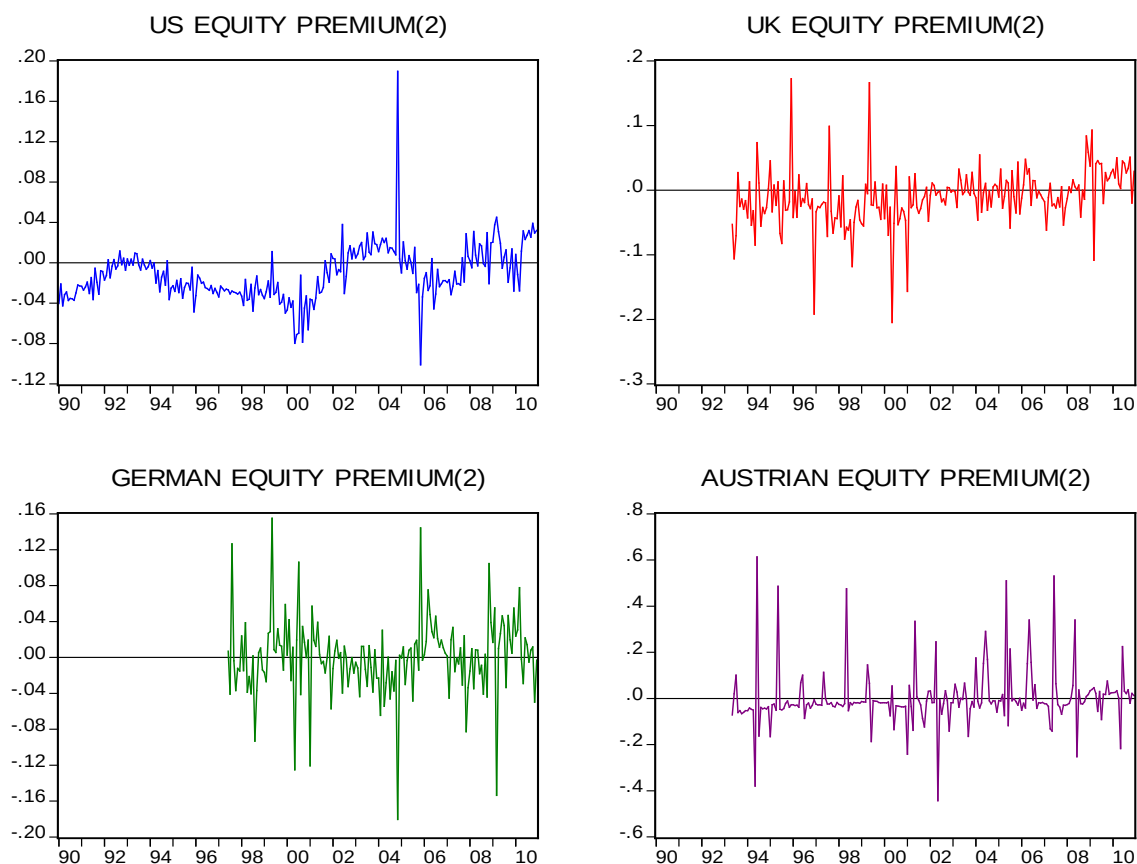


Fig.11: Equity Premium through the Dividend Growth Model across four countries

Monthly average, 1990-2010

Table 1 shows estimates of the monthly-expected equity premium to U.S., UK, Germany and Austria for 1990 to 2010. The market portfolios are the S&P 500, UKX, DAX and ATX and theirs antecedents. The risk-free interest rate is the monthly return on 3-month Treasury bill²⁸. Table 1 includes also the sharp ratio for the equity premium from the average stock return model, shortly named SR and the sharp ratio for the equity premium from the dividend growth model, shortly SD²⁹.

Equity Premium and Related Statistics											
		DP Ratio	Return(1)	Return(2)	GP	GD	Treasury Bill	ERP(1)	ERP(2)	SR	SD
1990-2010	Means of monthly values of variables										
	U.S.	2.42%	3.90%	2.80%	1.46%	0.36%	4.85%	-0.95%	-2.05%	-21.17%	-45.68%
	UK	2.44%	3.70%	3.68%	1.20%	1.18%	5.97%	-2.27%	-2.29%	-60.4%	-60.9%
	Germany	1.92%	4.47%	4.84%	2.51%	2.87%	3.16%	1.31%	1.68%	16.33%	20.95%
	Austria	0.97%	1.67%	3.14%	0.70%	2.17%	4.09%	-2.42%	-0.95%	-40.27%	-15.81%
	Standard deviations of monthly values of variables										
	U.S.	0.74%	4.49%	1.13%	4.43%	0.88%	1.23%	4.55%	1.42%		
	UK	0.32%	3.76%	4.98%	3.70%	4.90%	0.79%	3.79%	5.04%		
	Germany	0.34%	8.02%	10.79%	7.98%	10.70%	0.26%	7.97%	10.84%		
	Austria	0.43%	6.01%	12.44%	6.01%	12.41%	1.07%	5.98%	12.45%		
2000-2010	Means of monthly values of variables										
	U.S.	1.86%	1.86%	2.14%	0.00%	0.28%	2.48%	-0.62%	-0.34%	-12.89%	-7.07%
	UK	3.37%	3.34%	3.50%	-0.02%	0.13%	3.90%	-0.56%	-0.40%	-12.39%	-8.85%
	Germany	2.58%	2.80%	3.20%	0.22%	0.62%	2.97%	-0.17%	0.23%	-2.49%	3.37%
	Austria	1.89%	2.77%	3.60%	0.89%	1.72%	2.97%	-0.20%	0.63%	-3.13%	9.84%
	Standard deviations of monthly values of variables										
	U.S.	0.52%	4.81%	2.45%	4.73%	2.44%	1.90%	4.55%	1.42%		
	UK	0.75%	4.52%	3.35%	4.38%	3.26%	1.78%	5.24%	3.82%		
	Germany	1.00%	6.82%	8.20%	6.67%	8.11%	1.33%	7.30%	8.24%		
	Austria	1.25%	6.40%	11.95%	6.38%	11.95%	1.33%	7.00%	12.03%		

Table 1: Equity Premium and Related Statistics

Explication. All data series are available monthly from 1990 to 2010. DP ratio is the dividend-price ratio, which is the paid dividends D divided by the stock market price level P.

²⁸ Only for Germany and Austria I adopted the short-term interest rate instead of 3-month Treasury bill from 1990 to 1998 and from 1999 to 2010 the EURIBOR 3-month interest rate taken from ECB

²⁹ Sharp ratio, by the definition, is a measure of the risk premium per unit of deviation in an a trading strategy. The Sharpe ratio is used to characterize how well the return of an asset compensates the investor for the risk taken. Source: http://en.wikipedia.org/wiki/Sharpe_ratio

Return(1) is the total return on the value-weighted stock market from 1990 to 2000 and from 2000 to 2010 calculated under the average stock return model(1). Return(2) is the total stock market return from the last two decades under the dividend model. The rates of growth of the

stock price and dividends are $GP = \frac{P_t}{P_{t-1}} - 1$, and $GD = \frac{D_t}{D_{t-1}} - 1$. Treasury bill is the 3-month

Treasury bill rate over the last two decades. ERP(1) is the monthly equity premium from the average stock model (1) from 1990 to 2000 and from 2000 to 2010 and ERP(2) is the dividend growth estimate (2) of the monthly equity premium from 1990 to 2000 and 2000 to 2010. The last two abbreviations are SR and SD, i.e. the sharp ratio for the equity premium from the average stock return model and the sharp ratio for the equity premium from the dividend growth model.

Table 1 demonstrates these results.

United States

Under the average stock return model (1), the average monthly stock return during 2000 and 2010 has decreased to about one half during 1990-2000. Under the dividend growth model (2) there is a reduction but in a smaller proportion percentage. The average monthly Treasury bill return from 1990-2000 to 2000-2010 has approximately decreased to one half. The estimate of the expected equity premium for 1990 to 2000 from the average stock return model (1) is minus 0.95 percent per month. The estimate from the dividend growth model (2) gives a value of minus 2.05 percent, almost 46% lower than the average stock model (1). The monthly equity premium for 2000-2010 from the average stock return (1) is minus 0.62 percent, while from the dividend growth model (2) it is smaller and closes to minus 0.34 percent, almost 55 percent higher. The growth rate of the stock prices during 1990-2000 is 1.46 percent per month, 25 percent higher than the monthly rate of growth of dividend, respectively 0.36 percent. In contrast, the growth rate of dividend from 2000 to 2010 turns out to have a higher value (i.e. 0.28 percent) than the growth rate of the stock prices (0.00 percent). Why?

Dimson et al. (2002) estimate the annual equity premium for U.S. (i.e. Stocks minus T-Bill) between 1990 and 2000. They obtain an annual arithmetical mean equity premium of 9.2 percent. Damodaran (2011) determines the annual arithmetical mean equity premium between 2000 and 2010 around 1.37 percent. I calculated the

monthly mean equity premium³⁰ during 1990-2000 and during 2000-2010 from the Dimson et al. and Damodaran estimates and I found that the U.S. equity premium is around 0.766 percent for 1990-2000 and around 0.1141 percent during those time intervals respectively. They seem to be in positive value range. Is it that the yearly returns during the past two decades change so much from the monthly ones?

The two types of evidence suggest that the equity premium during the last two decades is lower and negative. Another remark is that the two models show that equity premium from 2000-2010 is higher from the two models than from 1990-2000, but still negative.

United Kingdom

Under the consideration of two models: the average stock return model (1) and the dividend growth model (2), the UK monthly equity premium has declined significantly during the last two decades. Interestingly, the average stock return model and the dividend growth model produce the same estimates of the stock return during the first decade: 1990 to 2000. The average monthly stock return is around 3.80 percent and has a growth rate of 1.20 percent from two approaches. The UK monthly equity premium has almost the same value to minus 2.29 percent for both methods. During the second decade, the two estimates diverge slightly in values. The average monthly stock return is around 3.34 percent under the average stock return model (1) and is around 3.50 percent under the dividend growth model (2). The monthly growth rate of the stock return has decreased by minus 0.02 percent, while the monthly dividend growth rate has increased by 0.13 percent. The UK monthly Treasury bill rate has increased twice from 1990-2000 to 2000-2010. The UK monthly equity premium of the 2000 to 2010 compared to the 1990 to 2000 for both approaches has increased but lies still in negative value range.

Dimson et al. estimated the UK annual equity premium - the annual stock return minus the annual return on bills during 1990-2000 - around 4.8 percent. Calculating the monthly equity premium from the estimate of Dimson above, it comes up to 0.4 percent. Why do these monthly data deviate so much from the yearly data?

³⁰ These results are not available in the Table 1

From the Credit Suisse Research Institute Global Investment Returns, Yearbook 2011³¹, the annual equity premium (stock return minus Treasury bill return) for UK during the 2000-2010 is around minus 0.1 percent, which considering my estimations gives a value of minus 0.0087 percent monthly. Both my estimation of the 2000 to 2010 and the estimation of the Credit Suisse Institute are negative, apart from the fact that my result is highly valued. Why? Is it that due to the highly values of 3-month Treasury bill returns, which I took into consideration?

Germany

It was difficult finding data on the stock returns and short-term government bond returns for Germany from 1990 until 1997, especially for the monthly ones. I adapted the data during the period of 1997 to 2010. As Treasury bill rates of returns, as I mentioned above, I assume the 3-month Euro interest rates (EURIBOR) of the 1997 to 2010.

Some interesting results are shown in the table 1 for Germany. The estimates of the expected stock return for 1990 to 2000 from the two models are similar (4.47 percent per month and 4.84 percent per month). The monthly growth rate of stock prices and the monthly dividend growth rate go in the same direction, respectively, 4.47 percent and 4.84 percent. However, these rates tend to decrease during the 2000 to 2010 (namely 2.80 percent and 3.20 percent). Interestingly, when comparing the monthly growth rates of the German stock price between 1990 to 2000 and 2000 to 2010, it is obvious that this estimate has extremely decreased, about 11 times lower. The same argument holds for the dividend growth rates. What happened during the last decade? Why such huge value reductions? The estimates of the Germany equity premium based on the two models have positive values during the 1990 to 2000 (namely, 1.31 percent under the average stock return model (1) and 1.68 percent under the dividend growth model (2)). While the estimates of the 2000 to 2010 show that, the average stock return model (1) turns to be negative, minus 0.17 percent and the dividend growth model (2) has a lower value of 0.23 percent.

³¹ Source: https://infocus.credit-suisse.com/data/_product_documents/_shop/300847/credit_suisse_global_investment_yearbook_2011.pdf

Does it mean that under the dividend growth model (2) equity premium is overvalued from 2000 to 2010? Does it explain the fact that dividend yield over 2000 to 2010 has been higher in value?

There is no evidence of the annual or monthly equity premium from the other researchers (authors as well) during the 1990 to 2000. However, Credit Suisse Institute estimated a lower annual risk premium for the 2000 to 2010, by which the equities beat bills by minus 1.0 percent. This gives a value of minus 0.083 percent per month and is closer to my estimates by using the average stock return model.

Austria

The Austrian equity premium based on the two models is presented during the period of 1993 to 2010³². I took the interest rates 1990 to 1998 and I adopted the EURIBOR 3-month interest rate from 1999 to 2010 same as in the section of German Equity Premium, as a proxy for the Austrian Treasury bill rates.

Table 1 shows that under the dividend growth model (2) the equity stock return is two times higher than under the average stock return model (1) from 1990 to 2000. The same interpretation of stock return applies to the period from 2000 to 2010. While comparing the equity stock returns between the two last decades it is clear that the equity stock returns have increased in value but in a lower percentage. The monthly dividend growth rate (GD) between 1990 to 2000 and 2000 to 2010 has also decreased, by 79 percent. The Austrian monthly equity premium over 2000 to 2010 seems to have the same interpretation as the Germany. The table 1 demonstrates that the monthly equity premium is negative during 1990 to 2000 and the average stock return model (1) estimates a higher value (minus 2.42 percent) in contrast to the dividend growth model (2), a value of minus 0.95 percent per month. Over the last decade these two models present interesting values: under the dividend growth model (2) the monthly equity premium is positive and around 0.63 percent, while under the average stock return model (1) the equity premium is slightly negative, minus 0.20 percent per month. Does it mean that dividend returns are highly valued during the last decade although we obviously know that there has been a financial crisis?

³² This is due to the data availability to Austria up to 1993.

Again, there is no evidence to compare my result to those of other papers when we look at the Austrian case, even annual equity premium versus T-bills during the last two decades. The world annual equity premium versus the U.S. bills is around 3.3 percent³³, but this result does not give me a reasonable value for Austria. The Austrian equity premium during 1970 to 2005 results to 3.33 percent³⁴, which is still higher and not applicable to my finding. The time horizon is also more than 10 years, i.e. a 35-year time horizon.

4.2 Which of the two models is more precise?

In this section, I will try to explain which of the two models: the average stock return model (1) or the dividend growth model is likely to be more precise when estimating the monthly expected stock returns.

In their paper, Fama and French (2002) suggest that the dividend growth model and the average stock return model have produced similar estimates of expected US equity premium historically; the two measures have diverged significantly in the more recent periods. They argue that the dividend model produces estimates closer to the true expected equity premium because the average stock returns are affected by price jumps associated with declining discount rates. I do agree somehow with their empirical finding but this is not true when using different sample periods (they used three different periods: 1872-2000, 1872-1950, and 1951-2000) to demonstrate that the expected equity premium will be nearly the same. I stress this point because the time span that I am using here is just a decade and I compare the last two decades to each other taking into consideration four countries.

To illustrate, Table 1 shows that the U.S. expected stock return (Return(1)) has a higher value under the average stock return model (1) than Return(2) under the dividend growth model (2) during 1990 to 2000. For UK and Germany, the two models produce similar estimation results of the expected return. Interestingly, the Austrian expected stock return (Return(1)) is sharply lower, a value of 1.67 percent under the average stock return model (1), while Return(2) under the dividend growth

³³Dimson, Marsh and Staunton, 2002: "Triumph of the optimists: 101 years of global investment returns", Book

³⁴Schneider Christoph, 2006: "Die Rendite längstlaufender Staatsanleihen in Österreich", Diploma thesis

model (2) has a considerable value of 3.14 percent. There is also much reason to favor the average stock return model of the expected stock return over the dividend growth model (2), except for the United States. Table 2 provides the standard errors of two estimates of the expected stock return from 1990 to 2000. It is obviously true that the dividend growth model (2) for US is preferred during 1990 to 2000; the U.S. has a lower standard error of expected stock return of 0.004 percent rather than under the average stock return model (1), about 0.014 percent.

	Standard error of the expected return,1990-2000(%)	
	Average stock return model	Dividend Growth Model
US	0.014	0.004
UK	0.012	0.016
Germany	0.025	0.034
Austria	0.019	0.039

Table 2: Standard error of the expected return across countries, 1990-2000

When we look at the other countries, the estimates of the standard error of the expected stock return is favorable under the average stock return model (UK: Average stock return model 0.012% vs. Dividend growth model 0.016%; Germany: 0.025% vs. 0.034 and Austria: 0.019% vs. 0.039%).

For the 2000 to 2010 period, the competition between the average stock return model (1) and the dividend growth model (2) is more interesting. Under the dividend growth model (2), the standard error of the expected return is higher for UK, Germany and Austria than under the average stock return model (1). However, considering the standard errors of two estimates calculated in Table 3, it turns out that under the dividend growth model the U.S. and UK have lower values, while for Germany and Austria the two models seem to produce similar results by looking the table 3, which shows the standard error of the expected return during 2000-2010.

	Standard error of the expected return, 2000- 2010 (%)	
	Average stock return model	Dividend Growth Model
US	0.015	0.008
UK	0.014	0.011
Germany	0.022	0.026
Austria	0.020	0.038

Table 3: Standard error of the expected return across countries, 2000-2010

I argue that the estimates of the expected stock return for 2000-2010 from the dividend growth model are closer to the true value of expected return. First, the estimates of expected stock return from dividend growth model are more precise than the average stock return model. Being precise on this issue is not the main goal; comparing the two main models it is the main purpose here. The standard error of the expected stock return under the dividend growth model for 2000-2010 is lower for U.S. and for the other countries the two models show similar results. Second, Table 1 also presents the Sharp ratios for the two equity premium estimates. The Sharp ratios change across countries and during periods. For example, the U.S. Sharp ratio for the dividend growth model is two times higher than the sharp ratio for the average stock return during 1990 to 2000.

For UK and Germany Sharp ratios for both models are similar, while the Austrian Sharp ratio for the average stock return model is much lower than the dividend growth estimate.

More interesting, the Sharp ratios for the 2000 to 2010 equity premium for the dividend growth model are much higher than the average stock return, e.g.: for Austria the Sharp ratio is 9.84 percent under the dividend growth model while under the average stock return model it has a value of minus 3.13 percent. How can we interpret this result?

In asset pricing theory, the Sharp ratio is related to aggregate risk aversion³⁵. The sharp ratios for the 1990 to 2000 and 2000 to 2010 equity premium from the two models suggest that risk aversion decreases so much. For example, Austria has a Sharp ratio for the 1990 to 2000 equity premium from the dividend growth model

³⁵Fama and French, 2002: "The Equity Premium", Paper
35

about minus 15.81 percent³⁶, while during 2000 to 2010 it has a much lower value of Sharp ratio under the same model, a positive value of 9.84 percent. The return volatility falls a bit during the last two decades and the equity premium from the dividend growth model increases from minus 0.95 percent for 1990 to 2000 to 0.65 percent for 2000 to 2010.

As a result, the estimates of the expected stock return from the dividend growth model are likely to be more precise than the average stock return model.

4.3 Bottom Up

Here I will further focus on the explanation of the equity premium during the period from 2000 to 2010. I consider this period for two reasons. First, there is an availability of dividend prices and T-bill data for each country. Second, I generate a sample of 132 observations for each country instead of the period 1990 to 2000 with different observations, e.g. US with 120 observations, UK with 80 observation, Germany with 31 observations³⁷ and Austria with 80 observations. There is clearly evidence to suggest that the historical equity premium observed in these four countries is significantly smaller and surprisingly negative for 2000 to 2010. Figure 12 gives again a summary over the equity premium calculated above. Under the average stock return model (1), all the countries show a negative equity premium and Germany has lowest absolute value, about minus 0.17 percent compared to the other countries. While under the dividend growth model (1), Germany and Austria have a positive equity premium but still lower values, respectively 0.23 percent and 0.63 percent. In contrary to the model (1) the U.S have an expected equity premium around minus 0.43 percent, which suggests new evidence for the low U.S equity premium during the 21th century. In both models, Germany and Austria are positioned very well while considering the equity premium estimates.

³⁶ Negative risk aversion means that investor is willing to take the financial risk.

³⁷ There is a low number of observation for Germany cause of the data availability to dividend prices

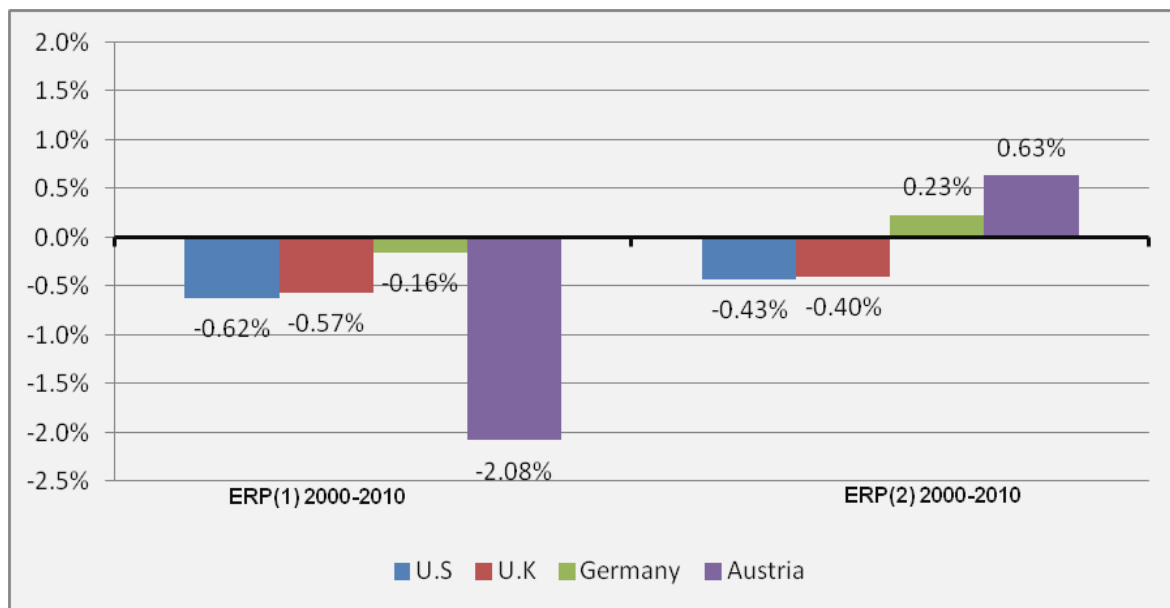


Fig.12: A summary of the Equity premium across four countries, 2000-2010

The question that I stress is why does there exist a big discrepancy between the two models? Is there an explanation behind this? Is it related to the stock price valuation? Or has it to do with dividend level by taking into consideration for four countries the same observations, the same period of time (10 years)? Does it depend on the different types of firms listed in the stock exchange market of these countries? How do taxes, regulatory constraints and diversification costs change across four countries?

In the previous chapter, I will try to give some explanations to these questions. I will start with the different types of firms listed in the stock exchange markets respectively. Further, I will explain through my empirical study the evidence of the equity premium with dividend ratios. In addition, I will show how taxes vary between the countries in different periods and the role of market imperfection. Finally, I will discuss the question, whether the smaller equity premia are due to the higher volatility of stock prices.

CHAPTER 5: ROBUSTNESS

5.1 Industry Composition

After the fall of Berlin Wall and the disruption of the Soviet Union, the Internet and the World Wide Web represented a new technological revolution bearing a “new economy” during the second half of the 1990s. I emphasize the term a “new economy” due to technological changes. These technological changes included the high-tech sectors of computers, Internet, new sources of energy (electricity, gas and Oil), new industries (automobiles and pharmaceuticals), new products (cars, washing machines, antibiotics), new transportation techniques (airlines, telecommunications and media (telephone and radio). *These profoundly altered what was produced and how. They also transformed the way people lived.*³⁸.

According to these changes, Dimson et al. tried to illustrate and explain in their book the shifting composition of different types of firms listed on stock market over the twentieth century. Table 4 presents the industrial composition for the United States and the United Kingdom at three points in time: end-1899, 1950, and 2000.

In table 4, it is shown that Railroads have a great importance for both countries at the beginning of the twentieth century. In the United States, they made up around 63 percent of the total market value (i.e. the value of the top 100 companies), while in the United Kingdom, they reached up to 50 percent. At the End-2000, railroads lost their importance representing 0.2 percent of the U.S. equity market and 0.3 percent of the UK market. Some sectors that were small or non-existent in 1900 started to have higher importance by 1950, but then declined by end-2000. For example, Insurance grew from 1.9 percent to 11.5 percent in the United Kingdom between 1900 and 1950, but declined again to 4.4 percent by end-2000. Some other sectors and the sectors that were small in 1900, interestingly, have grown in importance consequently, starting by end-1899 with very small percentages and increasing these percentages during 1950 and end-2000. Table 4 also shows a distinction among the old industries and nowadays-listed companies, for e.g. telephone with mobile phone.

³⁸Kettell, Brain(2002):“Valuation of Internet and technology stocks implications for investment analysis”

Sectors using industry classification from end-1899	United Kingdom			United States		
	1899	1950	2000	1899	1950	2000
Railroads	49.2	0.0	0.3	62.8	4.2	0.2
Banks and finance	15.4	9.7	16.8	6.7	0.7	12.9
Mining	6.7	5.3	2.0	0.0	1.1	0.0
Textiles	5.0	3.3	0.0	0.7	1.3	0.2
Iron, coal, steel	4.5	5.4	0.1	5.2	0.3	0.3
Breweries and distillers	3.9	8.8	2.1	0.3	0.7	0.4
Utilities	3.1	0.2	3.6	4.8	8.3	3.8
Telegraph and telephone	2.5	0.0	14.0	3.9	6.0	5.6
Insurance	1.9	11.5	4.4	0.0	0.4	4.9
Other transport	1.4	1.7	1.5	3.7	0.3	0.5
Chemicals	1.3	6.3	0.9	0.5	13.9	1.2
Food manufacturing	1.0	4.6	2.0	2.5	2.0	1.2
Retailers	0.7	7.3	4.4	0.1	6.7	5.6
Tobacco	0.0	13.1	1.0	4.0	1.5	0.8
Sectors that were small in 1900	3.4	22.8	46.9	4.8	52.6	62.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 4: Sector weightings within UK and US equity markets using end-1899 classification³⁹

Table 5 presented below, provides the classification of the same companies listed on the stock markets considering the United States, United Kingdom, Japan, Germany and the rest of the world (based on 47 other countries).

Germany shown in Table 5 has its importance in three main sectors: basic industries, general industries and financial sectors compared to the three other countries. At the beginning of 2001, information technology sector for the United States was 23.1 percent - five times higher than for the United Kingdom. For the United Kingdom, media and telecommunications services have the highest weightings in the other “new economy” sectors. Austria is placed as a part of the rest of the world and its main sectors are the non-cyclical consumer goods, information technology and financial sectors.

Table 5 also provides a large distinction between countries in the sector weightings. *These large differences are not new, but they are one of the reasons for the divergence in the past performance and risk levels between countries' equity*

³⁹Dimson, Marsh and Staunton (2002): “Triumph of the optimists: 101 years of global investment returns”, Book, p.24

markets, and they are likely to continue to lead to differential performance in the future⁴⁰.

Sector	United States	United Kingdom	Japan	Germany	World
Resources	5.2	13.1	0.6	0.0	6.0
Mining	0.0	2.0	0.0	0.0	0.6
Oil and gas	5.2	11.0	0.6	0.0	5.4
Basic industries	2.0	2.7	7.4	8.1	3.8
Chemicals	1.2	0.9	3.4	7.1	1.6
Construction and building materials	0.2	1.6	2.2	0.6	1.1
Forestry and paper	0.4	0.0	0.5	0.2	0.5
Steel and other metals	0.3	0.1	1.3	0.2	0.6
General industrials	8.6	2.5	13.1	18.9	9.2
Aerospace and defense	1.5	1.3	0.5	0.0	1.0
Diversified industrials	5.1	0.0	0.2	7.1	3.9
Electronic and electrical equipment	1.3	0.6	9.3	8.3	3.0
Engineering and machinery	0.7	0.6	3.2	3.5	1.3
Cyclical consumer goods	1.3	0.4	12.1	9.4	3.1
Automobiles	0.8	0.4	8.4	8.8	2.0
Household goods and textiles	0.5	0.0	3.8	0.6	1.1
Non-cyclical consumer goods	20.5	17.2	9.7	5.1	15.8
Beverages	2.2	2.1	0.9	0.0	1.6
Food producers and processors	1.2	2.0	1.5	0.2	1.8
Health	3.1	0.7	0.3	1.0	1.7
Packaging	0.1	0.1	0.2	0.1	0.1
Personal care & household products	1.9	0.3	1.2	1.9	1.4
Pharmaceuticals	11.2	11.0	5.3	1.9	8.5
Tobacco	0.8	1.0	0.5	0.0	0.7
Cyclical services	10.3	14.9	12.9	6.9	10.2
Distributors	0.1	0.3	2.0	0.3	0.4
General retailers	4.5	2.4	2.4	2.2	3.0
Leisure, entertainment and hotels	2.0	2.4	1.2	0.1	1.4
Media and photography	2.5	5.9	2.3	0.7	3.0
Support services	0.6	2.0	0.9	2.5	0.9
Transport	0.7	1.8	4.1	1.1	1.5
Non-cyclical services	6.8	16.0	11.8	9.4	10.1
Food and drug retailers	1.1	2.0	1.9	0.2	1.4
Telecommunications services	5.6	14.0	9.9	9.3	8.7
Utilities	3.8	3.6	3.5	2.0	3.7
Electricity	2.6	2.1	2.9	1.6	2.7
Gas distribution	1.2	0.9	0.6	0.3	0.9
Water	0.0	0.6	0.0	0.0	0.1
Information technology	23.1	4.7	11.9	8.6	15.7
Information technology hardware	15.0	2.0	8.2	2.6	10.6
Software and computer services	8.1	2.6	3.7	5.9	5.1
Non-financials	81.7	74.9	83.0	68.3	77.5
Financials	18.3	25.2	17.0	31.7	22.5
Banks	7.4	15.2	9.4	12.4	11.3
Insurance	4.1	0.7	1.3	18.6	4.3
Life assurance	0.8	3.7	0.0	0.4	1.4
Investment companies	0.0	2.7	0.0	0.0	0.6
Real estate	0.5	1.4	1.0	0.3	1.1
Speciality and other finance	5.5	1.6	5.3	0.0	3.8
All sectors	100.0	100.0	100.0	100.0	100.0

Table 5: Sector weightings for selected countries and the world as the start-2001⁴¹

⁴⁰Dimson, Marsh and Staunton (2002): "Triumph of the optimists: 101 years of global investment returns", Book, p.28

⁴¹Dimson, Marsh and Staunton (2002): "Triumph of the optimists: 101 years of global investment returns", Book, p.27

5.2 Does it mean that the Dividend-Price ratios are Too Low?

All valuation models suggest that D/P is determined by expected future returns (discount rates) and expectations about future dividend growth.⁴² To predict the monthly equity premium with dividend ratios I adapted this typical regression⁴³ given by:

$$R_m(t) - R_f(t) = \gamma_0 + \gamma_1 \left[\frac{D(t-1)}{P(t-1)} \right] + \varepsilon(t) \quad (3)$$

Where $R_m(t)$ is the return on the stock market:

$$R_m(t) = \log \left(\frac{P(t) + D(t)}{P(t-1)} \right) \text{ and } P \text{ is the stock level.}$$

The return on 3-month Treasury bill is given by: $r_f(t) \equiv \log[1 + R_f(t)]$

and the dividend price ratio: $DP(t) \equiv \log \left(\frac{D_t}{P_t} \right)$. I use only monthly data for the four countries.

Table 6 estimates the dividend models for the U.S., UK, Germany and Austria in the last two decades. The results from the table 6 show that in both samples the dividend-price ratios are not statistically significant. This implies that we cannot predict the monthly equity premium estimates with the dividend-price ratios in the short-term.

The interesting evidence offered in this research work is that the monthly dividend price ratios for UK, Germany and Austria have slightly increased during the last two decades: from 1990 to 2000 and 2000 to 2010, while for U.S. the monthly dividend price ratios have turned to slight decreases from the 1990-2000 to the 2000-2010 period.

⁴²Fama and French, 2001: "The Equity Premium", Paper

⁴³Goyal and Welch, (2003): "Predicting the Equity Premium with Dividend Ratios", Paper

Sample		α %	β %	R^2 %	$\bar{R}^2$	s.e. %	N
1990-2000	U.S.	-1.475	-0.5974	0.2641	-0.5811	1.71	120
1993-2000	UK	-5.11133	-2.578	0.7813	-0.4907	1.6	80
1997-2000	Germany	-25.98	-14.85	10.19	7.2	3.273	32
1993-2000	Austria	-0.716	0.1843	0.0111	-1.271	2.6	80

Sample							
2000-2010	U.S.	7.852	4.676	5.2848	4.5562	2.2511	132
2000-2010	UK	8.48	5.904	6.075	5.353	2.1573	132
2000-2010	Germany	-4.6	-2.066	0.886	0.124	3.148	132
2000-2010	Austria	-1.7828	-0.9012	0.474	-0.3	3.05	132

Table 6: Dividend price ratios during the last two decades

I stress this point and I argue that this decline for the U.S may be due to a higher effective tax rate⁴⁴, which affects the dividend price. For example, the S&P monthly dividend-price ratio falls from 2.42% during 1990 to 1999, to a lower value, 1.86% between 2000 and 2010.

The figure 13 shows that dividend-price ratios during 2008-2009 reach a higher value, about 6.9% and after that start to fall drastically. This explains the fact that in that period the financial crisis began.

⁴⁴ In the next section I explain the tax factor on the equity premium estimates

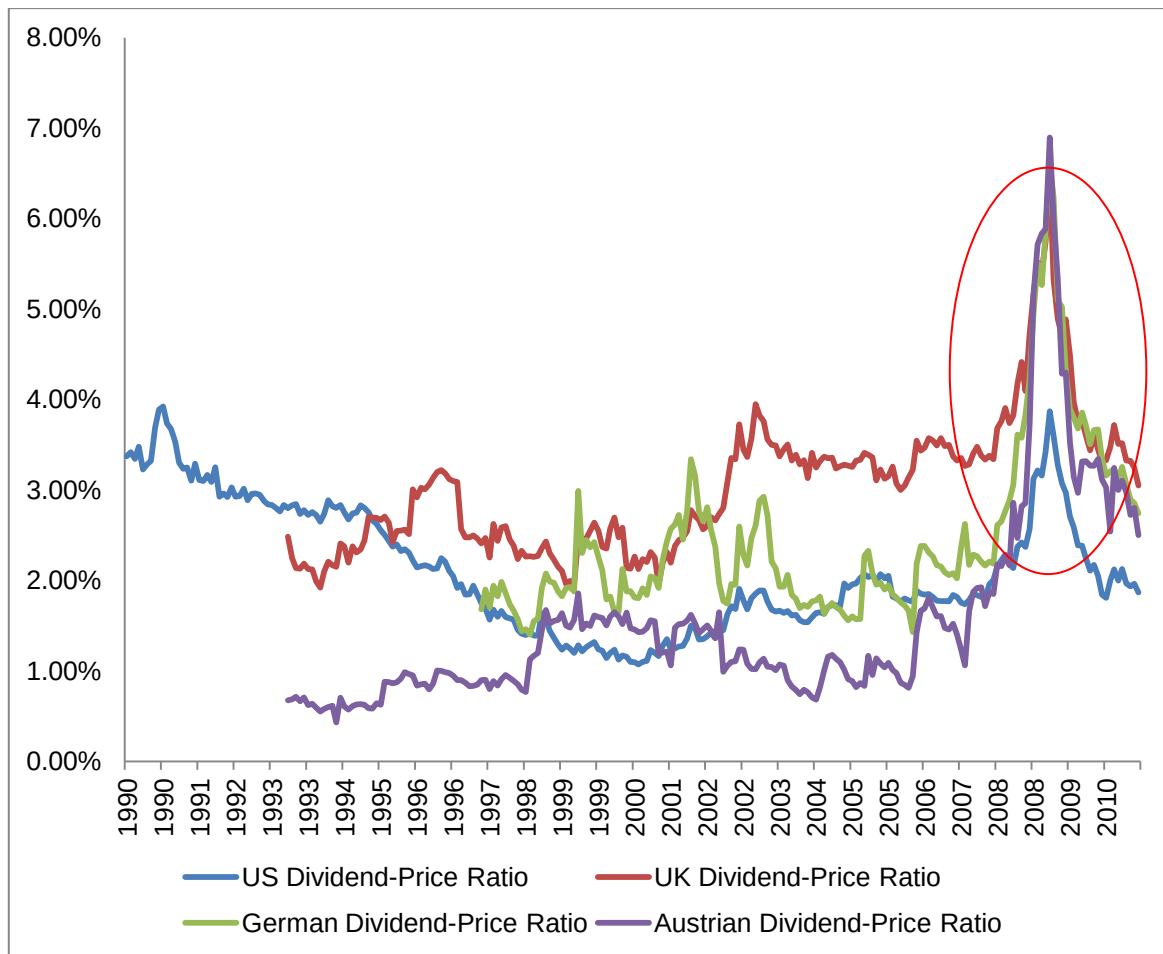


Fig.13: Dividend –Price in the four countries, 1990-2010

5.3 Taxes and Market Imperfections

Tax is a key issue at any time and it has become even more important. In their paper, McGrattan and Prescott (2003) argued that when re-examining the equity premium puzzle it is important to account for taxes. This issue was ignored by Mehra and Prescott (1986).

The topic of marginal tax rates became the main discussion of a revolution in economic policy during the last two decades of the twentieth century. The tax rates vary a lot over time because of changes in both the tax code and the regulations governing financial intermediaries⁴⁵. Figure 14⁴⁶ shows the tax rates on corporate income, which were reduced in most of the countries except for the United States.

⁴⁵McGrattan and Prescott, 2003: "Average debt and Equity returns: Puzzling?", Paper

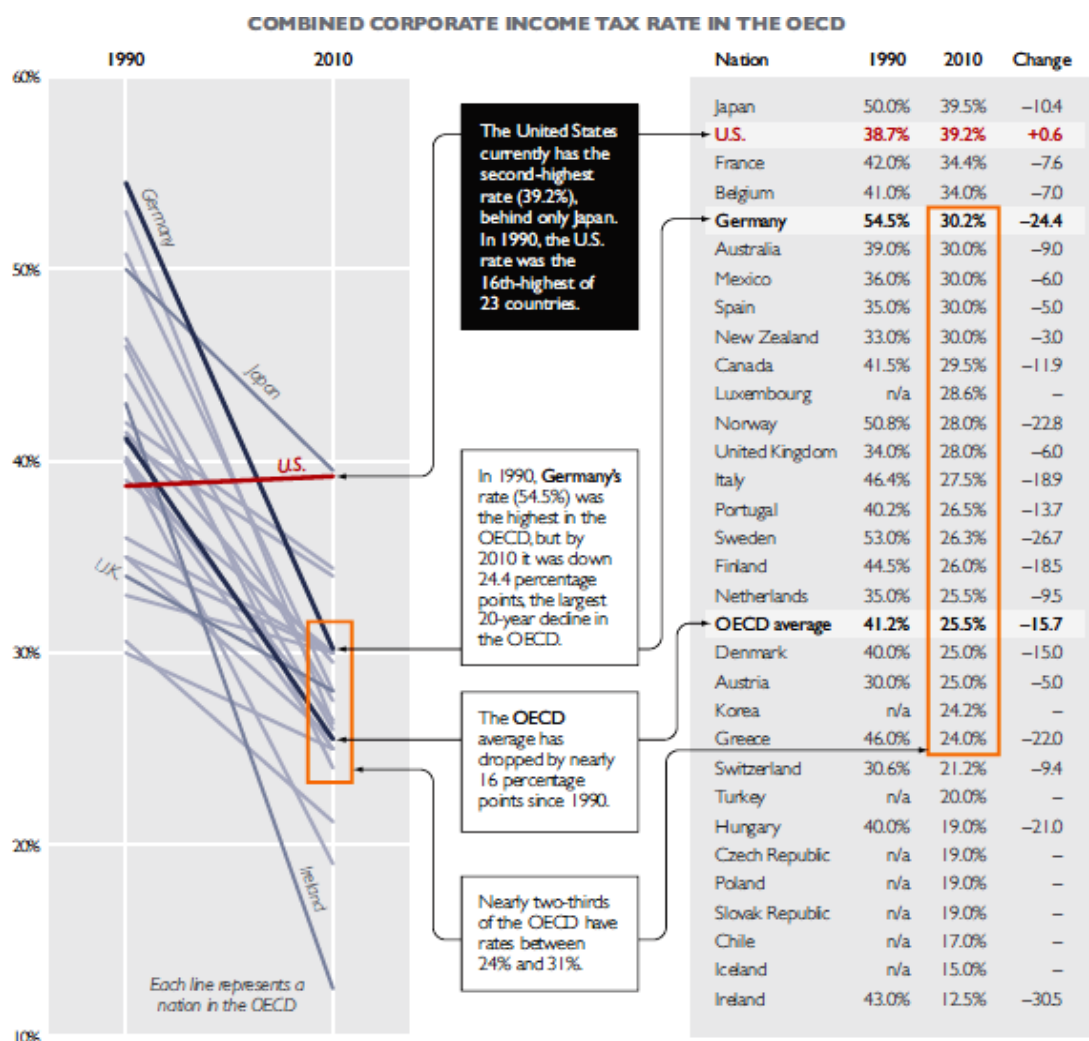


Figure 14: Corporate income tax rate across countries, 1990- 2010

The U.S corporate income tax rate from 1990 to 2010 has slightly increased, 38.7 percent in 1990 to 39.2 percent, a change of 0.6. *The United States has bucked that trend and increased its rate, creating a less-hospitable environment for corporations*⁴⁷. In contrast to UK, Germany and Austria, the corporate income taxes seem to have clearly decreased during the last two decades of the twentieth century. More interesting, Germany's rate was the highest in the OECD in the 1990s, but by 2010, it was down 24.4 percentage points, i.e. to one half decrease, the largest 20-year decline in the OECD. Does it explain the fact that the equity premium estimates in these three countries are somehow "different" and higher than the U.S. equity premium estimate? The answer is quite simple, yes. The explanation is that the personal taxation rate on dividends has fallen in the last two centuries. This is due to

⁴⁶Source: OECD, "Taxation of Corporate and Capital Income (2010)," Table 2.1. "Corporate Income Tax Rate," at <http://www.oecd.org/dataoecd/26/56/33717459.xls> (December 9, 2010).

⁴⁷Source: http://thf_media.s3.amazonaws.com/2011/pdf/wm3146.pdf

a large fall in corporate income taxes. Figure 15⁴⁸ shows the overall statutory rates on dividend income.

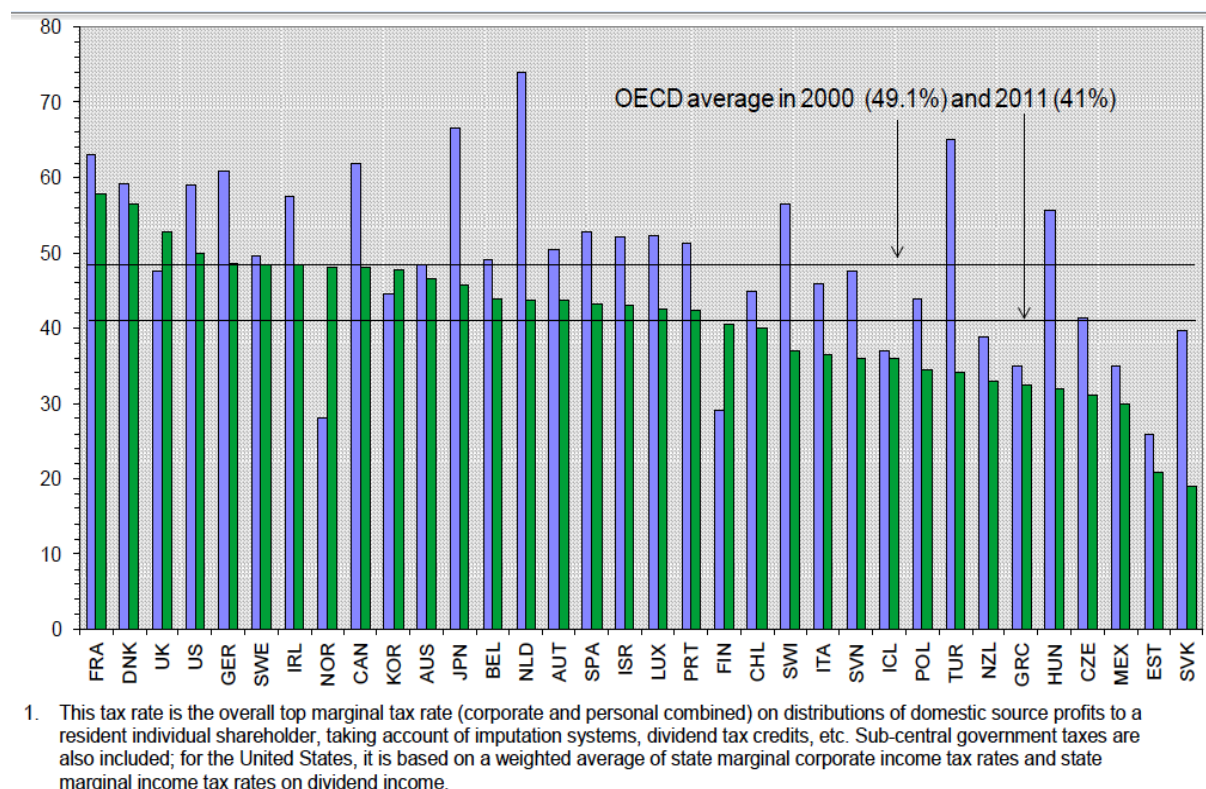


Figure 14: Overall statutory rates on dividend income¹, 2000 and 2011

The figures show that on average, the top marginal tax rate on dividends in OECD-countries was reduced by 8.1 percentage points between 2000 and 2011, from 49.1% to 41.0%⁴⁹.

In short, it is clear now that the tax rates on corporate income and on dividends gives evidence on the equity premium estimates, higher tax rates affect a decline in stock returns, which also affect a reduction in the equity premium.

Another argument is the market imperfections *like the inability of investors to fully insure against risks outside the stock markets; the direct and indirect costs that investors face in order to make transactions; and incomplete knowledge between investors about existing investment opportunities*⁵⁰.

⁴⁸Source: OECD Tax Database (www.oecd.org/ctp/taxdatabase)

⁴⁹<http://www.oecd.org/dataoecd/9/23/48193734.pdf>

⁵⁰McGrattan et al. (2000): "The Declining U.S. Equity Premium."

McGrattan et al. argued that these imperfections reduce the investors' willingness to bear risks and so increase the returns they require for investing in risky stocks.

Considering the results of table 1, I argue that the monthly equity premium estimates are negative and significantly lower in value. Is it reasonable that due to market imperfections, the premium can reasonably decline when such imperfections decrease?

Further, theorists and practitioners argue that all assets, no matter where they are traded, should face the same global equity premium, with differences in country risk. Damodaran (2011) argued that *if country risk is not diversifiable, either because the marginal investor is not globally diversified or because the risk is correlated across markets, we are then left with the task of measuring country risk and considering the consequences for equity premiums*. The Economist estimated the country risk assessment unit that measures risk from 0 to 100, with 0 being the least risk and 100 being the most risk. Surprisingly, Germany and Austria are ranked in 8th and 9th place as least risky countries compared to UK and U.S., ranked in 14th place.

Economist.com rankings			
Country risk			
Selected countries and territories, September 2008 (except where noted)			
Least risky		Most risky	
Rank	Score*	Rank	Score
1	Switzerland †	120	Zimbabwe
2	Finland **	119	Iraq
	Norway **	118	Sudan
	Sweden ††	117	Myanmar
5	Canada **	116	Nicaragua
	Denmark †	115	Jamaica
	Netherlands §	114	Kenya
8	Germany ††	113	Cuba
9	Austria **	112	Cambodia
	France ††	111	Côte d'Ivoire
11	Belgium ††		Ecuador
12	Singapore		Pakistan
13	Japan **		Venezuela
14	Ireland #		Vietnam
	Britain	106	Syria
	United States †		

*Out of 100, with higher numbers indicating more risk. Scores are based on indicators from three categories: currency risk, sovereign debt risk and banking risk.
† May 2008; ** July 2008; †† June 2008; § August 2008; # February 2008

Figure 16: Country risk, September 2008

5.4 Are the smaller equity premia due to the higher volatility of stock prices?

In this section, I will try to focus on the volatility of the stock market prices for each country during the last two decades. The data are provided by Bloomberg and are used for short-term periods (monthly). My empirical finding provides a relationship between risk and returns. The monthly data collected for U.S., UK, Germany and Austria generate a monthly equity premium that is too low, moreover, it is negative for the 1990 to 2010 period⁵¹. Additionally, a risk free rate that is too high during the last two decades over stock returns, standard deviations of monthly stock returns that are too low, and monthly dividend-price ratios that are too low relative to their actual value.

Figure 17 shows the fluctuations of the stock price volatilities for each of four countries from 1990 to 2010.

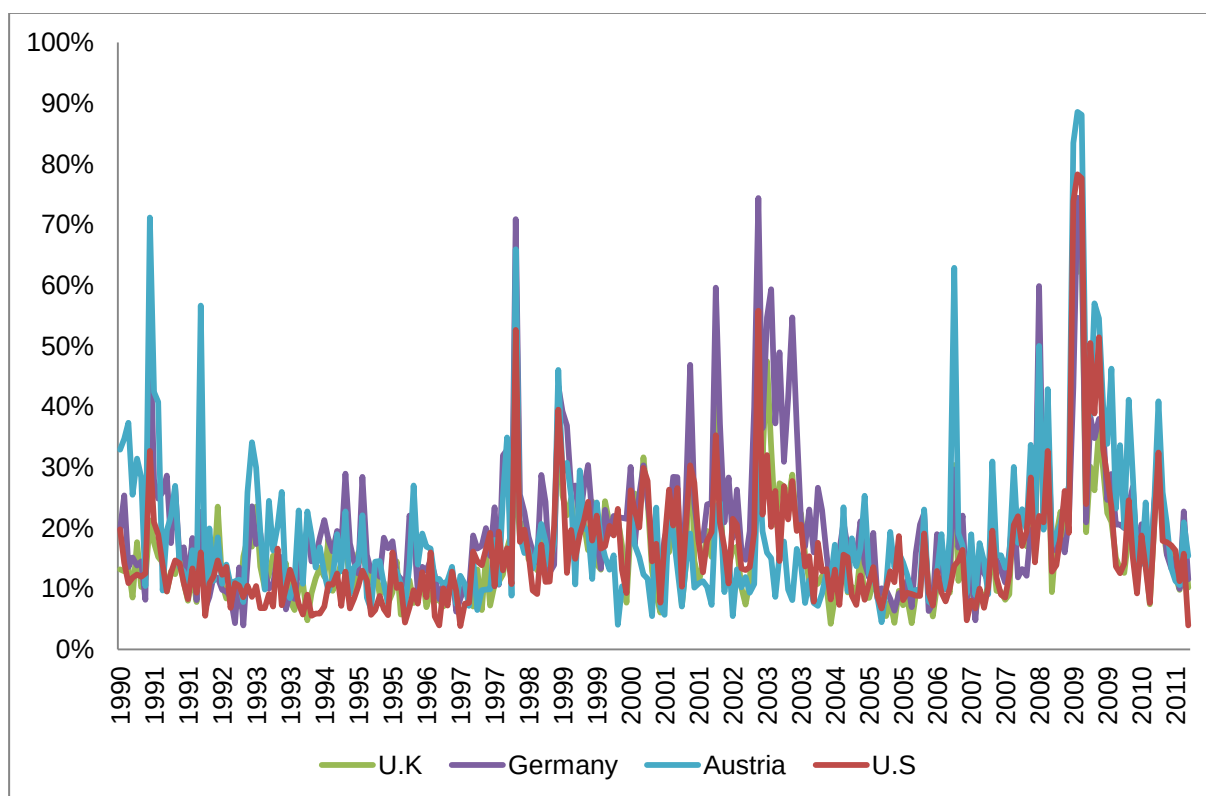


Fig.17: The volatility of the stock prices for each country, 1990-2010

⁵¹Only Germany and Austria show a positive but low monthly equity premium under the dividend growth model

The U.S average stock price volatility from 2000 to 2010 is particularly great, almost 18.75% than from 1990 to 1999 about 12.83%. The same argument holds also for the three other countries: U.K from 1990-1999, 13.56%, from 2000-2010, 18.05%; Germany 17.96% from 1990-1999 and 22.73% from 2000-2010; Austria 18.09% from 1990 to 1999 and 19.84% from 2000-2010. The stock market exchanges seem to be more volatile during the period of the 2000 to 2010. These results are given below in the Table 7.

	U.S.	UK	Germany	Austria
1990-2000	12.83%	13.56%	17.96%	18.09%
2000-2010	18.75%	18.05%	22.73%	19.84%

Table 7: The average stock price volatility for each country during the past two decades

CHAPTER 6: CONCLUSION

There is an enormous literature explaining the equity premium puzzle. My diploma thesis has sought to provide a recent new research on the monthly equity premium in the last two decades. My research work is based on Fama and French paper considering the two main models in the asset pricing model theory: the average stock return model (1) and the dividend growth model (2). I have shown that these two models somehow give different results for the monthly equity premium estimates among decades. An interesting fact is that the monthly equity premium for Germany and Austria turns to be positive under the dividend growth model but have a lower percentage values during the 2000 to 2010. For the U.S and UK, the monthly equity premium estimates remain low and negative during the decades. As it is obviously shown in table 1, the monthly equity premium has increased by a small percentage from one decade to the other.

Further, I have discussed the discrepancy between the two models and I have tried to argue which of these two models was better. Again, precision is not the issue⁵²; but still I came up with the conclusion that the estimates of the expected stock return from the dividend growth model (2) are likely to be more precise than from the average stock return model (1).

Interesting evidence is that under the prediction of the equity premium with dividend price ratios, in both samples the dividend-price ratios are not statistically significant.

I have also suggested that different equity premiums across countries between the last two decades were due to industry composition of different firms listed in the stock exchange markets. In addition, I have shown that an important factor for the equity premium estimation is tax variations between the four countries in different periods. Tax rates on corporate income and on dividends gives evidence on the equity premium estimates, higher tax rates affect a decline in stock returns, which also affect a reduction in the equity premium. Furthermore, market imperfections have shrunk the equity premium estimates. Finally, I have argued that smaller equity premia are due to the higher volatility of stock prices.

However, much work is needed, the high volatility of stock market returns is puzzling the low volatility of capital returns⁵³.

⁵²Fama and French, 2001: "The Equity Premium"

⁵³McGrattan and Prescott, 2003: "Average debt and Equity returns: Puzzling?"

REFERENCES

Brealey, Richard A. and Myers, Stewart C. "Principles of Corporate Finance" McGraw Hill Series in Finance, Book.

Benartzi, Shlomo and Thaler Richard H. "Myopic Loss Aversion and the Equity Premium Puzzle," Quarterly Journal of Economics, 1995, 110(1), pp. 73-92.

Cheng and Tong. "Asset pricing: a structural theory and its applications," Book, Chapter 1, 2008, pp. 6.

Constantinides, George M. "Habit Formation: A Resolution of the Equity Premium Puzzle," Journal of Political Economy, University of Chicago Press, vol. 98(3), June 1990, pp. 519-43.

Damodaran, Aswath. "Equity Risk Premiums (ERP): Determinants, Estimation and Implications - The 2011 Edition", February 2011.

Derrig, Richard A. and Orr, Elisha D. "Equity Risk Premium: Expectations Great and Small," August 2003.

Dimson, Elroy, Marsh, Paul and Staunton, Mike. "Triumph of the optimists: 101 years of global investment returns", Book, 2002

Eden, Benjamin. "Liquidity, Equity Premium and Participation," Working Papers 0715, Department of Economics, Vanderbilt University, 2008.

Epstein, L. G. and S. E. Zin. "'First-Order' Risk Aversion and the Equity Premium Puzzle," Journal of Monetary Economics 26(3), 1990, pp. 387-407.

Fama , Eugene F. and French Kenneth R. "The Equity Premium," Journal of Finance, American Finance Association, vol. 57(2), 2002, pp. 637-659, 04.

Fisher, Irving. "Stocks vs. Bonds," American Review of Reviews, July 1925.

Fisher, Lawrence and James Fisher. "Rates of Return on Investments in Common Stocks." Journal of Business 37, 1964, pp. 1-21.

Goetzmann, William and Ibbotson. "The Equity Risk Premium: Essays and Explorations,"Book, 2005.

Goyal, Amit, and Ivo, Welch. "Predicting the Equity Premium with Dividend Ratios," Management Science 49-5, May 2003, pp.639-654.

Ibbotson Associates. "Stocks, Bonds, Bills, and Inflation, Yearbook,"Chicago: Ibbotson Associates, 2001.

Ibbotson Associates. "Stocks, Bonds, Bills, and Inflation Valuation, Edition Yearbook," 2003.

Jagannathan, Ravi, McGrattan, Ellen R. and Scherbina, Anna. "The Declining U.S. Equity Premium," NBER Working Papers 8172, National Bureau of Economic Research, Inc., 2001.

Hall, R. E. "Stochastic Implications of the Life Cycle–Permanent Income Hypothesis: Theory and Evidence." Journal of Political Economy 86, 1978, pp.971–87.

Kettell, Brain. "Valuation of Internet and technology stocks implications for investment analysis," Book, 2002.

Knight, Frank H. "Risk, Uncertainty and Profit", Hart, Shaftner and Marx, New York, 1921.

Kyriacou, Kyri, Madsen, Jacob and Mase, Bryan. "The Equity Premium," Public Policy Discussion Papers 04-10, Economics and Finance Section, School of Social Sciences, Brunel University, 2004.

Lucas, Robert E. "Econometric Policy Evaluation: A Critique," Carnegie-Rochester Conference Series on Public Policy 1, 1976, pp.19-46.

McGrattan, Ellen R. and Prescott, Edward C. "Average Debt and Equity Returns: Puzzling?," American Economic Review, American Economic Association, vol. 93(2), May 2003, pp. 392-397.

Mehra, Rajnish and Prescott, Edward C. "The Equity Premium: A Puzzle,"Journal of Monetary Economics, March 1985, 15(2), pp. 145-61.

Mill, John Stuart. "The principles of Political Economy," Chapter 16. Book 2. London, 1848.

Mill, John Stuart. "Essays on some unsettled questions of political economy," Essay IV, 1845, pp. 90.

OECD. "Taxation of Corporate and Capital Income" 2010.

Research Institute. "Credit Suisse Global Investment Returns," Yearbook 2011.

Reitz, Thomas. "The Equity Premium: A Solution?," Journal of Monetary Economics, vol. 22, no. 1, July 1988, pp. 133–136.

Smith, Edgar. "Common Stock as Long Term Investment," Book, 1924.

Schneider, Christoph. "Die Rendite längstlaufender Staatsanleihen in Österreich," Diploma thesis, 2006.

Internet

- http://en.wikipedia.org/wiki/Euro_Interbank_Offered_Rate
- http://en.wikipedia.org/wiki/Sharpe_ratio
- https://infocus.credit-suisse.com/data/product_documents/shop/300847/credit_suisse_global_investment_yearbook_2011.pdf
- <http://www.oecd.org/dataoecd/26/56/33717459.xls>
- http://thf_media.s3.amazonaws.com/2011/pdf/wm3146.pdf
- www.oecd.org/ctp/taxdatabase
- <http://www.oecd.org/dataoecd/9/23/48193734.pdf>
- http://corporate.morningstar.com/ib/documents/MarketingOneSheets/DataPublication/Q4_2004_IPCoListReport.pdf

APPENDIX

Zusammenfassung

Die Diplomarbeit baut auf das berühmte von Mehra und Prescott in 1985 formulierte Equity Premium Puzzle auf. Sie haben darauf hingewiesen, dass historisch gesehen die durchschnittliche Eigenkapitalrendite höher als die durchschnittliche Rendite auf kurzfristiges risikoloses Fremdkapital gewesen ist⁵⁴. In der vorliegenden Arbeit wird dieses Puzzle für USA, GB, Deutschland und Österreich analysiert und erklärt. Dafür werden Zeitreihen von 2000 bis 2010 herangezogen. Es wird gezeigt, inwieweit es in dieser Zeit zwischen diesen Ländern ein Equity Premium gegeben hat.

Die monatlichen Zeitreihen der Aktienkurse, Volatilitäten und Wechselkurse der jeweiligen Länder wurden Bloomberg entnommen. Herangezogen wurden Standard and Poor 500 (S&P 500), United Kingdom Index (UKX), Deutsche Index (DAX) und Austrian Index (ATX).

Die Preise der Staatsanleihen wurden den Datenbanken aus den jeweiligen offiziellen Seiten der entsprechenden Regierungsbehörden entnommen.

In dieser Arbeit werden die zwei grundlegenden Modelle verwendet: das Durchschnittliche Aktienrenditen- und das Dividendenwachstum-Modell.

Aufbauend auf den Datensätzen werden im Rahmen dieser Arbeit die Ergebnisse aus diesen zwei Modellen verglichen und diskutiert. Es wird auch der Versuch unternommen, einige Erklärungen für das Equity Premium Puzzle zu zeigen.

Die Ergebnisse zeigen, dass Equity Premium Puzzle auf diese Länder zutrifft: Es ist niedrig und leicht negativ.

⁵⁴ Mehra and Prescott (1986): The Equity Premium A Puzzle

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References

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