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Measuring expected stock returns - The implied cost of capital and its applications

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Summary

The determination of the expected return on equity is one of the most discussed topics in finance, both in academics and practice. The prevalent approach is to use the extrapolation of historical returns as an indication for future expected returns. In this thesis, I advocate the implied cost of capital as an alternative approach to estimate expected stock returns, which does not rely on realized returns or the specification of an asset pricing model. Equity return expectations for each point in time are derived from current market prices and earnings expectations using reverse-engineered equity valuation models. The implied cost of capital for a given asset is defined as the internal rate of return, which equates the stock's current market price to the present value of all expected future dividends. The use of the approach to proxy for firm level expected stock returns or aggregate market risk premiums offers several advantages over the use of realized returns, which are elaborated and empirically proven.

Using data for a broad set of European countries between January 1994 and December 2011, I apply different methods to calculate firm level implied cost of capital and risk premium estimates. I aggregate those estimates to obtain market level equity risk premiums and find that the estimates for the 15 countries lie between 4.83% for Italy and 7.48% for Ireland. The average implied risk premium across all European firms in the sample amounts to 5.42%. Furthermore, I derive implied industry risk premiums and beta factors. Not surprisingly, the financial services industry showed the largest implied beta in 2011 at 1.26. The low volatility of the risk premium estimates and the rarity of negative values in comparison to the use of historical realizations emphasize the benefits of the approach. As cash flow revisions and the resulting stock price reactions

cancel out within the implied cost of capital methodology, estimates are solely driven by expected return news. Furthermore, the results provide evidence for time-series variations in risk premiums, which can only be captured when taking into account information available to investors at each point in time. In an extensive sensitivity analysis, I show that the weighting procedure, the applied estimation method and the assumed risk-free rates have a substantial influence on the absolute level of the results but less on the relative evolution of the implied risk premiums over time. With respect to the growth rate assumption and analyst forecast error, absolute deviations are less pronounced. More problematic, however, is the fact that differences are systematically related to certain market phases.

Building on the advantageous properties of the implied cost of capital compared to realized returns, I apply the obtained firm level estimates to re-examine one asset pricing and one corporate finance question.

First, I analyze the relative importance of country and industry effects in explaining expected stock returns in the context of the EMU financial integration process. Instead of using realized returns, as most of previous research, I use the implied cost of capital to derive expected returns. This enables me to distinguish between the convergence in discount rates resulting from financial integration and the convergence in cash flows resulting from economic integration. I find strong evidence of increased financial integration after the launch of the common currency in January 1999. Pure country effects have lost importance in the post-euro period, while industry effects have gained significant influence. The drop in the average explanatory power of country-specific effects is mainly attributable to countries with weaker pre-EMU economic linkages, like Greece, Portugal, or Italy. The recent eurozone crisis has led to a rebound of the country effect for Greece but left the other countries almost unaffected. Investigating possible explanations, I find that the results cannot be explained by pure nominal and real convergence or a more global trend towards integration but are mainly driven by the EMU's attempt to form a single European financial market, including the introduction of a common currency.

Second, I investigate the relationship between corporate geographical and industrial diversification and a firm's cost of equity as measured by the implied cost of capital. Additionally, I analyze how this relationship is influenced by the level of financial market integration. Assuming that investors can diversify their portfolios across industries and countries, firms should not achieve a lower cost of equity capital by spreading operations across different countries and industries. I argue that only if investors are not able to acquire a broadly diversified portfolio due to certain market frictions, they will compensate a diversified firm for delivering a superior risk-return profile. As expected, my results do not provide evidence for a significant association between corporate diversification itself and a firm's cost of equity as measured by the implied cost of capital. However, when taking into account exchange rate risk and interest rate divergence, I find that the relationship between the implied cost of capital and corporate diversification is conditional on the degree of financial market integration. The results indicate that benefits of corporate diversification are higher for firms operating in less financially integrated markets with respect to major monetary variables. The findings are highly significant for geographical diversification but much weaker for industrial diversification. Additionally, my results fail to provide evidence for a varying relationship between corporate diversification and a firm's implied cost of capital depending on the level of convergence in financial reporting standards across European countries.

Taken together, all individual parts of the thesis support the use of the implied cost of capital approach as an alternative measure for the expected rate of return on equity. Next to the estimation of market and industry risk premiums, several valuable features of the implied cost of capital make the approach suitable for a number of different applications.

Contents

List of abbreviations

AGR	Easton (2004); simultaneous estimation of discount and growth rate
AR	autoregressive
AREAER	Annual Report on Exchange Arrangements and Exchange Restrictions
capex	capital expenditure
CAPM	capital asset pricing model
CDS	credit default swap
cf.	confer
CT	Claus and Thomas (2001)
DPS	dividend per share
DS	Datastream
EBIT	earnings before interest and taxes
e.g.	exempli gratia
EMEA	Europe, the Middle East and Africa
EMU	European Monetary Union
EPS	earnings per share
et al.	et alii
EU	European Union
FS	real estate, banking and financial service
FTSE	Financial Times Stock Exchange
G-7	U.S., U.K., France, Germany, Italy, Canada and Japan
GDP	gross domestic product
GG	Gordon and Gordon (1997)
GLS	Gebhardt et al. (2001)

IAS	International Accounting Standards
I/B/E/S	Institutional Brokers' Estimate System
ICB	Industry Classification Benchmark
ICC	implied cost of capital
i.e.	id est
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
IRP	implied risk premium
KAOPEN	capital account openness index from Chinn and Ito (2008)
LTG	long-term growth
M&A	mergers and acquisitions
MAD	mean absolute deviation
MPEG	modified price-earnings-growth
MSCI	Morgan Stanley Capital International
N	number of observations
no.	number
OECD	Organization for Economic Co-operation and Development
OJ	Ohlson and Juettner-Nauroth (2005)
PE	price-earnings
PEG	price-earnings-growth
PIIGS	Portugal, Italy, Ireland, Greece and Spain
R&D	research and development
ROE	return on equity
SIC	Standard Industrial Classification
S&P	Standard & Poor's
TMT	technology, media and telecommunications
TP	target price
U.K.	United Kingdom
U.S.	United States
U.S.-GAAP	United States Generally Accepted Accounting Principles
VIF	variance inflation factor

WS	Worldscope

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1 Introduction

1.1 Motivation

The determination of the expected rate of return on equity capital[1] is one of the most discussed topics in finance. The issue on how to measure a firm's expected return or the market's equity risk premium has challenged both academics and practitioners for many years. The expected stock return is the average return an investor requires when holding an equity security. The premium compared to a risk-free benchmark compensates the investor for the risk inherent in the stock. On an aggregate level, a country's market risk premium measures the average expected return on a portfolio of risky equity assets above the risk-free rate. The need for such firm and market level proxies is far reaching, from accounting, corporate finance and firm valuation to investment management and capital market regulation.

First, the expected equity return plays a major role for firms when making corporate finance or accounting decisions. It is crucial for companies to know their cost of equity capital to assess the profitability of investment projects. A valid proxy for the true cost of capital is also necessary for firm valuations, for instance, in the context of a merger or spin-off. In addition, potential outcomes of corporate finance decisions can be evaluated in the light of their impact on a firm's cost of capital. Academic research can provide helpful assistance to managers in investigating the relationship between certain firm characteristics and the expected rate of return. Information on the empirically documented influence of, e.g., reporting quality or organizational structure on a firm's cost of capital provides a helpful indication for managers in their decision making

[1] Also referred to as expected return on equity capital, expected stock return, cost of equity capital, expected discount rate or required rate of return.

process. Likewise, being able to evaluate the influence of new regulation with respect to its influence on the cost of capital of corporations is of major relevance for policy makers. An understanding of the economic consequences of, e.g., the mandatory implementation of new accounting standards or the harmonization of European monetary policies is crucial when making sensible regulatory changes.

Second, the expected equity return is of central relevance for the field of asset pricing and allocation. The expected return on a security determines the average return an investor can expect to achieve when holding the respective stock. On an aggregate level, investors need to have an understanding of the current level and the dynamics of the market risk premium. Thereby, they have an indication of what to expect on a portfolio of risky equity assets when pursuing a passive investment strategy. Knowledge on stock level as well as market level expected return data is crucial for making rational and informed investment decisions. Furthermore, the asset pricing literature is interested in which risk factors determine a firm's expected return to explain variations in the required rate of return across firms and over time. This understanding is the basis for investment managers to make optimal portfolio allocation as well as individual stock picking decisions.

Although the expected equity return is, therefore, one of the most discussed topics in different finance areas, there is currently no consensus about the superiority of a specific estimation approach. The difficulty in evaluating the suitability of different approaches stems from the fact that market participants' expectations of equity returns are not observable.

The prevalent approach, especially in practical applications of the aggregate market risk premium, is the extrapolation of historical premiums. The historical equity premium is the average return on the market portfolio minus the risk-free rate. In the U.S. the most cited provider of historical premiums is Ibbotson Associates, whose database starts in 1926. Dimson et al. (2008), the most widely used source in an international setting, compute historical premiums for a sample of 17 countries over a period of 106 years.

On a firm-specific level, historical returns are used to estimate input parameters for asset pricing models like the capital asset pricing model (CAPM) or the Fama-French three-factor model (Fama and French, 1993). These models require estimates for the market risk premium and for the coefficients on the included risk factors. These are generally calculated on the basis of historical return realizations.

The preferential use of observed ex post returns stems from their wide availability, objectivity and easy interpretability. Their application as a proxy for expected returns is justified by the argument that the unexpected return due to new information should have a mean of zero, as positive and negative unexpected cash flow events should cancel each other out. In simple words, it is assumed that investors get what they expect in the long-run.

However, problems arising from using realized returns to proxy for expected returns are in the meantime well known in the academic literature. Elton (1999) argues that realized returns are a very poor indicator of expected returns. He identifies periods longer than 10 years, during which realized stock market returns are, on average, lower than the risk-free rate (1973-1984) and periods longer than 50 years, which are characterized by a return on risky bonds below the risk-free rate (1927-1981). Elton (1999) concludes that significant information events, such as large earnings surprises, may not cancel out in short or medium periods of study, which in turn makes realized returns a poor proxy for expected returns. Events like the oil price shock or the terror attacks on 11 September 2001 underpin his argument. These events are problematic in that they do not offset in the cross-section as the majority of firms is severely affected. Next to these enormous cross-sectional shocks, events that are correlated over time also contradict the assumption that unexpected returns due to new information are not systematic. Examples of such autocorrelated events include political, regulatory, environmental and social changes or technological progress like the computer or internet. These disruptive regime changes are not taken into account when historical returns are averaged over long periods of time. Return expectations based on realized returns are by definition backward-looking and not conditional on the information available to investors at each point in time.

In response to these limitations, academic literature began to turn away from realized returns as a proxy for expected returns. Four alternative ways were suggested to approximate the expected equity risk premium: Models derived from the utility function of investors, approximations using expert surveys, methods that derive equity premiums from credit market information and approaches based on equity valuation models.

In contrast to the use of historical realizations, models based on the utility function fulfill rather theoretical purposes and play only a minor role in practical applications. When applying standard general equilibrium models combined with plausible parameters for risk aversion, Mehra and Prescott (1985) find an extremely low equity risk premium for the U.S. of below 1%. They title the large differential between the results using their model and the historical observed premium the "Equity Premium Puzzle".

Another group of authors conduct surveys of certain groups of experts or investors to determine what they require as a premium to invest in equity relative to a risk-free investment. Subsets questioned in such surveys range from individual investors and investment professionals to corporate managers and academics. Welch (2008), for instance, asks finance professors on a regular basis about their opinion on the 30-year average equity premium. Similarly, Graham and Harvey (2008) question U.S. chief financial officers on a quarterly basis about their expectations of the equity risk premium relative to a U.S. treasury bond measured over a 10-year horizon. The major disadvantage of these two approaches is that they can only be applied to generate portfolio level estimates of the equity risk premium.

The third approach links equity and credit markets to derive firm-specific equity premiums. Conditional equity premium expectations are estimated from bond yield spreads (Campello et al., 2008) or CDS spreads (Berg and Kaserer, 2013; Friewald et al., 2013) by using structural models of default. The need for the availability of expectations on the objective default probability and the loss given default as well as data on traded CDS spreads or bond yields, however, limits the applicability of these methods.

The last approach, the implied cost of capital (ICC), derives an estimate for the expected premium from market prices and cash flow expectations. Equity valuation models are reverse-engineered to back out the internal rate of return implied by the firm's current stock price and its current earnings expectations. The implied equity risk premium for a given asset is defined as the internal rate of return minus the risk-free rate. This approach is by far the most commonly applied alternative to the use of historical realizations for the estimation of expected stock returns. It can be applied both on a portfolio level and an individual stock level and is thereby suitable for a large number of applications. In contrast to historical returns, which are not considered to be conditional on the current economic state simply because they heavily weight past data, the ICC is conditional on the information available to investors at each point in time (Claus and Thomas, 2001). Therefore, risk premiums derived from the ICC approach should always reflect the current level of risk perception of investors. Including current expectational data in the estimation of risk premiums also allows for the investigation of changes in risk perception over time. Additionally, the ICC enables researchers to differentiate between cash flow and discount rate effects and to analyze the impact of certain firm characteristics or developments exclusively on discount rates. With respect to firm level estimates, the ICC as a proxy for expected returns offers the further advantage that it does not rely on the specification of an asset pricing model other than the dividend discount model. Therefore, the identification of an appropriate set of risk factors for the calibration of such an asset pricing model is not required.

In light of these benefits, a growing body of literature makes use of the ICC approach to proxy for the expected return on equity capital. Different implementations of the classical dividend discount model have led to the three broad classes of dividend discount, residual income and abnormal earnings growth valuation models. Due to differences in how projected earnings are carried on after a finite forecasting horizon, several specifications of these models have evolved. In response to the growing body of literature, which has generated a wide range of variations of the ICC approach, different frameworks to assess their performance were proposed. However, consensus on the superiority of certain models on all dimensions is still missing. Because estimating a firm's expected return is an essential element of the risk-return tradeoff, the ICC has also been widely used in the accounting and corporate finance as well as asset pricing literature. While early applications focus on the estimation of the equity risk premium on an aggregate market level, recent research predominantly investigates cross-sectional differences in the ICC across firms.

The aim of this dissertation is to estimate the ICC and the implied risk premium for a broad set of European countries since the beginning of their reliable coverage through the Institutional Brokers' Estimate System (I/B/E/S) using different commonly applied methods. Results are presented on a country and industry portfolio level. In a second step, I use firm-specific estimates in two applications to answer one asset pricing and one corporate finance question. First, I analyze the importance of country versus industry effects within expected stock returns in the context of the European financial integration process. Second, I examine the relationship between corporate diversification and a firm's cost of equity capital and how this relationship is influenced by progress in financial integration.

1.2 Research questions and contribution

This thesis aims to empirically implement the ICC approach within a European context and to provide evidence for its advantageous application in different settings. Based on theoretical arguments and the documented empirical performance of the proxy, I argue that the ICC approach delivers a superior estimation for expected returns compared to the use of realized returns. Building on the ICC's desired feature of being able to differentiate between effects on the expected return and effects on the expected cash flows, I re-examine one asset pricing and one corporate finance topic.

In particular, this dissertation addresses the following research questions:

1. What is the implied equity risk premium for a broad set of European countries since the beginning of their reliable I/B/E/S coverage using different estimation methods?

    a) Four different models based on Claus and Thomas (2001), Gebhardt et al. (2001), Ohlson and Juettner-Nauroth (2005) and Easton (2004), which have been commonly used in previous research, are implemented to estimate the cost of equity implied by market prices, accounting numbers and earnings forecasts.

b) Estimates for a sample of firms from 15 European countries are aggregated in order to obtain country and industry level implied risk premiums.

c) Cross-sectional country and industry differences as well as time-series characteristics of the estimates are analyzed.

d) The robustness of the estimates, which form the basis for all further analyses, in terms of critical assumptions and input parameters is evaluated.

2. What is the relative importance of industry and country effects in expected stock returns when using the ICC to proxy for expected returns?

   a) The model developed by Heston and Rouwenhorst (1994), which decomposes stock returns into a global, a country, an industry and a stock-specific factor, is applied to implied returns.

   b) Based on the relative importance of these factors in explaining implied returns, the degree of financial integration among the eurozone countries is analyzed.

   c) The impact of the launch of the common currency and the current eurozone crisis on the level of financial integration is examined.

   d) The euro introduction as a potential driver of the results as well as other explanations are investigated.

3. What is the impact of corporate diversification on a firm's cost of equity capital proxied by the ICC, and how is this relationship influenced by the level of financial market integration?

   a) Based on Worldscope segment data for the sample firms, their level of industrial and geographical diversification is estimated and presented over time.

   b) The general effect of industrial and geographical diversification on the ICC is investigated.

   c) Introducing three variables for financial integration, the interaction effect between both dimensions of diversification and financial integration is analyzed.

I focus my dissertation on the European capital markets. First, to my best knowledge, the ICC approach has not been applied with the focus on estimating the ICC and the implied risk premium for different European countries. Second, the European capital markets are of particular interest, as there was an enormous process of financial and economic integration among those countries observable over the last two decades. Within the European Monetary Union (EMU) in particular, several steps were initiated to substantially foster the level of financial capital market integration among the member states (cf. Hardouvelis et al., 2007). Prior to the introduction of the common currency, the harmonization and finally the full convergence of monetary policies across the EMU member states were achieved. This has led to a gradual assimilation of inflation rates and bond yields, resulting in the convergence of real risk-free rates towards German levels. Most importantly, the adoption of the single currency in January 1999 led to the disappearance of exchange rate risk among EMU capital markets. In January 2005, the elimination of currency risk was complemented by a major effort to reduce financial reporting differences across Europe by the mandatory harmonization of corporate reporting policies. The resolution of the European Parliament, signed in 2002, required all firms that are listed on European stock exchanges to apply International Financial Reporting Standards (IFRS) within their financial statements from January 2005 onwards. The last few years in Europe have been characterized by the eurozone or euro crisis. Rising government debt in combination with rating downgrades of some European countries escalated into concerns of a sovereign debt crisis. As a result, some eurozone member countries have experienced difficulties in repaying or re-financing their public debt and have been reliant on the support of the European Union (EU). Moreover, the sovereign debt crisis has been accompanied by a banking crisis, resulting from the undercapitalization of several banks in the crisis states.

Aside from being novel at the descriptive level, the dissertation adds to prior research on the advantages of the ICC approach to estimate expected returns, as compared to using historical premiums. New fields of application are proposed and investigated.

Finally, this thesis complements the bodies of literature on the equity risk premium, European financial integration and the effects of corporate diversification. First, a consensus on the magnitude of the equity risk premium is still missing. The results should provide new insights on the level of the risk premium for different European markets and industries when using the ICC approach. In addition, the extensive robustness analysis should create awareness for the critical assumptions underlying the approach as well as their influence on the results.

Second, the financial integration literature is supplemented by an alternative measure for financial integration that does not rely on realized equity returns or the specification of an asset pricing model. Using implied returns, researchers are able to differentiate between the convergence in the fundamentals and the convergence of the pricing mechanism applied by European investors. Only the latter is likely to be due to financial integration.

Third, the investigation of the relationship between corporate diversification and the ICC, as well as the moderation effect of European financial convergence variables on this relation, adds to the question of whether corporate diversification is beneficial for firms. Previous research has predominantly focused on total value effects of diversification and was thereby not able to distinguish between unfavorable or beneficial effects of diversification on a firm's cash flows versus on its expected return.

1.3 Structure of thesis

Chapter 2 provides a summary and discussion of the existing literature and the fundamental models underlying the ICC approach. I begin by introducing different equity valuation models and their specifications for the ICC calculation. Next, I discuss different frameworks for the evaluation of the ICC measures. The literature review concludes with a summary of different applications of the ICC approach in accounting, corporate finance and asset pricing research.

The focus of Chapter 3 is to provide the implied market risk premium for a broad set of European countries from January 1994 to December 2011 using different commonly applied methods. After a detailed explanation of the applied methods, I show descriptive statistics and the evolution of the ICC and the implied equity risk premium for different countries. In addition, I calculate industry risk premiums and industry beta coefficients. I continue the analysis with an extensive section on different robustness and sensitivity tests that challenge the influence of critical assumptions within the ICC models. To conclude, I discuss the remaining shortfalls and limitations of the ICC approach.

In Chapter 4 I examine the evolution of the relative importance of country and industry effects in determining a firm's expected equity return as a measure of European financial integration. After revisiting existing literature in the field, I give a short overview of the underlying definition of financial integration and its hypothesized effects on the implied discount rate. The next sections explain the Heston-Rouwenhorst framework, which I apply to measure the relative importance of country and industry effects on implied returns, and introduce the data set. I present results for the full period and for the pre- and post-euro as well as the eurozone crisis periods separately. The implications of changes in the relative importance of country and industry effects are discussed. To confirm the robustness of the estimates, I perform several sensitivity analyses. In addition, I investigate the impact of alternative explanatory variables on the results. The chapter concludes with a summary of the limitations of the analysis.

Chapter 5 presents another application of the ICC approach to proxy for the firm-specific cost of equity capital. The chapter investigates the relationship between both dimensions of corporate diversification and the cost of equity capital as well as the influence of capital market integration on this relation. The chapter begins with a review of the related literature in the field of corporate diversification. Next, I provide some theory on the underlying definition of diversification and financial integration and their hypothesized association with the ICC. After the data set is introduced, I present the regression results, first for the general effect of product and geographical diversification on the ICC, and second, for how this relationship is influenced by the level of financial integration among European stock markets. After challenging the robustness of the findings with several sensitivity analyses, I conclude with a discussion on the limitations of the approach.

Chapter 6 summarizes the major findings of this dissertation, discusses their implications and identifies open questions for future research.

2 Existing literature and review of valuation models

This chapter establishes the theoretical fundament by introducing equity valuation models that are commonly used within the ICC estimation. Moreover, relevant literature in the field will be reviewed.

After describing the dividend discount, residual earnings and abnormal earnings growth models, various earnings forecasting methods will be specified in Section 2.1. A discussion of frameworks for the performance evaluation of the ICC approach and a review of the results of previous studies with respect to the reliability of different proxies are topics of Section 2.2. Sections 2.3 and 2.4 summarize the most important applications of the ICC methodology within the areas of accounting, corporate finance and asset pricing.

2.1 Equity valuation models

Equity valuation models form the basis for the ICC estimation. Generally, equity valuation models determine the value of a particular asset based on the present value of the asset's expected future cash flows. The focus of the ICC approach is not on valuing a firm's equity but on using these models to derive the cost of equity capital. The ICC for a given asset is defined as the internal discount rate, which equates its current market price to the present value of all expected future cash flows (Pastor et al., 2008). Therefore, classical valuation models need to be reverse-engineered to calculate the internal rate of return implied by the firm's current market value and its cash flow expectations.

In the following three forms of equity valuation models on a stock level basis will be introduced: The dividend discount model, the residual income model and the abnormal earnings growth model. Due to differences in how dividends and earnings are extrapolated after a finite forecasting horizon, several specifications of these models have evolved. All these specifications are also commonly used in an ICC context. Instead of solving for the value of the stock, the equations need to be rearranged to solve for the expected rate of return on the equity investment.

2.1.1 The dividend discount valuation model

The dividend discount model is a straightforward application of bond valuation to equity (Penman, 2001). In the case of equity, dividends are the cash flows the shareholders obtain from a firm, similar to coupons, which represent the cash flows bondholders receive from a firm. The dividend discount model, also named dividend capitalization model, can be written as:

$$p_0 = \sum_{t=1}^{\infty} \frac{d_t}{(1 + r_E)^t}, \tag{2.1}$$

where p_t is the value of the share at time t, d_t is the dividend per share (DPS) in period t and r_E is the expected rate of return on the equity investment. The stock value is calculated as the present value of all future expected dividends. The used discount rate is the expected equity return. To avoid the practical problem of forecasting dividends for an infinite horizon, two adjusted forms of the dividend discount model have evolved. In these simplifications, the value of the stock equates a finite stream of future dividends plus a terminal value, discounted to the present at the required rate of return.

The first specification is based on a constant expected growth rate in the terminal value (g_{lt}), which yields the following equation (Gordon, 1959):

$$p_0 = \sum_{t=1}^{T} \frac{d_t}{(1 + r_E)^t} + \frac{d_T \cdot (1 + g_{lt})}{(r_E - g_{lt}) \cdot (1 + r_E)^T}. \tag{2.2}$$

Gordon and Gordon (1997) further simplify this equation by assuming that forecasts of abnormal performance have a finite horizon (I refer to the model as GG hereafter). Beyond this horizon, investors are assumed to expect the firm to realize a return on their equity investment equal to the expected return on its shares. Their model can be written as:

$$p_0 = \sum_{t=1}^{T} \frac{d_0 \cdot (1+g_{lt})^t}{(1+r_E)^t} + \frac{ne_1 \cdot (1+g_{lt})^T}{r_E \cdot (1+r_E)^T}, \tag{2.3}$$

where ne_t refers to the normalized earnings per share (EPS) in period t. The terminal value dividend is assumed to be the capitalized normalized earnings in the last period.

Depending on the length of the explicit forecasting horizon, different specifications of this finite-horizon model can be distinguished. The simplest version with T=1 is called the expected return model (Lee et al., 2010).

The second attempt to deal with the infinite forecasting problem, uses a forecast of the share price at the end of the detail forecast horizon (p_T) and may be expressed as:

$$p_0 = \sum_{t=1}^{T} \frac{d_t}{(1+r_E)^t} + \frac{p_T}{(1+r_E)^T}. \tag{2.4}$$

This model is also called target price method (TP hereafter), developed by Botosan and Plumlee (2002). In their model the terminal value calculation is replaced by analysts' forecasts of target prices.

The major advantage of the dividend discount model is that dividends are less volatile than earnings. The resulting estimates are hence less driven by short-term variations in the underlying input parameters (Pinto et al., 2010). However, the model is not applicable to non-dividend paying stocks and less suited for firms pursuing a dividend policy, which is largely unrelated to their profitability. Dividend payout is not directly related to value, as the capital gain component of the investment is ignored in the short-run (Penman, 2001). Another disadvantage is the limited availability of reliable dividend forecast data.

2.1.2 The residual income valuation model

The second category of valuation models is the residual income method. Residual income refers to total earnings in a given period minus the opportunity costs of generating these earnings. The opportunity cost is equal to the cost on the equity capital employed. To derive the standard residual income equation from the dividend discount model, dividends need to be substituted by earnings assuming the clean surplus relation holds. Clean surplus accounting states that the book value of common shareholders' equity at the beginning of the period, plus net income generated during the period, minus dividends distributed during the period, equals the book value of equity at the end of the period (Easton, 2007). It can be expressed as:

$$bv_t = bv_{t-1} + e_t - d_t, \tag{2.5}$$

where e_t are EPS generated in period t, bv_{t-1} refers to the book value per share at the beginning of the period t, whereas bv_t is the book value per share at the end of period t. In addition, I introduce the following algebraic zero-sum equality as explained in Ohlson and Gao (2006):

$$\begin{aligned} 0 &= bv_0 + \frac{bv_1 - (1+r_E) \cdot bv_0}{(1+r_E)} + \frac{bv_2 - (1+r_E) \cdot bv_1}{(1+r_E)^2} + ... \\ &= bv_0 + \sum_{t=1}^{\infty} \frac{bv_t - (1+r_E) \cdot bv_{t-1}}{(1+r_E)^t}. \end{aligned} \tag{2.6}$$

Adding the two equations 2.1 and 2.6 leads to:

$$p_0 = bv_0 + \sum_{t=1}^{\infty} \frac{bv_t + d_t - (1+r_E) \cdot bv_{t-1}}{(1+r_E)^t}. \tag{2.7}$$

Solving 2.5 for DPS and substituting this in equation 2.7, yields the standard residual income valuation formula:

$$p_0 = bv_0 + \sum_{t=1}^{\infty} \frac{e_t - r_E \cdot bv_{t-1}}{(1+r_E)^t}. \tag{2.8}$$

Thus, the value of the stock equals the current book value of equity plus the present value of future residual income. To overcome the problem of forecasting residual income for an infinite horizon, researchers normally apply finite-horizon versions of the model. Depending on the timing and assumptions of the terminal value calculation, several specifications of the residual income model can be distinguished. Commonly made assumptions for the residual income in the terminal value are (cf. Easton, 2007; Pinto et al., 2010): (1) The return on equity (ROE) equals the cost of equity, resulting in a residual income of zero, (2) the residual income remains constant at a certain level, (3) the residual income grows at a constant rate and (4) the ROE fades to a specific level other than the cost of equity capital, e.g., the industry median ROE.

Three of the most cited variations of the residual income valuation model have been proposed by Claus and Thomas (2001), Gebhardt et al. (2001) and Easton et al. (2002). Their models differ with regards to the length of the explicit forecast horizon as well as the growth rate assumption beyond this period. The advantage of the first two approaches is that they are able to generate firm-specific estimates of the ICC, while the latter only calculates a portfolio level cost of capital estimate.

Claus and Thomas (2001) assume that the residual earnings growth rate after the explicit forecast horizon is constant and equal for all firms (hereafter CT). Their model can be written as:

$$p_0 = bv_0 + \sum_{t=1}^{T} \frac{e_t - r_E \cdot bv_{t-1}}{(1+r_E)^t} + \frac{(e_T - r_E \cdot bv_{T-1}) \cdot (1+g_{lt})}{(r_E - g_{lt}) \cdot (1+r_E)^T}. \tag{2.9}$$

The authors set the long-term growth rate in residual earnings (g_{lt}) to be equal to the risk-free rate minus 3%. Based on the assumption that the real risk-free rate is approximately 3%, residual income is assumed to grow at the inflation rate. Claus and Thomas (2001) identify two arguments to justify a constant growth rate above zero: (1) Long-term growth in investments and (2) accounting conservatism. If book values are a correct reflection of market values, residual income should be equal to zero (Easton, 2007). However, if book values measure input costs fairly but do not include expected future economic rents reflected by the market value, residual income should be positive. But even in the absence of economic rents, residual income could be different from zero if accounting conservatism leads to an underestimation of the true input costs. Penman (2001) states that accounting value added can deviate from true economic value added for reasons like accelerated depreciation, the categorization of R&D investments as expenditures, or excessive restructuring charges. Zhang (2000) shows that conservative accounting can cause residual earnings to be positive on average and to grow at a rate greater than zero.

Gebhardt et al. (2001) propose another specification of the residual income model to generate firm level estimates of the ICC. They include a transition period, in which a firm's ROE fades to the industry median ROE. After this transition period, they assume the residual income to remain constant. In contrast to the classical formulation of the residual income model, Gebhardt et al. (2001) directly use the ROE (ROE_t) and compare it to the cost of equity. Their implementation may be expressed as (hereafter GLS):

$$\begin{aligned} p_0 = bv_0 &+ \sum_{t=1}^{\tau} \frac{ROE_t - r_E}{(1+r_E)^t} \cdot bv_{t-1} + \sum_{t=\tau+1}^{T-1} \frac{ROE_t - r_E}{(1+r_E)^t} \cdot bv_{t-1} + \\ &+ \frac{ROE_T - r_E}{r_E \cdot (1+r_E)^{T-1}} \cdot bv_{T-1}. \end{aligned} \tag{2.10}$$

The first sum term refers to the detail forecasting period using explicit earnings expectations. The second part of the equation reflects the transition period, in which the ROE fades to the historical industry median. The last expression of the formula refers to the terminal value calculation using the industry median ROE and the assumption of zero growth in perpetuity. The authors justify the mean reversion in ROE by the notion that individual firms tend to become more like their industry peers in the long-run, resulting in an erosion of abnormal ROE over time. Assuming no terminal value growth, they also ignore the issue of accounting conservatism, which could result in a discrepancy between the accountant's measure of the expected rate of return on equity (ROE) and the market's expected rate of return on equity (r_E) (Easton, 2007).

Easton et al. (2002) develop a method for estimating the cost of capital implied by stock prices, current book values and short-term earnings forecasts, which does not rely on an assumption about growth beyond the forecast horizon. The problem about their estimation method is that it can only be calculated for a portfolio of stocks, rather than on a firm-specific level.

The authors start with a finite-horizon residual income model:

$$p_0 = bv_0 + \frac{x_1 - r_E \cdot bv_0}{r_E - g_{lt}}. \tag{2.11}$$

Because the timing of dividends is relevant, Easton et al. (2002) use cum-dividend earnings (x_t). There are two unknown variables, growth and the expected rate of return. The authors define growth (g_{lt}) as the expected annual rate of growth in residual income from the date, on which the forecasts of earnings are made.

Using the fact that accounting earnings may be summed over time, the authors introduce cumulated earnings, x_{cT} that refer to the cumulated earnings for one quarter, one year, or even several years. Cumulated earnings are defined as:

$$x_{cT} = \sum_{t=1}^{T} e_t + \sum_{t=1}^{T-1} ((1 + r_E)^{T-t} - 1) \cdot d_t. \tag{2.12}$$

Using these cumulated earnings, introducing the following two variables:

$$y_0 = (1 + g_{lt})^T - 1 \tag{2.13}$$

and

$$y_1 = (1 + r_E)^T - (1 + g_{lt})^T, \tag{2.14}$$

and rearranging equation 2.11, yields:

$$\frac{x_{cT}}{bv_0} = y_0 + y_1 \cdot \frac{p_0}{bv_0}. \tag{2.15}$$

Expanding the equation to the portfolio level including a number of firms equal to I, the residual income growth rate and the rate of return from year t to T can be estimated using the following regression relation for each firm i:

$$\frac{x_{icT}}{bv_{i0}} = y_0 + y_1 \cdot \frac{p_{i0}}{bv_{i0}} + e_{i0}. \tag{2.16}$$

The linear relation suggests that the average expected return over horizon T and the average growth of residual income over horizon T can be estimated by the intercept and slope coefficient from a linear regression of aggregate cum-dividend earnings over book value on the current price-to-book ratio. To overcome the circularity in solving the equation system, the authors start by assuming a return on equity capital equal to the historical market return of 12%. Using an iterative procedure, the cost of equity capital estimate is revised until further iterations result in no further revision of either the implied growth rate or the implied rate of return.

A major advantage of the residual income model compared to the dividend discount model is that it is not necessary to forecast the dividend growth rate, which may depend on factors other than profitability (cf. Pinto et al., 2010). Reasons for not paying dividends can range from the shortage of cash to the availability of attractive investment opportunities. Also, dividend policy practices show variations over time and across countries. Using residual income valuation, the value is less sensitive to the growth rate assumption, as the fraction of value in the terminal value is much lower. In fact, a substantial value fraction is determined by parameters that are publicly available and do not need to be assumed by the researcher (Claus and Thomas, 2001). Current book value acts as a valuation anchor and the present value of future residual income only adjusts for the difference between book and market values. In addition, the model is also applicable to non-dividend paying stocks (Pinto et al., 2010). Finally, as a practical matter, the availability of earnings forecasts is superior to the one of dividend forecasts.

According to Ohlson (2005) the most deficient aspect of the residual income model is its assumption about clean surplus accounting. In fact, equity transactions that change the number of shares outstanding generally imply that the clean surplus relation does not hold.[1] Another major disadvantage is the fact that the model relies on accounting data, which can be manipulated by the management (Penman, 2001).

[1] The only exception for this violation, which is of little practical relevance, would be if the issue price per share equals the book value per share at the transaction date.

2.1.3 The abnormal earnings growth model

While the residual income model anchors the valuation on book values, the abnormal earnings growth model bases the analysis only on capitalized future expected earnings. Following Easton (2007) and Ohlson and Juettner-Nauroth (2005), the model can also be derived directly from the dividend capitalization model. I begin with the equation for the classical dividend capitalization model, namely equation 2.1. Applying the same scheme as in the residual income valuation formula derivation, I introduce the following algebraic zero-sum equality:

$$0 = \frac{e_1}{r_E} + \sum_{t=1}^{\infty} \frac{\frac{e_{t+1}}{r_E} - (1 + r_E) \cdot \frac{e_t}{r_E}}{(1 + r_E)^t}. \tag{2.17}$$

Adding the two equations 2.1 and 2.17 leads to:

$$p_0 = \frac{e_1}{r_E} + \sum_{t=1}^{\infty} \frac{\frac{e_{t+1}}{r_E} + d_t - (1 + r_E) \cdot \frac{e_t}{r_E}}{(1 + r_E)^t}. \tag{2.18}$$

Instead of using the last reported book value, the valuation starts from capitalized next-period's expected EPS. The remainder of the equation expresses the premium. Rearranging the premium term yields:

$$p_0 = \frac{e_1}{r_E} + \sum_{t=1}^{\infty} \frac{e_{t+1} + r_E \cdot d_t - (1 + r_E) \cdot e_t}{r_e \cdot (1 + r_E)^t}. \tag{2.19}$$

Abnormal earnings growth refers to the numerator in the sum expression, meaning the difference between cum-dividend earnings in period t+1 and "normal" earnings conditional on earnings in period t. The dividend term is essential in this equation, as future earnings depend on the retention rate of the prior year.

Each specification of the latter model capitalizes one-year-ahead earnings but makes different assumptions regarding abnormal earnings growth beyond the first period. Ohlson and Juettner-Nauroth (2005) propose a variation that determines value based on one-year-ahead earnings and dividends forecasts as well as a near-term and a long-term growth rate in abnormal earnings (hereafter OJ). Near-term growth g_{st} is defined as:

$$g_{st} = \frac{e_2 - e_1}{e_1} + \frac{r_E \cdot d_1}{e_1} - r_E. \tag{2.20}$$

Therefore, the near-term growth rate measures the growth in EPS between period one and two under the assumption of any dividend payout. The deduction of r_E means earnings are assumed to be "normal" if g_{st} is equal to zero. Long-term growth g_{lt} refers to the very long-run steady state, in which a firm's earnings should grow in accordance with the overall economy.

Using the relation above and rearranging equation 2.19 yields the OJ model:

$$p_0 = \frac{e_1}{r_E} + \frac{g_{st} \cdot e_1}{r_E \cdot (r_E - g_{lt})}. \tag{2.21}$$

Easton (2004) uses equation 2.21 as a basis for the derivation of the price-earnings (PE), price-earnings-growth (PEG) and modified price-earnings-growth (MPEG) valuation ratios as well as for the simultaneous estimation of the rate of growth and return.

The simplest case of the abnormal earnings growth model is the PE ratio. In this case, the sum expression in equation 2.19 equals zero. A zero premium implies "normal" earnings performance for all future periods (Easton, 2007). The formula for the value of a stock using the PE ratio may be expressed as:

$$p_0 = \frac{e_1}{r_E}. \tag{2.22}$$

The formula simplifies equation 2.21 because abnormal earnings growth after period one is assumed to equal zero. The next-year's forecast of earnings is sufficient for the valuation.

Another widely used metric is the PEG ratio, which equals the PE ratio divided by an earnings growth rate. Thus, it takes into account differences in short-term earnings growth. To derive the PEG ratio from equations 2.20 and 2.21, the long-term abnormal earnings growth rate and the DPS in period t=1 are set to equal zero. Under these assumptions the value of the stock can be expressed as follows:

$$p_0 = \frac{e_2 - e_1}{r_E^2}. \tag{2.23}$$

The PEG ratio relates a firm's PE ratio to its growth prospects. A high ratio indicates that the PE ratio is high relative to the expected earnings growth rate, while the opposite is true for a low PEG ratio. Both the PE ratio and the PEG ratio find wide applications as a basis for stock recommendations. The use of the PE ratio relies on the notion that a high (low) PE implies a low (high) expected rate of return supporting a sell (buy) recommendation (Easton, 2004). For the PEG ratio a value of one is generally seen as a fair valuation, while a PEG ratio below one supports a buy and a ratio above one a sell recommendation.

A further refinement of the PEG ratio is the so called MPEG ratio, suggested by Easton (2004). Using a two-period abnormal earnings model, in this modification only the change in abnormal earnings growth rate is set to equal zero. Under this assumption the value of the stock may be written as:

$$p_0 = \frac{e_2 + r_E \cdot d_1 - e_1}{r_E^2}. \tag{2.24}$$

The addition *modified* refers to the inclusion of expected dividends in the estimate of short-term growth as compared to the PEG ratio.

Finally, like for the residual income model, Easton (2004) proposes a portfolio level approach for the abnormal earnings growth model to simultaneously obtain estimates for the expected rate of return and the expected rate of growth (hereafter AGR).

The regression equation for the portfolio level estimate of the ICC, including a number of firms equal to I, may be expressed as:

$$\frac{x_{ic2}}{p_{i0}} = y_0 + y_1 \cdot \frac{e_{i1}}{p_{i0}} + e_{i0}, \tag{2.25}$$

with y_0 and y_1 defined as:

$$y_0 = r_E \cdot (r_E - g_{lt}) \tag{2.26}$$

and

$$y_1 = (1 + g_{lt}). \tag{2.27}$$

Ohlson (2005) states that the abnormal earnings model anchors the valuation to expected earnings and expresses the premium in terms of subsequent increments in expected future earnings (adjusted for dividends). In contrast to the residual income model, the abnormal earnings growth model does neither require book values nor assumptions about clean surplus accounting. Investment practice revolves much more around earnings and their subsequent growth than around book values and their subsequent growth. The major drawback of abnormal earnings growth models is that they are only applicable to firms with positive earnings forecasts.

2.1.4 Earnings forecasting methods

In order to compute ICC estimates out of the described models, forecasts of dividends or earnings are necessary. These numbers can be obtained from different data sources, the most common of which will be shortly described.

Analysts' forecasts are the most popular data source within the ICC literature. The two major providers in this area are Thomson Reuters I/B/E/S and the Value Line Investment Survey.

I/B/E/S is a global database that contains analysts' forecasts beginning in 1976 for the U.S., 1985 for Canada, 1987 for EMEA and Asia Pacific markets and 1992 for Latin America. The database includes a total of over 22,000 active companies across more than 80 countries, which corresponds to a coverage ratio of 98% of the MSCI World index and 100% of the S&P 500 index (Thomson Reuters, 2013).

Founded in 1931, the Value Line Investment Survey provides an alternative to Thomson Reuters I/B/E/S forecasts, which is less used in current research. The coverage is limited to the U.S. stock market, with approximately 1,700 of the most actively traded U.S. exchange-listed stocks representing about 95% of total U.S. stock market capitalization (Value Line, 2013).

The body of literature dealing with the topic of analysts' forecasts is enormous. Ramnath et al. (2008) and a recent working paper of Bradshaw (2011) summarize the vast literature on analyst forecasts. Research in the area mainly focuses on the statistical properties of analysts' forecasts as well as the incentive and decision making processes that give rise to these properties. One common finding in almost all studies is that analysts' forecasts exhibit systematic bias. Independently of their research objective and research design, researchers almost unanimously agree on a certain degree of optimism within analysts' earnings forecasts. The magnitude of this bias and the analysts' motivation for being overly optimistic vary across studies.

Easton and Monahan (2005), Easton and Sommers (2007), Guay et al. (2011) and Mohanram and Gode (2013) analyze the use of sluggish or biased analyst forecasts in the ICC approach. Easton and Monahan (2005) document that the lack of reliability of different ICC proxies is partially due to the limited quality of analysts' earnings forecasts. Easton and Sommers (2007) estimate the bias in the ICC caused by optimistic analysts' earnings forecasts to be 2.84%. The bias, calculated as the difference between estimates of the ICC based on analysts' forecasts and results based on actual realized earnings, differs especially with respect to firm size, leading to a bias in the value-weighted estimate of only 1.60%. Guay et al. (2011) analyze the influence of errors in analysts' forecasts on the accuracy of different ICC implementations (GLS, CT, OJ and GG models and PEG ratio) and find predictable error in the ICC estimates, resulting from sluggish analysts' forecasts that do not incorporate information from past stock returns. They and Mohanram and Gode (2013) provide methods to remove predictable analysts' forecast errors to improve the properties of the ICC estimates.

Another major problem of analyst forecasts noted by Hou et al. (2012) is their limited cross-sectional and time-series coverage. Analysts generally focus on large cap firms, which leads to an underrepresentation of smaller firms in the databases. But even for covered firms, earnings forecasts beyond the second year or long-term growth forecasts are often not available, especially in the earlier years of coverage.

To address some of the limitations, Hou et al. (2012) propose an alternative approach to using analyst earnings forecasts. They generate earnings forecasts with a cross-sectional model. More specifically, for each year, the authors estimate the following pooled cross-sectional regressions:

$$E_{it+\tau} = \alpha_0 + \alpha_1 A_{it} + \alpha_2 D_{it} + \alpha_3 DD_{it} + \alpha_4 E_{it} + \alpha_5 NegE_{it} + \alpha_6 AC_{it} + e_{it+\tau}, \quad (2.28)$$

where $E_{it+\tau}$ are the earnings of firm i in year $t + \tau$. A_{it} refers to total assets, D_{it} to the dividend payment and AC_{it} to the accruals of firm i in year t. DD_{it} is a dummy variable indicating if firm i pays dividends in year t and $NegE_{it}$ is a dummy equaling one for firms with negative earnings and zero otherwise.

The approach allows computing up to five-year-ahead earnings forecasts and the ICC for any listed firm with information on the included accounting items. To generate earnings forecasts, Hou et al. (2012) multiply the independent variables as of year t with the coefficients from the regression estimated using the previous 10 years of data. This ensures that earnings forecasts are computed strictly out-of-sample. Even though, Hou et al. (2012) state that their earnings estimates are superior to analysts' forecasts especially in terms of coverage and forecast bias, their cross-sectional estimation model is not yet widely applied in the ICC literature.

2.2 Evaluation of the ICC approach

In response to the growing body of literature, which has generated a wide range of variations of the ICC approach, different frameworks to assess their performance were proposed. Before reviewing literature on the evaluation of individual models, I want to summarize evidence on the general appropriateness of the ICC approach as a proxy for expected returns. The focus of Pastor et al. (2008), Hughes et al. (2009) and Li et al. (2013) is not to take a position on which ICC approach is the best but to judge over the usefulness of the whole class of ICC models.

Pastor et al. (2008) re-examine the conditional mean-variance relation using the ICC as a proxy for the conditional expected return. Their focus is on the time-series relation between the market level ICC and market risk. First, the authors analyze the theoretical relationship between the ICC and the conditional expected stock return.

They argue that if dividend growth can be described by an AR(1) process, the ICC is a linear function of the dividend yield and dividend growth. If one further assumes that the conditional expected return also follows an AR(1) process, then the ICC should be perfectly correlated with the conditional expected return. In a second step, the authors conduct a simulation analysis to examine the ability of the ICC to detect the intertemporal risk-return tradeoff. They design a simple framework, assuming the conditional mean and variance of stock returns are positively associated, and simulate a time-series of these variables. Then they compare the usefulness of various proxies for the conditional mean in describing the positive mean-variance relation. The ICC considerably outperforms realized returns in this analysis. Finally, in their empirical analysis Pastor et al. (2008) estimate the intertemporal relation between the conditional mean and variance of excess market returns in the G-7 countries over the period from 1981 to 2002 for the U.S. and 1990 to 2002 for all other countries. The market-wide conditional mean is estimated using the equally and value-weighted ICC from a model based on the GLS approach minus the risk-free rate. The conditional variance for a given country is the average squared daily market return over the previous month. The authors find a statistically significant positive relation between the implied risk premium and volatility. In summary, their results indicate that the ICC should be a useful proxy for expected returns.

Hughes et al. (2009) examine the relation between the ICC and expected returns under the assumption that expected returns are not constant. They theoretically explore the average relation between the ICC and expected returns and identify how the two may differ when expected returns are assumed to be stochastic. They demonstrate that the ICC deviates from expected returns by a function including volatilities of, as well as correlation between, expected returns and cash flows, growth in cash flows and leverage. When expected returns are assumed to be constant, these variables do not influence the relation between the ICC and expected returns.

Finally, Li et al. (2013) examine the relationship between an aggregate ICC estimate and future market returns at horizons from one month to four years. Using a version of the dividend discount model following Pastor et al. (2008) and Lee et al. (2009) within the standard return forecasting regression methodology, the authors provide evidence for the predictive power of the ICC for future market returns.

Most of the literature in the area of performance evaluation focuses more on comparing different ICC methods than on the assessment of the usefulness of the ICC approach as a whole. Major research in the area of comparing different ICC models can be split into two approaches (see Easton (2007) for a detailed summary): (1) Examining the correlation of the ICC proxy with future realized stock returns, or (2) studying their association with major proposed risk factors.

The first method for assessing the reliability of ICC estimates asks the question if those ex ante expected returns explain ex post realized returns. The use of this approach is justified by the notion that positive and negative unexpected cash flow events should cancel each other out, or are at least unsystematic. ICC estimates that show a higher correlation with future realized returns are thus assumed to show a higher validity.

Following this approach, Gode and Mohanram (2003) compare the OJ model to the GLS model and a residual income model of Liu et al. (2002). They find economically significant relations between the implied risk premium proxies and future returns when dividing the firms into five portfolios, grouped according to the level of the implied risk premium. The GLS model outperforms the OJ estimate in forecasting one-year- and two-year-ahead returns, while both perform well for three-year-ahead returns. The residual income model of Liu et al. (2002) only shows predictive power for one-year-ahead returns.

Guay et al. (2011) estimate Fama-McBeth regressions of future firm level stock returns on the cost of capital estimates. They find that the GLS, CT, OJ and GG models and the PEG ratio estimates are not significantly positively associated with one-year-ahead stock returns. They explain this difficulty in explaining future returns with the sluggishness in analysts' forecasts and propose different methods to mitigate the influence of these forecast errors on the ICC estimates. Running the regression analysis again on the revised cost of capital estimates, the authors find significantly positive relations with future realized returns for the GLS, CT and GG model estimates.

The major critique of using the association to realized returns as a performance measure for ICC methods is similar to the one for using realized returns as a proxy for expected returns. Guay et al. (2011, p.129) even acknowledge "that realized returns are a noisy proxy for expected returns, and that this is, in fact, an important motivation behind implied cost of capital measures. However, despite the limitations, we are unaware of a superior benchmark to validate cost of capital measures that does not rely on realized returns". Elton (1999) and Fama and French (2002) support the conclusion that information surprises, which cause a divergence between realized returns and expected returns, do not necessarily cancel out over time. Easton (2007) points out that if those information surprises are correlated with expected returns, the simple regression of realized returns on the ICC as an expected return proxy will yield spurious results due to omitted variable bias. Therefore, when using realized returns to evaluate ICC estimates, researchers need to develop a research design that controls for the bias and noise in realized returns.

Easton and Monahan (2005) develop a method, which takes explicitly into account that realized returns may be biased and noisy measures of expected returns. Their approach is based on the return decomposition developed by Vuolteenaho (2002). Realized returns are assumed to have three components: Expected returns, changes in expectations about future discount rates and changes in expectations about future cash flows. This concept provides the foundation for a regression of realized returns on proxies for expected returns, cash flow news and discount rate news, to test for the reliability of different expected return proxies. Using this validity measure, the authors evaluate seven ICC models: The PE, PEG and MPEG ratios and the AGR, OJ, GLS and CT models. They conclude that for their sample, all seven applied proxies are unreliable. However, the authors also demonstrate that when analysts' forecast errors are low, all of the proxies have a positive association with expected returns.

Following a similar approach, Lee et al. (2010) assume that superior expected return estimates should perform better in predicting cross-sectional future returns and show a lower time-series error variance. Using this framework, they evaluate seven alternative ICC models (the PEG and MPEG ratio, the OJ, AGR, GLS models and two versions of the GG model) and three traditional measures of expected returns (based on time-series betas and the Fama-French one-, three- and four-factor risk models) based on their performance in explaining the true expected return at the beginning of the period.

They show that all seven ICC estimates outperform factor model based expected return estimates.

Botosan et al. (2011) use a similar return decomposition, where realized return is modeled as expected return at time t conditional on information available at time t-1 plus unexpected return due to cash flow and expected return news. Using nine individual ICC proxies, the Fama-French four-factor model and two composite ICC proxies, they provide evidence for the validity of all proxies, except for the Fama-French model and the PEG ratio using short-term growth. The authors argue that the difference between their findings and Easton and Monahan (2005) is due to the choice of proxies for discount rate news. While they employ the change in the risk-free rate and the change in market beta to proxy for macroeconomic and firm-specific expected return news, respectively, Easton and Monahan (2005) use the scaled measure of the difference in consecutive ICC estimates.

The more common method for evaluating different ICC proxies uses the relation between ICC estimates and various firm characteristics. The major argument for this approach is that a valid proxy for expected returns should be correlated with known risk proxies in the cross-section. In other words, ICC estimates that exhibit more significant and robust correlations with risk proxies are assumed to be of higher validity (Easton, 2007). Most studies using this approach include market risk and firm characteristics out of the following five categories defined by Gebhardt et al. (2001): Market volatility, leverage, information environment, earnings variability and predictability and other pricing anomaly variables, like the book-to-market ratio or momentum. Two major statistics of the cross-sectional regression framework are used to evaluate the performance of different ICC estimates: The regression r-square and the signs, magnitude and significance of the coefficients (Easton, 2007).

This validity test method was among others adopted by Botosan and Plumlee (2005). They assess different ICC estimates based on their association with firm-specific risk measured by unlevered beta, leverage, information risk, market value of equity, book-to-price and expected growth in earnings. The authors find that the estimates from the TP method and the PEG ratio are consistently related to the risk variables in the predicted way, while the alternatives are not.

Gode and Mohanram (2003) test how risk premium estimates from different ICC models correlate with the following frequently used risk factors: Systematic risk, earnings variability, unsystematic risk, leverage and size. Comparing the OJ model to the GLS model and a residual income model of Liu et al. (2002), they find that the OJ proxy is correlated with the independent variables in the expected direction, while the regression coefficients for the residual income models are sensitive to the concrete model specification.

Finally, Botosan et al. (2011) also hypothesize that a positive correlation between an expected return proxy and the risk-free rate, market beta, leverage, book-to-price ratio and growth, and a negative correlation with equity market value would provide evidence for the usefulness of an expected return proxy. Examining the validity of nine individual ICC proxies, the Fama-French four-factor model and two composite ICC proxies, the authors find only the two different PEG ratios and the TP method to be associated with all firm-specific risk factors in the predicted way.

The major shortcoming of the regression of ICC estimates on commonly used risk proxies is similar to the one for using the regression on realized returns. The ICC approach is suggested as an alternative to unsatisfactory asset pricing models. Therefore, using risk factors based on these models to evaluate the performance of an ICC proxy is illogical according to Easton (2007). He states that similar to realized returns, also risk proxies are noisy and this noise may be correlated to the noise in expected returns. Second, regression results may be affected by the way that a particular ICC estimate is constructed. For instance, it is little surprising that earnings growth has a significant association, given the fact that this parameter directly enters the equation for estimating several ICC estimates. Furthermore, the use of r-square as a performance measure implies that all included factors are indeed risk factors and that the included factors are exhaustive.

Based on the shortcomings of the existing evaluation frameworks, Daske et al. (2010) propose a new approach to overcome the key problem that true expected returns are unobservable. They simulate a model economy, assuming the true cost of capital is known, and calibrate it to empirical data in order to compare the true cost of capital to the ICC estimates from different methods. Their results indicate that residual income based estimates outperform those based on abnormal earnings growth models. While abnormal earnings growth models generally overestimate the true cost of capital, residual income models lead to a slight underestimation.

In summary, previous literature provides evidence for the usefulness of the general ICC approach as a measure for expected returns from a theoretical and empirical perspective. A consensus about the superiority of an individual model, however, is missing in the literature. This is also the reason, why asset pricing, accounting and corporate finance research that makes use of the ICC approach, often applies several estimation models. The fact that true expected returns are unobservable makes the development of appropriate evaluation frameworks a challenging task. As soon as a *superior* way for evaluating different proxies exists, this knowledge should already be incorporated into a new and *superior* expected return proxy.

2.3 Applications in accounting and corporate finance

Because estimating a firm's expected return is an essential element of the risk-return tradeoff, the ICC has also been widely used both in the accounting and the corporate finance literature. Literature in these areas uses the ICC approach mostly in order to examine the effect of an accounting or corporate finance characteristic of interest on a firm's expected cost of capital. More specifically, researchers compare estimates of the cost of capital across stock portfolios that differ with respect to the attribute of interest. The majority of studies in this area bases the analysis on a regression of firm-specific ICC estimates on the respective variable.[2]

The following section intends to give a quick overview of different applications in the area but does not claim to be exhaustive. One of the most prominent questions in this area is if and by how much firms are compensated for higher disclosure levels or information quality through a lower cost of capital. Botosan (1997) was the first to examine the effect of the level of disclosure on a firm's ICC. Her measure of disclosure

[2]See Easton (2007) for a more detailed discussion of the methodology applied in most studies.

is based on the amount of voluntary disclosure in the 1990 annual report of 122 manufacturing firms. For the estimation of the ICC she applies a residual income model. For firms with a low analyst following, the results suggest that higher disclosure levels are associated with a lower cost of capital. The author, however, fails to provide evidence for such an association for firms with a high analyst following.

Botosan and Plumlee (2002) extend the earlier study by analyzing the relation between the cost of equity capital, the degree of annual report and timely disclosure and investor relations activities. Using an extended data set over the period from 1985/86 through 1995/96, they do not find a relationship between the ICC and the level of investor relations activities. In addition, they prove that the ICC decreases in the annual report disclosure level but increases in the level of timely disclosure.

Using a data set of 40 countries over the years 1992 through 2001, Hail and Leuz (2006) investigate the association between a country's legal institutions and securities regulation and its cost of equity capital. They calculate firm level cost of equity capital as the average of the CT, GLS, OJ and MPEG model estimates. The authors conclude that firms domiciled in countries with stricter disclosure requirements, stronger securities regulation and more severe enforcement mechanisms are charged a significantly lower cost of capital by investors.

Francis et al. (2005) examine the effect of disclosure incentives and consequences on the cost of capital. Their focus is on both firm level cost of debt, estimated using actual interest expense, and firm level cost of equity, using the PEG ratio. Within a sample of firms from 34 countries, they find a positive association between the external financing need of a firm's industry and voluntary disclosure levels. By means of an enhanced disclosure policy, firms out of those industries are able to reduce the cost of both debt and equity capital. Furthermore, the authors provide evidence that voluntary disclosure incentives are effective independently of country level factors in providing access to cheaper financing.

Francis et al. (2004) investigate the relation between the cost of equity capital and seven earnings attributes: Accrual quality, persistence, predictability, smoothness, value relevance, timeliness and conservatism. Using the ICC derived from the PEG approach, they find that firms with the most favorable values of each attribute enjoy lower costs of equity capital.

Hribar and Jenkins (2004) investigate the impact of accounting restatements on a firm's cost of equity capital. Using ICC estimates from the GLS, OJ and MPEG models, they apply an event study design to capture changes in the cost of capital in response to accounting restatements. They find that the restatements result in decreases in expected future earnings but increases in the cost of equity capital.

Daske (2006) examines whether the adoption of IFRS leads to a measurable reduction in the cost of capital. For the estimation of the ICC the authors apply four models, the OJ and the GLS methods for firm level estimates and the methodology proposed by Easton (2004) and Easton et al. (2002) to simultaneously estimate the expected return and long-term growth within the abnormal earnings growth and residual income models. In addition, Daske (2006) develops a methodology to adjust the methods to allow for monthly estimation. Using a data set of German firms in the period from 1993 to 2002, their results do not suggest that firms adopting IAS/ IFRS or U.S.-GAAP enjoy a decrease in the cost of equity capital.

Further applications of the described approach include examining the relation between a firm's cost of capital and its ownership structure, the tax regime, organizational structure or capital market access. Using firm data from Asia and Western Europe, Attig et al. (2008) examine whether the presence of multiple large shareholders reduces a firm's cost of capital through the reduction of agency costs and information asymmetry. As their cost of capital measure they use the average of the CT, GLS, OJ and MPEG models. Their study provides evidence that firms with large shareholders beyond the controlling owner show a lower implied cost of equity. Additionally, voting rights, the relative voting size and the number of blockholders are associated with a decrease in a firm's cost of equity capital.

Using a similar research design and data set, Guedhami and Mishra (2009) find evidence that the cost of equity capital is positively related to excess control, measured as the discrepancy between voting and cash flow rights of the ultimate owner.

Dhaliwal et al. (2005) examine the effect of dividend taxes on the cost of equity capital and provide evidence for a positive relationship between the ICC and the tax-penalized portion of dividend yield that is decreasing in institutional ownership. The authors estimate the firm-specific ICC using the CT, GLS and OJ models but use the GLS method as their major specification.

Dhaliwal et al. (2006) investigate the associations among leverage, corporate and investor level taxes and a firm's cost of equity capital. Firm level cost of equity capital is computed as the average of the CT, GLS, OJ and MPEG model estimates. The analysis provides evidence that the equity risk premium is positively related to a firm's leverage. The corporate tax benefit from debt mitigates this relationship, while the premium is enhanced by the personal tax penalty associated with debt.

Hann et al. (2013) examine whether organizational form matters for a firm's cost of capital, arguing that coinsurance among a firm's business units can reduce systematic risk. Total cost of capital is computed as the weighted average of the GLS estimate and the bond yield from the Barclays Capital Aggregate Bond Index. Hann et al. (2013) find that diversified firms enjoy a lower cost of capital than comparable portfolios of standalone firms. In particular diversified firms with little correlation among their segments' cash flows exhibit a lower cost of capital, indicating the existence of a coinsurance effect.

Using observations from 45 countries between 1990 and 2005, Hail and Leuz (2009) analyze the impact of a cross-listing in the U.S. on a firm's cost of equity capital. Again, the authors use the average from four models (CT, GLS, OJ and MPEG) as their cost of capital estimate. Their results indicate that a cross-listing on a U.S. exchange, on average, is associated with a decrease in a firm's cost of equity.

In summary, most studies find the ICC to be helpful in documenting significant relations between a firm's cost of capital and a corporate finance or accounting issue of interest. Relations, which may be obscured by the noise in realized returns seem much clearer when using the ICC. Thus, a significant relationship between a firm's cost of capital and its information quality, ownership structure, organizational structure, tax regime, or the capital market access could be identified.

2.4 Applications in asset pricing

While the accounting and corporate finance literature focuses more on the impact of different firm attributes, in the capital markets area the ICC has been predominately used to study market efficiency and asset pricing theory.

Claus and Thomas (2001) are among the first to propose the estimation of a market wide implied equity risk premium based on earnings-based valuation models. They estimate the ICC for the U.S. and five other markets between 1985 and 1998 using the residual income model. They find that for each year the implied equity risk premium was only around 3% for the U.S., Canada, France, Germany, Japan and the U.K., compared to the Ibbotson estimates of roughly 8%.

Likewise, Fama and French (2002) provide evidence that the implied equity risk premiums using realized dividends and earnings growth rates were on average 2.55% and 4.32% between 1951 and 2000, and therefore, much lower than the historical premium of 7.43% over the same period. They conclude that observed ex post returns during this period were significantly higher than ex ante expected. This finding can be explained with unexpected capital gains as a result of a decline in expected stock returns.

Gebhardt et al. (2001) examine firm characteristics that are systematically related to their estimates. They investigate the cross-sectional relation between the implied risk premium and 14 firm characteristics and find that firms with high book-to-market ratios, high growth forecasts and low analyst dispersion show a higher implied risk premium. Surprisingly, the association between a firm's risk premium and its beta factor is quite weak. Developing a multivariate model for explaining the implied risk premium, they show that a firm's ICC is a function of industry membership, the book-to-market ratio, the forecasted long-term growth rate and the dispersion in analysts' earnings forecasts.

Lee et al. (2009) apply the ICC methodology for the estimation of expected returns to test international asset pricing models. To calculate the ICC they apply variations of the GLS, OJ, MPEG and CT models over the period from 1990 to 2000. First, the authors estimate the factor loadings of a three-factor asset pricing model, including a world market factor, a country-specific local market factor and a currency factor and find that expected returns are statistically significantly related to market and currency betas only. Including several firm characteristics, they document a positive association between expected returns and idiosyncratic volatility, leverage and the book-to-market ratio and a negative correlation between size and expected returns. Together, the global, local and currency betas as well as the firm characteristics explain approximately 20% of the cross-sectional variance in implied risk premiums across the G-7 sample firms. Finally, the authors compare the results with identical tests using realized returns and prove that the associations are much weaker than with implied risk premiums.

Hanauer et al. (2013) test the Fama-French three-factor model in an international setting using the ICC as a proxy for expected returns. They compute firm level ICC estimates using the GLS method (and the OJ, MPEG and CT approach for robustness reasons) for the G-7 countries over the period from 1990 to 2011 in order to re-run the analysis of Fama and French (1993). The authors provide evidence for the explanatory power of the Fama-French three-factor model for the cross-sectional variation in expected returns when using the ICC as a proxy. The three-factor model outperforms the CAPM, suggesting that the small-minus-big and high-minus-low factors are important ingredients of return expectations. The explanatory power of the model using implied risk premiums is much higher than with realized returns.

Chava and Purnanandam (2010) examine the relationship between default risk and expected stock returns. They follow Pastor et al. (2008) and Lee et al. (2009) in their ICC implementation and use the hazard rate and the expected default frequency as a proxy for default risk. The authors find a strong positive relationship between default risk and expected stock returns in the cross-section. The average expected return in the top 1% default risk portfolio is approximately 1.5-2.0% higher than the return for stocks with a median default risk level. This positive risk-return relation was not found by prior studies using realized returns. On the contrary, these studies document even a negative relationship between default risk and realized returns, indicating market inefficiency. Chava and Purnanandam (2010) explain the post-1980 underperformance of high default risk stocks with surprisingly low realized returns during this period, which were not in line with investors' expectations.

Focusing on the time-series rather than the cross-section, Pastor et al. (2008) use the ICC approach to test for the intertemporal risk-return relation. They re-examine the time-series relation between the conditional mean and variance of excess market returns in the G-7 countries. They apply a version of the GLS model to proxy for the market-wide conditional mean and estimate the conditional variance as the average squared daily market return over the previous month. Using equally weighting, the authors provide evidence for a positive relation between the levels of the implied risk premium and volatility in all G-7 countries (statistically significant for five countries). In addition, they find a statistically significant positive relation between shocks to the risk premiums and shocks to volatility in most of the countries. Evidence for value-weighted implied risk premiums is weaker but still supportive.

Chen et al. (2013) use the ICC to re-examine the relative importance of expected cash flow and discount rate news within stock price revisions. Following the GLS approach by Pastor et al. (2008) and Lee et al. (2009), they define cash flow news as the price change holding the ICC constant and discount rate news as the price change holding cash flow forecasts constant. Using U.S. firm level data from 1985 to 2010, drivers of stock price movement at the aggregate and firm level for different horizons are analyzed. The results show that cash flow news contribute significantly to stock price variation. At the one-year horizon their explanatory power amounts to 36% of stock price variation at the aggregate level and 48% at the firm level. The percentage of stock price variation explained by cash flow news even increases further with the investment horizon until they outweigh discount rate news beyond two-year horizons. In addition, the results show that cash flow news are more important at the firm level than at the aggregate level, indicating a certain diversification effect.

Li et al. (2013) introduce the ICC as a new forecasting variable into the predictive regression framework. Using a version of the GLS model following Pastor et al. (2008) and Lee et al. (2009), they test the predictive power of the aggregate ICC estimate for future market returns over one month to four year horizons. Based on monthly U.S. data between January 1977 and December 2011, their results indicate that the ICC is a good predictor variable for future market returns both in-sample and out-of-sample. The forecasting power remains strong even after controlling for widely-used other forecasting variables, such as the earnings-to-price ratio, dividend-to-price ratio, book-to-market ratio, payout yield, term spread, default spread, long-term government bond yield and the T-Bill rate. In addition, the performance of the ICC is superior to the one of these valuation ratios and business cycle variables.

Taken together, in the majority of the described papers the ICC approach was helpful in providing evidence on the cross-sectional or time-series risk-return tradeoff more consistent with theoretical considerations than when using realized returns.

3 Estimation of the ICC for European stock markets

This chapter applies the ICC approach to a sample of European firms from the beginning of their reliable I/B/E/S coverage.[1] Different methods for the estimation and their underlying assumptions will be described and implemented and results will be presented on a country and industry portfolio level.

Section 3.1 starts with the motivation for this chapter, illustrating the importance of the estimation of expected equity returns. Section 3.2 explains the four methods applied to compute the ICC and discusses several underlying assumptions. Section 3.3 introduces the data set and Section 3.4 presents the estimates of the ICC and the implied equity risk premium. Results are presented on a country and industry level. Next to major descriptive statistics, the time-series evolution of the estimates is shown. In order to confirm the robustness of the estimates, I perform several sensitivity analyses in Section 3.5. Section 3.6 discusses the limitations of the ICC approach.

3.1 Motivation

A basic principle in modern finance is that risk has a major impact on valuation assessments and thereby riskier investments should have higher expected returns than safe investments. More precisely, the expected return on a risky investment is the sum of the risk-free rate and a risk premium to compensate for the risk inherent in the investment. The specified risk-return tradeoff is not only important to investors for their portfolio allocation and performance evaluation, but also to managers who want

[1] This chapter is based on Jäckel and Mühlhäuser (2011) and Jäckel et al. (2013).

to examine the impact of their investment and financing decisions. Therefore, a central topic of discussion in finance research and practice is on how to determine the risk premium required for investing into a risky investment in general and equity in particular. The average risk premium for an equity investment in a certain market is called equity or market risk premium.

The classical way to determine the expected equity risk premium is to look at realized stock returns. The historical equity premium is the average realized return on the market portfolio minus the risk-free rate. Even though this is the prevalent approach, especially in practical applications, it possesses major weaknesses. In particular, the argument that positive and negative unexpected cash flow events should cancel each other out over time can be overturned. Elton (1999) argues that significant information events might not offset in small periods of study, which in turn makes realized returns a poor proxy for expected returns. But even over the long-run, the so-called "Equity Premium Puzzle" identified by Mehra and Prescott (1985) states that observed historical premiums are too high to be rationalized by standard intertemporal economic models. In addition, estimates using realized returns suffer from very high volatility caused by the inclusion of cash flow surprises in the return figures.

In response to these limitations, academic literature began to turn away from realized returns as a proxy for expected returns. Claus and Thomas (2001) and Gebhardt et al. (2001) have proposed an alternative measure for the expected cost of equity using the ICC. Both studies obtain an implied return estimate to approximate for expected stock returns by reverse-engineering earnings-based valuation models. The implied risk premium for a given asset is defined as the internal rate of return that equates the asset's current market price to the present value of all expected future cash flows minus the risk-free rate. The ICC approach directly links the estimates to information currently available to investors and thereby offers a better reflection of the current economic state than historical returns, which are by definition backward-looking. Thus, the implied risk premium should always reflect the current level of risk perception of investors. As cash flow revisions and the resulting stock price reactions cancel out within the ICC methodology, estimates are only driven by expected return news. This also translates into a much lower volatility as observed for realized returns.

Pastor et al. (2008) examine the theoretical relationship between the ICC and the conditional expected stock return. They show that if dividend growth and the conditional expected return follow an AR(1) process, the ICC is perfectly correlated with the conditional expected return.[2] Hence, their results indicate that the ICC should be a useful proxy for expected returns.

Given these benefits, the focus of this chapter is to provide the ICC and the implied market risk premium for a broad set of European countries since the beginning of their reliable I/B/E/S coverage. I apply four different approaches based on Claus and Thomas (2001), Gebhardt et al. (2001), Ohlson and Juettner-Nauroth (2005) and Easton (2004), which have been commonly used in previous research, in order to estimate the cost of equity implied by market prices, accounting numbers and earnings forecasts. In addition, I provide portfolio level implied risk premium estimates for different industries and derive their beta factors. Extensive sensitivity analysis aims at giving new insights on the influence of critical assumptions on the ICC estimates.

To my best knowledge the ICC approach has not been applied with the focus on estimating the market risk premium of different countries since Claus and Thomas (2001). Industry level estimates have been neglected even more. In addition, the comparability of previous research on the ICC or the implied equity risk premium is hindered by various methods applied as well as different time frames.

3.2 Estimation methodology

Theoretically, the ICC is the discount rate that equates the present value of future dividends to the current market price of a firm. Thus, all changes in the price of a stock represent adjusted expectations about future dividends or revisions in the firm's discount rate. I apply four methods to calculate the ICC, which are all derived from the dividend discount model but are adjusted to enable empirical feasibility. Consequently, differences in the ICC estimates in each method are exclusively a result of different empirical implementations and not the theoretical basis.

[2]Further results of their study are discussed in Sections 2.2 and 2.4.

In the following, I present the four methods and my assumptions if they differ from the original paper. While the authors calculate yearly ICC estimates, I apply all models to generate monthly numbers. See Section 3.2.5.6 for a detailed description of the monthly estimation procedure.

3.2.1 Claus and Thomas (2001)

The first two proxies are derived from the residual income valuation model, which states that the value of a firm equals its book value plus the present value of the expected residual income from its activities, where residual income is the reported earnings minus a charge for equity capital. The first specification follows the approach of Claus and Thomas (2001), as already briefly described in Subsection 2.1.2.

The ICC from the CT model r_{CT} is derived from the following equation:

$$p_0 = bv_0 + \underbrace{\sum_{t=1}^{5} \frac{e_t - r_{CT} \cdot bv_{t-1}}{(1 + r_{CT})^t}}_{\text{explicit forecast period}} + \underbrace{\frac{(e_5 - r_{CT} \cdot bv_4) \cdot (1 + g_{lt})}{(r_{CT} - g_{lt}) \cdot (1 + r_{CT})^5}}_{\text{terminal value}}, \tag{3.1}$$

where p_t is the stock price at date t, bv_t is the reported or forecasted book value per share at the end of period t, e_t is the EPS forecast for period t and g_{lt} is the forecasted perpetual growth rate in residual income.

Claus and Thomas (2001) first aggregate all relevant numbers such as book values and earnings forecasts to calculate one market wide ICC. To make sure that the book value for year t=0 was already publicly available at the estimation date, the authors identify the most popular fiscal year-end month for each country and use the month following the country's reporting deadline as their yearly estimation date. Using a two-stage model, they explicitly forecast residual earnings until year five and use a constant perpetual residual income growth rate afterwards. For the explicit forecasting period Claus and Thomas (2001) use EPS median forecasts from I/B/E/S. If forecasts for the third to fifth year are not available, they use the I/B/E/S consensus long-term growth rate expectation to generate the respective earnings forecasts. As their growth rate into perpetuity, they use the expected inflation rate computed as the difference between the risk-free rate and an assumed real interest rate of 3%. They use the country-specific 10-year treasury bond rate as their risk-free rate. Future book values are calculated using clean-surplus accounting. Claus and Thomas (2001) identify a dividend payout ratio of 50% to be representative for their U.S. as well as their international sample.

To validate the robustness of their method, Claus and Thomas (2001) consider a variety of alternative ways to choose their input parameters. First of all, they allow for an expected variation in the risk-free rate to take into account the term-structure of interest-rates and find almost identical results as with a constant risk-free rate. Moreover, they find that varying the assumed payout ratio has little impact on the estimated discount rate. In order to investigate the impact of the long-term growth rate, Claus and Thomas (2001) assume two alternative growth cases: 3% lower and 3% higher than their base case. Besides, they consider a synthetic yearly market portfolio constructed to have no future abnormal earnings, to avoid the need for an estimated growth rate. The influence of all modifications on their results is only modest.

In contrast to the authors, I use monthly firm level data to estimate firm level ICCs and aggregate those estimates only in a second step. In addition, I use synthetic book values as explained in Subsection 3.2.5.2 prior to the reporting deadline and follow Gebhardt et al. (2001) in using the latest actual payout ratio instead of a general 50% quota for all firms.

3.2.2 Gebhardt, Lee and Swaminathan (2001)

The next applied method is based on the residual income specification of Gebhardt et al. (2001). The major difference between their model and the CT model is the timing and growth rate assumed for the terminal value calculation. While Claus and Thomas (2001) assume a constant growth rate into perpetuity for every firm within a country, Gebhardt et al. (2001) imply no residual income growth in their terminal value term. However, in contrast to Claus and Thomas (2001), Gebhardt et al. (2001) include a transition period between year four and 12, in which the firm's ROE reverts linearly to the median industry ROE. The transition period reflects competition that should force ROEs across firms to converge in the medium-run within an industry.

The ICC based on the GLS method is computed by numerically solving the following equation for r_{GLS}:

$$p_0 = \underbrace{bv_0 + \frac{ROE_1 - r_{GLS}}{(1 + r_{GLS})} \cdot bv_0 + \frac{ROE_2 - r_{GLS}}{(1 + r_{GLS})^2} \cdot bv_1 +}_{\text{explicit forecast period}}$$
$$+ \underbrace{\sum_{t=3}^{11} \frac{ROE_t - r_{GLS}}{(1 + r_{GLS})^t} \cdot bv_{t-1}}_{\text{transition period}} + \underbrace{\frac{ROE_{12} - r_{GLS}}{r_{GLS} \cdot (1 + r_{GLS})^{11}} \cdot bv_{11}}_{\text{terminal value}}, \tag{3.2}$$

where ROE_t refers to the forecasted ROE for period t.

After an explicit forecasting period of three years, using earnings forecasts, book values and the cost of capital to compute residual income, Gebhardt et al. (2001) achieve mean reversion from a firm's ROE of year three to the target ROE through a simple linear interpolation. The target industry ROE is a moving median of past ROEs from all profitable firms in the same industry over the last five to 10 years. The applied industry classification is based on Fama and French (1997). In order to test the influence of the length of their transition period, Gebhardt et al. (2001) additionally apply mean reversion until year six, nine, 15, 18 and 21, but find that their results are quite insensitive to the length of the transition period. The terminal value beyond the transition period is computed as perpetuity of the residual income in period 12. This specification implicitly assumes that any growth in earnings after year 12 is value neutral. The implied rate of return is estimated at the end of June each year for every firm. Different from Claus and Thomas (2001), who accept an estimation upward bias for firms with non-December year ends, Gebhardt et al. (2001) create synthetic book values from the month of the earnings announcement until four months after the fiscal year-end using the clean surplus relation. From the fourth month onwards until the next earnings announcement, they use the actual reported book values. Future book values are generated in the same way using clean surplus accounting and assuming a constant payout ratio. For each firm they define the payout ratio as the most recent paid dividend divided by the corresponding earnings. If actual earnings are negative, they construct an earnings proxy by multiplying total assets by 0.06. Also, they restrict payout ratios to range between zero and one.

The here applied target industry ROE is a moving median of past ROEs from all profitable firms in the same industry over the last three years. I follow the Campbell (1996) industry classification instead of the Fama and French (1997) schema to avoid industry groups consisting of only a few companies in small countries (cf. Hail and Leuz, 2006, 2009). Moreover, the ICC is calculated on a monthly basis.

3.2.3 Ohlson and Juettner-Nauroth (2005)

In contrast to the first two models, which are based on the residual income valuation model, the third and fourth proxies for the ICC are derived from the abnormal earnings growth model. While residual income valuation models base a firm's value on the book value of common equity and simply adjust this value by taking into account expected future residual income, the abnormal growth in earnings approach already anchors the valuation on capitalized future expected earnings and fine tunes this value with future expected abnormal earnings growth (Easton, 2007).

For the third ICC proxy I apply the model of Ohlson and Juettner-Nauroth (2005). Their approach determines the stock price of a firm as a function of next-period EPS and DPS as well as near- and long-term growth in abnormal earnings. Since the model does not require forecasts of book values, assumptions about clean surplus accounting are unnecessary. In implementing this model, I follow the approach of Gode and Mohanram (2003), i.e., the stock price of a firm at date t is calculated as follows:

$$p_0 = \frac{e_1}{r_{OJ}} + \frac{g_{st} \cdot e_1 - r_{OJ} \cdot (e_1 - d_1)}{r_{OJ} \cdot (r_{OJ} - g_{lt})}, \tag{3.3}$$

where g_{st} is the short-term and g_{lt} is the long-term earnings growth rate and r_{OJ} refers to the ICC estimate derived from the OJ model. The required input parameters for the OJ model are the one-year-ahead EPS forecast, the one-year-ahead DPS forecast, the short-term growth rate and the perpetual growth rate. Following Gebhardt et al. (2001), Gode and Mohanram (2003) assume that the one-year-ahead payout ratio will be equal to the current one. Likewise, they create a normalized earnings number derived from total assets in case current earnings are negative and winsorize the payout ratio to lie between zero and one. After the first year earnings are forecasted only implicitly using a short-term growth rate, which converges asymptotically to a long-term growth rate. As a proxy for the short-term growth rate[3] Gode and Mohanram (2003) use the average of the growth rate between e_1 and e_2 and the long-term growth rate from I/B/E/S (LTG). In line with Claus and Thomas (2001), the perpetuity growth rate is set to be equal to the risk-free rate minus 3% considering that the analyst forecasts are given in nominal not real terms. They use the 10-year U.S. treasury bond yield as a proxy for the risk-free rate. The risk premium is calculated each year on June 30th. As in Gebhardt et al. (2001) firm level estimates of the ICC are only aggregated in a second step.

I follow all assumptions of Gode and Mohanram (2003) in implementing the OJ model except for the estimation of monthly instead of yearly ICCs.

3.2.4 Easton (2004)

The last model applied, a simple derivation of the OJ approach, is based on Easton (2004). Following related research (e.g., Hail and Leuz, 2009, 2006; Botosan et al., 2011; Easton and Monahan, 2005; Attig et al., 2008), I focus on the so called MPEG ratio, which is a special case of the Easton (2004) model that assumes the next period's expected abnormal growth in earnings to be an unbiased estimate of all period's abnormal growth expectations. Easton (2004) shows for a sample of 1,499 portfolios of 20 stocks over the period from 1981-1999 that the Spearman correlation between the MPEG proxy and his ICC measure including differentiated abnormal earnings growth expectations is 0.90. Setting $g_{lt} = 0$ and $g_{st} = \frac{e_2 - e_1}{e_1}$ in equation 3.3 and rearranging, I obtain the so-called MPEG ratio by solving the following equation:

$$p_0 = \frac{e_2 + r_{MPEG} \cdot d_1 - e_1}{r_{MPEG}^2}, \tag{3.4}$$

where r_{MPEG} refers to the ICC estimate derived from the MPEG model. Therefore, the

[3]Different from the original OJ model formulation in Subsection 2.1.3, Gode and Mohanram (2003) do not directly normalize the short-term growth rate. Moreover, the authors do not incorporate the payout ratio into the growth rate calculation.

only required input parameters are the one-year- and two-year-ahead EPS forecasts as well as a one-year-ahead DPS estimate. The model implicitly assumes that the growth in abnormal earnings stays constant into perpetuity after the first two periods.

Including only firms with December fiscal year-ends, Easton (2004) estimates the ICC as of December each year. Using mean forecasts instead of median forecasts does not change the results of his analysis.

Again, I follow all assumptions of the authors in implementing the model but calculate monthly instead of yearly ICCs.

3.2.5 Estimation procedure

In this section, I provide a detailed overview of the additional assumptions I make in implementing the four mentioned models.

First of all, I filter the data beforehand to ensure that a computation of all four ICC proxies is possible. Therefore, I do not only remove firms with missing or implausible data, but also with negative one-year-ahead earnings forecasts or negative two-year-ahead earnings growth forecasts, as the MPEG model requires a positive earnings growth rate between year one and two. In contrast to Claus and Thomas (2001), I compute the ICC on a firm level basis and only aggregate those estimates to a country or industry wide number in a second step. I estimate the ICC at the I/B/E/S release date each month, namely the Thursday preceding the third Friday of each month.

3.2.5.1 Earnings forecasts

I use analyst consensus median forecasts from I/B/E/S as earnings forecasts for the next one to five years, depending on the applied model. For most companies I/B/E/S supplies a one-year-ahead and a two-year-ahead earnings forecast as well as an estimate for the long-term earnings growth rate. The one-year-ahead consensus forecast is always related to the next unannounced fiscal year-end. This means, if earnings for the last fiscal period are not yet announced, the I/B/E/S one-year-ahead earnings forecast represents past and not forward looking data. Once annual earnings are released, I/B/E/S rolls all its forecasts forward by one year. I assign earnings forecasts accordingly to the respective fiscal period.

For periods with unavailable I/B/E/S EPS forecasts, the long-term growth rate forecast is used to generate those earnings forecasts for up to five years. If a long-term growth rate forecast is unavailable in I/B/E/S, the growth rate is estimated as the change between the two-year-ahead and three-year-ahead I/B/E/S earnings forecasts.

3.2.5.2 Book values

For the residual income estimation approach book values are required in addition to earnings forecasts. As pointed out by Easton (2007), certain data issues are encountered when matching stock prices, book values and future earnings at the same date. One of them arises from the delay between the fiscal year-end and the reporting of actual earnings and book values. Because basing the computation on actual not-yet-reported book values would contradict the principle of using only publicly available information, I create synthetic book values until the annual report is released. Annual reporting dates are, however, not available in the Thomson database. Therefore, the annual report release date is approximated by assuming that financial statements are available no later than 120 days after the fiscal year-end.

Similar to Gebhardt et al. (2001), I generate synthetic book values based on the principle of clean surplus accounting using previous book values, reported or forecasted earnings and the payout ratio. This ensures that the calculation is not based on stale book values. Reported earnings are only available after the earnings announcement date. Consequently, I use the I/B/E/S one-year-ahead earnings forecasts before the earnings announcement date.

3.2.5.3 Dividend payout ratio

All four methods require future dividends; the CT and GLS approaches to derive future book values and the OJ and MPEG models to calculate cum-dividend earnings. I calculate these future dividends assuming a constant dividend payout ratio over time.

In order to generate the future payout ratio, the most recent dividend is divided by the earnings of the same period. If actual earnings are negative, they are replaced by 6% of total assets, following Gebhardt et al. (2001). Finally the payout ratio is winsorized to lie between zero and one.

3.2.5.4 Growth rate assumptions

With regards to the terminal value growth assumptions, I follow the method-specific procedure described above. Only for the Gebhardt et al. (2001) approach, I adjust the calculated industry ROE median. Following Hail and Leuz (2006) and Hail and Leuz (2009), I use the Campbell (1996) industry classification instead of the Fama and French (1997) schema to avoid industry groups consisting of only a few companies in those countries.

3.2.5.5 Risk-free rates

Because I am dealing with a European data set and all accounting numbers and consensus forecasts are kept in the local currency before the introduction of the euro, I also use local risk-free rates on the basis of long-term country-specific bond yields to compute the risk premiums before 1999. From January 1999 onwards I apply the yield on the German 10-year government bond for all countries adopting the euro.[4] Furthermore, I make the simplifying assumption of a flat term-structure of interest rates, as consistent with the majority of researchers applying the ICC approach (e.g., Gebhardt et al., 2001; Daske et al., 2006; Fama and French, 2002).[5]

In Subsection 3.5.3, I will check the robustness of the results by reporting risk premiums based on local risk-free rates independently of the EMU membership as well as the 30-year instead of the 10-year government bond yield.

[4] The euro was introduced two years later in Greece, so I use the German 10-year government bond yield from January 2001 onwards.

[5] Claus and Thomas (2001) repeat their estimation of the equity risk premium using non-flat risk-free rates and note that the results are very similar to those based on flat risk-free rates.

3.2.5.6 Monthly estimation procedure

Finally, to ensure that book values, share prices and I/B/E/S forecasts are matched on the same date, fiscal year-end accounting data has to be adjusted to reflect information available at the monthly estimation date. To handle this matching problem, Daske et al. (2006) compute a virtual book value at the intra-year estimation date under the assumption that earnings accrue evenly over the year. Then, they deduct the share of one-year-ahead earnings, which has already been implicitly added to the book value as compounded interest. Accordingly, in the residual income calculation for year one, only the share of compounded interest on the virtual book value for the remainder of the year has to be deducted. In the Appendix, I show that this approach yields the same result as to simply impute a time equivalent synthetic price into the model. I follow the latter approach and discount prices with the ICC instead of adjusting book values and earnings forecasts. This approach can be written as:

$$p_0 = \frac{p_t}{(1 + r_E)^{\frac{\text{days(fiscal year-end 0, t)}}{365}}}, \tag{3.5}$$

where r_E refers to the ICC estimate derived from any of the four models. This procedure has the additional advantage that it can easily be applied to all four estimation methodologies.

3.3 Data and sample selection

The sample is comprised of all countries, entering the EU before 2004 as well as Switzerland. Firms contained in the Worldscope database, which are also covered by I/B/E/S are included in the data set. The availability of reliable I/B/E/S consensus forecasts limits the analysis to the period from January 1994 to December 2011. Additionally, due to the limited number of firm observations, I exclude Luxembourg from the analysis.

I obtain monthly explicit analyst EPS forecasts for the next five years as well as the long-term growth rate from the I/B/E/S database. I/B/E/S provides the median value of individual forecasts as of the Thursday before the third Friday of each month. The database also contains data for share prices, the number of shares outstanding as well as the yearly earnings release date. Yearly fiscal end dates, reported common equity, actual DPS and EPS, historical ROE, total assets and primary SIC codes are obtained from the Worldscope database. Additionally, I use MSCI country indices from Datastream to compare the calculated market risk premiums with premiums based on historical return realizations. The Appendix summarizes the input parameters.

All items are denominated in local currency. Because Worldscope translates data for euro area countries into euro retroactively using the reference exchange rate, I adjust I/B/E/S data accordingly.[6]

To generate equity risk premiums from the ICC estimates, I subtract the country-specific risk-free rates. Risk-free rates are proxied by the yields on 10-year government bonds obtained from Datastream and the Statistical Data Warehouse of the European Central Bank. For countries in the eurozone, I use the yield on the Bundesanleihe from January 1999 onwards (for Greece from January 2001 onwards).

To be included, I require the availability of information on stock prices, shares outstanding, book values, earnings and dividends for each firm-month observation. I also require one-year-ahead and two-year-ahead EPS forecasts as well as the availability of either the three-year-ahead EPS forecast or the long-term growth rate forecast from the I/B/E/S database. If the long-term growth is missing, I use the growth between the two-year- and three-year-ahead EPS forecasts.[7] If the three-year, four-year and five-year-ahead EPS forecasts are unavailable, I calculate them as follows: $e_{t+1} = e_t \cdot (1 + LTG)$.

I make several adjustments to the data set to deal with missing or implausible data. First, I exclude all firm observations with negative book values. Furthermore, because the OJ and MPEG models anchor their valuation on capitalized expected one-year-ahead earnings, I do not consider firms with negative one-year-ahead earnings forecasts. Additionally, because I use equity book values from Worldscope and shares outstanding from I/B/E/S to calculate book values per share, I rely on the compatibility of the two

[6]The adjustment is done before January 1999 for all euro area countries but Greece for which I adjust the data before January 2001.

[7]If this calculation yields a value that is either negative or larger than 400%, I exclude the observation.

databases. Hail and Leuz (2009) point out that there are a few cases of mismatches, predominantly after stock splits. I am able to eliminate the obvious cases by applying the following filter: I exclude every firm month for which the one-year-ahead forecast in month t is at least 1.95 times higher or 1/1.95 lower than both the one-year-ahead forecast in month $t-1$ and $t+1$.[8]

Table 3.1 gives an overview of the average number of monthly observations per year and country. The sum of all average country-month observations varies from 1,767 in 1994 to 2,689 in 1999. Interestingly, while the number of observations rises steadily in the first years and remains fairly constant thereafter, there are three noteworthy exceptions. First, after the dot-com bubble the number of observations drops from 2,550 in 2000 to 1,896 in 2003. Second, the recovery in the total number of observation thereafter is interrupted in 2009 by the financial crisis, when the number of observations falls substantially for all countries. Finally, the number of average monthly observations falls again slightly in 2011, where we saw a market correction caused by unhealthy fiscal balance sheets of several euro countries. All drops are attributable to crisis situations, which resulted in negative earnings forecasts or earnings growth for many firms, which in turn leads to their exclusion from the analysis. I will analyze the potential bias introduced by excluding loss-making firms in Subsection 3.5.2. The country with the highest number of observations is the U.K., followed by France and Germany. Austria, Ireland and Portugal exhibit a constantly low number of average monthly observations. Greece stands out with an enormous variation in the average number of monthly observations. While the number rises from 23 in 1994 to 101 in 2001, it reaches a new trough in 2011. Particularly visible in Greece was the eurozone crisis, where the average number of monthly firm observations decreased from 64 in 2008 to 16 in 2011.

Table 3.2, which shows the monthly average number of observations per industry, also reveals some differences in the development of certain industries. While the average number of monthly observations clearly decreased in the construction, food and tobacco as well as the textile industry, a substantial rise is observable especially in the services

[8] I choose 1.95 as the barrier to be able to identify cases, in which a 2:1 stock split adjustment in the database takes place with a one month delay.

Table 3.1: Yearly number of observations per country

Year	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
1994	32	43	97	65	31	204	208	23	30	62	112	24	59	56	719	1,767
1995	40	49	107	72	46	244	229	42	30	69	118	30	86	77	764	2,003
1996	41	50	110	77	52	265	204	62	30	86	119	31	81	90	792	2,091
1997	51	57	120	96	56	324	246	84	30	98	133	41	92	121	950	2,499
1998	48	64	127	98	62	341	305	74	37	118	141	41	103	152	961	2,672
1999	42	66	128	86	79	377	320	85	38	121	153	42	104	164	883	2,689
2000	37	73	133	85	80	374	324	61	41	111	138	38	97	160	799	2,550
2001	30	77	132	64	80	324	298	101	38	132	119	30	96	132	630	2,283
2002	26	66	119	58	79	288	236	95	33	123	98	24	93	113	576	2,025
2003	23	65	108	54	74	276	208	65	32	118	90	21	82	112	566	1,896
2004	28	65	115	55	79	275	217	66	30	124	88	19	86	113	585	1,944
2005	25	63	120	59	73	289	228	62	28	134	84	23	83	114	702	2,088
2006	31	66	134	58	87	318	268	73	28	150	88	29	88	128	728	2,273
2007	38	73	132	59	84	350	308	73	31	166	91	27	89	137	749	2,406
2008	36	72	126	56	75	327	317	64	24	152	78	24	82	133	707	2,275
2009	21	55	104	36	58	264	260	48	18	118	52	23	62	120	601	1,840
2010	30	56	125	45	77	299	319	35	22	143	71	26	74	156	697	2,175
2011	30	61	121	47	80	305	301	16	21	135	69	18	70	163	686	2,123

The table contains the average monthly number of firm observations per year for each of the EU 15 countries (except Luxembourg) and Switzerland as well as the full sample. The numbers reported are based only on those observations for which every method (CT, GLS, MPEG and OJ) returns an ICC estimation. The observation period spans from January 1994 to December 2011. (Country abbreviations: AUT= Austria, BEL= Belgium, CH= Switzerland, DK= Denmark, FIN= Finland, FRA= France, GER= Germany, GRE= Greece, IRE= Ireland, ITA= Italy, NL= Netherlands, POR= Portugal, SPA= Spain, SWE= Sweden, UK= United Kingdom, EUR= all sample countries)

Table 3.2: Yearly number of observations per industry

Year	BAS	CAP	CDR	CNS	FRE	FTB	LSR	Others	PET	SVS	TEX	TRN	UTI	All
1994	176	183	276	157	268	148	87	57	21	104	160	40	91	1,767
1995	216	218	310	178	296	150	94	64	24	117	184	54	98	2,003
1996	222	226	332	172	307	153	105	71	24	126	188	60	104	2,091
1997	261	268	386	215	366	166	150	91	26	169	216	72	113	2,499
1998	263	276	399	214	402	176	170	97	30	217	227	77	124	2,672
1999	267	275	382	203	395	170	178	97	29	277	220	78	118	2,689
2000	227	261	358	167	361	147	180	104	21	343	199	78	105	2,550
2001	193	225	306	145	314	134	164	98	12	344	167	69	111	2,283
2002	183	200	251	125	286	125	139	86	18	291	149	66	105	2,025
2003	180	199	225	111	272	112	128	86	15	260	140	65	102	1,896
2004	175	210	225	109	284	112	130	88	20	275	134	69	114	1,944
2005	179	213	248	112	303	110	145	94	28	320	133	75	127	2,088
2006	190	237	272	121	336	115	142	106	32	378	137	72	136	2,273
2007	208	252	293	128	374	111	132	118	42	396	134	80	139	2,406
2008	211	233	267	110	364	111	123	124	44	364	118	72	132	2,275
2009	181	174	208	82	275	103	93	99	46	309	96	58	114	1,840
2010	207	239	257	115	326	102	112	112	52	339	114	70	129	2,175
2011	202	237	252	111	327	96	108	104	47	342	112	67	117	2,123

The table contains the average monthly number of firm observations per year for each of the 13 industries as well as the full sample. The numbers reported are based only on those observations for which every method (CT, GLS, MPEG and OJ) returns an ICC estimation. The observation period spans from January 1994 to December 2011. (Industry classification according to Campbell (1996): BAS= basic industry, CAP= capital goods industry, CDR= consumer durables industry, CNS= construction industry, FRE= finance/ real estate industry, FTB= food/ tobacco industry, LSR= leisure industry, PET= petroleum industry, SVS= services industry, TEX= textiles/ trade industry, TRN= transportation industry, UTI= utilities industry)

industry. For the latest, the average number of monthly observations tripled within the 18 years period. Crisis periods are especially visible in the financial services sector, where the number of average observations decreased from 361 in 2000 to 272 in 2003 and from 364 in 2008 to 275 in 2009.

Finally, Table 3.3 shows the total number of observations per industry and country. The table reveals that the industrial composition of different countries as well as the geographical distribution of different industries vary significantly. For example, while no Portuguese observation falls into the capital goods industry, approximately 26% do so for Switzerland. Similarly, observations of the petroleum industry are heavily clustered in the U.K. and France, while the food and beverage industry is far more evenly distributed across countries.

3.4 Empirical results

I compute the ICC for each firm and month at the I/B/E/S release date using the four methods described in Section 3.2. For portfolio level estimates I calculate value-weighted means. A firm's market capitalization is calculated as the I/B/E/S share price multiplied by the I/B/E/S number of shares outstanding. Subsection 3.5.1 also presents equally weighted estimates.

Despite the growing body of literature evaluating different models of the ICC, there is currently no consensus about the theoretical or empirical superiority of a particular model.[9] Pastor et al. (2008) show that, in general, any ICC method can be used to explain time variable expected returns. Daske et al. (2010) simulate a model economy, in which the true cost of capital is known and calibrate it to empirical data in order to compare the true cost of capital to the ICC estimates from different methods. They show that abnormal earning growth models generally overestimate the true cost of capital, whereas residual income models lead to a slight underestimation. The authors suggest combined estimates to compensate the distortions from individual methods. Following recent research (e.g., Hail and Leuz, 2006, 2009; Attig et al., 2008) I use the

[9]See Section 2.2 for a detailed discussion on the literature evaluating different ICC approaches.

Table 3.3: Total number of observations per country and industry

Country	BAS	CAP	CDR	CNS	FRE	FTB	LSR	Others	PET	SVS	TEX	TRN	UTI	All
AUT	801	723	1,043	772	1,405	344	213	122	147	178	340	264	939	7,291
BEL	1,250	1,013	1,870	566	3,446	1,268	658	249	0	901	1,125	241	869	13,456
CH	3,393	6,707	2,602	670	4,577	1,250	676	613	36	1,642	1,717	870	1,141	25,894
DK	1,613	1,358	2,240	1,366	2,534	1,165	584	378	82	719	646	997	373	14,055
FIN	1,872	1,868	2,371	721	1,159	1,153	554	996	130	1,768	1,157	496	794	15,039
FRA	6,059	4,857	9,738	2,630	7,253	4,964	3,040	3,804	955	11,729	5,711	1,484	3,114	65,338
GER	5,516	9,570	8,768	2,766	8,704	1,575	1,969	1,488	384	8,991	3,621	1,068	3,141	57,561
GRE	2,039	436	1,477	1,715	1,877	1,230	710	137	179	1,146	1,141	534	911	13,532
SPA	1,836	967	983	2,819	3,525	1,810	904	289	195	800	1,177	565	2,489	18,359
IRE	640	35	444	1,090	1,177	1,046	460	85	91	386	552	427	67	6,500
ITA	1,534	2,048	3,609	1,801	7,031	673	1,673	446	302	1,474	1,621	918	2,791	25,921
NL	1,873	2,080	3,983	1,908	2,543	1,768	1,262	836	0	3,241	1,512	724	362	22,092
POR	903	0	268	990	1,070	754	412	156	35	217	372	167	770	6,114
SWE	3,372	4,607	3,414	1,025	3,462	777	1,158	1,409	330	4,414	1,240	682	1,000	26,890
UK	12,173	13,240	20,149	10,070	20,527	8,326	14,303	9,333	3,522	22,075	12,005	5,245	6,181	157,149
EUR	44,874	49,509	62,959	30,909	70,290	28,103	28,576	20,341	6,388	59,681	33,937	14,682	24,942	475,191

The table contains the total number of firm-month observations per industry and country. The numbers reported are based only on those observations for which every method (CT, GLS, MPEG and OJ) returns an ICC estimation. The observation period spans from January 1994 to December 2011. For country and industry abbreviations see Table 3.1 and 3.2.

average monthly estimates of the four methods. For reasons of comparability, I only include firms with sufficient information to compute all four ICC estimates.

In Subsection 3.5.2, I will check the robustness of the results by reporting estimates for each of the four methods separately.

3.4.1 Country level estimates

Table 3.4 presents the summary statistics for the monthly ICC, the monthly implied risk premium and the annual realized premium per country.

The table shows that implied equity risk premium estimates are relatively homogenous across European countries. The mean market risk premium for the sample countries ranges from 4.83% for Italy to 7.48% for Ireland. France, Germany and the U.K., the three largest countries in the sample, have implied risk premiums below 5.5%, while only three of the remaining 12 countries, namely Spain, Italy and Sweden have similarly low premiums. This could be evidence of a small-country premium.

The comparison of the statistics of the implied and historical risk premium estimates emphasizes several desired features of the ICC approach. The documented high volatility of realized returns, as well as the criticism expressed by Elton (1999) that significant information events do not necessarily cancel each other out in small periods of study, are confirmed. Foremost, the standard deviation of the implied risk premium estimates is only around one tenth of the standard deviation of historical returns for most countries. This striking difference in volatility, previously identified by Lee et al. (2009), is attributable to the noise in realized returns, i.e., unexpected positive or negative cash flow news that result in unexpectedly high or low realized returns. Implied risk premium estimates directly take into account revisions in cash flow expectations and thereby eliminate volatility caused by cash flow surprises.

Furthermore, it seems hard to explain the high returns for Denmark, Finland and Sweden with an additional risk premium for these countries of approximately 10% compared to Ireland or Austria. In fact, these high historical returns must be driven by unexpected positive cash flow news. It is counter-intuitive that stock market booms

Table 3.4: Country level descriptive statistics for the ICC, the implied risk premium and the realized return (value-weighted)

	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
Panel A: ICC (value-weighted)																
ICC arithm. mean	10.97	10.45	9.12	10.45	10.97	10.07	9.78	13.69	12.29	10.14	10.49	10.84	10.62	10.55	10.43	10.17
ICC geom. mean	11.01	10.48	9.16	10.49	10.99	10.11	9.82	13.61	12.34	10.17	10.53	10.87	10.66	10.59	10.48	10.21
ICC median	10.56	10.38	9.12	10.24	10.34	9.91	9.60	12.15	11.95	9.62	10.51	10.63	10.47	10.50	10.16	10.08
ICC st. dev.	2.00	1.61	1.00	1.46	2.72	1.48	1.71	4.42	1.60	2.09	1.63	2.03	1.60	1.75	1.30	1.36
ICC max.	17.23	17.28	11.58	14.39	19.88	13.10	14.38	41.17	18.36	16.27	14.50	16.61	14.48	15.54	13.99	13.47
ICC min.	7.64	6.77	7.14	8.10	6.14	7.34	6.65	7.29	9.57	6.75	7.59	6.88	7.40	6.94	8.17	7.73
Panel B: Implied risk premium (value-weighted)																
IRP arithm. mean	6.39	5.79	6.15	5.51	6.12	5.47	5.24	6.74	7.48	4.83	5.95	5.66	5.46	5.38	5.19	5.42
IRP geom. mean	6.38	5.80	6.17	5.52	6.13	5.47	5.24	6.63	7.50	4.80	5.95	5.66	5.45	5.38	5.20	5.42
IRP median	5.74	5.54	5.79	5.21	5.85	5.14	5.19	6.44	7.08	5.14	5.58	5.32	5.74	5.01	4.91	5.23
IRP st. dev.	2.81	1.94	1.48	1.96	2.12	2.11	2.58	4.96	2.18	3.54	2.26	2.29	2.58	1.96	2.16	2.20
IRP max.	14.11	14.07	10.06	10.89	10.50	11.17	12.02	38.97	14.17	14.34	11.42	12.22	12.55	10.28	11.06	10.96
IRP min.	0.69	1.87	3.73	2.68	0.79	1.97	1.30	-1.80	2.86	-1.67	2.39	1.77	1.27	1.35	2.41	2.42
Panel C: Average number of observations per month																
N	33	62	119	65	69	302	266	62	30	120	102	28	84	124	727	2,193
Panel D: Realized MSCI risk premium																
MSCI arithm. mean	5.98	8.92	8.37	13.36	19.95	8.08	8.98	7.43	5.00	6.75	9.16	8.36	12.68	15.36	7.36	
MSCI geom. mean	0.94	4.17	6.10	10.00	9.34	5.20	5.45	-2.51	-0.15	3.75	6.21	4.62	9.40	10.64	6.01	
MSCI median	3.56	10.52	8.28	17.91	13.20	7.90	18.61	15.55	11.09	7.49	9.26	9.88	20.55	21.95	13.42	
MSCI st. dev.	29.74	29.18	22.35	26.42	57.78	24.46	26.22	43.52	27.81	24.97	24.20	28.49	26.81	32.81	16.59	
MSCI max.	59.89	56.45	57.34	56.72	196.78	51.93	45.90	76.07	37.56	58.59	45.91	74.49	51.47	90.34	27.66	
MSCI min.	-66.58	-64.39	-34.10	-44.70	-52.32	-39.75	-43.06	-64.25	-70.25	-46.57	-45.18	-49.28	-36.96	-41.91	-28.46	

The table contains the summary statistics for the monthly time-series of the ICC, the implied risk premium and the realized return for each of the EU 15 countries (except Luxembourg) and Switzerland. The statistics are computed over the period from January 1994 to December 2011. Panel A exhibits descriptive statistics for the ICC, calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Firm level estimates are aggregated using value-weighting. Implied risk premiums in Panel B are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. Panel C shows the average monthly number of observations for which all four methods generate results. In addition, summary statistics for the monthly annualized realized excess returns per country are given in Panel D, computed as the time-series of the MSCI country indices minus the yield on the local risk-free rate. All numbers are reported in percent per year except for the number of observations. For country abbreviations see Table 3.1.

are accompanied by higher expected returns, while stock market crashes are followed by lower return expectations. On the contrary, one would expect that the risk aversion of market participants rises in times of crisis, which should be reflected in higher expected returns. Historical premiums are, thus, generally unsuited for the estimation of time-varying risk premiums, because expected and realized returns move in opposite directions in the short-run. Increasing expected returns result in a decrease of stock prices, as future cash flows are being discounted with a higher discount rate.

In addition, basing the expected risk premium on a negative average historical risk premium, as for instance in the case of geometric means for Ireland and Greece, is incompatible with finance theory, which assumes a linear positive relationship between risk and return. The weakness of historical risk premiums in reflecting this risk-return relation is supported by the fact that all countries have negative excess return observations. The implied risk premium shows negative values only for two countries, namely for Greece and Italy. Its application is much more in line with the notion of a positive risk-return relation.[10]

Some of the mentioned poor statistical properties of realized return estimates in Table 3.4, however, are due to the short observation period considered. It is common in the literature to estimate historical premiums over substantially longer horizons than 18 years. Dimson et al. (2008) compute historical arithmetic country risk premiums over government bonds from 1900 to 2005 and find a substantially smaller range of values, with a minimum risk premium of 3.27% for Denmark and a maximum risk premium of 9.98% for Japan. However, using such a long period has the severe drawback that changes in the expected risk premium are not captured timely, as past data is heavily weighted. Using historical risk premiums as a proxy for expected ones, computed over a hundred years, Japan will have the highest expected premium for many years to come, irrespective of what investors currently expect. This example is part of a broader argument: Realized returns, by definition, capture the past, not the future. The implied estimate for the market risk premium is advantageous because it is conditional on the current economic state. It always reflects the prevailing expected risk perception of

[10] Cf. Pastor et al. (2008) and Section 2.2 for a detailed discussion on the detection of a positive risk-return relation when using the ICC approach.

Figure 3.1: Time-series characteristics of the ICC and the implied risk premium for the full sample

The figure plots the monthly time-series of the annual ICC and the implied risk premium over the period from January 1994 to December 2011. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Firm level estimates per month are aggregated using value-weighting. The implied risk premium is computed as the difference between the ICC and the local 10-year government bond yield. For euro area countries the yield on the German 10-year government bond is used after the euro introduction.

investors. As a result, the implied market risk premium should be superior in explaining the timing and magnitude of different market phases.

Such changes in risk perception can be seen in Figure 3.1 and Figure 3.2 as well as Table 3.5. Table 3.5 breaks down the mean implied risk premiums by country and observation year and Figure 3.1 and Figure 3.2 plot the ICC and risk premium for the full sample and each country individually.

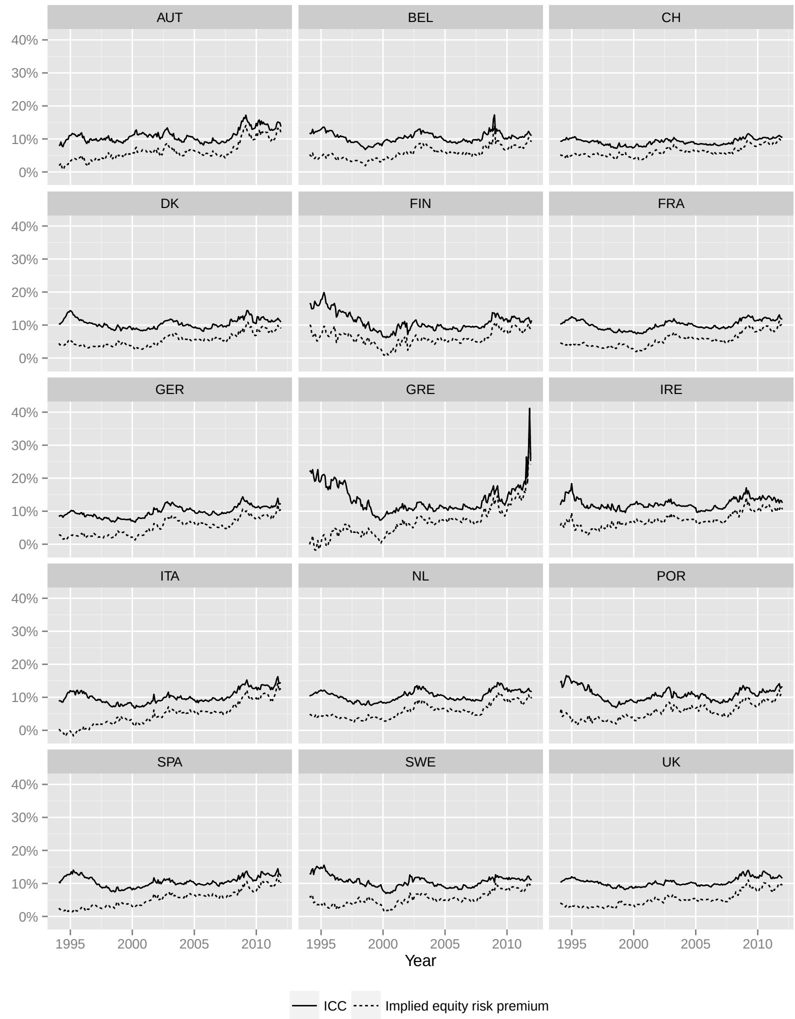
Following a phase of fluctuating risk premiums at the beginning of the observation period, I observe an increase in risk perception for the full sample, resulting from the terrorist attack on the World Trade Center in September 2001. Following the burst of the internet bubble, the charts show a continuing rise in market risk premiums. Afterwards, there is a long period of fairly stable or slightly falling risk premiums until the beginning of the financial crisis. This event presents an unprecedented example of the adjustment speed of investors' risk perception. For instance in the U.K., the implied equity risk premium more than doubled from 4.5% in June 2007 to 11.1% in March 2009. In the course of the second half of 2009 risk premiums decline again but do not reach pre-crisis levels. The recent eurozone crisis has led to new peaks in the European implied risk premium. Looking at the country level estimates, especially Greece stands out with risk premiums of up to 39% in 2011. In summary, the charts and the table provide substantial evidence to support a time-varying risk premium. The required risk premium is conditional on the state of the economy, which means that the average investor expects less compensation for systematic risk during bull markets than during bear markets.

In accordance with Pastor et al. (2008) and Daske et al. (2006), I am able to observe a tendency of rising market risk premiums for the European sample countries over time. In order to verify the visual time trend statistically, Table 3.6 divides the observation period into two roughly equally long subperiods.

The table shows that all country risk premiums are significantly higher in the second subperiod. While the average risk premium across the European sample is 3.68% between 1994 and 2002, the estimate rises to 7.06% in the second part of the sample period. The difference of more than 3% is highly statistically significant.

Additionally, I run a simple regression of the risk premium on time and find a positive coefficient (annualized) of on average 0.39% across countries with a highly significant t-statistic, except for Finland. The upward trend is accompanied by declining risk-free rates, which have a negative coefficient on time (annualized) in the sample of 0.22% (minimum modulus t-statistic: 3.61). The ICC estimates, on the other hand, show

Figure 3.2: Time-series characteristics of the ICC and the implied risk premium for each country



The figure plots the monthly time-series of the annual ICC and the implied risk premium over the period from January 1994 to December 2011 for every country in the sample. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Firm level estimates per month are aggregated using value-weighting. The implied risk premium is computed as the difference between the ICC and the local 10-year government bond yield. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. For country abbreviations see Table 3.1.

Table 3.5: Implied risk premium per year and country (value-weighted)

Year	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
1994	2.15	4.52	4.87	4.39	7.13	4.11	2.15	-0.01	6.74	-0.55	4.43	4.64	1.80	4.61	3.28	3.26
1995	4.09	5.18	5.26	4.14	8.01	4.20	2.74	1.98	5.08	-0.48	4.52	2.82	1.91	3.34	2.98	3.35
1996	3.25	4.23	5.11	3.39	7.09	3.71	2.52	4.35	3.96	0.93	3.90	3.24	2.79	3.03	2.82	3.15
1997	4.24	3.40	5.01	3.69	6.36	3.17	2.24	4.01	4.97	2.04	3.12	3.16	2.80	4.19	2.83	3.09
1998	4.81	2.88	4.83	4.12	5.55	3.53	2.79	3.37	5.97	2.68	3.48	2.84	3.20	4.98	3.40	3.49
1999	5.33	3.70	4.80	4.12	3.52	3.49	2.95	1.97	6.49	3.38	3.72	4.20	3.78	4.08	3.62	3.62
2000	6.39	4.11	4.08	2.98	1.53	2.37	2.29	3.25	6.72	1.94	3.44	3.67	3.42	2.04	3.62	2.95
2001	6.19	5.53	5.78	3.77	4.84	4.35	4.80	6.06	7.00	3.77	5.60	5.48	5.25	4.49	5.11	4.92
2002	6.91	6.92	6.49	5.74	5.23	5.75	6.45	6.60	7.73	4.98	7.36	6.77	6.05	6.27	5.42	5.90
2003	6.16	7.79	7.11	6.70	5.62	6.76	7.61	7.31	7.83	5.94	7.93	6.23	6.06	6.17	5.55	6.46
2004	6.24	6.30	6.28	5.48	5.23	6.09	6.30	6.85	7.50	5.54	6.45	6.83	6.31	4.96	5.20	5.83
2005	5.72	5.63	6.37	5.45	5.48	5.92	6.22	7.51	6.64	5.51	6.08	7.04	6.32	5.30	4.98	5.72
2006	5.30	5.56	5.75	5.70	5.34	5.41	5.39	7.32	7.01	5.47	5.72	5.08	6.17	5.03	5.00	5.43
2007	5.09	5.29	5.65	5.76	5.11	5.04	5.26	6.80	7.83	5.46	4.83	4.70	6.07	5.29	5.01	5.28
2008	8.96	8.81	7.14	7.41	7.24	7.37	8.08	10.74	10.08	8.47	7.77	7.86	7.58	7.19	7.65	7.71
2009	11.31	8.13	8.53	8.88	9.03	8.86	8.85	10.72	11.19	10.23	10.18	8.37	8.72	8.60	8.97	9.01
2010	11.86	7.66	8.61	8.93	9.12	9.08	8.48	13.62	11.26	10.47	9.32	8.89	9.88	8.52	9.23	9.15
2011	10.97	8.48	9.07	8.57	8.71	9.16	9.25	19.92	10.66	11.22	9.23	10.10	10.11	8.67	8.80	9.23

The table contains the average monthly implied equity risk premium per year for each of the EU 15 countries (except Luxembourg) and Switzerland as well as the full sample. The observation period spans from January 1994 to December 2011. The implied risk premium is calculated as the difference between the value-weighted ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All numbers are reported in percent per year. For country abbreviations see Table 3.1.

Table 3.6: Country level descriptive statistics for the implied risk premium (value-weighted) for two subperiods

Country	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
Panel A: First subperiod																
Arithm. mean	4.64	4.50	5.14	4.01	5.44	3.83	3.16	3.01	5.95	2.03	4.41	3.82	3.40	4.07	3.59	3.68
Geom. mean	4.63	4.49	5.13	4.00	5.42	3.83	3.15	2.98	5.94	2.01	4.40	3.81	3.39	4.07	3.58	3.68
Median	4.83	4.24	5.09	3.88	5.66	3.77	2.57	3.11	6.20	2.11	4.00	3.54	3.27	4.01	3.34	3.28
St. dev.	1.71	1.29	0.80	0.90	2.11	1.01	1.55	2.47	1.43	1.86	1.40	1.46	1.43	1.30	0.95	1.05
Max.	8.75	8.66	7.41	6.99	9.76	6.95	8.16	8.23	9.45	6.24	9.11	8.22	7.23	7.04	6.31	6.87
Min.	0.69	1.89	3.70	2.65	0.82	1.97	1.36	-2.56	2.92	-1.55	2.43	1.52	1.18	1.38	2.43	2.47
Panel B: Second subperiod																
Arithm. mean	7.94	7.03	7.17	7.00	6.73	7.05	7.26	9.90	9.08	7.54	7.49	7.15	7.43	6.66	6.68	7.06
Geom. mean	7.91	7.02	7.16	6.99	6.71	7.04	7.25	9.82	9.05	7.51	7.48	7.13	7.41	6.64	6.66	7.05
Median	6.70	6.98	6.67	6.56	5.88	6.43	6.94	7.93	8.38	6.04	6.97	6.96	6.63	6.44	5.69	6.40
St. dev.	2.80	1.62	1.28	1.64	1.82	1.65	1.62	4.36	2.35	2.45	1.87	1.95	1.73	1.67	1.99	1.74
Max.	14.29	14.98	10.06	10.86	10.39	11.19	11.68	27.73	15.63	14.15	11.46	12.42	12.46	10.33	11.24	10.95
Min.	4.35	4.46	5.23	4.68	4.22	4.48	4.70	5.63	6.10	4.73	4.48	3.90	5.38	4.36	4.38	4.76
Panel C: T-values mean comparison																
	10.45	12.69	13.94	16.61	4.80	17.35	18.98	14.25	11.80	18.61	13.69	14.25	18.65	12.68	14.59	17.36

The table contains the summary statistics for the monthly time-series of the implied risk premium for each of the EU 15 countries (except Luxembourg) and Switzerland. The statistics are computed over two subperiods: The first subperiod ranges from January 1994 to December 2002; the second subperiod ranges from January 2003 to December 2011. The implied risk premium is calculated as the difference between the value-weighted ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All quantities except the t-values are reported in percent per year. For country abbreviations see Table 3.1.

stronger reversion to a constant mean over the same period with no visible evidence of a positive or negative trend. This rules out other possible explanations for the positive trend in risk premiums, such as an increasing analyst bias or a changing composition of the sample towards smaller firms.

A possible interpretation of the findings is that investors expect rather a constant absolute compensation for equity investments than a steady level of relative return compared to a risk-free benchmark. When running a simple regression of the risk premium on the risk-free rate, I find a significant inverse relationship between the equity risk premium and government bond rates for most countries. This suggests a much greater stability in total required equity returns than often assumed by classical asset pricing models, such as the CAPM. These models presume that a 1% increase in the risk-free rate translates into a 1% increase in equity returns. The presented results, however, indicate that the rise in the risk-free rate is absorbed to a great extent by a decreasing market risk premium. This finding is in line with Harris and Marston (2001).

The positive trend also explains differences in the level of the mean risk premium estimates as compared to previous studies. For example, Claus and Thomas (2001) report an implied risk premium of 2.60% for France (1987 to 1998), 2.02% for Germany (1988 to 1997) and 2.81% for the U.K. (1989 to 1998). Pastor et al. (2008) present similar low estimates of value-weighted risk premiums for those countries from 1990 to 2002. Also, their sample includes Italy with a mean of less than 1% (1990 to 2002). For a German sample ranging from 1989 to 2002, Daske et al. (2006) find an equally weighted mean of 3.9% applying a modified GLS method. In contrast to the findings of Claus and Thomas (2001) and Fama and French (2002), applying the implied risk premium approach does not help to explain the "Equity Premium Puzzle" over the period from 1994 to 2011. The approximation of expected returns with the ICC does not lead to the conclusion of decreasing expected discount rates, which would have resulted in unexpected capital gains.

3.4.2 Industry level estimates

Aside from estimating country level market risk premiums, the ICC approach can also be used to derive industry-specific risk premiums or beta factors. The industry level results can be seen in Table 3.7. The used industry classification, which follows Campbell (1996), is the same as in the GLS-method for the industry ROE median.

The tendency of rising risk premiums documented in the last paragraph, can be confirmed for all industries. This finding provides evidence that the positive trend in market risk premiums is not driven by certain industries but seems to be a more general economic effect. Looking at differences in risk premiums across industries, especially the finance and real estate industry sticks out with a risk premium of 12.08% in 2011. Comparing this number to the 1994 estimate for the same industry yields an increase of over 300%. While the financial industry had one of the lowest risk premiums at the beginning of the observation period, already before the financial crisis in 2007 its mean estimate was the highest of all industries with 6.26%. As a result of the financial crisis and the ongoing eurozone crisis, the industry premium almost doubled again. The textiles industry, on the contrary, has the lowest equity risk premium with a number of only 6.58% in 2011.

In a second step, I derive beta coefficients from the industry level risk premiums. These can be seen in Panel B of Table 3.7. The beta coefficient measures an industry's volatility in relation to the overall market, which is in this case the European market sample. A beta higher than one indicates an above average systematic risk of the stocks within a certain industry, whereas a beta below one means that an industry is less susceptible to fluctuations of the market portfolio. Looking at Panel B significant variations across industries but also across time can be observed. While the beta estimates span from 0.52 for the leisure industry to 1.72 for the services industry in 1994, their range tightened until 2011 to a minimum of 0.64 for the textile industry and a maximum of 1.26 for the finance and real estate industry, suggesting an increase in similarity across industries. Interestingly, the industries with the highest beta factor in 1994, food and tobacco and services, show values substantially below one in 2011, indicating a reduction in their systematic risk. Not surprisingly the financial industry

Table 3.7: Implied risk premium and beta coefficient per year and industry (value-weighted)

Year	BAS	CAP	CDR	CNS	FRE	FTB	LSR	Others	PET	SVS	TEX	TRN	UTI
Panel A: Implied risk premium (value-weighted)													
1994	4.21	3.47	4.53	2.98	2.83	3.04	2.45	4.23	3.54	4.05	2.83	4.09	2.40
1995	4.65	3.90	4.91	3.45	2.36	3.13	2.58	4.49	2.89	3.82	2.88	4.32	2.60
1996	3.52	4.17	4.80	3.35	2.51	2.97	2.37	3.36	2.11	3.24	2.74	4.10	2.99
1997	3.77	4.29	4.32	3.59	2.22	2.91	2.83	4.20	1.89	3.18	2.96	4.81	3.02
1998	3.86	5.63	5.31	4.57	2.72	3.03	3.68	5.37	3.88	3.70	3.78	5.05	2.75
1999	3.77	5.32	4.55	4.95	3.61	3.36	3.74	5.52	4.15	4.18	3.39	4.89	2.35
2000	2.99	3.97	3.17	5.46	3.71	3.68	2.99	2.90	2.71	2.53	3.01	5.29	1.40
2001	3.74	6.76	6.88	6.45	5.27	4.92	4.81	5.67	3.33	5.21	4.64	6.26	3.84
2002	4.76	7.45	7.76	7.05	6.74	5.46	5.35	7.88	4.43	6.07	5.40	7.07	5.05
2003	5.40	6.93	8.25	8.37	7.13	6.58	5.78	7.63	4.29	5.54	6.30	7.29	5.45
2004	5.26	5.72	6.34	7.17	6.50	5.76	4.73	6.12	5.44	4.40	5.82	6.52	5.22
2005	5.28	5.50	6.47	6.31	6.07	5.63	4.51	5.61	4.69	4.81	5.34	5.78	5.62
2006	4.79	5.32	6.27	5.62	5.82	5.23	4.52	5.60	4.31	4.85	4.91	5.32	5.50
2007	4.61	5.09	5.91	5.40	6.26	4.38	4.17	5.40	4.29	4.95	4.60	5.47	4.82
2008	6.81	7.38	7.99	7.88	10.37	5.98	6.75	7.19	8.33	6.57	6.13	7.17	6.75
2009	8.47	7.66	9.69	8.47	10.93	7.20	7.33	7.57	12.16	6.97	6.34	8.41	8.13
2010	8.61	7.81	9.66	9.32	11.70	7.06	7.06	7.51	12.39	7.25	6.51	8.61	7.44
2011	8.50	8.25	9.42	9.82	12.08	7.36	7.81	8.20	10.20	7.73	6.58	8.86	8.62
Panel B: Implied beta (value-weighted)													
1994	1.36	1.33	1.16	0.66	0.61	1.55	0.52	1.51	0.99	1.72	1.05	1.13	0.72
1995	1.46	1.29	1.39	0.97	0.52	1.32	0.53	1.45	0.74	1.29	0.89	1.30	0.79
1996	1.14	1.50	1.53	0.98	0.67	1.21	0.63	1.05	0.53	1.14	0.76	1.55	0.99
1997	1.25	1.71	1.50	1.14	0.55	1.13	0.92	1.46	0.58	1.09	0.93	1.86	0.94
1998	1.18	1.87	1.72	1.39	0.56	0.98	1.14	1.88	1.09	1.15	1.10	1.83	0.80
1999	1.06	1.86	1.51	1.55	0.87	1.08	1.16	1.90	0.78	1.50	1.01	1.88	0.55
2000	1.09	1.43	1.07	2.18	1.22	1.65	1.15	0.93	1.02	1.10	1.04	2.43	0.28
2001	0.69	1.55	1.45	1.36	1.04	1.17	0.96	1.34	0.76	1.23	0.93	1.46	0.80
2002	0.70	1.22	1.35	1.31	1.12	0.95	0.88	1.59	0.78	1.05	0.97	1.26	0.94
2003	0.81	1.04	1.24	1.45	1.09	1.09	0.86	1.21	0.85	0.81	1.03	1.25	0.88
2004	0.83	0.93	1.15	1.44	1.16	1.10	0.70	1.01	0.83	0.66	0.98	1.21	0.88
2005	0.86	0.87	1.20	1.31	1.12	1.01	0.68	0.94	0.88	0.71	0.90	1.03	0.97
2006	0.84	0.79	1.11	1.10	1.09	0.97	0.62	0.91	1.05	0.72	0.81	0.94	1.09
2007	0.82	0.78	1.03	1.08	1.25	0.78	0.63	0.91	1.20	0.81	0.72	0.96	0.92
2008	0.83	0.86	1.06	1.11	1.32	0.73	0.87	0.88	1.21	0.81	0.78	0.92	0.84
2009	0.86	0.84	0.95	1.03	1.25	0.80	0.93	0.90	1.28	0.77	0.72	0.94	0.96
2010	0.88	0.83	1.00	1.07	1.24	0.77	0.97	0.86	1.33	0.79	0.69	0.97	0.96
2011	0.92	0.88	1.01	1.06	1.26	0.78	0.87	0.87	1.15	0.78	0.64	0.98	1.03

The table contains the average monthly implied equity risk premium and the beta coefficient per year for each of the 13 industries. The observation period spans from January 1994 to December 2011. Implied risk premiums in Panel A are calculated as the difference between the value-weighted ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. Premiums are reported in percent per year. Panel B reports implied beta coefficients for each industry. Firm beta coefficients are calculated as the quotient of the firm's implied risk premium and the implied European market risk premium. Firm level beta estimates are aggregated using value-weighting. For industry abbreviations see Table 3.2.

exhibits the highest beta coefficient in 2011 with 1.26.

3.5 Sensitivity analysis

In this section, I will evaluate the impact of certain assumptions on the level and the time-series characteristics of the ICC and equity risk premium. First, I compare the equally weighted equity premiums with the value-weighted results from the main empirical part. Next, the relation between the choice of method and the implied risk premium will be analyzed. As a third robustness check, I will re-calculate the risk premiums using local risk-free rates over the full observation period as well as 30-year bond yields. Afterwards, the sensitivity of the CT estimates towards the assumed terminal growth rate will be tested. And finally, I respond to the criticism of potential analyst forecast bias by using actual reported earnings instead of I/B/E/S forecasts. I only present country level or full sample results to give an indication of the direction and amplitude of the influence of certain assumptions and estimation choices.

3.5.1 Weighting procedure

First, the sensitivity of the results towards the weighting procedure shall be analyzed. Pastor et al. (2008) point out that relying the analysis on I/B/E/S forecasts could bias the data set towards larger firms, leading to their overemphasis compared to the country's market portfolio. To mitigate this concern, they decide to equally weight their ICC. I follow the authors in calculating a country's equally weighted ICC in the following analysis.

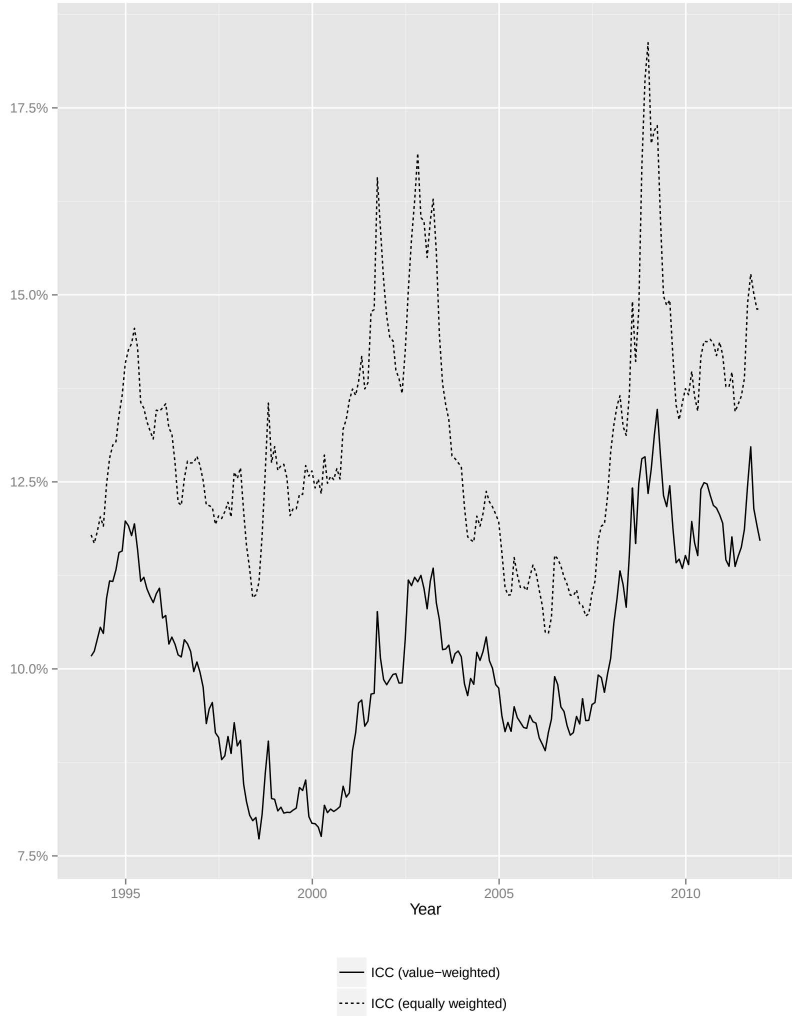
Table 3.8 presents summary statistics for the equally weighted ICC and risk premium and Figure 3.3 shows the time series of the equally weighted ICC in comparison with the value-weighted results. Similar to Pastor et al. (2008), I find higher estimates for smaller firms, resulting in roughly 3% higher equally weighted risk premiums for the European sample. This result can be explained by the fact that large companies, which have a greater weight in the value-weighting procedure, generally have lower risk premiums. The time-series characteristics remain fairly unchanged by the weighting,

Table 3.8: Country level descriptive statistics for the ICC and the implied risk premium (equally weighted)

	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
Panel A: ICC (equally weighted)																
ICC arithm. mean	12.29	12.13	11.25	13.15	13.89	12.52	12.93	15.03	14.29	12.22	13.30	12.96	11.49	13.82	13.92	13.12
ICC geom. mean	12.27	12.12	11.24	13.13	13.86	12.51	12.90	14.87	14.26	12.20	13.28	12.94	11.48	13.80	13.91	13.11
ICC median	11.94	11.97	11.17	12.94	13.48	12.40	12.14	13.88	14.07	11.85	13.24	12.53	11.54	13.81	13.71	12.84
ICC st. dev.	2.39	1.76	1.50	1.93	2.28	1.50	2.59	4.35	2.66	2.03	2.16	2.46	1.70	2.05	1.64	1.55
ICC max.	25.46	16.54	15.42	19.33	21.21	17.40	19.93	28.15	24.92	17.33	21.71	22.55	15.64	19.45	20.77	18.37
ICC min.	8.33	9.24	8.76	9.16	10.02	9.88	8.55	6.40	9.89	8.05	9.84	8.28	8.27	9.00	11.38	10.47
Panel B: Implied risk premium (equally weighted)																
IRP arithm. mean	7.70	7.47	8.28	8.21	9.04	7.91	8.39	8.07	9.48	6.92	8.76	7.78	6.33	8.65	8.68	8.24
IRP geom. mean	7.67	7.45	8.26	8.18	9.03	7.89	8.34	7.91	9.43	6.88	8.72	7.74	6.31	8.63	8.65	8.22
IRP median	6.89	6.86	7.70	7.47	8.76	7.46	8.10	7.78	9.23	6.38	8.11	7.20	6.18	8.14	8.14	7.68
IRP st. dev.	2.82	2.02	1.87	2.59	1.65	2.15	3.31	5.09	3.40	2.94	2.67	3.27	2.41	2.20	2.60	2.39
IRP max.	22.25	13.33	12.81	15.83	12.79	13.15	15.90	25.95	21.20	15.39	18.50	20.62	13.06	14.49	17.29	15.13
IRP min.	1.38	4.17	5.54	4.08	5.56	3.95	1.82	-1.68	4.22	1.56	4.65	2.79	1.07	4.84	4.22	4.18
Panel C: Average number of observations per month																
N	33	62	119	65	69	302	266	62	30	120	102	28	84	124	727	2,193

The table contains the summary statistics for the monthly time-series of the ICC and the implied risk premium for each of the EU 15 countries (except Luxembourg) and Switzerland. The statistics are computed over the period from January 1994 to December 2011. Panel A exhibits descriptive statistics for the ICC, calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Firm level estimates are aggregated using equally weighting. Implied risk premiums in Panel B are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. Panel C shows the average monthly number of observations for which all four methods generate results. All numbers are reported in percent per year except for the number of observations. For country abbreviations see Table 3.1.

Figure 3.3: Time-series characteristics of the ICC using value- versus equally weighting



The figure plots the monthly time-series of the ICC and the implied risk premium over the period from January 1994 to December 2011. The ICC per month is the simple average of the ICC estimate of the CT, GLS, MPEG and OJ methods. Firm level estimates are aggregated using (1) value-weighting and (2) equally weighting. The results are based only on those observations for which every method returns an ICC estimate.

as shown in Figure 3.3.

I conclude that the weighting procedure is of substantial relevance for the absolute level of the ICC and equity premium estimates but less for their relative evolution. In the context of common asset pricing models, the estimation of the market portfolio's equity risk premium can be best achieved through the computation of a value-weighted implied risk premium. If however, data availability limits the number of observations of small firms, the market risk premium is likely to be underestimated.

3.5.2 Choice of estimation method

As mentioned in Section 2.2, a consensus on the superiority of any ICC method does not exist in the literature. In the empirical part, a decision towards one specific model has been avoided by simply using the average of two residual income and two abnormal earnings models. In this section, I analyze the divergence in the results of different models. All methods are based on the same theoretical fundament, the dividend discount model. Divergences in their results can, on the one hand, be caused by differences in data availability and, on the other hand, by the specific design of the model. Of particular interest for the following analysis is only the second cause. Therefore, only firm-month observations for which all four methods yield a result are considered. The issue of excluding certain observations with respect to data requirements will be subject of the last part of this subsection.

In a first step, I want to determine theoretically how differences across the four methods can arise. Based on Section 3.2, I conclude the following: (1) The higher the inflation rate, calculated as the maximum of the 10-year government bond yield minus three percent and zero, the higher r_{CT} and r_{OJ}; (2) the higher the historical industry median ROE over the last three years, the higher r_{GLS}; and (3) the higher the long-term I/B/E/S growth estimate, the higher r_{CT} and r_{OJ} and, to a smaller extent, the r_{GLS} result.

(1) and (2) are straightforward, while (3) is less obvious. The CT and GLS methods use the long-term growth rate to calculate missing earnings forecasts. Whereas the OJ and MPEG models only use one-and two-year-ahead forecasts, the GLS method includes the three-year-ahead and the CT method even the four-and five-year-ahead forecasts. Since the CT model bases the terminal value on the five-year-ahead forecast, the influence of the long-term growth rate can be substantial. The sensitivity of the OJ model to long-term growth is explained by the fact that the future short-term growth rate g_{st} used in the OJ method comprises the I/B/E/S five-year-ahead growth forecast. Even though the GLS method uses the three-year-ahead earnings forecast,

which might be based on long-term growth, as a starting point for the transition period, the convergence to the industry median ROE reduces the influence of the long-term growth rate.

Figure 3.4 plots the value-weighted ICC for the various methods over time and Table 3.9 gives the summary statistics. Not surprisingly, the residual income models, on the one hand, and the abnormal earnings growth models, on the other hand, return similar results. However, I obtain consistently higher ICC estimates with the abnormal earnings growth models than with the residual income models, except for Ireland. For the full sample, the difference between the residual income models and the abnormal earnings models measures up to 1.9%. The maximum divergence between the arithmetic mean of alternative methods varies between 1.1% for Ireland and 4.9% for Greece.

Daske et al. (2010) simulate a model economy, in which the true costs of capital are known, and evaluate the performance of different methods via Monte Carlo simulation. Their findings are consistent with mine in that they report an overestimation of the ICC by abnormal earnings methods and a slight underestimation by residual income methods.

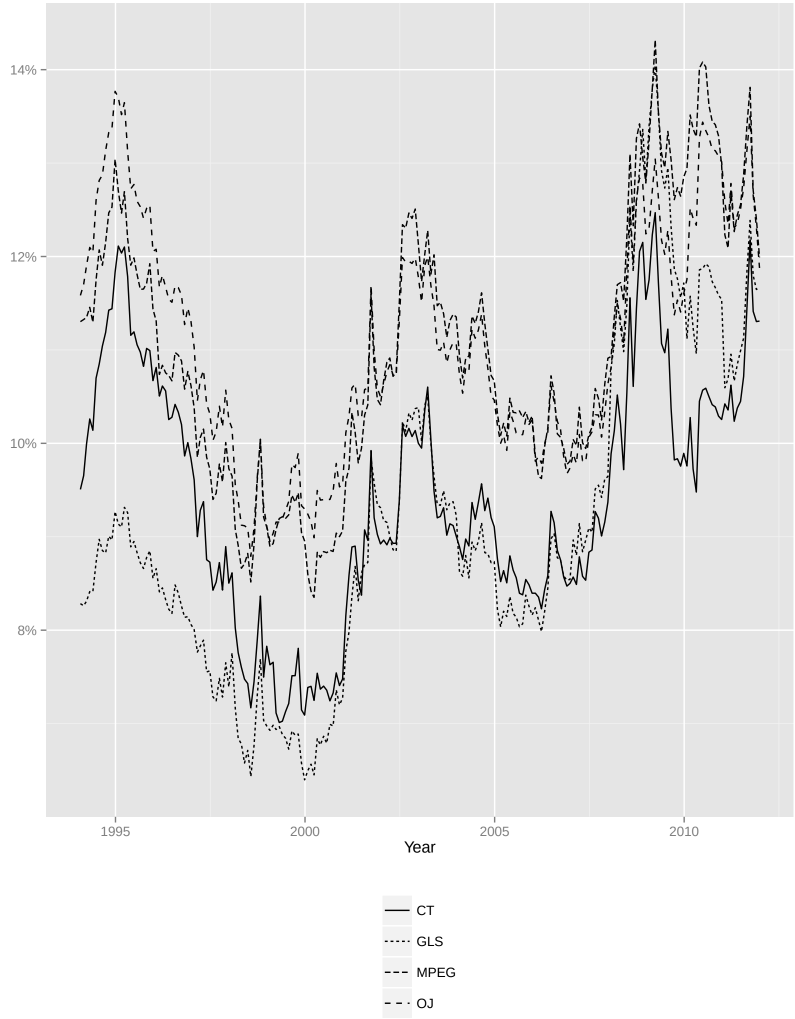
Looking at Figure 3.4, while the OJ and MPEG models always yield very similar results, the CT and GLS methods exhibit noteworthy level discrepancies up to year 2001 and shortly before the end of the observation period. Especially at the beginning of the sample period, the GLS method generates extremely low results compared to the other methods. This finding is caused by two main reasons, first high risk-free rates, which drive the CT and OJ results, and second, by the high earning forecasts relative to historical industry ROE medians. Analyst optimism generally has a substantially higher influence on the OJ, MPEG and CT models than on the GLS method, which introduces the median industry ROE as a balancing effect. At the end of the observation period, the fall of the CT results below the GLS line can be explained, at least partly, by declining risk-free rates. Focusing on the time-series characteristics, the four methods show a very similar pattern. This impression is confirmed by the correlation coefficients of the estimates from the four models, exhibited in Table 3.10. Not surprisingly the MPEG and OJ model have a Pearson correlation coefficient of over 0.9. The method

Table 3.9: Country level descriptive statistics for the ICC (value-weighted) for different estimation methods

	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
Panel A: CT method																
Arithm. mean	10.52	9.76	8.24	9.47	9.87	9.19	8.83	13.88	11.77	9.73	9.46	10.37	10.14	9.41	9.86	9.43
Geom. mean	10.56	9.80	8.28	9.51	9.86	9.23	8.86	13.84	11.81	9.76	9.50	10.39	10.17	9.43	9.90	9.47
Median	10.02	9.69	8.20	9.11	8.81	8.99	8.87	11.92	11.49	9.36	9.53	9.71	9.90	9.04	9.84	9.27
St. dev.	1.76	1.52	1.02	1.37	3.63	1.41	1.42	5.07	2.08	1.99	1.58	2.62	1.77	2.14	1.19	1.32
Max.	17.05	13.94	10.47	14.20	23.00	12.82	13.08	30.66	22.04	15.31	13.31	17.90	14.63	16.84	13.10	12.47
Min.	7.45	6.11	6.22	6.88	5.04	6.61	6.07	7.35	8.33	5.76	6.21	6.20	6.89	5.71	7.24	7.01
Panel B: GLS method																
Arithm. mean	9.11	9.40	7.86	10.06	9.70	9.00	8.15	10.85	12.85	7.53	10.64	8.76	9.14	9.90	9.92	9.14
Geom. mean	9.13	9.44	7.88	10.10	9.73	9.02	8.17	10.86	12.90	7.53	10.68	8.79	9.15	9.94	9.95	9.17
Median	8.58	9.06	7.68	9.82	9.58	9.19	8.03	10.18	12.48	6.76	10.35	8.55	8.76	9.66	9.33	8.82
St. dev.	2.42	1.50	1.35	1.76	1.96	1.91	2.09	3.30	2.18	2.59	1.75	1.96	2.59	1.72	1.84	1.75
Max.	17.57	14.78	11.09	14.48	14.85	13.40	13.27	20.69	19.36	15.77	15.71	14.21	15.52	13.48	15.34	14.04
Min.	4.87	6.19	5.02	6.87	5.19	5.42	4.69	4.50	9.90	4.00	7.84	4.81	4.89	5.74	7.14	6.40
Panel C: MPEG method																
Arithm. mean	12.32	11.33	10.33	11.27	12.30	11.05	11.21	14.30	12.02	11.49	11.09	11.88	11.38	11.45	10.84	11.02
Geom. mean	12.35	11.37	10.38	11.30	12.32	11.09	11.25	14.28	12.06	11.52	11.12	11.92	11.43	11.49	10.88	11.07
Median	11.68	11.36	10.38	10.74	11.58	10.86	11.04	12.90	11.64	10.98	10.76	11.86	11.22	11.03	10.52	10.85
St. dev.	2.49	1.97	1.07	2.07	3.12	1.63	2.08	4.71	1.76	2.32	2.02	2.13	1.39	2.05	1.41	1.44
Max.	21.47	21.84	13.19	18.07	20.75	14.38	16.15	56.03	19.47	18.40	16.62	17.49	15.14	17.39	15.42	14.32
Min.	8.25	7.12	8.19	7.79	6.62	7.86	7.32	7.52	9.21	7.66	7.75	7.82	8.69	7.55	8.39	8.35
Panel D: OJ method																
Arithm. mean	11.94	11.29	10.04	11.01	12.00	11.06	10.95	15.75	12.54	11.80	10.78	12.35	11.81	11.44	11.12	11.08
Geom. mean	11.98	11.33	10.09	11.05	12.01	11.11	10.99	15.70	12.59	11.84	10.82	12.38	11.85	11.48	11.17	11.13
Median	11.55	11.24	10.05	10.70	10.84	10.99	10.89	13.52	12.36	11.02	10.76	11.88	11.47	10.97	10.83	11.00
St. dev.	1.98	1.78	0.84	1.79	3.46	1.37	1.56	5.68	1.65	2.15	1.59	2.42	1.63	2.33	1.26	1.26
Max.	18.35	18.55	12.03	17.09	23.37	14.25	15.00	57.43	18.98	18.68	14.47	19.56	16.94	19.24	14.66	13.77
Min.	8.85	7.67	8.47	8.04	7.59	8.92	7.81	9.40	9.60	8.64	7.86	8.61	9.12	8.27	8.64	8.79

The table contains the summary statistics for the monthly time-series of the ICC for each individual method. Results are reported for each of the EU 15 countries (except Luxembourg) and Switzerland as well as for the full sample. The statistics are computed over the period from January 1994 to December 2011. Firm level estimates are aggregated using value-weighting. The results are based only on those observations for which every method returns an ICC estimation. All numbers are reported in percent per year. For country abbreviations see Table 3.1.

Figure 3.4: Time-series characteristics of the ICC using different estimation methods



The plot shows the monthly time-series of the ICC for the four methods, CT, GLS, MPEG and OJ. The ICC is computed over the period from January 1994 to December 2011 as the value-weighted average of all firm observations for that month. The results are based only on those observations for which every method returns an ICC estimate.

with the lowest correlation coefficients is the GLS model, which is the only approach that relates a firm's ICC estimate to the overall historical industry profitability.

Overall, there are substantial differences between the absolute levels of the estimates generated by different models. However, the relative development of the ICC is quite similar across different models. For the purpose of this study it is reassuring to note that the GLS method reduces the impact of upward biased earnings forecasts. Together with the findings of Daske et al. (2010), I conclude that the decision to average the four

Table 3.10: Correlations between ICC estimates of individual methods

	CT	GLS	MPEG	OJ
CT	1.00	0.76	0.86	0.92
GLS	0.76	1.00	0.78	0.67
MPEG	0.86	0.78	1.00	0.94
OJ	0.92	0.67	0.94	1.00

The table reports the Pearson correlations between the monthly time-series of the ICCs, calculated using different methods. The correlations are computed over the period from January 1994 to December 2011. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. To aggregate firm level estimates value-weighting is used. The correlations are based only on those observations for which every method returns an ICC estimation.

methods is reasonable and should yield a close proxy for the true expected return.

Finally, I analyze the influence of the data requirements for the individual methods. While the CT and GLS models only demand the availability of one-year and two-year-ahead earnings forecasts as well as a growth rate thereafter, the OJ and MPEG models require the one-year-ahead forecast to be positive. Therefore, I cannot dismiss the possibility that the results are biased towards better performing and lower risk firms.

Table 3.11 shows the number of observations that are excluded in each method. As expected, the OJ and MPEG methods have the highest number of missing values. Especially in economic downturn or crisis situations, more companies have negative earnings forecasts, which leads to their exclusion for the MPEG and OJ models. For example, I am not able to compute the ICC using the MPEG model for 827 firm-month observations in 2009. By contrast, the number of missing values for the GLS method is negligible. Thus, the impact of omitting observations can be best analyzed by comparing the results of the GLS method using all possible observations to the estimates for the comparable sample (base case).

Figure 3.5 shows the results. In most cases the ICC computed for the full sample yields very similar results as the base case. The introduced bias seems rather negligible, only during the peak of the financial crisis is it noteworthy at around 1% difference for the value-weighted case.

Table 3.11: Number of missing values for different estimation methods

Year	CT	GLS	MPEG	OJ
1994	236	31	256	342
1995	208	28	186	278
1996	184	39	241	328
1997	174	86	235	294
1998	89	34	274	285
1999	89	30	314	300
2000	106	43	342	359
2001	130	42	462	443
2002	142	14	476	472
2003	90	8	396	365
2004	55	9	294	267
2005	46	10	322	281
2006	70	23	325	290
2007	75	19	339	334
2008	107	20	542	495
2009	134	15	827	756
2010	117	25	504	483
2011	141	16	430	404

The table shows the average monthly number of firm observations per year for which the respective method does not return a numerical solution, either because of additional data requirements that have to be met or because the solving algorithm aborts.

3.5.3 Risk-free rate

In a next step, the sensitivity of the results with respect to the risk-free rate shall be analyzed. So far, the yield on a local government bond with a residual maturity of 10 years was used to compute the equity risk premium from the ICC estimate. Beginning with the introduction of the euro, I use the 10-year German government bond yield for all member countries of the EMU. Table 3.12 shows the results if the local government bond yield is used for the whole observation period.

Substantial differences in comparison to Table 3.5 can be observed for the countries at the core of the current eurozone crisis, the so called PIIGS: Portugal, Italy, Ireland, Greece and Spain. Since the beginning of the eurozone crisis, these countries are suffering from a growing return expectation of investors. Particularly for Greece, the discrepancy of the equity risk premium amounts to almost 15% in 2011. For the other countries the results remain fairly unchanged.

Next, I examine the robustness of the results with respect to the use of the 30-year instead of the 10-year government bond yield as a proxy for the risk-free rate. Because

Table 3.12: Implied risk premium per year and country using alternative proxies for the risk-free rate (local 10-year government bonds)

Year	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
1994	2.15	4.52	4.87	4.39	7.13	4.11	2.15	-0.01	6.74	-0.55	4.43	4.64	1.80	4.61	3.28	3.26
1995	4.09	5.18	5.26	4.14	8.01	4.20	2.74	1.98	5.08	-0.48	4.52	2.82	1.91	3.34	2.98	3.35
1996	3.25	4.23	5.11	3.39	7.09	3.71	2.52	4.35	3.96	0.93	3.90	3.24	2.79	3.03	2.82	3.15
1997	4.24	3.40	5.01	3.69	6.36	3.17	2.24	4.01	4.97	2.04	3.12	3.16	2.80	4.19	2.83	3.09
1998	4.81	2.88	4.83	4.12	5.55	3.53	2.79	3.37	5.97	2.68	3.48	2.84	3.20	4.98	3.40	3.49
1999	5.17	3.47	4.80	4.12	3.31	3.37	2.95	1.97	6.27	3.14	3.58	3.91	3.53	4.08	3.62	3.54
2000	6.12	3.80	4.08	2.98	1.32	2.23	2.29	3.25	6.46	1.61	3.28	3.35	3.14	2.04	3.62	2.85
2001	5.93	5.22	5.78	3.77	4.61	4.22	4.80	5.59	6.81	3.40	5.45	5.12	4.96	4.49	5.11	4.82
2002	6.77	6.75	6.49	5.74	5.05	5.67	6.45	6.26	7.52	4.74	7.25	6.55	5.91	6.27	5.42	5.84
2003	6.15	7.75	7.11	6.70	5.60	6.73	7.61	7.14	7.80	5.78	7.88	6.17	6.04	6.17	5.55	6.43
2004	6.23	6.24	6.28	5.48	5.16	6.04	6.30	6.63	7.49	5.36	6.40	6.75	6.28	4.96	5.20	5.80
2005	5.74	5.59	6.37	5.45	5.51	5.88	6.22	7.32	6.28	5.34	6.08	7.02	6.31	5.30	4.98	5.69
2006	5.29	5.53	5.75	5.70	5.34	5.39	5.39	7.04	7.01	5.20	5.71	4.95	6.15	5.03	5.00	5.40
2007	5.02	5.20	5.65	5.76	5.05	4.97	5.26	6.56	7.76	5.22	4.77	4.52	6.00	5.29	5.01	5.23
2008	8.71	8.42	7.14	7.41	6.97	7.15	8.08	9.95	9.51	7.82	7.53	7.41	7.22	7.19	7.65	7.55
2009	10.66	7.50	8.53	8.88	8.58	8.47	8.85	8.80	9.26	9.18	9.73	7.45	7.94	8.60	8.97	8.72
2010	11.50	7.04	8.61	8.93	8.91	8.74	8.48	7.34	8.34	9.26	9.10	6.49	8.39	8.52	9.23	8.81
2011	10.32	6.90	9.07	8.57	8.36	8.46	9.25	5.05	3.49	8.46	8.89	2.64	7.27	8.67	8.80	8.59

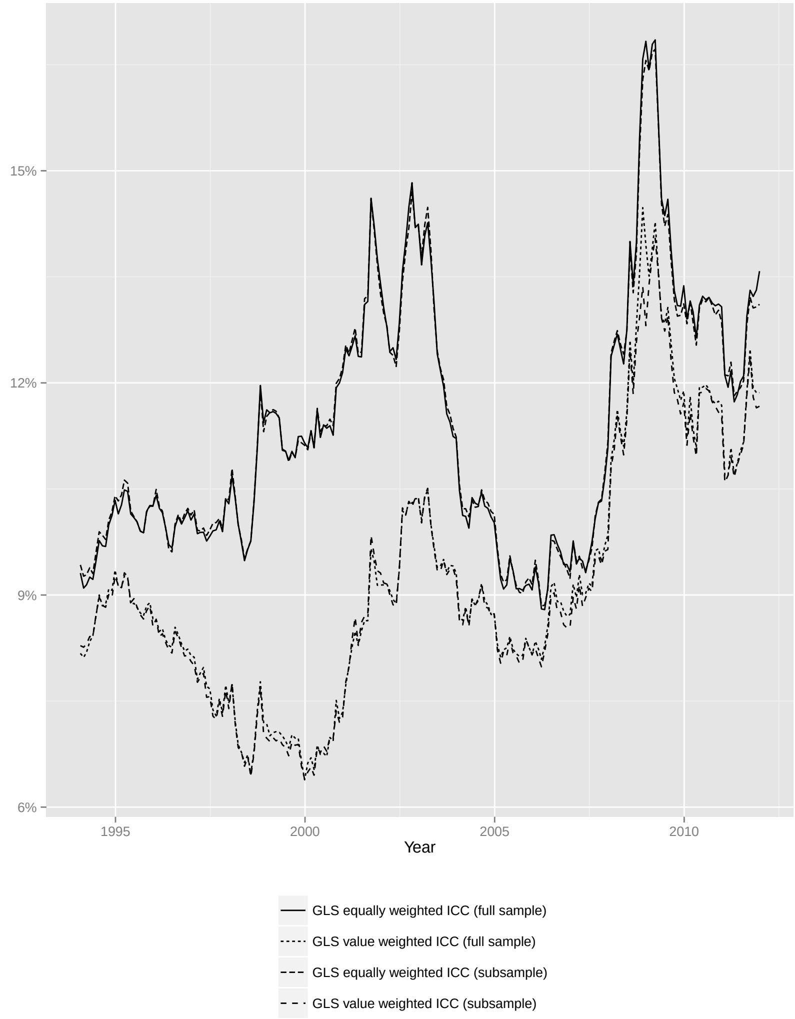
The table contains the average monthly implied equity risk premium per year for each of the EU 15 countries (except Luxembourg) and Switzerland as well as the full sample. The observation period spans from January 1994 to December 2011. The implied risk premium is calculated as the difference between the value-weighted ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. All numbers are reported in percent per year. For country abbreviations see Table 3.1.

Table 3.13: Implied risk premium per year and country using alternative proxies for the risk-free rate (local 30-year government bonds)

Year	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK	EUR
1994	1.77	4.14	4.49	4.02	6.75	3.62	1.66	-0.38	6.37	-0.94	3.94	4.26	1.43	4.24	3.27	2.98
1995	3.56	4.66	4.74	3.53	7.49	3.57	2.05	1.46	4.56	-1.01	3.94	2.30	1.38	2.82	2.88	2.93
1996	2.63	3.61	4.48	2.55	6.47	2.93	1.76	3.73	3.34	0.49	3.26	2.62	2.16	2.41	2.55	2.61
1997	3.48	2.69	4.31	2.83	5.65	2.30	1.44	3.30	4.27	1.25	2.39	2.45	2.09	3.49	2.70	2.53
1998	4.05	2.16	4.21	3.45	4.94	2.83	2.01	2.76	5.36	1.97	2.78	2.22	2.53	4.36	3.52	3.04
1999	4.42	2.70	4.20	3.40	2.71	2.70	2.18	1.38	5.67	2.40	2.87	3.31	2.84	3.48	4.08	3.19
2000	5.76	3.47	3.89	2.76	1.13	1.93	1.96	3.06	6.27	1.22	3.01	3.16	2.84	1.85	4.40	2.85
2001	5.37	4.68	5.36	3.41	4.19	3.70	4.25	5.17	6.39	2.81	4.99	4.70	4.43	4.07	5.46	4.54
2002	6.30	6.29	6.12	5.44	4.69	5.25	5.99	5.90	7.15	4.25	6.84	6.19	5.47	5.90	5.59	5.60
2003	5.42	7.03	6.47	6.19	4.96	6.01	6.87	6.50	7.16	5.00	7.21	5.54	5.30	5.53	5.42	5.91
2004	5.54	5.52	5.68	5.00	4.56	5.33	5.56	6.03	6.88	4.56	5.73	6.15	5.55	4.36	5.34	5.35
2005	5.27	5.10	5.96	5.12	5.10	5.41	5.74	6.90	5.87	4.76	5.58	6.61	5.82	4.88	5.06	5.38
2006	5.11	5.32	5.65	5.82	5.24	5.20	5.21	6.94	6.90	4.90	5.52	4.85	5.94	4.93	5.42	5.39
2007	4.89	5.06	5.66	6.38	5.06	4.85	5.13	6.57	7.77	4.96	4.66	4.54	5.85	5.30	5.55	5.31
2008	8.33	8.06	6.91	8.01	6.74	6.76	7.60	9.72	9.27	7.37	7.20	7.17	6.82	6.96	7.72	7.31
2009	10.12	6.90	7.95	8.51	8.00	7.94	8.15	8.21	8.67	8.34	9.30	6.87	7.41	8.02	8.24	8.09
2010	10.86	6.40	7.98	8.46	8.27	8.16	7.87	6.71	7.71	8.42	8.59	5.86	7.71	7.89	8.51	8.16
2011	9.75	6.45	8.48	8.06	7.78	7.89	8.57	4.48	2.90	7.88	8.46	2.06	6.73	8.08	7.84	7.90

The table contains the average monthly implied equity risk premium per year for each of the EU 15 countries (except Luxembourg) and Switzerland as well as the full sample. The observation period spans from January 1994 to December 2011. The implied risk premium is calculated as the difference between the value-weighted ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 30-year government bond. If yield data for a country's 30-year government bond is unavailable, the average spread between the 30-year bond yield and the 10-year bond yield over all other countries is added to the country's 10-year government bond yield. All numbers are reported in percent per year. For country abbreviations see Table 3.1.

Figure 3.5: Impact of omitted observations in the GLS estimation



The plot shows the monthly time-series of the ICC for the GLS method computed over two different samples: (1) All firm-month observations returning a numerical solution for the GLS method (full sample) and (2) all firm-month observations returning a numerical solution for all four methods (subsample). The observation period spans from January 1994 to December 2011.

the 10-year government bond is the common and most liquid long-term refinancing instrument with the most complete return track record in most countries, the issue of maturity matching has been neglected so far. In theory, the estimation of the equity risk premium should be carried out relative to a portfolio of safe bonds, which have the same duration as the cash flows of the market portfolio. Under simplified assumptions, the duration of a stock equates the reciprocal of the dividend yield. Thus, assuming a dividend yield of 2% to 3% for the market portfolio, the duration of the risk-free rate should also be 33 to 50 years. Because bonds with such a long maturity are only available in a few countries, I use local 30-year government bond yields as the best alternative. For countries without a traded 30-year government bond on Datastream, the average yield difference between the 10-year and 30-year government bond of all other countries is added to the local 10-year government bond yield. In comparison to Table 3.12, Table 3.13 shows equity premiums, which are approximately 0.5% lower for most countries. The only exception is the U.K., where the yield on the 30-year government bond is lower than the 10-year yield in some of the observation years, suggesting an inverted yield curve. This results in a higher risk premium when using the longer-term bond. To sum up, the decision for a certain risk-free benchmark has an influence on the implied equity risk premium which is far from being negligible.

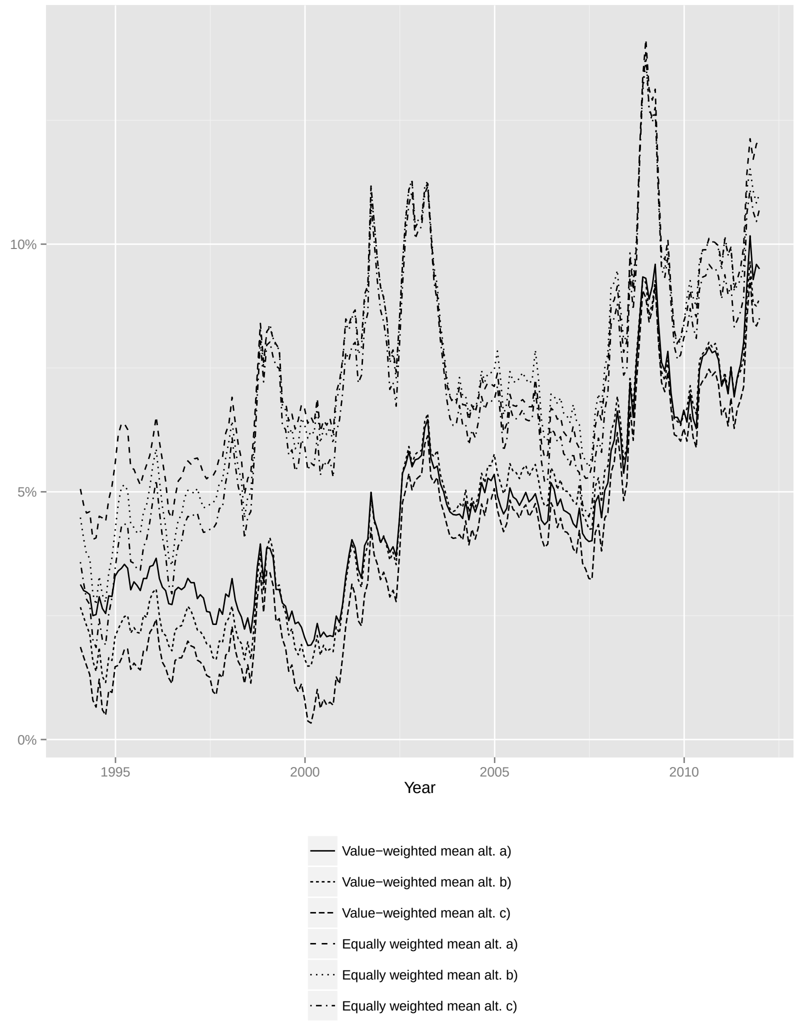
3.5.4 Growth rate

One of the most critical assumptions within residual income and abnormal earnings growth models is the terminal growth rate. To analyze the sensitivity of the results with respect to this assumption, the implied equity risk premium is re-estimated with varying growth rates. This is done only in an exemplary way for the CT method. In their specification, Claus and Thomas (2001) assume a terminal growth rate after the fifth period in the amount of the inflation rate. As a proxy for the inflation rate they use the maximum out of zero and the difference between the risk-free rate and 3%.

Figure 3.6 shows the evolution of the equally weighted and value-weighted implied risk premiums computed with the CT method under three different growth rate assumptions. The first case a) represents the standard assumption used in the main empirical part. The second variation b) is based on the true local inflation rate measured as the change in the consumer price index of each country, sourced from the database of the International Monetary Fund (IMF). The conservative last alternative c) assumes no growth of the residual income in the terminal value. Therefore, this variation represents the lower limit for the implied risk premium estimated using the CT method.

Differences across the alternative growth assumptions are particularly pronounced when using value-weighting. The standard specification clearly describes the upper limit until

Figure 3.6: Time-series characteristics of the implied risk premium using different growth assumptions within the CT model



The figure plots the monthly time-series of the equally and value-weighted implied risk premium over the period from January 1994 to December 2011 for all sample firms. The implied risk premium is estimated using the CT method under three alternative terminal growth rate assumptions: a) The local government bond yield minus 3%; b) the change in the local consumer price index; c) no growth.

the end of the 1990s. After a few years with almost no difference between alternative a) and b), the use of the consumer price index yields higher equity premiums between 2003 and 2008. This finding is mainly driven by constantly falling risk-free rates. Following the eurozone crisis, the risk-free rates of the countries concerned rose, resulting in higher terminal growth rates for these countries. This relationship is reflected in higher risk premiums for alternative a).

To sum up, the growth rate assumption is definitively a critical factor when estimating implied risk premiums. The discrepancy between estimates using different growth rate assumptions can amount to more than one percent within an individual estimation method.

3.5.5 Analyst forecast bias

Finally, a growing body of literature points out that analyst forecasts may be biased, resulting in spurious results of the ICC estimation (cf., e.g., Guay et al., 2011; Easton and Sommers, 2007). To rule out any possible bias introduced through analysts' optimism, the following analysis compares estimates using analyst forecasts with estimates using actual realized earnings. In case analyst forecasts are in fact too optimistic, this should result in higher estimates for the ICC as overestimated earnings need to be discounted with higher discount rates to yield given stock prices. However, the actual implications of this point of criticism can be challenged in two ways.

First, even if a certain over-optimism exists in analyst forecasts, this is not necessarily problematic for the analysis if the majority of market participants share those views. In this case, the estimates represent an adequate measure of the premiums required to compensate investors for bearing the average risk of equity investments. However, several studies argue that the incentive structure of analysts leads to systematically more optimistic forecasts than shared by other market participants.[11]

Second, Easton and Sommers (2007) show that, even though analysts' forecasts are, on average, too optimistic, analyst estimates are getting more precise with the size of a company. Thus, the influence on value-weighted risk premiums is less severe than would be expected when looking at the average analyst forecast bias.

Figure 3.7 shows the ICC computed with analyst forecasts as well as with realized earnings assuming perfect foresight. Due to the reporting lag of realized earnings, the time-series only reaches from 1994 to 2008. As expected, the value-weighted lines for real EPS and I/B/E/S EPS are much closer than the equally weighted ones. For the value-weighted case, no clear systematic distortion can be observed. There are both

[11] A good overview about the current state of research can be found in Ramnath et al. (2008).

Figure 3.7: Time-series characteristics of the ICC using forecasted versus realized earnings

The figure plots the monthly time-series of the ICC using two different proxies for future earnings: (1) I/B/E/S analyst forecasts and (2) realized earnings. The ICC per month is the simple average of the ICC estimate of the CT, GLS, OJ and MPEG models. Firm level estimates are aggregated using value-weighting. The observation period spans from January 1994 to December 2008.

periods with overestimated and phases with underestimated discount rates. The average bias amounts to 1.04% for the value-weighted and 2.17% for the equally weighted estimates. More problematic is the fact that differences between the estimates using forecasts and realized earnings, respectively, are systematically related to different market phase. While upturns are accompanied by overoptimistic analyst forecasts, in downturns the ICC using I/B/E/S forecasts tends to be closer to the one using realized EPS. Therefore, the average distortion may not be a good reference when evaluating the influence of forecast bias.

3.6 Limitations

When evaluating absolute levels and time-series properties of country and industry level cost of capital and risk premium estimates, several topics have to be kept in mind. Apart from the critical assumptions tested in the robustness analysis, the applied ICC estimation is subject to several caveats.

Most importantly, the procedure is very much dependent on I/B/E/S data availability. This data requirement restricts the sample size in its cross-sectional and time-series coverage. I start the analysis in 1994 because data provided from I/B/E/S for the European countries seems to be unreliable beforehand. That means, I have generally substantially fewer observations for all countries and months, and in particular, certain items with no or almost no data for individual months before 1994.

In addition, smaller firms are generally underrepresented in the I/B/E/S database, resulting in a potential downward bias of risk premiums. With respect to small countries or industries, the implied market or industry risk premium estimate is dependent on only a few firms. While this is a general problem of small countries and industries, as it affects estimates based on realized returns as well, it is exacerbated by the analyst forecast requirement, which further diminishes the sample size.

Moreover, due to the volatile I/B/E/S coverage ratio in the observation period, time-series results may be biased through a changing composition of the sample. Also, if the I/B/E/S coverage correlates with certain firm criteria, researchers should be careful when making statements about the cross-section of implied risk premiums.

Next, the analysis faces several accounting issues. First, the residual income models rely on a correct matching between book values from Worldscope and share prices, EPS forecasts as well as shares outstanding from the I/B/E/S database. As already mentioned in Section 3.3, these two databases should theoretically be compatible. I also run a filter to eliminate obvious mismatches.

Second, I cannot rule out a certain imprecision resulting from the assumption that there is a constant dividend payout throughout the year. In reality dividends are reflected in the share price at a certain point in time, the ex-dividend date. Therefore, the share price is abruptly reduced, while the value adjustment of the book value takes place continuously. This problem accrues from the unavailability of ex dividend dates in the Thomson database. Consequently, researchers should be careful when making any statements about the seasonality of the implied risk premium estimates.

4 Measuring financial integration using the ICC

This chapter applies the ICC approach to address a question within the asset pricing literature.[1] More specifically, it shall be re-examined whether a firm's industry or its home market have higher relative explanatory power for a stock's expected return. The relative importance of country and industry effects within the EMU stock portfolio is used as a measure of the degree of financial integration.

The chapter is structured as follows. I begin with the motivation underlying the study and a review of existing literature in Sections 4.1 and 4.2. Section 4.3 reviews the financial integration process within the EMU and derives its hypothesized impacts on the implied discount rate. Section 4.4 explains the Heston-Rouwenhorst framework, which I apply to measure the relative importance of country and industry effects on implied returns. Section 4.5 introduces the data set and shows some descriptive statistics. Section 4.6 presents the results of the empirical analysis and discusses their implications. To confirm the robustness of the estimates, I perform several sensitivity analyses in Section 4.7, while Section 4.8 investigates the impact of alternative explanatory variables on the results. Section 4.9 concludes with the limitations of the analysis.

4.1 Motivation

The increasing economic and financial integration within the EMU and finally the launch of the euro have led to a re-examination of the industry-country debate. With the facilitation of intra-EU investment opportunities, the alignment of monetary and

[1] This chapter is based on Mühlhäuser (2012*a*).

to some extent fiscal policies, as well as the elimination of exchange rate risk through the launch of a common currency, the EMU has initiated important steps towards an integrated financial market.

While several studies investigate the convergence process of bond and money markets in the context of the EMU integration process, only a few papers examine the effect on the member countries' equity markets. Baele et al. (2004) differentiate between three subgroups of measures for equity market integration: News-based measures, quantity-based measures and most importantly price-based measures.[2]

I propose an alternative approach for measuring the extent to which risks are priced identically in different markets that does not rely on realized equity returns or the specification of an asset pricing model. More specifically, I examine the evolution of the relative importance of country and industry effects in determining a firm's implied discount rate. Using expected returns instead of realized returns, I am able to differentiate between the convergence in the fundamentals underlying the priced assets and the convergence of the pricing mechanism applied by European investors (cf. Adjaouté and Danthine, 2003). Only the latter is likely to be linked to financial integration.

In evaluating changes in the relative importance of country or industry influences in the pricing of equities, I apply the model developed by Heston and Rouwenhorst (1994). It decomposes stock returns into a global, a country, an industry and a stock-specific factor at each point in time. When markets reach full financial integration, the required return of a stock should be predominantly driven by its industry and be largely independent of its home country. Therefore, the relative magnitude of country and industry effects within the return decomposition of Heston and Rouwenhorst (1994) enables me to evaluate the degree of financial integration. I address two related questions: First, what is the current degree of financial integration among the eurozone countries, and second, how have the launch of the common currency as well as the current eurozone crisis affected this level of integration?

[2]Also, see Jappelli and Pagano (2008) for a summary of the applied measures.

4.2 Literature review

The industry-country debate has already started in the early seventies with the research of Lessard (1974), who uses a multi-factor model and correlation analysis to study the importance of country and industry factors in the variance composition of portfolio returns. For a sample of 16 country stock price indices over the period from 1959 to 1973, he shows that the industry is less important than the country in explaining stock returns. Later studies of Grinold et al. (1989) and Drummen and Zimmermann (1992) confirm his results. Grinold et al. (1989) propose a model, which breaks down portfolio returns into currency returns and excess local market returns, which are further decomposed into local systematic returns, industry returns and other returns related to attributes such as volatility, size, or yield. Using the returns on all stocks within the Financial Times Actuaries World Index over the period from 1979 to 1989, they provide evidence that, on average, the country dimension is more important than the industry dimension. However, the most relevant industries define returns more than the least important countries. Similarly, when investigating daily returns from 11 European countries between 1986 and 1989 within a factor and variance analysis, Drummen and Zimmermann (1992) find that country factors explain 19% of stock return variance while industry effects only account for 9%.

Roll (1992) questions the aforementioned results with the argument that differences in the industrial composition of country indices may account for part of the found dominance of country effects in return variance. Using equity price indexes from 24 countries over the period from March 1988 to March 1991, he documents three explanatory influences responsible for the large differences in volatilities across equity markets: (1) Index construction, (2) differences in industrial structure across equity market indices and (3) changes in exchange rates.

The European integration process and especially the introduction of the euro have led to a re-examination of the industry-country debate. The elimination of currency risk, the alignment of fiscal and monetary policies as well as the growing European corporate diversification should lead to increased European capital market integration and as a consequence to a re-thinking of portfolio managers to structure their investment process along industries instead of countries.

Baele et al. (2004) differentiate between three subgroups of measures for European equity market integration: News-based measures, quantity-based measures and price-based measures.

News-based measures for equity markets examine stock return reactions to common news factors through the analysis of return variance proportions (for example, see Bekaert and Harvey (1997) for an analysis of the relationship between return variance proportions and financial integration). Fratzscher (2002) finds that the EMU and especially the elimination of exchange rate volatility have in fact promoted financial integration in Europe. Likewise, Baele (2005) finds equity returns in the euro area to be increasingly defined by common innovations and less by country-specific news factors.

The second category, quantity-based measures, applies indicators like cross-border capital flows or the composition of investment portfolios to assess the degree of equity market home bias. Examining institutional investors' equity holdings, Adam et al. (2002) and Baele et al. (2004) find evidence of an increasing share of foreign equities in the portfolios of European investment funds, pension funds and insurance companies.

Most of previous research, however, focuses on price or return-related measures of equity market integration. The simplest approach is to analyze correlation or dispersion trends across equity markets. Calculating cross-sectional dispersion in both country and industry index returns, Adjaouté and Danthine (2003) provide evidence for an increasing superiority of industry over country portfolio diversification benefits at the end of the 1990s.

Heston and Rouwenhorst (1994) apply a new methodology that allows for the disentanglement of pure country effects from differences in industrial structure of country indices.[3] I will explain the methodology in more detail in Section 4.4. Using a sample of 12 European countries and seven industries between 1978 and 1992, they find that the low correlation between country indices is, indeed, almost completely due to country-specific variance. Industrial structure plays only an insignificant role in

[3]Even though the initial intention of the model was to assess the effectiveness of country versus industry diversification, results are also often interpreted as an indication of the level of financial integration.

explaining country portfolio return variance. They conclude that the benefits of international portfolio diversification reach beyond the effects of industry and exchange rate diversification. Building on this model, Rouwenhorst (1999) confirms their findings.

Investigating stocks of the MSCI indices of 12 countries over the period between 1978 and 1998, Rouwenhorst (1999) provides evidence supporting the importance of country effects without any indication for their disappearance among EMU countries' stock returns.

Applying different factor models, including the Heston-Rouwenhorst model, Beckers et al. (1996) conclude that global and national influences are of similar importance in explaining monthly excess return variance among 19 developed markets over the period from 1982 to 1995. Industry factors play only a minor role. However, for the EU they find statistically significant evidence for an increase in the explanatory power of the global and industry factors and a drop in the importance of country factors, suggesting increasing European integration.

After the introduction of the euro, empirical research applying the Heston-Rouwenhorst model provides strong evidence for a reversal of the relative importance of country and industry factors in stock return variation. Isakov and Sonney (2004) and Ferreira (2006) document an increasing relative importance of industry effects in the EMU in the final part of their observation window after the introduction of the euro. Also Flavin (2004) finds that there is a reversal in factor importance from country to industry effects, when employing the Heston-Rouwenhorst model to the 11 original eurozone member countries from January 1995 to December 2002.

Brooks and Del Negro (2004) argue that the rise of industry factors was only a short-lived phenomenon driven by the upturn in stock markets shortly after the introduction of the euro. Applying an augmented Heston-Rouwenhorst model over the period from January 1985 to April 2003, they show that the higher relative importance of industry factors was only a temporary phenomenon associated with the Dot-com bubble. Brooks and Del Negro (2004) refute the argumentation that the growing importance of industry factors was driven by increased market integration.

As an alternative to the Heston-Rouwenhorst model, Eiling et al. (2011) use returns-based style analysis based on Sharpe (1992) to investigate the relative importance of industry and country effects over the period from 1999 to 2008. Their methodology is based on the notion that assuming no influence of country or industry affiliation, country indices should simply be portfolios of industry returns and industry indices should simply be portfolios of country returns. Hence, all country return variance should be captured by a replicating portfolio composed of industry returns. Likewise, all industry return variance should be captured by a replicating portfolio of country returns. If however, these replicating portfolios leave some variance unexplained, country or industry effects seem to play a role. The authors use the residual variance to measure country effects and the fraction of industry return variance left unexplained to estimate industry effects. Eiling et al. (2011) find that country effects dominate before the introduction of the euro, while industry effects are relatively more important afterwards. When differentiating the countries in their sample on the basis of their economic linkages prior to the start of the EMU convergence process, they find that the reversal is mainly driven by the countries with the weakest economic linkages to the EMU and other world markets in the early 1990s. For markets already strongly integrated at this time, industry effects prevail both before and after the introduction of the euro.

All these studies have in common that they use equity returns or stock market valuations to assess the level of financial integration. Stock prices, however, reflect both financial integration through its impact on discount rates and economic integration through its impact on fundamentals. Higher country return co-movements can be the result of an increase in discount rate correlations or a reduction in country-specific innovations in expected cash flows. In fact, only the first cause is attributable to pure financial market integration. In order to overcome this imprecision, Hargis and Mei (2006) propose a framework that allows for the decomposition of innovations in stock returns into news about future dividends, interest rates and equity risk premiums. In another attempt to avoid the noise in realized return, researchers have turned to analyzing the ex ante returns in European markets. In a fully integrated market, ex ante returns should solely depend on the systematic risk in the form of covariance with the world portfolio, as country-specific risk is diversifiable and should, therefore, not influence expected returns. Hardouvelis et al. (2006) investigate the pricing of EU-wide and country-specific risk factors within expected returns using a conditional asset pricing model, which allows for a time-varying degree of integration. They find that integration among eurozone countries increased in the second half of the 1990s. As major drivers of the increased integration, they identify the probability of joining the EMU and the evolution of inflation differentials. At the end of their observation period in 1998, EMU stock markets converged towards full integration.

Focusing on valuation ratios instead of equity return data, Bekaert et al. (2013) use stock market valuations of industry portfolios in different countries to assess the degree of bilateral integration in Europe. More specifically, they measure the degree of bilateral financial integration represented by the convergence of the earnings yield among same industries in different countries. The authors argue that integration should lead to valuation convergence of similar firms across different countries. They document that EU membership reduced average bilateral earnings yield differentials by approximately 1.5% between 1990 and 2007. In addition, they find that EU membership led to strong convergence of both expected returns and expected earnings growth, with the effect on discount rates being more pronounced. The introduction of a common currency, however, was not associated with increased financial or economic integration.

4.3 Financial integration and the ICC

In line with Adjaouté and Danthine (2003, p.8), I define financial integration as "the law of one price" applying to financial markets. This means that the same discount factor is used to value the cash flows of equally risky assets, leading to the same price for those assets independently of the geographical markets they are traded in. According to Baele et al. (2004, p.5), financial integration "is achieved when all economic agents in euro area financial markets face identical rules and have equal access to financial instruments or services in these markets".

In the context of the EMU, Hardouvelis et al. (2007) specify four channels through which it may have increased the level of financial market integration across the participating countries. First of all, the creation of the eurozone was preceded by a gradual abolition of various ownership restrictions on non-residents, and therefore, an opening of intra-EU investment opportunities even before the launch of the euro. The second channel was the harmonization and finally the full convergence of monetary policies across EMU member states. This has led to a gradual assimilation of inflation rates and bond yields, resulting in a convergence of real risk-free rates towards German levels. In addition, the adherence to the Maastricht criteria and the Stability and Growth Pact has, to some extent, promoted the coordination in fiscal policies. The final step, the adoption of the single currency in January 1999, led to the full elimination of intra-EMU currency risk. It also facilitated cross-country investments in the sense that portfolio currency composition restrictions for institutional investors were no longer relevant within the EMU markets.

Following Adjaouté and Danthine (2003), I identify three ways in which this financial integration among the member states of the EMU is expected to affect implied risk premiums of country and industry portfolios in these markets. In fully segmented markets, where investors and suppliers do not have access to foreign investment opportunities and foreign resources, respectively, the demand and supply of capital are matched domestically depending on local risk aversion circumstances. The lack of a common pricing mechanism affects the valuation of both country and sector portfolios. First, taking the example of Germany and Spain and assuming their complete financial segmentation, the pricing of a portfolio of German stocks by German investors happens largely disconnected from the pricing of a portfolio of Spanish stocks by Spanish investors. Second, on the industry side, full segmentation also means that stocks in one industry in Germany are valued with a discount rate that can be completely independent from the one used in Spain to value stocks in the same industry. Since these two markets are not financially integrated and thus not open for cross-border investments, pricing differences between identical assets in both markets cannot be arbitraged away. The last aspect of full segmentation is the adjustment in the objects being priced. As investors in one domestic market do not have access to the full spectrum of global diversification benefits, they would compensate a firm for delivering a reduction in idiosyncratic risk by spreading firm operations across different countries and sectors. This should lead to firms being less specialized as well as country portfolios being highly diversified across industries.

When a country opens up its capital market to foreign capital and allows its residents to take advantage of investment opportunities abroad, the price of risk should converge, as pricing differences can now be arbitraged away. As a result, a portfolio of German stocks should be valued by German and foreign investors with the same pricing mechanism as a portfolio of Spanish stocks is valued by Spanish and foreign investors. Likewise, the same pricing kernel should apply for firms exposed to the same industry risk but domiciled in different countries. Finally, in financially integrated markets firms do not have an incentive to diversify their activities geographically or industrially. The lack of a financial premium for operational diversification allows firms to concentrate on their competitive advantage and promotes more specialization of national industrial structures.

To shed light on the effects of financial integration on the pricing mechanism across member states, I measure how country and industry effects in implied risk premiums have evolved over time. If EMU stock markets are becoming more financially integrated, I expect that the law of one price will become increasingly applicable to these markets, resulting in a convergence of the pricing of equity risk. To measure the impact, I decompose country portfolio risk premiums into a common factor for all European markets, a pure country effect and the sum of industry effects, which is determined by the industrial constitution of a country index. The methodology used for this decomposition, the Heston-Rouwenhorst framework, is explained in further detail in Section 4.4. Likewise, I split the expected returns on an industry portfolio into a common component, the pure industry effect and the sum of country effects. With regards to the three proposed outcomes of financial integration, I hypothesize that (1) through the convergence of country-specific risk premiums, there will be a disappearance of, or at least a major decrease in, the importance of the pure country effect, (2) the use of one pricing mechanism for firms in the same industry, irrespective of their country of origin, will lead to an increase in pure industry effects, resulting in their superiority over country effects, and (3) the increase in industry effects, combined with the trend towards further industry specialization, will lead to a divergence in country index compositions, resulting in an increase in the explanatory power of the sum of industry effects within the expected return of country portfolios.

4.4 Methodology

Following the methodology developed by Heston and Rouwenhorst (1994), I decompose the return on each stock into four components: A common factor, a country factor, an industry factor and a firm-specific disturbance. Thus, the return of security i that belongs to industry j and country k can be expressed as:

$$r_{it} = \alpha_t + \beta_{jt} + \gamma_{kt} + e_{it}, \tag{4.1}$$

where r_{it} is the return of security i at time t, α_t refers to the base level return, β_{jt} is the industry j effect, γ_{kt} is the country k effect and e_{it} is the firm-specific component. The firm-specific disturbances are assumed to have a mean of zero, a finite variance for returns in all countries and industries, and to be uncorrelated across firms.

A time-series for the realizations of the global factor, the industry factors and country factors can be estimated using a simple generalization of equation 4.1, for every month of the sample period:

$$r_{it} = \alpha_t + \sum_{j=1}^{J} \beta_{jt} I_{ij} + \sum_{k=1}^{K} \gamma_{kt} C_{ik} + e_{it}, \tag{4.2}$$

where I_{ij} is an industry dummy variable that equals one if the security i belongs to industry j and zero otherwise and C_{ik} is a country dummy that is equal to one if the security i belongs to country k and zero otherwise. K and J denote the number of countries and industries considered in the analysis. Every security i belongs both to exactly one industry and one country. Due to the resulting perfect multicollinearity between the regressors, it is not possible to estimate equation 4.2 directly. However, it is possible to measure cross-sectional differences between industries and cross-sectional differences between countries. In other words, one can measure industry and country effects relative to some benchmark. Heston and Rouwenhorst (1994) propose to use the average firm as a benchmark, which is equivalent to estimating country and industry effects relative to the equally or value-weighted EMU market portfolio. This choice also avoids difficulties in interpreting the results caused by the use of an arbitrary country or industry benchmark. I follow the literature (e.g., Rouwenhorst, 1999; Brooks and Del Negro, 2004) in implementing the framework using the restriction that the market-cap-weighted averages of both the industry and country coefficients need to be zero.

I impose the following constraints for each period:

$$\sum_{j=1}^{J} w_j \beta_{jt} = 0 \tag{4.3}$$

and

$$\sum_{k=1}^{K} v_k \gamma_{kt} = 0, \tag{4.4}$$

where w_j and v_k are the market capitalization weights of industry j and country k at the beginning of the month. The sums of both all industry and all country weights are equal to one each month. Under this restriction, equation 4.2 is estimated via weighted least squares, with the estimate of the regression intercept equaling the value-weighted average return of the sample. I obtain a monthly time-series of this intercept as well as the industry and country coefficients by running a cross-sectional regression. The pure industry return $\hat{\alpha} + \hat{\beta}_j$ is the regression estimate of the return on a geographically-diversified portfolio of firms in the jth industry. Similarly, $\hat{\alpha} + \hat{\gamma}_k$ is an estimate of the pure country return within an industrially diversified portfolio of country k. Diversified in this context means having the same geographic or industrial composition as the value-weighted EMU index. The estimates can be used to decompose country returns into a component $\hat{\alpha}$ that is common to all countries, the weighted industrial composition component of the country and a country-specific component $\hat{\gamma}_k$ as:

$$r_k = \hat{\alpha} + \sum_{j=1}^{J} v_{kj} \hat{\beta}_j I_{kj} + \hat{\gamma}_k, \tag{4.5}$$

where r_k is the value-weighted return of country k and v_{kj} is the share of industry j in the total market capitalization of country k. This means, the return for country k can diverge from the value-weighted average EMU return for two reasons. First, because of differences in the industrial composition of country k, and second, because the return of country k firms is different from firms in the same industry but located in different countries. If the industrial composition of a country would be equal to the one of the EMU value-weighted index, the resulting sum of industry effects for that country would be zero. By similar reasoning, I can decompose each value-weighted industry return into a component $\hat{\alpha}$ that is common to all industries, the weighted average of the country effects of the securities that make up the industry index and an industry-specific component $\hat{\beta}_j$ as:

$$r_j = \hat{\alpha} + \sum_{k=1}^{K} w_{jk}\hat{\gamma}_k C_{jk} + \hat{\beta}_j, \tag{4.6}$$

where r_j is the value-weighted return of industry j and w_{jk} is the share of country k in the total market capitalization of industry j. I do not include disturbance terms in equation 4.5 and 4.6 because by construction the residuals for each country and industry sum up to zero.

The time-series of these estimates can be used to assess the varying role of industry and country factors across time and provide useful insights on the underlying sources of changes in country co-movements. I follow the literature (e.g., Brooks and Del Negro, 2004) in using two metrics to evaluate the relative importance of industry and country effects. The first metric compares the estimated variance of the industry and country coefficients. The higher the variance of the pure country effect in relation to the total return variance, the higher is the explanatory power of the home country for deviations from the value-weighted market index. The average pure country effect variance, therefore, represents a measure for the benefits of diversification across countries. Likewise, the higher the variance of the pure industry effect, the higher the proportion of the total industry index return variation attributable to industry membership. I also present the ratios between the two pure effect variances ($\frac{var(\gamma_k)}{var(\beta_j)}$). A ratio higher than one indicates that the explanatory power of country effects on stock return variability dominates industry effects.

I use the absolute average country and industry effects, proposed by Rouwenhorst

(1999), as a second metric. This measure, also called mean absolute deviation (MAD), weights the absolute value of individual country and industry effects by their respective market capitalizations each month. The higher the MAD, the more disperse are returns around the EMU weighted average. The country and industry MAD can be calculated as:

$$MAD_{Ct} = \sum_{k=1}^{K} v_{kt} |\hat{\gamma}_{kt}| \tag{4.7}$$

and

$$MAD_{It} = \sum_{j=1}^{J} w_{jt} |\hat{\beta}_{jt}|. \tag{4.8}$$

Whereas the variance analysis identifies the influence of country and industry effects on the stock return's variance, the MAD provides insights on the absolute return impact of country and industry effects. Furthermore, using a moving window, the MAD can also be used to describe the development of country and industry effects over time. Following Cavaglia et al. (2000), I additionally plot the MADs ratio, calculated as the country MAD divided by the industry MAD ($\frac{MAD_{Ct}}{MAD_{It}}$). A ratio higher than one indicates a relatively greater importance of country effects, while a ratio below one stands for a dominance of industry effects.

4.5 Data and sample selection

The full sample contains the monthly risk premiums of 6,026 stocks from 15 European countries. Based on Chapter 3, I include all countries entering the EU before 2004 (except for Luxembourg) as well as Switzerland. For the main analysis in Section 4.6, however, I only include countries that are part of the EMU and adopted the euro. Denmark[4], Sweden, Switzerland and the U.K. act as a control group to evaluate the influence of the launch of the euro, but are only included in the descriptive analysis

[4]Denmark is part of the European Exchange Rate Mechanism II. This means, the Danish krone is allowed to fluctuate not more than 2.25% around its assigned value to the euro (cf. http://www.nationalbanken.dk/).

in this section as well as the robustness test in Subsection 4.7.4. Each stock is dedicated to one of 19 industries according to the Industry Classification Benchmark (ICB) Supersector definitions[5].[6] The average industry is thus similar in size to the average country in the sample.

The expected return is proxied with the help of the ICC approach. I apply four methods to calculate the ICC, which are described in detail in Section 3.2. I build the average from the cost of equity estimates derived from the different models in order to reduce the possibility of spurious estimates resulting from the outliers of any individual model. Only observations for which all four models yield a result are included.

To generate implied premiums, I subtract country-specific risk-free rates proxied by local 10-year government bond yields. For eurozone countries, I use the German bond yield from January 1999 onwards. As described in detail in Section 3.2, I make several adjustments to deal with missing or implausible data. Besides, I exclude firms with less than 12 monthly observations. The data requirements and filters result in a final sample of 467,285 firm-month observations in the period from January 1994 to November 2011[7].

Table 4.1 gives an overview of the number of firms per country and industry included in the full sample of all countries. The U.K. clearly sticks out with a total of 2,156 firms. The lowest number of firms can be found in Portugal and Ireland with 75 and 62, respectively. On the industry side, most of the firms belong to the industrial goods and technology sector. Only 84 and 90 firms operate in the telecommunications and automobiles sector, respectively. The table reveals that the industrial composition of different countries varies significantly. For example, approximately 13% of the Italian firms operate in the banking sector, while only 1% do so in Sweden. Similarly, the geographical distribution of industries is not uniform. Oil and gas companies are heavily clustered in Germany and the U.K, while the food and beverage industry is far more

[5] ICB sector classifications are a four-tier hierarchical industry classification structure developed by Dow Jones Indexes and FTSE Group.

[6] I do not use the industry classification of Campbell (1996) as in Chapter 3 for the estimation of the median industry ROE. While it is essential for the industry ROE calculation to have a decent number of firms per industry in each country, this application aggregates all firms across the European sample countries within one industry. To evaluate the influence of certain industries on the results, using a finer clustering is useful. In addition, the cluster *Others* within the Campbell (1996) classification is too imprecise for this application.

[7] The last month of the sample period, December 2011, is excluded, as there is not at least one observation per country and industry.

Table 4.1: Total number of firms per country and industry

	AM	BK	BR	CH	CO	FS	FB	HC	IG	IN	ME	OG	PG	RE	RT	TE	TC	TL	UT	Total
Austria	6	7	5	2	15	2	7	1	23	5	1	2	7	8	1	2	1	4	4	103
Belgium	2	9	6	6	7	10	11	6	20	2	4	1	6	16	7	20	2	4	5	144
Switzerland	2	14	4	9	14	10	12	22	55	9	5	1	12	11	14	16	1	9	11	231
Denmark	0	15	0	2	20	2	10	10	40	7	3	1	12	10	3	12	1	3	4	155
Finland	2	4	11	2	9	4	7	7	41	3	8	1	9	7	6	25	6	2	2	156
France	18	14	19	12	26	25	40	41	162	15	66	10	72	50	47	127	8	28	15	795
Germany	23	19	18	33	38	53	30	38	159	21	50	27	71	41	28	153	13	10	32	857
Greece	0	17	14	7	25	4	17	8	18	4	7	2	31	8	10	13	2	14	5	206
Ireland	0	4	3	1	4	2	9	2	11	2	2	1	5	2	4	4	0	6	0	62
Italy	13	42	7	10	16	17	11	6	61	16	15	7	34	8	6	27	9	9	22	336
Netherlands	2	5	4	8	12	5	13	4	59	3	11	3	15	16	14	33	3	2	0	212
Portugal	1	8	8	1	11	0	5	0	11	2	7	1	1	3	4	3	3	4	2	75
Spain	2	17	14	4	22	4	17	9	20	4	8	6	5	13	9	4	2	8	16	184
Sweden	5	5	20	5	16	18	7	26	88	3	7	5	23	27	20	58	6	14	1	354
U.K.	14	14	58	43	76	133	69	98	514	51	150	61	153	114	167	221	27	161	32	2,156
Total	90	194	191	145	311	289	265	278	1,282	147	344	129	456	334	340	718	84	278	151	6,026

For every country the table presents the total number of firms included in the sample for each industry (AM= automobiles and parts, BK= banks, BR= basic resources, CH= chemicals, CO= construction and materials, FS= financial services, FB= food and beverage, HC= health care, IG= industrial goods and services, IN= insurance, ME= media, OG= oil and gas, PG= personal and household goods, RE= real estate, RT= retail, TE= technology, TC= telecommunications, TL= travel and leisure, UT= utilities). The observation period spans from January 1994 to November 2011.

evenly distributed across countries.

Table 4.2 shows the average weight per country and industry measured in terms of euro market capitalization. Again, I find substantial differences across countries and industries. Also, in terms of market capitalization, the U.K. is the most important market with a share of 28.8%. Second is France with around 17.5% followed by Germany with 12.8%. Banks show the largest relative market value in the total sample with a share of 16.2%. Real Estate only accounts for 1.4% of the total market capitalization. Interestingly, the average market value per firm varies considerably across countries and industries. Spain accounts for 6.5% of the total market capitalization with only 184 firms, whereas Sweden only has a share of 3.5% with a number of 354 firms. Similarly, the industrial goods and services sector accounts for the largest number of firms with 1,282 firms in the sample, but provides only 8.7% of the total market capitalization. The average firm in the industrial goods and services sector has thereby a relatively low market capitalization compared to the telecommunications sector, which has a share of 8.2% of the sample's market value with only 84 firms.

To investigate the role of the common currency, I divide the sample countries into EMU member and other European countries. Furthermore, I follow Eiling et al. (2011) in distinguishing the countries participating in the EMU as core member countries, including Germany, Belgium, Finland, France, the Netherlands and Austria on the one hand, and PIIGS [8] or non-core countries, including Portugal, Italy, Ireland, Greece and Spain, on the other hand.

On average, a monthly premium of 0.435% is implied in the valuation of European securities over the period from January 1994 to November 2011, as shown in Table 4.3. The highest monthly implied risk premium can be found in Ireland and Greece with 0.596% and 0.531%, respectively, whereas Italy only shows an average monthly risk premium of 0.384%. Differences to the yearly results in Chapter 3 are driven by a slightly different sample composition caused by the need for the availability of the ICB Supersector classification as well as the criterion of at least 12 monthly observations per firm. Equally weighted implied risk premiums are substantially higher, caused by

[8] An abbreviation or acronym which was introduced during the eurozone crisis and refers to the economies of Portugal, Italy, Ireland, Greece and Spain.

Table 4.2: Average weight within the value-weighted market index per country and industry

	AM	BK	BR	CH	CO	FS	FB	HC	IG	IN	ME	OG	PG	RE	RT	TE	TC	TL	UT	Total
Austria	0.00	0.26	0.04	0.00	0.05	0.00	0.02	0.00	0.11	0.07	0.00	0.09	0.00	0.04	0.00	0.00	0.07	0.01	0.09	0.86
Belgium	0.00	0.59	0.01	0.15	0.03	0.23	0.39	0.10	0.19	0.29	0.02	0.00	0.01	0.04	0.18	0.02	0.05	0.01	0.20	2.49
Switzerland	0.00	1.65	0.00	0.35	0.25	0.18	1.71	3.18	0.70	0.50	0.03	0.01	0.09	0.05	0.05	0.09	0.19	0.04	0.15	9.22
Denmark	0.00	0.26	0.00	0.00	0.05	0.00	0.07	0.46	0.23	0.05	0.00	0.00	0.02	0.01	0.00	0.01	0.10	0.00	0.00	1.27
Finland	0.02	0.03	0.25	0.02	0.05	0.00	0.02	0.02	0.22	0.08	0.04	0.03	0.03	0.01	0.03	1.13	0.09	0.01	0.13	2.21
France	0.59	1.87	0.11	0.32	0.98	0.21	0.67	1.29	1.26	1.05	1.08	1.34	1.80	0.35	1.05	0.74	0.80	0.34	1.63	17.46
Germany	1.17	0.98	0.05	1.43	0.23	0.30	0.09	0.56	1.84	1.62	0.10	0.07	0.34	0.06	0.43	0.90	1.14	0.17	1.37	12.83
Greece	0.00	0.41	0.03	0.00	0.06	0.02	0.09	0.01	0.03	0.01	0.01	0.03	0.03	0.01	0.02	0.02	0.15	0.08	0.05	1.07
Ireland	0.00	0.33	0.02	0.00	0.02	0.00	0.09	0.05	0.04	0.04	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.09	0.00	0.74
Italy	0.22	1.99	0.01	0.01	0.10	0.12	0.06	0.03	0.39	0.93	0.28	0.69	0.25	0.03	0.01	0.03	0.93	0.08	0.68	6.86
Netherlands	0.00	0.45	0.00	0.27	0.06	0.03	1.05	0.00	0.43	1.09	0.38	0.07	0.49	0.14	0.29	0.22	0.34	0.00	0.00	5.32
Portugal	0.00	0.22	0.03	0.00	0.07	0.00	0.00	0.00	0.05	0.01	0.03	0.03	0.00	0.00	0.10	0.00	0.16	0.00	0.15	0.85
Spain	0.01	1.99	0.06	0.01	0.45	0.04	0.08	0.04	0.25	0.09	0.11	0.34	0.10	0.08	0.31	0.04	1.23	0.09	1.21	6.53
Sweden	0.01	0.39	0.10	0.02	0.15	0.14	0.01	0.10	0.71	0.06	0.04	0.03	0.25	0.07	0.39	0.65	0.31	0.02	0.01	3.46
U.K.	0.11	4.83	1.73	0.35	0.36	0.55	2.02	2.47	2.27	1.28	0.80	2.86	1.40	0.54	1.92	0.52	2.60	0.96	1.26	28.83
Total	2.13	16.23	2.44	2.94	2.91	1.82	6.38	8.33	8.72	7.16	2.94	5.59	4.83	1.43	4.79	4.38	8.15	1.90	6.93	100.00

For every country the table presents the average percentage market capitalization for each industry, expressed as a share of the total market. Market capitalizations are denominated in euro. The average is calculated over the period from January 1994 to November 2011 using monthly observations. For industry abbreviations see Table 4.1.

Table 4.3: Descriptive statistics of the implied risk premiums for country indices

	Value-weighted		Equally weighted	
Country	Arithm. mean	St. dev.	Arithm. mean	St. dev.
Austria	0.508	0.216	0.604	0.205
Belgium	0.464	0.151	0.586	0.151
Switzerland	0.495	0.115	0.656	0.141
Denmark	0.441	0.153	0.643	0.194
Finland	0.490	0.166	0.713	0.124
France	0.438	0.164	0.621	0.162
Germany	0.420	0.203	0.651	0.246
Greece	0.531	0.374	0.623	0.386
Ireland	0.596	0.166	0.735	0.238
Italy	0.384	0.279	0.542	0.225
Netherlands	0.477	0.176	0.688	0.198
Portugal	0.452	0.180	0.608	0.246
Spain	0.438	0.203	0.503	0.186
Sweden	0.432	0.154	0.676	0.160
U.K.	0.417	0.168	0.670	0.189
Cross-country average	0.435	0.172	0.643	0.178
EMU	0.437	0.186	0.621	0.186
Non-EMU	0.432	0.155	0.666	0.176
Core EMU	0.436	0.187	0.624	0.189
Non-Core EMU	0.425	0.232	0.569	0.218

The table presents the mean and standard deviation of the monthly value-weighted and equally weighted implied risk premiums covering the period from January 1994 to November 2011 for each of the EU 15 countries (except Luxembourg) and Switzerland. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Implied risk premiums are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All returns are measured in local currency and expressed in percentage. Averages for the entire sample, EMU member countries, other European countries, core EMU and non-core EMU countries are given below.

the higher weight of small companies with higher estimates.

Table 4.4 shows the average monthly implied risk premiums and their standard deviations using value- and equally weighted industry indices. Differences in the implied risk premiums are much more pronounced across industries than across countries. The expected industry risk premium spans from 0.286% in the real estate industry to 0.662% in the automobile industry.

Tables 4.5 and 4.6 show the correlation coefficients for the aggregate country and industry implied risk premiums. The correlation statistics presented do not confirm the

Table 4.4: Descriptive statistics of the implied risk premiums for industry indices

	Value-weighted		Equally weighted	
Industry	Arithm. mean	St. dev.	Arithm. mean	St. dev.
Automobiles & parts	0.662	0.203	0.769	0.221
Banks	0.540	0.251	0.567	0.236
Basic resources	0.618	0.155	0.869	0.230
Chemicals	0.456	0.130	0.625	0.174
Construction & materials	0.505	0.166	0.656	0.192
Financial services	0.445	0.191	0.623	0.212
Food & beverage	0.394	0.124	0.547	0.161
Health care	0.369	0.135	0.574	0.143
Industrial goods & services	0.481	0.130	0.700	0.176
Insurance	0.430	0.317	0.524	0.255
Media	0.380	0.175	0.595	0.228
Oil & gas	0.421	0.243	0.641	0.263
Personal & household goods	0.396	0.097	0.710	0.165
Real estate	0.286	0.152	0.459	0.185
Retail	0.389	0.148	0.621	0.159
Technology	0.386	0.152	0.717	0.199
Telecommunications	0.369	0.177	0.508	0.216
Travel & leisure	0.465	0.136	0.580	0.184
Utilities	0.390	0.162	0.446	0.179
Cross-industry average	0.435	0.172	0.643	0.178

The table presents the mean and standard deviation of the monthly value-weighted and equally weighted implied risk premiums returns covering the period from January 1994 to November 2011 for each of the 19 industries. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Implied risk premiums are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All returns are measured in local currency and expressed in percentage. The average of the entire sample is given below.

impression of more uniform expected returns across countries than across industries. On the contrary, the average pairwise value-weighted industry correlation is, at 0.85, even slightly higher than the average pairwise cross-country correlation of 0.83. A closer analysis shows that well integrated markets, like Germany, France, or the U.K., show above average pairwise correlations with the other European countries. Also worth noting is the low correlation of the value-weighted Finnish index with other European markets. This result is mainly driven by Nokia, which had a share of approximately 50% of the Finnish market capitalization during the sample period. Pairwise correlations using the equally weighted index are substantially higher.

Table 4.5: Correlation matrix for country indices

	AUT	BEL	CH	DK	FIN	FRA	GER	GRE	IRE	ITA	NL	POR	SPA	SWE	UK
Austria	1.00	0.88	0.77	0.87	0.66	0.87	0.87	0.70	0.86	0.81	0.89	0.75	0.81	0.81	0.89
Belgium	0.77	1.00	0.85	0.90	0.72	0.91	0.90	0.71	0.84	0.84	0.92	0.80	0.83	0.84	0.86
Switzerland	0.85	0.87	1.00	0.87	0.68	0.88	0.85	0.68	0.74	0.82	0.88	0.83	0.74	0.75	0.74
Denmark	0.83	0.85	0.93	1.00	0.62	0.96	0.92	0.76	0.90	0.92	0.93	0.87	0.90	0.88	0.93
Finland	0.44	0.52	0.66	0.60	1.00	0.64	0.57	0.37	0.62	0.49	0.71	0.50	0.52	0.69	0.58
France	0.84	0.90	0.97	0.96	0.66	1.00	0.94	0.76	0.88	0.94	0.93	0.87	0.90	0.89	0.91
Germany	0.85	0.92	0.93	0.91	0.48	0.95	1.00	0.71	0.85	0.89	0.92	0.84	0.86	0.80	0.90
Greece	0.83	0.76	0.86	0.80	0.49	0.84	0.85	1.00	0.69	0.88	0.67	0.82	0.84	0.70	0.71
Ireland	0.87	0.79	0.82	0.88	0.40	0.85	0.84	0.73	1.00	0.84	0.89	0.79	0.88	0.86	0.93
Italy	0.90	0.80	0.89	0.89	0.41	0.90	0.93	0.89	0.87	1.00	0.86	0.93	0.95	0.83	0.86
Netherlands	0.84	0.92	0.95	0.92	0.58	0.96	0.95	0.79	0.84	0.87	1.00	0.85	0.85	0.85	0.88
Portugal	0.83	0.86	0.90	0.85	0.47	0.91	0.92	0.83	0.84	0.89	0.91	1.00	0.89	0.75	0.76
Spain	0.89	0.83	0.90	0.89	0.42	0.91	0.95	0.90	0.86	0.98	0.89	0.92	1.00	0.83	0.88
Sweden	0.80	0.78	0.91	0.92	0.65	0.92	0.88	0.80	0.83	0.87	0.88	0.85	0.86	1.00	0.90
U.K.	0.93	0.86	0.93	0.93	0.54	0.94	0.93	0.86	0.93	0.95	0.93	0.91	0.95	0.91	1.00

For every country index the table presents the pairwise Pearson correlation coefficients with all other country indices covering the period January 1994 to November 2011. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Implied risk premiums are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All returns are measured in local currency. The correlations above the diagonal refer to equally weighted implied risk premiums and those below the diagonal belong to value-weighted implied risk premiums. For country abbreviations see Table 3.1.

Table 4.6: Correlation matrix for industry indices

	AM	BK	BR	CH	CO	FS	FB	HC	IG	IN	ME	OG	PG	RE	RT	TE	TC	TL	UT
Automobiles & parts	1.00	0.82	0.85	0.91	0.94	0.93	0.91	0.86	0.94	0.88	0.92	0.88	0.90	0.86	0.93	0.85	0.75	0.93	0.85
Banks	0.89	1.00	0.83	0.78	0.86	0.91	0.79	0.75	0.75	0.94	0.86	0.91	0.70	0.86	0.81	0.73	0.86	0.80	0.88
Basic resources	0.65	0.70	1.00	0.79	0.88	0.83	0.80	0.78	0.83	0.81	0.80	0.84	0.77	0.83	0.82	0.74	0.68	0.84	0.79
Chemicals	0.89	0.78	0.66	1.00	0.93	0.89	0.91	0.89	0.90	0.86	0.89	0.88	0.90	0.84	0.93	0.83	0.80	0.92	0.88
Construction & materials	0.91	0.91	0.68	0.90	1.00	0.93	0.94	0.91	0.95	0.89	0.91	0.91	0.93	0.85	0.96	0.84	0.81	0.96	0.90
Financial services	0.91	0.95	0.68	0.82	0.91	1.00	0.89	0.84	0.89	0.93	0.95	0.91	0.83	0.90	0.91	0.86	0.86	0.90	0.88
Food & beverage	0.93	0.89	0.58	0.90	0.94	0.89	1.00	0.87	0.94	0.85	0.88	0.89	0.96	0.82	0.93	0.78	0.79	0.95	0.87
Health care	0.82	0.90	0.66	0.72	0.80	0.91	0.82	1.00	0.91	0.83	0.90	0.85	0.87	0.76	0.90	0.87	0.80	0.89	0.87
Industrial goods & services	0.89	0.87	0.68	0.89	0.97	0.90	0.91	0.76	1.00	0.82	0.90	0.85	0.96	0.79	0.96	0.88	0.71	0.96	0.83
Insurance	0.92	0.94	0.64	0.85	0.94	0.93	0.95	0.88	0.91	1.00	0.91	0.93	0.77	0.88	0.86	0.79	0.89	0.84	0.94
Media	0.90	0.94	0.65	0.81	0.92	0.95	0.91	0.92	0.91	0.95	1.00	0.89	0.84	0.89	0.89	0.92	0.87	0.90	0.87
Oil & gas	0.83	0.89	0.73	0.77	0.83	0.89	0.82	0.90	0.79	0.88	0.87	1.00	0.84	0.89	0.89	0.75	0.86	0.89	0.89
Personal & household goods	0.89	0.82	0.59	0.91	0.92	0.87	0.93	0.81	0.92	0.89	0.90	0.78	1.00	0.74	0.95	0.77	0.69	0.96	0.80
Real estate	0.90	0.85	0.58	0.82	0.91	0.83	0.92	0.72	0.90	0.91	0.86	0.77	0.82	1.00	0.80	0.74	0.81	0.81	0.79
Retail	0.92	0.91	0.59	0.89	0.95	0.92	0.97	0.85	0.91	0.95	0.94	0.82	0.93	0.89	1.00	0.84	0.78	0.97	0.88
Technology	0.82	0.86	0.64	0.70	0.83	0.88	0.80	0.87	0.85	0.87	0.93	0.82	0.83	0.77	0.82	1.00	0.75	0.84	0.79
Telecommunications	0.83	0.89	0.56	0.72	0.84	0.89	0.86	0.91	0.81	0.90	0.95	0.81	0.85	0.79	0.91	0.89	1.00	0.77	0.89
Travel & leisure	0.90	0.88	0.70	0.87	0.96	0.88	0.90	0.77	0.96	0.92	0.88	0.81	0.88	0.89	0.90	0.81	0.78	1.00	0.85
Utilities	0.90	0.91	0.62	0.87	0.93	0.92	0.95	0.89	0.90	0.95	0.95	0.86	0.91	0.87	0.96	0.86	0.93	0.89	1.00

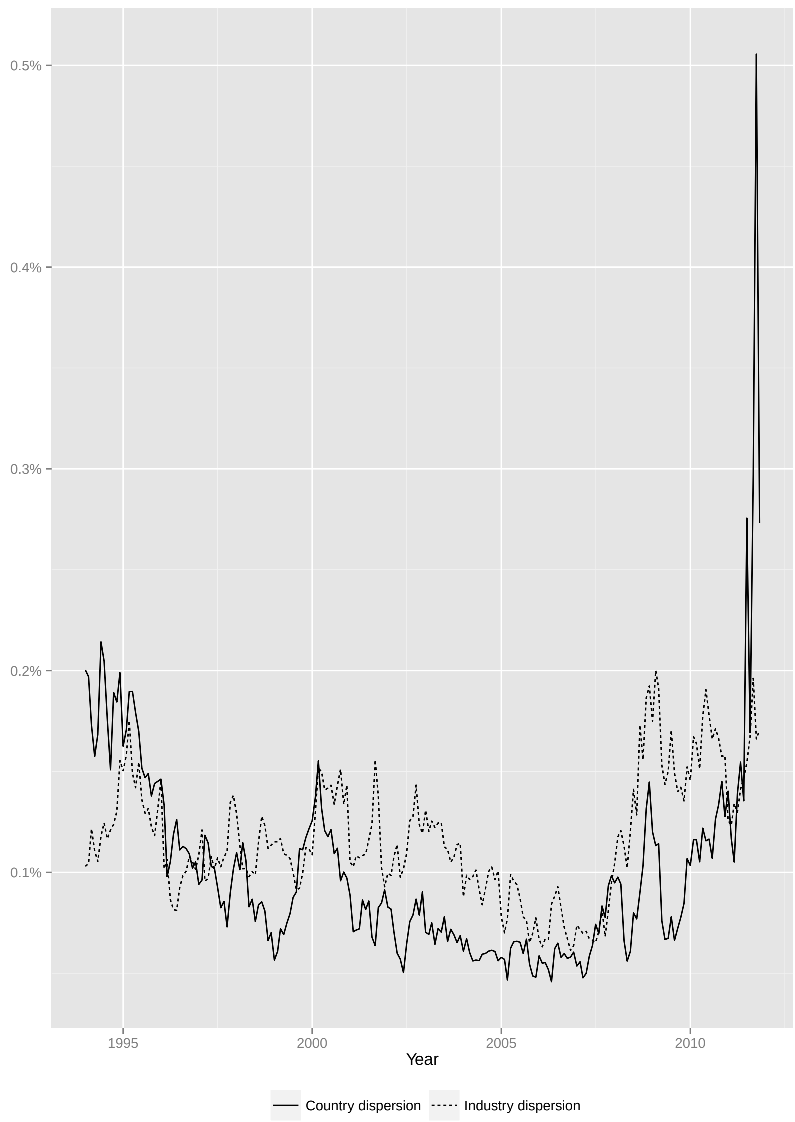
For every industry index the table presents the pairwise Pearson correlation coefficients with all other industry indices covering the period from January 1994 to November 2011. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Implied risk premiums are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All returns are measured in local currency. The correlations above the diagonal refer to equally weighted implied risk premiums and those below the diagonal belong to value-weighted implied risk premiums. For industry abbreviations see Table 4.1.

To evaluate relationships among European equity markets over time, I use cross-sectional dispersion, as for the first time applied in this context by Solnik and Roulet (2000). Dispersion and correlation are inversely related and should provide the same information (cf. Adjaouté and Danthine, 2003). If returns move closely together in all market phases, they show a high correlation. At the same time, this translates into a low cross-sectional variance and thereby a low dispersion. The latter, however, has the advantage of not being dependent on a minimum number of observations across time to be reliable.

Figure 4.1 presents the results for country and industry implied risk premium dispersions. Financial integration among European equity markets should be reflected in a similar pricing of equity risk and thereby in a decreasing cross-country dispersion of country-specific risk premiums. Indeed, while country dispersion is higher than industry dispersion in the first observation years, dispersion across industries dominates from around 1997 to 2010. Remarkable is the high dispersion for industries and especially countries at the end of the observation period, which is shaped by the financial and eurozone crisis. Especially the eurozone crisis has incited investors to again increasingly differentiate among different European markets.

In summary, even though the correlation matrix shows more commonality between industries than countries, the dispersion figure indicates that there may have been a shift in the relative importance of country and industry effects in expected returns over the sample period. This result should be interpreted with caution, however, as industry indices may be biased by the weight of certain countries in their composition and country indices may be biased by their industrial composition. This effect may even become stronger in the light of progressing financial integration, if a country's industrial structure becomes more specialized and industries are becoming more concentrated in a few countries.

Figure 4.1: Dispersion of implied country and industry risk premiums



The plot shows the monthly cross-sectional dispersion of the implied risk premiums using value-weighted country and industry indices. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. Implied risk premiums are calculated as the difference between the ICC and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All returns are measured in local currency. The statistics are computed over the period from January 1994 to November 2011.

4.6 Empirical results

I use local monthly returns from the EMU sample companies over the period from January 1994 to November 2011 to estimate industry and country coefficients within the Heston-Rouwenhorst framework. On the basis of these estimates, I compute the percent of fitted variance of each country's expected return that was explained by pure country effects and the percentage variance that was explained by the sum of industry effects.

Fully integrated markets should show no country effects in implied risk premiums after controlling for differences in industrial structure. A portfolio of stocks, industrially diversified in line with the value-weighted EMU index, should earn the same expected return above the risk-free rate in each country. For example, there should be no difference if the companies composing the portfolio are based in Germany or Spain and the expected return should solely rely on the risk profile of the companies. However, if markets are segmented and investors do not have full access to diversification benefits, stocks containing the same amount of risk but domiciled in different countries, can be valued with a different discount rate. Limits to cross-border investments prevent pricing differences from being arbitraged away.

4.6.1 Full period

My first set of results shows the variance decomposition of the implied risk premium across EMU countries over the full observation period between January 1994 and November 2011. In Table 4.7, next to the variances of the two effects, I list their ratio to the variance of the total implied risk premium. Pure country effects and the sum of industry effects can be correlated. Due to these covariances, the ratio of the pure country effects and the sum of industry effects to the total implied risk premium variance need not add up to one (cf. Heston and Rouwenhorst, 1994).

The cross-country EMU mean of the pure country effect variance measures $0.874‰^2$ and accounts for 80.0% of the total implied risk premium variance. France's pure country effect variance amounts only to $0.092‰^2$, indicating that it was the market most financially integrated into the EMU in this period. With a variance of $4.329‰^2$, Greece shows the highest pure country effect.

Only a small portion of the implied country risk premiums in excess of the EMU index premiums can be attributed to country-specific industrial compositions. In fact, the variance of the sum of the 19 industry effects in country indices is only 0.163‰^{2} for the EMU and accounts for 20.7% of the implied risk premium variability. Most pronounced is the variance of the sum of industry effects in Finland and Ireland, with 0.444‰^{2} and 0.397‰^{2}, respectively. This finding is attributable to the unique industrial composition of the two value-weighted indices; e.g., more than half of the Irish market capitalization is represented by firms of the banking sector.

On the industry side, I decompose implied industry risk premiums into the pure industry effect as well as the sum of the 11 country effects. Table 4.8 presents the variances of the two effects as well as their ratio relative to the total implied risk premium variance. The cross-industry average of the pure industry effect variance measures 0.835‰^{2} over the total observation period. The ratio to total implied risk premium variance amounts

Table 4.7: Decomposition of implied country risk premiums into pure country and sum of industry effects

	Pure country effect		Sum of 19 industry effects	
Country	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Austria	0.681	0.642	0.133	0.125
Belgium	0.314	0.488	0.228	0.354
Finland	1.315	0.484	0.444	0.163
France	0.092	0.648	0.019	0.132
Germany	0.136	0.905	0.025	0.169
Greece	4.329	0.825	0.137	0.026
Ireland	0.796	0.968	0.397	0.482
Italy	0.906	0.657	0.217	0.158
Netherlands	0.310	1.262	0.098	0.398
Portugal	0.463	1.034	0.034	0.076
Spain	0.275	0.888	0.059	0.190
EMU	0.874	0.800	0.163	0.207
Core EMU	0.475	0.738	0.158	0.223
Non-core EMU	1.354	0.874	0.169	0.186

The table shows the decomposition of the variability of the implied risk premiums of each value-weighted country index over the EMU value-weighted average into the variance of the pure country effect and the variance of the sum of the 19 industry effects. The ratio column shows the ratio of the variance of that component to the total implied risk premium variance. In addition, cross-country averages for the entire EMU, the core EMU countries as well as the non-core EMU countries are given at the bottom of the table. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

Table 4.8: Decomposition of implied industry risk premiums into pure industry and sum of country effects

	Pure industry effect		Sum of 11 country effects	
Industry	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Automobiles & parts	0.718	1.188	0.059	0.097
Banks	1.162	0.955	0.029	0.024
Basic resources	2.067	0.801	0.151	0.059
Chemicals	1.082	0.996	0.041	0.038
Construction & materials	0.373	1.001	0.014	0.039
Financial services	0.521	0.891	0.063	0.107
Food & beverage	0.499	1.080	0.071	0.154
Health care	1.110	1.041	0.009	0.009
Industrial goods & services	0.570	1.002	0.007	0.013
Insurance	2.249	0.870	0.033	0.013
Media	0.171	1.281	0.100	0.748
Oil & gas	1.125	0.917	0.051	0.041
Personal & household goods	0.784	0.835	0.038	0.041
Real estate	0.858	0.975	0.028	0.032
Retail	0.321	0.822	0.022	0.055
Technology	0.702	0.734	0.154	0.161
Telecommunications	0.691	0.996	0.172	0.248
Travel & leisure	0.643	1.452	0.042	0.094
Utilities	0.211	0.962	0.027	0.123
Cross-industry average	0.835	0.989	0.058	0.110

The table shows the decomposition of the variability of the implied risk premiums of each value-weighted industry index over the EMU value-weighted average into the variance of the pure industry effect and the variance of the sum of the 11 country effects. The ratio column shows the ratio of the variance of that component to the total implied risk premium variance. In addition, the average over all industries is given at the bottom of the table. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

to 98.9%. With a value of 2.249‰^{2} and 2.067‰^{2}, respectively, the insurance sector and the basic resource sector show the highest variance of the pure sector effect. The lowest pure effect variance can be found in the media sector (0.171‰^{2}) and the utilities industry (0.211‰^{2}). The average variance of the summed country effects is 0.058‰^{2} across industries and accounts for only about 11.0% of the implied risk premium variance. I find the highest value for the telecommunications sector, resulting from a rather uneven distribution of this sector across countries with regards to market capitalization. The industrial goods and services sector shows the lowest variance for the sum of the 11 country effects with a magnitude of only 0.007‰^{2}. A ratio to the total implied risk premium variance of 1.3% indicates that the geographical composition of the industrial goods and services index adds very little to explain its total excess volatility.[9]

To get an indication for the relative importance of industry and country effects, a comparison of their pure effect variance is helpful. The cross-industry average variance of the pure industry effect (0.835‰^{2}) is quite similar to the cross-country average variance for the pure country effect (0.874‰^{2}), leading to a pure effect ratio of roughly 1.05. Therefore, the industry has, on average, a similar explanatory power for the implied stock return variance as the country over the full observation period. The variance of the summed industry effects has an even more important impact on the country indices implied risk premium variance than the variance of summed country effects has on the industry indices implied risk premium variance. The average summed country effects account for only 11.0% of the implied risk premium variance in industry indices, whereas the summed industry effects explain around 20.7% of the implied risk premium variance of country indices.

To sum up, over the full observation period, industry and country effects have a comparable influence on the implied stock return variance in this sample. That the explanatory power of country-specific effects is far from being negligible means that investors still price risks differently depending on the home market of a stock.

4.6.2 Pre- versus post-euro period

The major objective of the analysis is to investigate whether the introduction of the common currency and the associated convergence of monetary policies in the EMU have changed the relative importance of country and industry effects. Additionally, I want to examine if the integration process was interrupted or even reverberated by the recent eurozone crisis. Thus, I repeat the analysis for the pre-euro period (January 1994 to December 1998), the post-euro period (January 1999 to December 2009) and the eurozone crisis period (January 2010 to November 2011) separately to shed light on the question of how country and industry effect variances have changed.

[9] Griffin and Karolyi (1998) additionally differentiate between industries producing goods traded internationally, like the automobiles sector, and industries producing non-traded goods, like the media and real estate sectors. They argue that industries producing non-traded goods should be more affected by country-specific factors, while industries with traded goods are stronger influenced by global industry factors.

Table 4.9: Decomposition of implied country risk premiums into pure country and sum of industry effects for the pre- and post-euro and the eurozone crisis periods

	Jan1994 - Dec1998 (pre-euro)				Jan1999 - Dec2009 (post-euro)				Jan2010 - Nov2011 (euro-crisis)			
	Pure count. eff.		Sum of 19 ind. eff.		Pure count. eff.		Sum of 19 ind. eff.		Pure count. eff.		Sum of 19 ind. eff.	
Country	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Austria	0.352	0.548	0.095	0.148	0.842	0.696	0.091	0.076	0.475	1.099	0.055	0.128
Belgium	0.311	0.741	0.041	0.099	0.252	0.587	0.168	0.390	0.188	2.319	0.109	1.346
Finland	0.836	0.952	0.178	0.202	0.208	0.601	0.177	0.509	0.180	0.986	0.015	0.085
France	0.106	1.230	0.012	0.138	0.016	0.497	0.012	0.383	0.009	0.562	0.005	0.288
Germany	0.034	1.224	0.005	0.188	0.106	0.945	0.035	0.309	0.069	1.269	0.005	0.085
Greece	1.996	0.801	0.081	0.032	0.876	1.009	0.042	0.048	11.908	0.800	0.591	0.040
Ireland	0.543	0.546	0.177	0.178	0.917	1.178	0.315	0.404	0.259	0.558	0.066	0.143
Italy	1.306	0.958	0.034	0.025	0.148	0.497	0.223	0.748	0.090	0.567	0.039	0.249
Netherlands	0.258	1.434	0.011	0.062	0.328	1.407	0.072	0.310	0.063	0.512	0.059	0.480
Portugal	0.707	1.085	0.043	0.066	0.375	0.942	0.029	0.072	0.317	1.405	0.024	0.105
Spain	0.285	0.990	0.012	0.042	0.200	1.040	0.022	0.112	0.144	1.656	0.093	1.066
EMU	0.612	0.955	0.063	0.107	0.388	0.854	0.108	0.306	1.246	1.067	0.097	0.365
Core EMU	0.316	1.021	0.057	0.140	0.292	0.789	0.092	0.329	0.164	1.125	0.041	0.402
Non-core EMU	0.967	0.876	0.069	0.069	0.503	0.933	0.126	0.277	2.543	0.997	0.163	0.321

The table shows the decomposition of the variability of the implied risk premium of each value-weighted country index over the EMU value-weighted average into the variance of the pure country effect and the variance of the sum of the 19 industry effects. The ratio column shows the ratio of the variance of that component to the total implied risk premium variance. In addition, cross-country averages for the entire EMU, the core EMU countries as well as the non-core EMU countries are given at the bottom of the table. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All measures are calculated separately for the pre-euro period (January 1994 to December 1998), the post-euro period (January 1999 to December 2009) and the eurozone crisis period (January 2010 to November 2011) based on the entire universe of firms.

Tables 4.9 and 4.10 report separate results for the three subperiods on a country and industry basis, respectively. The data reveals some interesting findings. Most importantly, I find that the pre-euro phase, from January 1994 to December 1998, is characterized by the dominance of country effects over industry effects in implied risk premiums, while the opposite is true for the post-euro period. In the pre-euro period, pure country effects, on average, have a variance of $0.612‰^2$, whereas pure industry effects only show a variance of $0.327‰^2$, resulting in a country to industry variance ratio of 1.87. Similarly, the contribution of the sum of industry effects in explaining the variance in the implied country risk premium is only minor in the pre-euro period (10.7%), while the ratio of the variability of the sum of country effects to the total industry risk premium variance amounts to 42.0%. The existence of pure country effects as well as the low relative importance of industry membership indicate that European equity markets were partially financially segmented before the launch of the common currency. The law of one price did not apply to the EMU stock markets in the pre-euro era, resulting in pricing differences between country portfolios. Furthermore, the low relative importance of industry effects compared to country effects suggests that firms facing the same global industry risk were valued with different discount rates depending on their country of origin. Especially among the PIIGS, country effects were more variable. On average, I find a pure country effect variance for those countries of $0.967‰^2$ in the pre-euro period. In particular, Greece and Italy stand out with a pure country effect variance of $1.996‰^2$ and $1.306‰^2$, respectively. Hence, these two markets were the most segmented from the other markets in the study over this period. Germany and France, on the other hand, are among the countries with the least prevalent pure country effect variance, which suggests they were the most financially integrated into the EMU before 1999.

Since the introduction of the euro, the relative importance of country and industry effects has reversed. The industry effect variance clearly dominates the country effect variance, which has declined substantially to $0.388‰^2$. This result is mostly attributable to the PIIGS countries, whose pure effect variance decreased from $0.967‰^2$ to $0.503‰^2$. The pure country variance for the core EMU countries decreased only slightly from $0.316‰^2$ to $0.292‰^2$. The sum of industry effects variance grew by more

Table 4.10: Decomposition of implied industry risk premiums into pure industry and sum of country effects for the pre- and post-euro and the eurozone crisis periods

	Jan1994 - Dec1998 (pre-euro)				Jan1999 - Dec2009 (post-euro)				Jan2010 - Nov2011 (euro-crisis)			
	Pure ind. eff.		Sum of 11 count. eff.		Pure ind. eff.		Sum of 11 count. eff.		Pure ind. eff.		Sum of 11 count. eff.	
Industry	Var. ($‰^2$)	Ratio	Var. ($‰^2$)	Ratio	Var. ($‰^2$)	Ratio	Var. ($‰^2$)	Ratio	Var. ($‰^2$)	Ratio	Var. ($‰^2$)	Ratio
Automobiles & parts	0.758	1.221	0.072	0.116	0.690	1.225	0.044	0.077	0.760	1.213	0.026	0.042
Banks	0.139	1.526	0.029	0.314	0.650	1.116	0.019	0.033	0.478	1.080	0.014	0.031
Basic resources	0.987	0.942	0.103	0.099	2.043	1.000	0.058	0.029	0.304	1.218	0.028	0.110
Chemicals	0.512	0.815	0.017	0.027	0.978	1.083	0.040	0.044	0.095	0.786	0.033	0.272
Construction & materials	0.262	1.021	0.011	0.042	0.448	0.952	0.013	0.027	0.106	1.285	0.006	0.079
Financial services	0.341	0.675	0.069	0.137	0.347	1.024	0.042	0.125	0.559	1.055	0.038	0.071
Food & beverage	0.079	4.412	0.057	3.203	0.503	1.158	0.058	0.133	0.127	1.431	0.018	0.205
Health care	0.324	1.015	0.006	0.020	0.287	1.044	0.007	0.025	0.151	1.066	0.011	0.075
Industrial goods & services	0.104	1.221	0.006	0.067	0.678	1.056	0.007	0.010	0.049	0.977	0.003	0.051
Insurance	0.141	0.549	0.039	0.150	1.506	0.951	0.011	0.007	0.782	1.002	0.002	0.003
Media	0.231	3.932	0.119	2.030	0.121	1.004	0.007	0.060	0.207	1.005	0.003	0.015
Oil & gas	0.323	0.685	0.112	0.237	1.269	0.979	0.026	0.020	0.420	1.026	0.006	0.014
Personal & household goods	0.218	1.356	0.042	0.260	0.435	0.928	0.009	0.019	0.189	0.972	0.003	0.016
Real estate	0.540	1.110	0.017	0.034	0.592	0.953	0.034	0.055	0.185	0.788	0.011	0.047
Retail	0.074	0.556	0.027	0.204	0.308	1.014	0.006	0.019	0.061	0.920	0.003	0.041
Technology	0.744	1.261	0.065	0.111	0.562	1.166	0.055	0.113	0.091	1.021	0.006	0.067
Telecommunications	0.244	0.385	0.290	0.458	0.653	0.854	0.015	0.020	0.107	1.433	0.022	0.299
Travel & leisure	0.139	1.015	0.009	0.065	0.712	1.456	0.045	0.092	0.320	1.047	0.020	0.066
Utilities	0.050	0.664	0.031	0.414	0.229	1.012	0.010	0.042	0.360	1.169	0.010	0.033
Cross-industry average	0.327	1.282	0.059	0.420	0.685	1.051	0.027	0.050	0.282	1.079	0.014	0.081

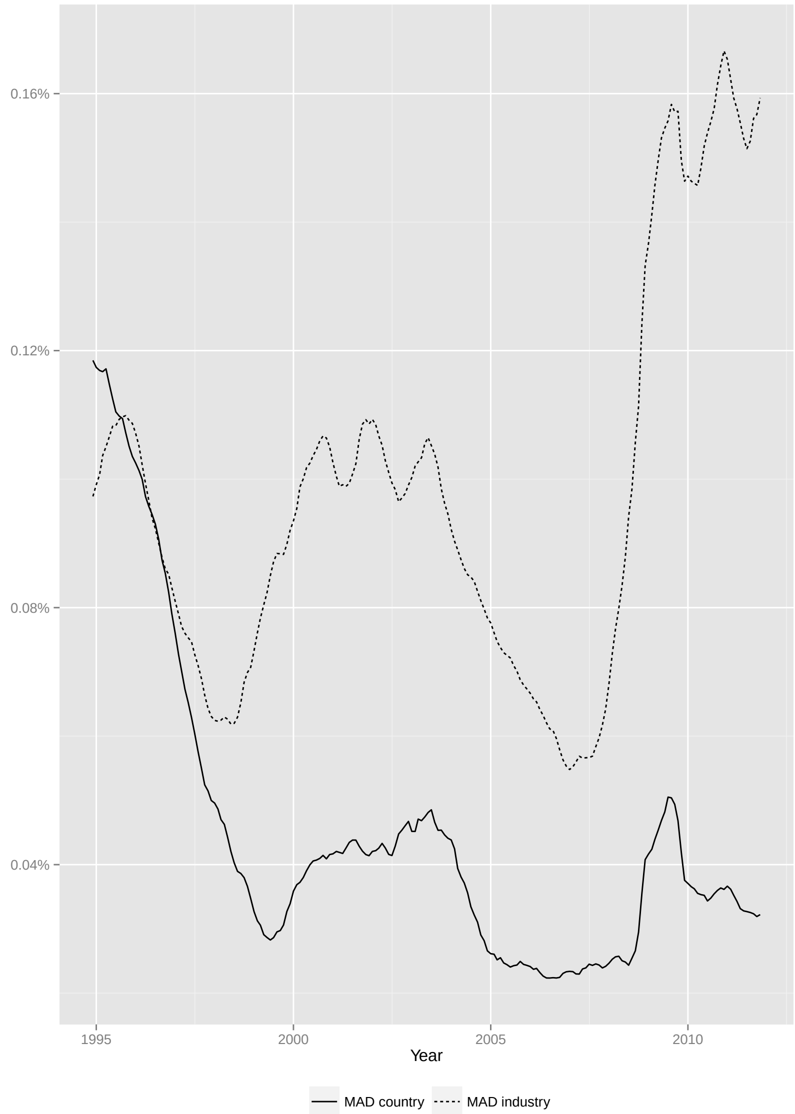
The table shows the decomposition of the variability of the implied risk premium of each value-weighted industry index over the EMU value-weighted average into the variance of the pure industry effect and the variance of the sum of the 11 country effects. The ratio column shows the ratio of the variance of that component to the total implied risk premium variance. In addition, the average over all industries is given at the bottom of the table. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All measures are calculated separately for the pre-euro period (January 1994 to December 1998), the post-euro period (January 1999 to December 2009) and the eurozone crisis period (January 2010 to November 2011) based on the entire universe of firms.

than 70% after the launch of the euro. Again, this result is mostly driven by the PIIGS countries. The ratio of the pure country effect to the total excess variance declined from 95.5% to 85.4%, while the ratio of the sum of industry effects to the total excess variance increased from 10.7% to 30.6%. For the industry indices, the pure effect variance more than doubled to $0.685‰^2$. The variance of the sum of country effects, on the other hand, decreased substantially to $0.027‰^2$, resulting in a ratio of only 5.0% of explained excess variance, compared to 42.0% in the pre-euro period. The country to industry pure effects ratio declined to 0.57 after the launch of the euro. This reversal in the relative importance of the pure effects, as well as the growing explanatory power of the sum of industry effects, provide evidence for an increase in financial integration among the EMU member states. There has clearly been some convergence in the pricing mechanism of different countries, even though the law of one price still does not fully apply to the EMU financial markets. In addition, companies facing the same industry risk are more similarly priced than before January 1999.

Finally, the tables also show the change in results for the recent eurozone crisis. The debt crisis in Greece, Portugal, Italy, Ireland and Spain has led to a re-thinking of investors. Increasing differentiation of the European economies should be reflected in a revival of country effects. In fact, Table 4.9 reveals a significant increase of the pure country effect from the post-euro to the eurozone crisis period. Responsible for this result is, in particular, the high pure country effect in Greece between January 2010 and November 2011. Excluding Greece, the pure effect variance for the EMU amounts to only $0.179‰^2$ and is thereby even below the one in the post-euro period. The influence of the eurozone crisis is substantially visible for Greece but negligible for all other EMU countries. On the industry index level, pure effect variance also decreases in the eurozone crisis period. But this drop is mainly driven by a reduction in total excess variance of industry risk premiums. The sum of country effects also dropped to a new low of $0.014‰^2$. Finally, the ratio between pure country effect variance (excluding Greece) and pure industry effect variance only increased slightly to 0.63.

To get a better understanding of the evolution of the relative importance of country versus industry effects within the EMU over time, I additionally plot the MADs over a moving window of 12 months.

Figure 4.2: Moving 12 months average of country and industry MADs



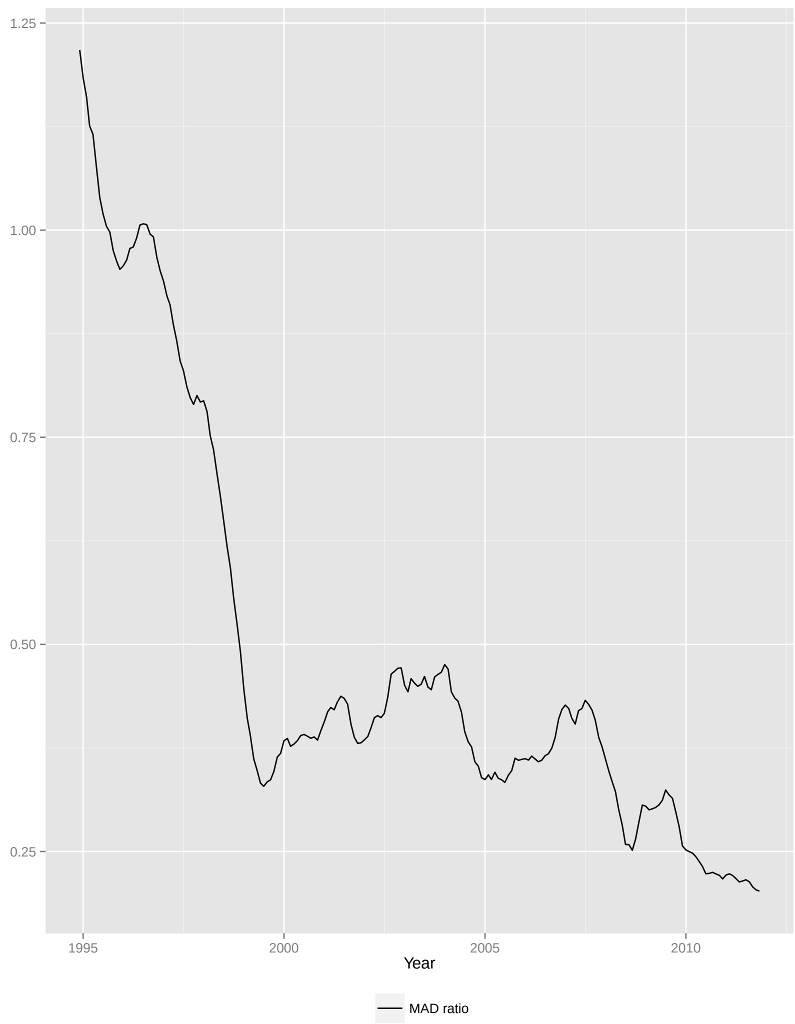
The plot shows the 12 months moving average MADs for country and industry indices. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

Figure 4.2 confirms my findings from the variance decomposition analysis. The weighted average country effect per month declines constantly from a level of 0.12% in 1994 to roughly 0.02% at the beginning of 1999. Since then, the country MAD has remained fairly stable at the trough level and increased slightly only during the internet bubble and the financial crisis. Figure 4.2 also shows that the magnitude of the industry MAD inclines from the beginning to the end of the observation period. The one-year average industry MAD at the beginning of the sample period measures 0.10%. This number drops constantly until the end of 1997, recovers in the early 2000s and falls again into its trough territory until the beginning of the financial crisis. Since then, the average industry effect per month has grown to a new peak with a magnitude significantly above the initial estimate for the industry MAD and consistent with Table 4.8. When comparing the country and industry MADs, I only find a short period before 1997, where the country MAD is larger than the industry MAD. After the two lines cross in 1997, the industry MAD remains consistently above the country MAD for the rest of the observation period. The gap between the two MAD lines widens considerably during the dot-com bubble and the financial crisis and remains extreme until the end of the sample period.

To assess the changing relative importance of country and industry factors over time, Figure 4.3 also plots the ratio of country and industry MADs. The moving country-industry MADs ratio is above one from the beginning of the observation period until the year 1997, which indicates the dominance of country factors during the earlier time frame. Afterwards, industry effects strongly gain relative significance, resulting in a fall of the plotted ratio from 1.0 to 0.3 at the beginning of 1999. The number fluctuates around 0.4 until the start of the financial crisis and then gradually falls to approximately 0.2 during the last three-year subperiod. The absolute industry effect, therefore, clearly dominates the country effect in recent years, which is consistent with the results from the variance analysis.

Overall, I find evidence for all three hypothesized effects of financial integration within the Heston-Rouwenhorst framework. First, pure country effects only have about half the magnitude in the post-euro period than they had in the years before the launch of the common currency. Second, industry effects gained significant importance and dominate country effects in the post-euro part of the observation period. Finally, the industrial composition of country indices explains substantially more of the variance in implied country risk premiums in the post-euro period than in the pre-euro period,

Figure 4.3: Ratio of the 12 months moving average of country and industry MADs



The plot shows the ratio between the 12 months moving average value-weighted country MAD and the 12 months moving average value-weighted industry MAD. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

suggesting that country portfolios are getting increasingly specialized. However, the sustained existence of pure country effects within the EMU means that investors still price risks differently across markets. After the elimination of currency risk and the harmonization of monetary policies, there remain reasons that prevent markets from becoming fully integrated. These can include differences in economic policies, tax and legal systems as well as psychological barriers, such as home bias.

4.7 Sensitivity analysis

In this section, I evaluate the impact of certain assumptions and data selection criteria on the results. I repeat the analysis on different data sets to check the robustness of the results with respect to the following influences: (1) The use of implied premiums, (2) the impact of certain industries, (3) the impact of a general European or global integration process, which is not directly linked to the EMU and (4) the impact of analyst forecast bias.

I begin by analyzing the same universe of companies but using the ICC instead of the implied risk premium, adding back the risk-free rate. The second sample uses implied premiums but excludes the firms of certain industries. First, because the beginning of the post-euro period coincides with the Dot-com bubble, I repeat the analysis on a subsample excluding the information technology sectors in order to distinguish these two impacts. Second, I omit the stocks of the financial industries, as it is both the sector most directly affected by the introduction of the euro and the sector at the heart of the recent financial crisis. Finally, to get a better feeling for the importance of the EMU with its monetary policy convergence and the introduction of a common currency, I repeat the analysis on a broader sample, including all countries that entered the EU before 2004 (except for Luxembourg) as well as Switzerland.

4.7.1 Absolute ICC estimates

The finding in the robustness test of Subsection 3.5.3 showed that the choice of the risk-free rate can have a substantial influence on the results. Thus, to check that the results are similar when I use the ICC instead of implied risk premiums, I add back the risk-free interest rates to the implied risk premium estimates. Because I use the German risk-free rate for all EMU countries after January 1999 (for Greece from January 2001 onwards), the findings for the post-euro period should not materially change. Therefore, I focus the analysis in this part on the variance decomposition for

Table 4.11: Decomposition of country ICCs into pure country and sum of industry effects for the pre-euro period

	Jan1994 - Dec1998 (pre-euro)			
	Pure country effect		Sum of 19 industry effects	
Country	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Austria	0.495	0.576	0.086	0.100
Belgium	0.212	0.708	0.037	0.123
Finland	0.851	0.790	0.153	0.142
France	0.055	1.063	0.011	0.209
Germany	0.172	1.166	0.005	0.032
Greece	3.313	1.011	0.072	0.022
Ireland	0.437	0.522	0.153	0.183
Italy	0.153	0.722	0.030	0.142
Netherlands	0.073	1.449	0.009	0.183
Portugal	1.582	0.933	0.038	0.022
Spain	0.310	1.123	0.011	0.040
EMU	0.696	0.915	0.055	0.109
Core EMU	0.310	0.959	0.050	0.131
Non-core EMU	1.159	0.862	0.061	0.082

The table shows the decomposition of the variability of the implied absolute return of each value-weighted country index over the EMU value-weighted average into the variance of the pure country effect and the variance of the sum of the 19 industry effects. The ratio column shows the ratio of the variance of that component to the total ICC variance. In addition, cross-country averages for the entire EMU, the core EMU countries as well as the non-core EMU countries are given at the bottom of the table. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. All measures are calculated only for the pre-euro period (January 1994 to December 1998).

the pre-euro period.

Including differences in local risk-free rates, I would expect country effects to be more pronounced, resulting in a higher pure country effect variance. This should, of course, only be true prior to the euro introduction or more specifically prior to the harmonization of monetary policies across the EMU member states. Interestingly, I find only light evidence for this theory. This could be the result of the nominal convergence process in interest rates that took place years before the introduction of the euro.

From Table 4.11, it can be seen that country variances are very similar, whether the expected return is expressed in absolute terms or as a premium. The cross-country average of the pure country effect variance amounts to 0.696‰^{2} in comparison to 0.612‰^{2} for the implied risk premium in the pre-euro period. Likewise, pure industry effect vari-

Table 4.12: Decomposition of industry ICCs into pure industry and sum of country effects for the pre-euro period

	Jan1994 - Dec1998 (pre-euro)			
	Pure industry effect		Sum of 11 country effects	
Industry	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Automobiles & parts	0.643	0.962	0.005	0.008
Banks	0.123	0.963	0.006	0.049
Basic resources	0.843	0.711	0.172	0.145
Chemicals	0.452	1.275	0.032	0.090
Construction & materials	0.239	0.726	0.020	0.062
Financial services	0.305	0.684	0.043	0.096
Food & beverage	0.067	1.365	0.024	0.494
Health care	0.287	2.323	0.056	0.457
Industrial goods & services	0.094	0.886	0.009	0.085
Insurance	0.116	0.534	0.031	0.144
Media	0.204	1.824	0.038	0.336
Oil & gas	0.295	1.218	0.072	0.297
Personal & household goods	0.196	0.992	0.020	0.100
Real estate	0.481	1.079	0.010	0.023
Retail	0.067	0.581	0.015	0.132
Technology	0.661	1.420	0.049	0.105
Telecommunications	0.216	0.650	0.081	0.245
Travel & leisure	0.124	0.955	0.040	0.306
Utilities	0.045	1.134	0.013	0.322
Cross-industry average	0.287	1.068	0.039	0.184

The table shows the decomposition of the variability of the implied absolute return of each value-weighted industry index over the EMU value-weighted average into the variance of the pure industry effect and the variance of the sum of the 11 country effects. The ratio column shows the ratio of the variance of that component to the total ICC variance. In addition, the average over all industries is given at the bottom of the table. The ICC is calculated as the average over the four estimation methods, CT, GLS, OJ and MPEG. All measures are calculated only for the pre-euro period (January 1994 to December 1998).

ances (see Table and 4.12) are 0.287‰^{2} and 0.327‰^{2}, respectively. This results in a country to industry variance ratio for absolute implied returns of 2.43 in the pre-euro period. Also, the variances of the sum of industry effects and the sum of country effects are very much in line with the results for implied risk premiums. Only the variability of the sum of country effects for the pre-euro period is with a magnitude of 0.039‰^{2} and a ratio of 18.4% slightly lower than in the analysis based on implied risk premiums (0.059‰^{2} and 42.0%).

In sum, these results demonstrate that my findings for the pre-euro period do not depend on the choice of absolute or excess expected returns.

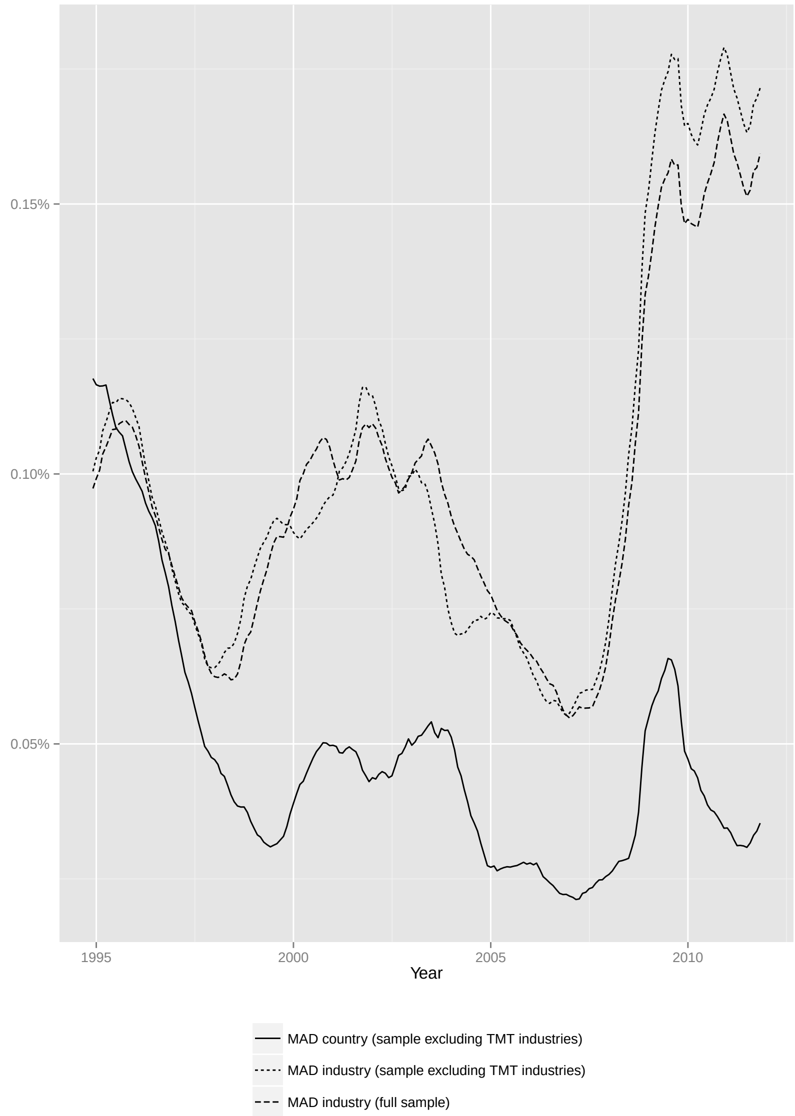
4.7.2 Exclusion of TMT industries

The purpose of the next robustness check is to investigate whether or not the findings of the previous chapter are solely driven by specific developments in certain industries. Brooks and Del Negro (2004) argue that the rise in industry effects was only a temporary phenomenon associated with the bubble in the technology, media and telecommunications (TMT) sectors. I address this issue by running the same analysis on a subsample that excludes the relevant sectors. To explore the impact of the TMT industries on the magnitude of industry effects over time, I concentrate the reported results on the moving MAD analysis. For comparison, I also include the MAD industry results of the main empirical part in the figures.

The pure sector variance tables in the last chapter revealed that TMT industries exhibited below average variation compared to the other sectors over the full sample period. Thus, I do not expect the industry MAD to be lower, on average, when these sectors are omitted. Looking at Figure 4.4 confirms this presumption, as the industry MAD line for the subsample excluding TMT lies on the same level as the one for the full sample most of the time. As anticipated, the exclusion of the TMT industries does not notably alter the results when compared to the full sample. The figure only shows a minor effect from the TMT sectors on the absolute industry effects during the IT bubble. The rise in the magnitude of the industry MAD around the year 2000 is slightly alleviated when the relevant sectors are omitted, but the gap between the two lines is almost negligible. In mid-2004, the two lines level again and afterwards proceed together until the financial crisis. Indeed, the absolute industry effects for the limited sample surpassed the ones of the full sample during the recent crisis. This gap can be interpreted in light of the increased weight of the financial sectors in the smaller subsample excluding TMT sectors. I will examine the impact of those sectors in the next sensitivity analysis. The country MAD is barely affected by the exclusion of certain industries (cf. Figure 4.2).

Finally, I plot the ratio of the moving country to industry MADs for the subsample excluding the information technology industries as well as for the full sample. The figure

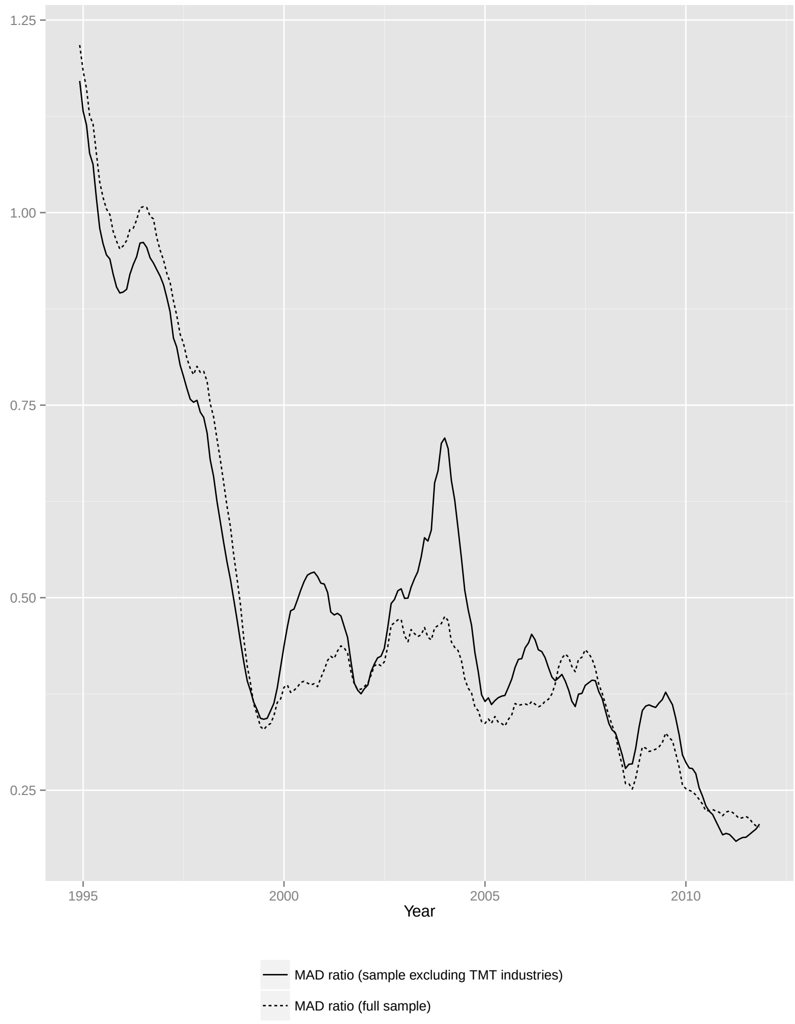
Figure 4.4: Moving 12 months average of country and industry MADs for the sample excluding TMT sectors



The plot shows the 12 months moving average MADs for country and industry indices. Industry MADs are given for the subsample excluding the TMT sectors as well as for the entire sample. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

reveals almost no differences between the ratios of the two samples. The exclusion of the TMT industries has only a slight impact on the ratio during the dot-com bubble,

Figure 4.5: Ratio of the 12 months moving average of country and industry MADs for the sample excluding TMT sectors



The plot shows the ratio between the 12 months moving average value-weighted country MADs and the 12 months moving average value-weighted industry MADs for the subsample excluding the TMT sectors as well as for the entire sample. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

where the moving country to industry MAD ratio is approximately 0.2 higher for the reduced sample. However, this effect has no influence on the general picture - industry effects clearly dominate country effects in the post-euro period.

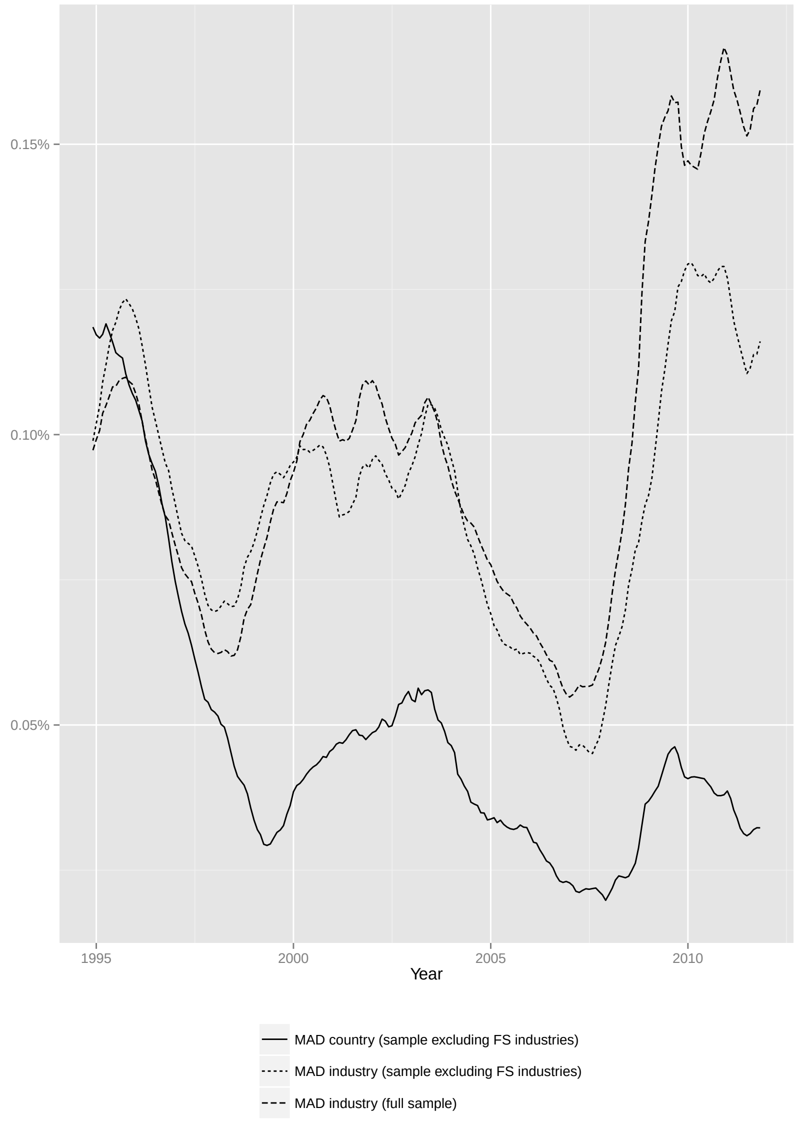
Overall, the analysis demonstrates that the increasing importance of the industry effect in explaining expected risk premiums cannot be explained by the TMT sectors alone, but that my results are robust with respect to their exclusion.

4.7.3 Exclusion of FS industries

Another possible concern is the impact of the financial crisis on my findings, since the financial sectors make up a significant part of the sample. Additionally, these industries were the ones most directly affected by the synchronization of monetary policies and the introduction of the euro. Figure 4.2 in the last chapter, where I plotted the 12 months moving country and industry MADs, revealed a drastically widening gap between the two MAD lines with industry effects gaining significant importance during the last part of the observation period. This time frame coincides with the global financial crisis, which was caused by the U.S. subprime mortgage crisis and the following shortage of liquidity, resulting in the collapse and bailout of large financial institutions and a simultaneous downturn in global equity markets. The industries that initiated and were largely affected by the financial crisis are the real estate, banking and financial service (FS) industries. Thus, I investigate the robustness of the MAD results with respect to the omission of these industries. As in the prior analysis, which examined the effect of the TMT sectors, I exclude the relevant financial industries from the total sample and re-run the Heston-Rouwenhorst model regression on this subsample. Figure 4.6 presents the 12 months moving MADs for the sample excluding FS firms over the whole observation period. In order to assess changes in results, the industry MAD for the full sample of Section 4.6 is also presented in the figure. Again, the country MAD is not mentionable altered when the financial sectors are omitted.

Figure 4.6 provides evidence that the rise in the importance of industry effects during 2008 and 2009 cannot be assigned solely to the FS industries. However, the peak in the industry MAD is significantly lowered when using the subsample that excludes FS sectors. For the remaining sample period, until the beginning of the financial crisis there is no observable difference between the industry MAD of the full sample and the one of the subsample that excludes the financial firms. Only during the dot-com bubble, I observe that financial firms were also heavily affected, leading to a reduction

Figure 4.6: Moving 12 months average of country and industry MADs for the sample excluding FS sectors



The plot shows the 12 months moving average MADs for country and industry indices. Industry MADs are given for the subsample excluding the FS sectors as well as for the entire sample. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

in industry effects if I exclude them.

Compared to the results of the previous analysis, which excluded the TMT firms, the

Figure 4.7: Ratio of the 12 months moving average of country and industry MADs for the sample excluding FS sectors

The plot shows the ratio between the 12 months moving average value-weighted country MAD and the 12 months moving average value-weighted industry MAD for the subsample excluding the FS sectors as well as for the entire sample. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to November 2011.

effect of omitting financial firms is much more pronounced. Therefore, I also plot the ratio of country to industry MADs for the subsample to examine the impact of the relevant industries on my conclusion of a reversal in the relative importance of country and industry effects in the post-euro era.

Figure 4.7 shows the 12 months moving MAD ratio for the full sample as well as for the reduced sample. The ratio for the subsample excluding the FS sectors lies slightly above the one for the full sample in the post-euro period. However, it is still substantially below the point where country and industry effects would be equally important.

I conclude that neither the influence of the TMT sectors nor the one of financial firms were solely responsible for the recent growth in industry effects. Rather, the dominance of industry effects over country effects was an industry-wide and permanent phenomenon.

4.7.4 Extended EU sample

Third, I consider an extended country sample that includes, in addition to the 11 EMU countries, other European countries, specifically the U.K., Switzerland, Denmark and Sweden. Except for Switzerland, all of these countries are part of the EU and show a high degree of economic integration with the original EMU sample. Their inclusion acts as a useful benchmark to find out about the underlying causes of the results. In particular, I am able to answer the question of whether the EMU and specifically the introduction of the euro were acting as the main drivers for the reversal in the relative importance of country and industry effects. In other words, I investigate if the findings are specific only to the EMU. Alternatively, a general European or global trend towards financial market integration could also be responsible for my results. Thus, I repeat the analysis on a broader sample. I focus the reported results on the pre- versus post-euro variance decomposition, which enables me to separate the contribution of single markets in the overall results.

The results are presented in Table 4.13 and 4.14. In the pre-euro period, the euro countries show a larger pure country effect variance ($0.693‰^2$) than the non-euro countries ($0.181‰^2$). The U.K. and Switzerland with values of $0.031‰^2$ and $0.081‰^2$, respectively, exhibit extremely low pure country effect variances. National factors seem to play a more important role in the eurozone countries compared to the non-euro countries before the launch of the common currency. This result is also driven by the different compositions of the two country groups. While the non-EMU group mainly consists

Table 4.13: Decomposition of implied country risk premiums into pure country and sum of industry effects for the pre- and post-euro and the eurozone crisis periods using an extended European sample

	Jan1994 - Dec1998 (pre-euro)				Jan1999 - Dec2009 (post-euro)				Jan2010 - Nov2011 (euro-crisis)			
	Pure count. eff.		Sum of 19 ind. eff.		Pure count. eff.		Sum of 19 ind. eff.		Pure count. eff.		Sum of 19 ind. eff.	
Country	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Austria	0.448	0.665	0.057	0.085	0.578	0.620	0.080	0.086	0.346	0.889	0.039	0.099
Belgium	0.391	0.816	0.017	0.036	0.216	0.532	0.128	0.315	0.231	2.038	0.087	0.767
Switzerland	0.081	1.156	0.022	0.317	0.184	0.760	0.068	0.283	0.059	0.751	0.017	0.217
Denmark	0.155	1.024	0.011	0.073	0.171	0.718	0.057	0.239	0.161	1.241	0.037	0.286
Finland	1.009	1.095	0.095	0.103	0.269	0.782	0.229	0.665	0.096	0.854	0.013	0.118
France	0.122	1.227	0.008	0.076	0.057	0.861	0.010	0.155	0.012	1.231	0.003	0.274
Germany	0.057	1.262	0.009	0.192	0.216	0.899	0.049	0.206	0.098	0.785	0.005	0.043
Greece	2.536	0.992	0.045	0.017	0.988	0.986	0.043	0.043	12.708	0.818	0.490	0.032
Ireland	0.541	0.613	0.112	0.127	0.632	1.199	0.220	0.418	0.202	0.614	0.037	0.112
Italy	1.390	1.060	0.017	0.013	0.139	0.411	0.211	0.624	0.215	0.804	0.042	0.157
Netherlands	0.247	1.244	0.007	0.034	0.269	1.051	0.056	0.219	0.068	0.736	0.049	0.532
Portugal	0.554	0.947	0.034	0.059	0.366	1.038	0.025	0.072	0.397	1.262	0.017	0.054
Spain	0.324	1.156	0.014	0.048	0.151	1.126	0.029	0.215	0.106	0.954	0.106	0.957
Sweden	0.456	0.975	0.023	0.049	0.201	0.889	0.130	0.573	0.081	1.942	0.029	0.694
U.K.	0.031	1.504	0.003	0.162	0.153	1.045	0.018	0.125	0.043	0.610	0.007	0.101
European average	0.556	1.049	0.032	0.093	0.306	0.861	0.090	0.283	0.988	1.035	0.065	0.296
EMU	0.693	1.007	0.038	0.072	0.353	0.864	0.098	0.274	1.316	0.999	0.081	0.286
Non-EMU	0.181	1.233	0.015	0.150	0.177	0.891	0.068	0.305	0.086	1.031	0.023	0.325
Core EMU	0.379	1.051	0.032	0.088	0.268	0.791	0.092	0.274	0.142	1.089	0.033	0.306
Non-core EMU	1.069	0.954	0.044	0.053	0.455	0.952	0.106	0.275	2.725	0.890	0.138	0.262

The table shows the decomposition of the variability of the implied risk premium of each value-weighted country index over the European value-weighted average into the variance of the pure country effect and the variance of the sum of the 19 industry effects. The ratio column shows the ratio of the variance of that component to the total implied risk premium variance. In addition, cross-country averages for the entire European sample, the EMU, the non-EMU countries, the core EMU countries as well as the non-core EMU countries are given at the bottom of the table. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All measures are calculated separately for the pre-euro period (January 1994 to December 1998), the post-euro period (January 1999 to December 2009) and the eurozone crisis period (January 2010 to November 2011) based on the entire universe of firms.

of countries with strong international linkages, namely the U.K., Switzerland, Sweden and Denmark, the EMU group also incorporates countries which could be regarded as less integrated prior to 1999, such as Portugal and Greece. Most interesting, however, is the evolution of the country effect from the pre- to the post-euro period. While the variability of the pure country effect, on average, stayed almost unchanged for the non-euro countries from the pre- to the post-euro period, it was almost halved for the countries adopting the euro. A closer look at the individual country level reveals that this drop is mainly attributable to the non-core EMU countries. Their pure country effect variance fell from $1.069‰^2$ to $0.455‰^2$. Also, the core EMU countries show a certain drop in pure effect variance from an average of $0.379‰^2$ in the pre-euro period to $0.268‰^2$ in the post-euro period. Comparing these results to the ones for the EMU sample in Table 4.9 reveals that the drop in country effect variance is even more pronounced in the extended sample. This result indicates that the EMU countries were also becoming increasingly integrated with the rest of Europe. Looking at the last subperiod, which comprises the eurozone crisis, the pure effect variance for the Non-EMU countries shows a similar development to the one for the core-EMU countries.

Table 4.14 shows evidence that results for the industry index variance decomposition obtained with the European sample are well in line with the ones from the EMU sample. The European sample provides less pronounced industry effects in the pre-euro period as well as in the post-euro and euro-crisis period with pure effect variances of $0.242‰^2$, $0.574‰^2$ and $0.221‰^2$, compared to $0.327‰^2$, $0.685‰^2$ and $0.282‰^2$ obtained for the EMU sample. Therefore, the industry effect variance more than doubled from the pre- to the post-euro period and halved again in the euro-crisis period in both samples. The variability of the sum of country effects remained fairly constant from the pre- to the post-euro period at approximately $0.02‰^2$ for the broader European sample, compared to $0.059‰^2$ (1994-1998) and $0.027‰^2$ (1999-2009) in the base sample. This reflects the drop in the importance of country effects in industry indices, which seems to be visible only for the EMU member countries.

Overall, I conclude that the drop in the importance of country influences is attributable to the euro or the EMU convergence process, since it is not observable for non-EMU countries in Europe. However, I also find that the EMU countries show some degree

Table 4.14: Decomposition of implied industry risk premiums into pure industry and sum of country effects for the pre- and post-euro and the eurozone crisis periods using an extended European sample

	Jan1994 - Dec1998 (pre-euro)				Jan1999 - Dec2009 (post-euro)				Jan2010 - Nov2011 (euro-crisis)			
	Pure ind. eff.		Sum of 15 count. eff.		Pure ind. eff.		Sum of 15 count. eff.		Pure ind. eff.		Sum of 15 count. eff.	
Industry	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio	Var. (‰^{2})	Ratio
Automobiles & parts	0.562	1.202	0.039	0.083	0.706	1.318	0.104	0.194	0.702	1.353	0.052	0.100
Banks	0.284	1.500	0.020	0.104	0.675	1.115	0.014	0.023	0.443	1.047	0.003	0.007
Basic resources	0.943	1.059	0.035	0.040	1.346	0.858	0.052	0.033	0.109	0.640	0.029	0.173
Chemicals	0.125	0.786	0.008	0.048	0.845	1.059	0.043	0.054	0.070	0.575	0.035	0.287
Construction & materials	0.210	1.202	0.005	0.026	0.474	1.138	0.012	0.029	0.098	0.918	0.003	0.028
Financial services	0.148	0.610	0.033	0.134	0.158	0.948	0.013	0.079	0.100	1.136	0.004	0.047
Food & beverage	0.025	1.168	0.008	0.380	0.344	0.814	0.028	0.067	0.114	1.005	0.004	0.039
Health care	0.080	1.144	0.022	0.318	0.239	1.087	0.035	0.159	0.085	1.357	0.015	0.248
Industrial goods & services	0.140	1.163	0.004	0.031	0.615	1.080	0.003	0.005	0.038	0.903	0.002	0.043
Insurance	0.149	0.862	0.033	0.190	1.258	0.919	0.011	0.008	0.485	0.960	0.002	0.004
Media	0.194	2.843	0.049	0.714	0.121	0.934	0.006	0.047	0.103	1.205	0.003	0.033
Oil & gas	0.293	0.794	0.032	0.087	1.179	0.939	0.025	0.020	0.793	0.949	0.006	0.007
Personal & household goods	0.123	1.799	0.020	0.286	0.573	1.074	0.004	0.008	0.116	1.088	0.003	0.031
Real estate	0.300	1.062	0.011	0.040	0.352	0.782	0.016	0.036	0.099	0.918	0.004	0.034
Retail	0.045	1.546	0.013	0.458	0.296	1.147	0.005	0.021	0.104	1.148	0.001	0.015
Technology	0.526	1.368	0.030	0.078	0.502	1.328	0.057	0.152	0.067	0.999	0.006	0.093
Telecommunications	0.171	0.725	0.045	0.192	0.343	0.862	0.010	0.024	0.262	1.295	0.012	0.061
Travel & leisure	0.195	1.238	0.008	0.053	0.716	1.111	0.031	0.048	0.104	0.876	0.008	0.070
Utilities	0.075	0.836	0.012	0.131	0.172	1.028	0.009	0.054	0.308	1.022	0.009	0.030
Cross-industry average	0.242	1.206	0.022	0.179	0.574	1.028	0.025	0.056	0.221	1.021	0.011	0.071

The table shows the decomposition of the variability of the implied risk premium of each value-weighted industry index over the European value-weighted average into the variance of the pure industry effect and the variance of the sum of the 15 country effects. The ratio column shows the ratio of the variance of that component to the total implied risk premium variance. In addition, the average over all industries is given at the bottom of the table. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. All measures are calculated separately for the pre-euro period (January 1994 to December 1998), the post-euro period (January 1999 to December 2009) and the eurozone crisis period (January 2010 to November 2011) based on the entire universe of firms.

of financial integration with the non-EMU European countries, which is only indirectly driven by the common currency and the harmonization of monetary policies. Of course, being part of the EMU, with its underlying stabilization criteria, and the adoption of one of the world's main reserve currencies, also help to promote a market's attractiveness to investors outside the EMU.

4.7.5 Analyst forecast bias

Finally, I want to analyze the impact of analyst forecast bias on the presented results. As already mentioned in Subsections 2.1.4 and 3.5.5, a growing body of literature mentions the possibility that I/B/E/S analyst earnings forecasts may be systematically biased (cf. Guay et al., 2011; Easton and Sommers, 2007). Since the purpose of this study is not to measure the absolute magnitude of expected returns but to measure the relative importance of country and industry effects, this would not affect my conclusions, as long as the bias is not systematically associated with certain countries or industries. Nevertheless, to rule out any possible bias introduced through analysts' optimism, the following analysis compares estimates using analyst forecasts with estimates using actual realized earnings.

Figure 4.8 presents the 12 months moving MADs for the sample firms using actual reported EPS figures versus forecasted I/B/E/S numbers. I assume perfect foresight to filter out the effect of analyst forecast bias. Thereby, I ignore the possibility that analyst forecasts could diverge from actual earnings but this opinion is shared by the majority of market participants. Because of the need of perfect foresight for three years and the reporting lag of earnings, the ICC based on actual EPS can only be calculated until 2008.

Both the industry and country MAD lines for reported EPS lie above the ones using forecasts. However, most importantly even when assuming perfect foresight, the industry MAD is higher than the country MAD after the two lines cross in 1997. To clarify this point, I show the MAD ratio in Figure 4.9.

The country to industry MAD ratio for real EPS is above the one for forecasted EPS for most of the time. The significant fall in the MAD ratio before 2000 is even more

Figure 4.8: Moving 12 months average of country and industry MADs using actual EPS versus forecasted EPS

The plot shows the 12 months moving average MAD for country and industry indices. Results are shown, first, using actual reported EPS, and second, using I/B/E/S EPS forecasts. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to December 2008.

pronounced for the perfect foresight case. Beginning in roughly 1997, the MAD ratio is clearly below one and stays below this level until the end of 2008. Thus, I conclude

Figure 4.9: Ratio of the 12 months moving average of country and industry MADs using actual EPS versus forecasted EPS

The plot shows the ratio between the 12 months moving average value-weighted country MAD and the 12 months moving average value-weighted industry MAD. Results are shown, first, using actual reported EPS, and second, using I/B/E/S EPS forecasts. MADs are calculated as the weighted absolute sum of the industry or country factors. Factors are estimated monthly using the Heston-Rouwenhorst regression framework on the basis of implied excess local-currency returns. Implied risk premiums are calculated as the difference between the ICC (average of CT, GLS, OJ and MPEG models) and the yield on a country's 10-year government bond. For euro area countries the yield on the German 10-year government bond is used after the euro introduction. The observation period spans from January 1994 to December 2008.

that, even though, my results are slightly weaker for the specification using realized EPS, the findings are not attributable to systematic forecast bias.

4.8 Other possible explanations

To separate the explicit influence of the euro introduction on the time-series characteristics of the country and industry effects, I investigate the impact of alternative explanatory variables in this section. More specifically, the introduction of the euro was preceded by several monetary and fiscal policy initiatives as well as a more general global trend towards integration, which could have resulted in the increased relative importance of industry effects found in Section 4.6. Therefore, I examine whether the evolution of the pure country to industry effect ratio can be explained by variables, which reflect these harmonization measures. I follow Ferreira (2006) in using a simple regression analysis in addressing this question and in their choice and construction of certain variables.

First, the member countries of the EMU have been subject to a gradual coordination of monetary policies in their effort to satisfy the Maastricht criteria. This led to a progressive convergence of inflation and interest rates, the so-called nominal convergence. Following, Ferreira (2006) I investigate the role of the cross-sectional variance of interest rates and foreign exchange rate changes in explaining the ratio of pure country to industry effects. Nominal convergence among the EMU countries should translate into a lower cross-country variance in both variables. The risk-free rate is an important component of the discount rate used to value equities. Therefore, I expect that the pricing mechanism for EMU equities is influenced by differences in interest rates. Exchange rate volatility can work as a major driver of market segmentation. Foreign investors require an additional risk premium to compensate for increased uncertainty and costly currency hedging. To calculate cross-sectional interest-rate dispersion (IRDISP), I use monthly changes in the short-term interest rate of each country from the OECD database.[10] Exchange rate dispersion (EXDISP) is measured using the monthly change of a country's exchange rate against the British pound from Datastream.

Second, the adherence to the Maastricht criteria also led, to some extent, to the har-

[10]Short-term rates are either the interbank offer rate or the rate associated with treasury bills, certificates of deposit or comparable instruments, each of three month maturity. After January 1999 the 3-month European interbank offered rate is used for the EMU countries. Data is provided by the national central banks.

monization of fiscal policies and an increased synchronization in business cycles across the EMU economies. The progressing integration of financial markets also promoted the creation of a single European market for goods and services. This so-called real convergence should be visible in a growing cross-country average of within EMU trade to GDP (EMUTRADE) as well as in a decreasing cross-country dispersion of industrial production growth rates (IPRDISP).[11] Synchronization in business cycles and interdependency through trade should result in an increased transmission of shocks across financial markets and more homogeneous valuations of EMU equities. Monthly trade data is taken from the IMF Direction of Trade Statistics and monthly industrial production data is available in the OECD database. I scale the annualized sum of exports and imports in each month with annual GDP data from the Worldbank.

Third, the euro was not the only measure to reduce barriers to cross-border financial transactions. The creation of the eurozone was preceded by a gradual abolition of various ownership restrictions for cross-border investments on non-residents. I introduce the KAOPEN index, a measure of a country's openness in capital account transactions, based on the work of Chinn and Ito (2008). Using information on capital controls from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), the authors aim to measure the extent of openness in cross-border financial transactions. They base the KAOPEN index on binary dummy variables codifying the restrictions on cross-border capital controls. Up to 1996, one dummy variable was assigned for each of four major categories: The presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and the requirement of the surrender of export proceeds. From 1996 onwards, when these four categories were disaggregated further in the AREAER, the authors follow Mody and Murshid (2005) in their approach. The index is constructed to take on higher values the more open the country is to cross-border capital transactions. I aggregate country indicators to an EMU average using equally weighting. Since the KAOPEN index is only reported once a year, it is assumed to remain constant throughout the year.

Fourth, as already mentioned in Section 4.7, I cannot rule out that the results are driven

[11] The real convergence variables are constructed similar to Fratzscher (2002).

by a broader global trend towards real convergence. Therefore, I include variables measuring the level of integration with markets outside the EMU. Again, I use trade and growth in industrial production as a proxy for real convergence. Global trade is calculated as the sum of monthly imports and exports outside the EMU divided by the country's GDP (TTRADE). To measure the synchronism in business cycles, I use the simple average of the EMU markets' absolute difference in industrial production growth to the U.S. (IPRDIFUS). The sources of the data are the IMF, OECD and Worldbank databases.

Finally, I cannot rule out the possibility that my results are driven by another event than the euro introduction, namely the IFRS implementation in Europe. In March 2002, the European Parliament passed a resolution requiring all firms that are listed on European stock exchanges to apply IFRS accounting standards within their financial statements for fiscal years beginning in or after January 2005.[12] I include a dummy variable (IFRS), which is equal to one after January 2005 and zero otherwise.

In line with Ferreira (2006), the dependent variable is the monthly ratio of country to industry effects (CIR). The Heston-Rouwenhorst model yields a monthly coefficient for each country and industry. I average absolute pure country and industry effects to calculate the monthly ratio of country to industry effects. The higher the ratio, the more important are country-specific factors in explaining expected returns relative to industry-specific factors.

Using the described variables, as well as a binary dummy variable (EURO) that equals one after the launch of the euro and zero otherwise, I estimate the following time-series regression:

$$\begin{aligned} CIR_t = \alpha_0 + \alpha_1 t + \alpha_2 EURO_t + \alpha_3 IRDISP_t + \alpha_4 EXDISP_t + \alpha_5 IPRDISP_t + \\ + \alpha_6 EMUTRADE_t + \alpha_7 KAOPEN_t + \alpha_8 TTRADE_t + \\ + \alpha_9 IPRDIFUS_t + \alpha_{10} IFRS_t + e_t. \end{aligned} \tag{4.9}$$

I use different combinations of the predictor variables on the right-hand side to separate

[12] For firms with traded securities in the U.S. and who report according to U.S. accounting standards, the required adoption date is January 2007 (Armstrong et al., 2008).

their influence in explaining the country to industry ratio.

In Table 4.15, I report the results of the regression analysis showing coefficients, heteroscedasticity and autocorrelation robust t-statistics and R-squares. The first estimation is based on the intercept and time trend only. As expected, the country to industry ratio shows a weak negative trend over the observation period with a significant slope coefficient of -0.004. Already between January 1994 and January 1999 the ratio declined from approximately 1.2 to 0.2. This translates into a trend coefficient of -0.014 for the pre-euro period. Following the adaption of the euro the ratio remained fairly stable with a trend coefficient of only -0.001.

Next, I include the euro dummy as an explanatory variable. The coefficient is negative with a value of -0.316 and significant at the 1% level. The trend coefficient is still statistically significant but declines to -0.002. The regression has an adjusted R-square of 71%. The result is consistent with the findings of Ferreira (2006), who document a significant and negative coefficient for the euro dummy using realized return data over the 1975-2001 period.

I now include step by step additional predictor variables to analyze the remaining explanatory power of the euro introduction, when nominal convergence and other measures of real and financial integration are taken into account. Regression (3) investigates the contribution of the short-term interest rate harmonization and declining exchange rate return dispersion in explaining the ratio of country to industry effects. Both coefficients show the expected sign. The higher the cross-sectional variance of interest rate and exchange rate changes, the more important are absolute country effects relative to absolute industry effects. However, none of the coefficients is statistically significant. Whereas Ferreira (2006) report that the cross-sectional variance of interest rates has significant explanatory power for the ratio of country over industry effects in realized returns, my findings indicate only an insignificant association with implied returns. The difference may be driven by a convergence in cash flow innovations resulting from the harmonization of interest rates. The coefficient and t-statistics of the euro dummy variable remain fairly unchanged.

Next, I run the regression including two variables for real convergence, industrial pro-

Table 4.15: Time-series regression results for the influence of different integration variables on the country to industry ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.930***	0.955***	0.922***	1.300***	4.960***	1.379***	4.444***	5.415***
	(7.892)	(10.419)	(10.326)	(8.101)	(3.605)	(6.844)	(3.812)	(5.606)
t	-0.004***	-0.002***	-0.002***	-0.002***	-0.001	-0.002***	-0.002	
	(-4.976)	(-3.598)	(-3.671)	(-3.123)	(-0.814)	(-3.865)	(-1.608)	
EURO		-0.316***	-0.290***	-0.210**	-0.250**	-0.275***	-0.169*	-0.237***
		(-3.057)	(-2.873)	(-2.030)	(-2.403)	(-3.046)	(-1.689)	(-2.631)
IRDISP			4.223				-4.186	-4.923
			(0.290)				(-0.448)	(-0.478)
EXDISP			271.933				202.439	226.176
			(1.252)				(1.552)	(1.608)
IPRDISP				-8.911			-10.634	-15.753
				(-0.508)			(-0.651)	(-0.756)
EMUTRADE				-1.306**				
				(-2.316)				
KAOPEN					-1.751***		-1.363***	-1.811***
					(-2.841)		(-2.691)	(-4.261)
IPRDIFUS						0.082	-1.165	-0.612
						(0.057)	(-0.553)	(-0.281)
TTRADE						-1.308**	-1.018***	-1.007**
						(-2.454)	(-2.717)	(-2.544)
IFRS							0.106	-0.002
							(1.333)	(-0.040)
Adjusted R^2	0.619	0.706	0.712	0.741	0.761	0.731	0.782	0.775

The table reports time-series regressions that relate the country to industry ratio to various measures of nominal convergence, real and financial integration. The sample period spans from January 1994 to December 2010. CIR is the average absolute pure country effect over the average absolute pure industry effect from the Heston-Rouwenhorst model. EURO is a dummy variable that equals one from January 1999 onwards and zero otherwise. IRDISP is the cross-sectional variance in short-term interest rate changes. EXDISP is the cross-sectional variance in exchange rate returns with respect to the British pound. IPRDISP is the cross-sectional variance in industrial production growth. EMUTRADE is the cross-country average of trade within the EMU relative to GDP. KAOPEN is the cross-country average of the capital account openness indices from Chinn and Ito (2008). TTRADE is the cross-country average total trade excluding trade with the EMU relative to GDP. IPRDIFUS is the cross-country average of differences in industrial production growth rates to the U.S.. IFRS is a dummy variable that equals one from January 2005 onwards and zero otherwise. The table reports estimated coefficients, Newey-West robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

duction growth dispersion and trade within the EMU. Only EMUTRADE shows a statistically significant coefficient, suggesting that an increase in exports and imports among EMU countries is associated with a decrease in the ratio of country to industry effects. When the euro dummy is used jointly with two real integration indicators, the coefficient increases to -0.210 but remains statistically significant at the 5% level.

To separate the effect of the euro from other financial integration measures within the EMU, I include the financial openness index as an explanatory variable in the next regression. The coefficient of KAOPEN is negative and significant (t-statistic of -2.841). The inclusion of the additional measure for financial integration leads to a similar coefficient and t-statistic for the euro dummy. The regression (5) shows, with an adjusted R-square of 76%, the highest share of explained variance so far.

Finally, I examine whether the industrial production growth difference to the U.S. and global trade excluding trade within the EMU contribute to explaining the country to industry effect ratio. The harmonization of business cycles between the EMU and the U.S. shows no significant relation with the ratio of absolute country to industry effects. The trade coefficient is again negative and significant. The inclusion of the two additional explanatory variables has only a marginal influence on the coefficient and t-statistic of the euro dummy variable.

After investigating the influence of the euro dummy in combination with variables measuring specific areas of harmonization or integration, I run the regression using all explanatory variables.[13] In addition, I include the IFRS dummy variable to filter out the effect of accounting harmonization in 2005. Both including and excluding the time trend, the euro dummy, the KAOPEN index and total trade show a significant association with the country to industry ratio. All their coefficients show the expected negative signs. This means, increased financial openness or less restrictions to cross-border capital transactions, increased trade activity as well as the introduction of a common currency reduce the relative importance of country effects compared to industry effects. Regressions (7) and (8) show an adjusted R-square of 78%. Comparing this result to regression (5) indicates that the inclusion of any variables, in addition to the

[13]Since EMUTRADE has a VIF above 10, when including all variables, I run the regression without EMUTRADE.

euro dummy and KAOPEN, adds little to the explanatory power.

Overall, there is strong evidence that the introduction of the euro was an important driver of financial market integration measured as the ratio between absolute country and industry effects in expected returns. Not surprisingly, the KAOPEN, an index constructed to reflect openness in capital account transactions, contributes in explaining the changing relative importance of country and industry effects. The reduction of the cross-sectional variance in interest and exchange rates as well as EMU-specific and global real convergence processes play a much smaller role in the decrease of the relative importance of country factors compared to industry factors.

4.9 Limitations

The general criticism of the ICC approach applies to my findings. The calculations are based on the assumption that the ICC is indeed a good proxy for the expected return.

I rely on the availability of I/B/E/S forecast items, like the one- and two-year-ahead earnings forecasts as well as the long-term earnings growth rate forecast. Not all companies are covered by the data provider and the I/B/E/S coverage ratio seems to be quite volatile over time. This variability introduces a certain cyclicality to the total number of observations and could bias the time-series results through a changing composition of the sample. Another critical issue in relation to the use of analyst forecasts is the short time frame I am able to consider. I start the analysis only in January 1994 because I require at least one observation for each country and industry in every month, and the data from I/B/E/S does not consistently fulfill this requirement prior to this date. The magnitude of industry and country factors varies over time. This means that although I find evidence that industry effects are dominating country effects in recent years, this finding could only be a temporary phenomenon, as suggested by Brooks and Del Negro (2004).

As for the ICC approach, I am also exposed to the criticism regarding the Heston-Rouwenhorst framework. Due to its easy applicability and interpretability, it is one of the most widely used models within the country-industry debate literature. Nevertheless, several studies point out weaknesses and limitations of the model (cf. Adjaouté and Danthine, 2003; Brooks and Del Negro, 2002) and propose potential modifications (e.g., Marsh and Pfleiderer, 1997; Brooks and Del Negro, 2005). The dummy variable model design requires that firms belong to exactly one industry and to exactly one country. This constraint is highly questionable in the age of multinational conglomerates, which operate in several industries and across multiple countries. Moreover, the Heston-Rouwenhorst model assumes that these company-industry and company-country connections remain constant over time, which is another questionable assumption. Nokia, for example, started as a paper producer and is now one of the most important multinational communications and information technology corporations.

Closely related to these drawbacks is the model's assumption that all stocks within a country and all stocks within an industry are affected by the respective country and industry factors in precisely the same way (cf. Marsh and Pfleiderer, 1997). In other words, all companies domiciled within a country are expected to have the same exposure to the common country factor, regardless of their level of geographical diversification. Likewise, all companies assigned to a certain industry, whether large conglomerates or highly specialized firms, are constrained to have the same sensitivity to that industry. Brooks and Del Negro (2002) test the hypothesis that all stocks within a certain country or industry have the same exposure to that country or industry and find strong evidence of within-group heterogeneity. In a subsequent paper, Brooks and Del Negro (2005) develop a latent factor model, which decomposes stock returns into global-, country- and industry-specific shocks, and allows for stock-specific exposure to those effects. The authors find that there is substantial variation in the exposure across stocks, partly explained by their international activity. Marsh and Pfleiderer (1997) propose another way to allow the sensitivities of stock returns to differ with regards to the respective country and industry factors. Using an iterative approach for their restricted factor model, they solve for both country and industry factors and the stocks' sensitivity to those factors. Bekaert et al. (2009), however, show that technical modifications of the Heston-Rouwenhorst framework, which allow for stock-specific exposures to country or industry factors as in Marsh and Pfleiderer (1997) or Brooks and Del Negro (2005), would not appear very helpful in improving the model's fit. Even though, their results indicate that the original Heston-Rouwenhorst model does not necessarily provide the best fit with stock return comovements, the authors argue that it has still dominated the important country-industry debate. Bearing those weaknesses and limitations in mind, the results need to be interpreted with caution.

Additionally, compared to the use of implied risk premiums denominated in a common currency, my country effect estimates based on local currency premiums may be too conservative. Exchange rate fluctuations are directly incorporated in implied risk premiums when prices and earnings forecasts are translated into a common currency, like the euro or U.S. dollar. Hence, currency fluctuations represent another source of pure country effect variance, not considered when using local currencies. While Heston and Rouwenhorst (1994) and Brooks and Del Negro (2004) document a negligible influence of currency effects within country effects, Marsh and Pfleiderer (1997) find that denominating returns in a common currency increases their estimate for the country effect by approximately 15% compared to the use of local currency returns. In the base EMU sample the issue of different currencies is naturally resolved through the introduction of the euro in 1999. Hence, I claim that local currency bias only plays against me, in the sense that it lowers the country effect results in the pre-euro period. This means that the decrease in country effects from the pre- to the post-euro period would have been even stronger when using implied returns denominated in a common currency.

Finally, my approach in taking January 1999 as the cut-off date for the EMU integration is not totally correct. In fact, the European financial integration was a gradual process that was initiated years before by the harmonization of monetary policies. The emergence of the euro in January 1999 did not come as a surprise but was anticipated by market participants.

5 Measuring the effect of corporate diversification using the ICC

This chapter applies the ICC approach to a corporate finance question.[1] The methodology for investigating the impact of a phenomenon of interest on a firm's cost of equity capital, as described in Section 2.3, is applied to the topic of organizational structure. In particular, the main purpose of the chapter is to investigate the relationship between corporate diversification and a firm's expected return as proxied by the ICC. In addition, it shall be analyzed how this relationship is influenced by the level of capital market integration.

After Section 5.1 gives a short introduction and elaborates some background on the relationship between organizational structure and a firm's cost of capital, Section 5.2 reviews how previous studies analyzed the topic. Section 5.3 gives a short overview of the underlying definition of diversification and financial integration and their hypothesized impacts on the ICC. Section 5.4 introduces and describes the data set, while Section 5.5 presents the regression results and discusses their implications. To confirm the robustness of the findings, I perform several sensitivity analyses in Section 5.6 and conclude with some limitations in Section 5.7.

5.1 Motivation

If returns in different countries and industries are less than perfectly correlated, investors can achieve a superior risk-return profile for their portfolio by diversifying across

[1] This chapter is based on Mühlhäuser (2012*b*).

geographies and business segments. The international portfolio diversification literature (see, for example, Solnik, 1974) suggests that well-diversified investors can reduce total portfolio risk, while maintaining their expected return level. Given the fact that investors can achieve portfolio diversification by directly investing across different industries and geographies, a measurable effect of corporate diversification on a firm's expected return should not exist in capital market theory. Spreading operations across different industries and countries may help to reduce the idiosyncratic risk of a diversified firm but should not have any impact on systematic risk. Investors will not compensate a firm for its multinational activities through a lower cost of equity capital, as long as owning shares in a number of domestic firms in different countries delivers the same risk-adjusted performance. Likewise, a firm operating in different business segments will not be remunerated for its diversification effort, if investors are able to achieve the same result by holding an industrially diversified portfolio of single-segment firms. According to Hughes et al. (1975), the survival of conglomerates and multinational firms can only be justified from an expected return perspective, if capital market imperfections prevent investors from acquiring broadly diversified portfolios. Assuming low trading costs, no information asymmetry and investor rationality, industrially or geographically diversified firms do not offer any benefits that could not be directly achieved by investors through portfolio diversification. However, if market frictions keep investors from holding a broadly diversified stock portfolio, corporations can offer this service to investors. As a result of a superior risk-return profile, these firms should be charged a lower cost of equity capital by investors.

The following analysis investigates the relationship between industrial and geographical corporate diversification and the cost of equity capital for a sample of European firms. Furthermore, it is tested if this relationship is influenced by the level of stock market integration. In particular, two major convergence events in the EU, namely the introduction of the euro and the mandatory adoption of IFRS, are considered. While the introduction of a common currency led to the full elimination of currency risk for countries participating in the EMU, the adherence to a common set of accounting rules should increase the transparency between firms and international investors. The disappearance of exchange rate volatility, the coordination of monetary policies and the harmonization of accounting standards should lower the risk of investing into foreign equity markets and thereby facilitate cross-border investments across Europe.

Previous research is complemented in several respects. Most importantly, I use expected return data derived from an ICC approach to examine the impact of corporate diversification. The use of implied discount rates enables me to separate between expected return and cash flow effects of diversification. Total value approaches are not able to distinguish between those two effects. Second, I focus on the European capital markets, where there has been an enormous effort to foster financial integration and regulatory convergence within the last two decades. Third, compared to previous research, which often focused on industrial diversification, I investigate both dimensions of corporate diversification, across business segments and across countries.

5.2 Literature review

Voluminous literature has investigated the shareholder wealth impact of corporate diversification.[2] Major research in this area can be split into two directions: Stock price performance based approaches and literature investigating the capitalized value or discount of diversification.[3]

Studies based on stock price performance related measures generally rely on events, such as diversifying acquisitions, to investigate the shareholder wealth impact of corporate diversification. Using this event study methodology, Morck et al. (1990) document negative abnormal returns after the announcement of diversifying acquisitions for a sample of 326 U.S. acquisitions between 1975 and 1987. Likewise, John and Ofek (1995) find greater stock returns at the announcement of divestitures, especially for focus-increasing divestitures, when using a sample of 321 U.S. divestitures from 1986 through 1988.

Valuation based measures provide the advantage that a larger cross-section of firms can be included, because the occurrence of a change in corporate focus is not required.

[2] Also, see Martin and Sayrak (2003) for a detailed overview of the corporate diversification literature.

[3] A third direction, which is not directly linked to shareholder wealth, is research on the relation between accounting based measures of performance and diversification.

In addition, the definition of an event date and the adjustment of subsequent returns for risk become unnecessary. Within this stream of literature, two major approaches can be distinguished. Earlier studies mostly investigate the effect of diversification on Tobin's q. Lang and Stulz (1994) compare the Tobin's q of diversified firms, as well as their industry adjusted Tobin's q, to the Tobin's q of specialized firms. Industry adjusted measures are constructed as the replacement cost-weighted average of the Tobin's q's of all divisions. The pure-play Tobin's q for each segment is proxied by the mean value of all specialized firms in the same industry. For U.S. firms, the authors find a negative effect of diversification on a firm's market valuation over the period from 1978 to 1990. Even though adjusting for industry effects decreases the valuation discount, it remains positive and significant. Likewise, when investigating the impact of geographical diversification on Tobin's q, Click and Harrison (2000), for instance, document a value discount for U.S. multinational corporations compared to otherwise similar domestic firms over the period from 1985 to 1997.

Most studies, however, address the economic effect of diversification by comparing the sum of the segments' stand-alone values to a firm's actual market value, a measure developed by Berger and Ofek (1995). The authors calculate the percentage difference between a firm's total value and the sum of imputed values for its segments as stand-alone entities. Imputed stand-alone values of all individual segments are calculated using valuation ratios (total capital to assets, sales, or earnings) of single-segment firms in the same industry. The majority of studies applying this approach draw a similar conclusion as when using Tobin's q, namely that corporate industrial as well as geographical diversification are negatively associated with firm value. Berger and Ofek (1995) find a value loss in the magnitude of 13-15% from product diversification for firms included in the Compustat Industry Segment database during the years 1986-1991. In addition, they find the value discount to be smaller for firms with related segments. Investigating the value impact of both industrial and geographical diversification for U.S. corporations, Denis et al. (2002) and Kim and Mathur (2008) find valuation discounts for international diversified businesses in the same magnitude of those for industrially diversified businesses for the periods 1984-1997 and 1990-1998, respectively.

More recent studies, however, have challenged previous findings for several reasons. Mansi and Reeb (2002) and Doukas and Kan (2006) argue that the value discount of diversified businesses is related to a firm's leverage. They claim that firms solely financed with equity do not trade at a discount. Campa and Kedia (2002) argue that the decision to diversify may not be completely exogenous. Controlling for the endogeneity of the diversification decision, the authors provide evidence supporting the self-selection of diversified firms. Similarly, when analyzing firms that diversify through acquisitions, Graham et al. (2002) find that those firms acquire already discounted business units resulting in the value discount of diversified corporations. Villalonga (2004*b*) uses a matching technique to avoid the self-selection bias of diversified firms. When matching single-segment and diversifying firms on the basis of the likelihood to diversify, the author does not find evidence for a valuation discount of diversified firms. Using the Business Information Tracking Series that does not rely on segment data, Villalonga (2004*a*) even documents a diversification premium.

Taken together, studies on the value impact of diversification provide mixed evidence for a discount or premium. The question of whether diversification has a measurable economic effect on firm value remains unresolved. All these studies have in common that they attempt to explain the relationship between corporate diversification and total shareholder value. Considerably less attention has been paid to the effect of corporate diversification on a firm's cost of capital. Several studies investigated the impact of diversification on capital structure but only a few examined the influence on the cost of debt or equity.

Comment and Jarrell (1995), Kochhar and Hitt (1998) and La Rocca et al. (2009) examine the relationship between corporate diversification and leverage. While Comment and Jarrell (1995) do not find a significant association between firm leverage and the degree of industrial diversification, Kochhar and Hitt (1998) and La Rocca et al. (2009) document a significant relationship when differentiating between related and unrelated diversification. They find that equity financing is preferred for related diversification but unrelated diversification is associated with more debt financing. Examining the difference in capital structure between domestic and multinational firms, Lee and Kwok (1988) and Burgman (1996) find that U.S. multinational companies tend to have lower financial leverage than their domestic counterparts. Chen et al. (1997) directly investigate the relationship between the level of international diversification and capital structure and document a positive association between leverage and international activity among multinational firms. Chkir and Cosset (2001), Singh et al. (2003) and Low and Chen (2004) take into account both industrial and geographical diversification. While Chkir and Cosset (2001) find that leverage increases with both dimensions of diversification, Low and Chen (2004) show that international diversity is negatively related to financial leverage, which is mainly attributable to U.S. firms, and that product diversity is positively related to debt ratios. Singh et al. (2003) find that product diversification individually is, on average, unrelated to capital structure. Multinationals that are product-diversified, however, do not have lower leverage ratios than domestic firms, indicating an interaction effect between both dimensions of diversification that alleviates the negative influence of international diversification on leverage.

Singh and Nejadmalayeri (2004) examine the relationship between international diversification, financial structure and the total cost of capital. Using a sample of French corporations and the cost of capital as computed by Stern Stewart, they find that international diversification is positively associated with long-term debt ratios resulting in a reduction of the overall cost of capital despite higher equity risk. Hann et al. (2013) also provide evidence for a negative relationship between the total cost of capital and industrial diversification. For a sample of U.S. firms over the period between 1988 and 2006, cost of capital is measured as the weighted average of the GLS estimate and the average bond yield from the Barclays Capital Aggregate Bond Index.

Only focusing on the cost of debt, Reeb et al. (2001) find that firms with a higher level of geographical diversification have better credit ratings. In addition, they provide evidence for a negative relation between the degree of international diversity and the cost of debt beyond that incorporated in credit ratings, suggesting that rating agencies do not fully incorporate the benefits of international activity. When investigating the other dimension of diversification, Franco et al. (2010) document that firms with industrially diversified operations pay significantly lower bond-offering yields. The negative relation gets stronger as quality of segment disclosures improves and coinsurance among business segments increases.

Reeb et al. (1998) and Lamont and Polk (2001) focus on the impact of diversification on the expected return on equity. In contrast to Fatemi (1984), who provides evidence for a risk reduction effect of international diversification, Reeb et al. (1998) find that firms that are geographically diversified face a higher systematic risk level than their domestic counterparts. The authors argue that this increase in systematic risk, measured by the beta coefficient, is due to an increase in the standard deviation of cash flows from internationalization, which more than offsets the effect of imperfect correlations among cash flows in different geographies. Finally, Lamont and Polk (2001) decompose the value difference between single-segment and industrially diversified businesses and find that more than half of the discount can be explained by the variation in expected future cash flows, with the remainder being due to variation in expected returns and the interaction between cash flows and returns.

Several authors also explore the sources and drivers of the diversification impact. For instance, Berger and Ofek (1995) find that overinvestment and cross-subsidization contribute, whereas tax benefits reduce the value loss of diversification. Moreover, Hann et al. (2013) argue that coinsurance among a diversified firm's business units can reduce systematic risk through the avoidance of countercyclical deadweight costs. In accordance with this hypothesis, they document a significant positive relation between excess cost of capital and cross-segment investment and cash flow correlations. Furthermore, using proxies for financial constraints, they find coinsurance effects to be stronger for more financially constrained firms.

While the focus is on firm characteristics that drive differences in value or the cost of capital of diversified businesses, the so far mentioned studies do not address the possibility that cross-sectional and time-series differences may be caused by different capital market environments. The only studies investigating the link between the value of corporate diversification and external capital market characteristics are Khanna and Tice (2000) and Fauver et al. (2003). Analyzing the performance of Indian conglomerates, Khanna and Tice (2000) argue that diversified businesses add value by replicating the functions of institutions that are missing in the emerging market. Using an international setting of 35 countries over the period 1991 through 1995, Fauver et al. (2003) find the value of industrial diversification to depend on the capital market development, the integration level and the legal system of the country the firm operates in. The authors suggest that internal capital markets should be most valuable for firms in countries, where it is costly to obtain external capital. Thus, they expect the benefits from diversification to be higher in countries with less developed and internationally integrated capital markets and where the legal system provides less protection to investors. As measures for the level of financial capital market integration, they use time-varying integration dates based on Bekaert and Harvey (1995) and the intensity of capital controls measure from Edison and Warnock (2003). Employing the methodology of Berger and Ofek (1995) to calculate the value of industrial diversification, they find a significant diversification discount for firms from highly developed and integrated countries but no discount or even a premium for firms from less developed and rather segmented capital markets. One major drawback to the study is that they do not include the main effect of their market development, integration level and legal system variables and may therefore overstate or even misinterpret the interaction effect between those variables and the level of diversification.

5.3 Diversification and the ICC

Industrial diversification refers to the distribution of corporate resources across different business segments to engage in a range of revenue producing activities. Because this involves offering a variety of products, this form of diversification is also often called product diversification. New products are added to the existing product range and offered in new markets (Thommen and Achleitner, 2006). A common differentiation is made between related and unrelated industrial diversification. While related diversification means a firm is operating in closely affiliated industries, unrelated diversification normally involves different fields of business activity that require a different set of skills. Alternatively or in addition to operating in different business segment, a firm may also diversify across different geographies. This dimension of diversification is called geographical or international diversification.

Montgomery (1994) summarizes the three comprehensive perspectives to explain the existence of diversified businesses: The market power view, the agency view and the resource based view. The market power view argues that firms diversify to gain market power over non-diversified firms. Montgomery (1994) emphasizes three ways, in which conglomerates may yield power in an anti-competitive way: Cross-subsidization, mutual forbearance and reciprocal buying. Within the agency view, managers are assumed to use diversification for 'empire-building'. In the light of the principal agency conflict, Montgomery (1994) identifies two further reasons that incentivize managers to diversify. First, a manager might try to secure his position through the diversification into fields, where his knowledge is indispensable. The second rationale states that managers may try to diversify their employment risk. Finally, the resource based view states that firms choose to diversify in response to excess capacity in productive resources. At the core of this theory is the notion of economies of scope.

Out of these mentioned perspectives, theoretical benefits and drawbacks of corporate diversification can be derived. Lewellen (1971) states that diversification is beneficial due to its coinsurance effect if cash flows among different segments are less than perfectly correlated. Coinsurance results in a reduced variability of earnings translating into lower risk. Hann et al. (2013) argue that a diversified firm is able to transfer resources from a cash-rich to a cash-poor unit and thereby avoid countercyclical deadweight costs that standalone firms are not able to avoid on their own.

Furthermore, the idea of internal capital markets suggests that diversified businesses have the ability to internalize capital market transactions. They can, therefore, overcome imperfections in external markets and avoid information asymmetry issues and transaction costs (Singh and Nejadmalayeri, 2004).

A major disadvantage of corporate diversification are agency problems arising from a decreased monitoring ability of external stakeholders (Scharfstein and Stein, 2000; Rajan et al., 2000). Especially within an international context, distance and cultural differences make it more difficult to monitor firms. But not only for external stakeholders may transparency issues arise. As an organization grows in size and complexity, internal information asymmetry increases, leading to higher administration and coordination costs. Information asymmetries between the central management and local or business unit managers may also result in inefficient investment and resource allocation decisions.

Finally, a drawback particularly important for geographically diversified corporates is that they face social, political, legal and financial risks unique to certain markets (Burgman, 1996). The lack of knowledge concerning the business conditions in foreign markets increases uncertainty and chances for disadvantageous investment decisions.

Bearing in mind these benefits and downsides, the influence of corporate diversification on the ICC is unclear. Since diversification has a documented effect on firm value, as shown in voluminous research, it may also directly affect a firm's required rate of return. The conventional view, however, states that organizational form does not matter. While there may be an synergetic effect of diversification, which could lead to differences in operating performance, impacting total value, the isolated influence on the cost of equity capital should be neutral. Imperfectly correlated cash flows among business units and geographies may help to reduce idiosyncratic risk but should have no impact on systematic risk. If stock returns in different countries and industries are less than perfectly correlated, investors can achieve a superior risk-return profile by diversifying their portfolio across geographies and business segments. As a result, a reduction in idiosyncratic risk should not matter to investors. Thus, I claim that organizational structure should have no measurable effect on a firm's cost of equity capital.

However, the argument that idiosyncratic risk reduction does not matter, because investors can themselves diversify their portfolios across geographies and industries, implicitly assumes that investors have access to the full spectrum of diversification opportunities. This unlimited access is only given in financially integrated capital markets. If market frictions, like restrictions to the free movement of capital flows, high transaction costs, currency risk, or information asymmetry keep investors from holding a broadly diversified stock portfolio, corporations can offer this valuable diversification service to investors by spreading firm operations across different countries and sectors. In an efficient capital market, diversified firms offering a superior risk-return profile should be charged a lower cost of capital by investors. Thus, I argue that the relationship between corporate diversification and the cost of equity capital is different for firms operating in financially less integrated capital markets.

The major focus of this chapter lies on the financial integration process within the EU. It shall be investigated if the change in the level of capital market integration among European countries had a measurable influence on the relationship between corporate diversification and the cost of equity capital. In other words, it is asked if investors changed their return expectations with respect to diversified businesses when their access to the global portfolio diversification benefits improved through certain integration measures of the EU. In particular, I am looking at two major measures of convergence among European markets: The introduction of a common currency and the adoption of uniform accounting standards.

In February 1992 the Maastricht Treaty, which led to the creation of a single European currency area, was signed (The European Commission, 2010). To participate in the euro, countries were required to adhere to strict criteria regarding their government finances, inflation levels and interest rates. The non-physical introduction of the euro currency on 1 January 1999 was, therefore, not a one-off event but was preceded by a several yearlong assimilation process (cf. Hardouvelis et al., 2007). First, the harmonization and finally the full convergence of monetary policies across the EMU member states was achieved. This has led to a gradual assimilation of inflation rates and bond yields, resulting in the convergence of real risk-free rates towards German levels. Most importantly, the adoption of the single currency in January 1999 led to the elimination of currency risk within the EMU area. The disappearance of exchange rate volatility, as well as the coordination of monetary policies between countries participating in the EMU, should lower the risk of investing into foreign capital markets and resulting hedging costs and thereby foster cross-border investments across Europe and particularly within the euro area.

Another unique event in Europe was the mandatory introduction of the IFRS accounting standards. In March 2002, the European Parliament passed a resolution requiring all firms listed on European stock exchanges to apply IFRS accounting standards within their financial statements for fiscal years beginning in or after January 2005.[4] The new regulation concerned approximately 7,000 companies in the EU. Like the introduction of the euro, the IFRS adoption was also rather a process than a clear-cut event. While reporting according to the IFRS standards became mandatory for listed firms in the EU from January 2005 onwards, within many countries an earlier adoption of the international accounting standards was allowed or even required. In addition, the convergence towards international accounting standards had been under consideration in Europe for several years even before 2002. The mandatory adoption of IFRS accounting standards reflects a major effort of the EU in achieving further capital market integration. The endorsement recommendation letter of the European Financial Reporting Advisory Group states that the "common basis for financial reporting based on high quality global standards provides a platform for efficient cross border investment both within and beyond the European Union" (European Financial Reporting Advisory Group, 2002, p.1). The increase in transparency, quality and comparability of financial statements should facilitate the comparison of investment opportunities across Europe and thereby lower the barriers for investors to invest into foreign capital markets.

While the introduction of a common currency reduces the risk of cross-border equity investments, the introduction of uniform accounting standards lowers the information asymmetry between firms and investors from different countries.

There are two ways, in which the convergence of European capital markets could affect the impact of geographical and industrial diversification on the ICC. First, if certain barriers prevent investors from investing into a broadly diversified portfolio, companies could offer this diversification service to investors. By improving the risk-return profile, diversified stocks should then be charged a lower cost of equity capital. Second, if foreign investors are kept from investing into a stock due to trading frictions like exchange rate risk or information asymmetry, it may be more efficient for a firm to maintain an internal capital market to avoid costly external capital market transactions. This more efficient capital sourcing should again be translated into a lower cost of equity capital. Once trading frictions in the form of exchange rate risk, monetary policy divergence

[4] For firms with traded securities in the U.S. and who report according to U.S. accounting standards, the required adoption date was January 2007 (Armstrong et al., 2008).

and information asymmetry cease to exist, investors will be able to acquire broadly diversified portfolios and corporations can efficiently use external capital markets to source new capital.[5]

I claim that the expected return effect of diversification should be more favorable for firms based in countries, where capital markets are less integrated in the sense of higher exchange rate risk and diverging interest rates. In addition, I hypothesize that the harmonization of accounting standards also reduces the benefits of corporate diversification, as cross-national information asymmetries are mitigated. I expect those effects to be stronger for international diversification. Investors' ability to diversify across different industries will only be restricted in very small segmented markets.

5.4 Data and sample selection

The sample consists of all firms from the analysis in Chapter 3 for which Worldscope segment data is available. Firms from countries entering the EU before 2004 (except for Luxembourg) as well as Switzerland are included. Reliable I/B/E/S consensus forecasts are only available from 1994 onwards. Annual accounting data is sourced beginning in 1993 until 2010.

For each geographic and industrial segment, firms report sales, assets, operating income, capital expenditures and depreciation. Based on the business segment description, Worldscope assigns a four digit SIC code to all industrial segments. A standardized categorization for geographic segments is missing in Worldscope. However, the database provides the fraction of sales generated outside the domestic market for each firm. To be included in the sample, firms must have data available on total sales and total assets. Following Berger and Ofek (1995), I exclude firms with segments in the financial industries (SIC codes 6000-6999). In addition, firms with total sales below EUR 20 million, as well as a difference between the sum of segment sales and total sales above 1%, are eliminated from the sample. Finally, segment sales data for segments with SIC

[5] I focus my interpretation on the first channel or the investor perspective, as I assume the access to a broader investor base to be of less importance for firms based in countries of a certain size with a developed capital market.

code 9999 and segments with negative sales are set to missing. I classify firms as being multi-segment firms if more than 10% of sales are generated outside the first business segment. Similarly, international firms comprise all firms with foreign sales ratios larger than 10%. The Herfindahl index and the foreign sales ratio are employed to measure the level of industrial and geographical diversification, respectively. The sales based Herfindahl index is calculated as the sum of the squared sales proportions generated in different business segments:

$$HERF_{it} = \sum_{k=1}^{n} (\frac{sales_{ikt}}{totalsales_{it}})^2, \tag{5.1}$$

where $HERF_{it}$ is the Herfindahl index of firm i at time t, $sales_{ikt}$ are the sales of segment k at time t, $totalsales_{it}$ are total firm sales at time t and n is the number of segments. For reasons of interpretability, I use one minus the Herfindahl index, which is also known as the Berry-Herfindahl-index (Berry, 1971). The constructed index measures the distribution of a firm's sales across its different business segments. It equals zero if all sales are generated within one segment and gets closer to one the more diversified a firm's sales are. The foreign sales ratio measures the percentage of total sales from operations outside a firm's home country.

The independent variable, the cost of equity capital, is estimated as the average of four different ICC models. I present the four methods applied and their underlying assumptions in more detail in Section 3.2. To assign monthly cost of capital estimates to the yearly diversification variables, I calculate the average from the cost of capital estimates between month +7 and +12 after the fiscal-year end. For simplicity reasons, I only include firms with fiscal-year end December.

To test for the interaction effect between financial market integration and corporate diversification strategies, two measures are constructed for the degree of assimilation due to the common currency and a third is used to proxy for the state of transition towards the IFRS accounting principles. First, I am particularly interested in the effects of the monetary convergence process among the EMU member countries, as well as the reduction and finally the abolition of currency risk that accompanied the introduction of the common currency. Interest rate deviation is measured as the difference between the local OECD short-term interest rate and the average short-term interest rate over all sample countries, computed as the average over the months -6 to +6 around the fiscal-year end. Using absolute values, the interest rate differential takes on values between 0% and 4.47%, indicating increasing financial segmentation. Exchange rate risk is proxied as the average correlation of a country's monthly exchange rate return towards the U.S. dollar from Datastream with all other sample countries, calculated over the months -6 to +6 around the fiscal-year end. It ranges from a minimum of 0.13 to a maximum of 0.98, representing increasing financial integration. Second, I measure the progress of the EU in adopting internationally recognized financial reporting standards. The IFRS adoption rate is measured as the percentage of sample firms preparing financial reports according to IFRS within a certain year. It ranges from 0% to 100%.

To isolate the effects of the diversification and integration variables, I include a number of firm-specific control variables that are known to affect a firm's cost of equity capital (e.g., Gebhardt et al., 2001; Hail and Leuz, 2006, 2009) or are commonly used in the diversification literature (e.g., Berger and Ofek, 1995; Denis et al., 2002; Campa and Kedia, 2002). It is important to ensure that the observed difference in the ICC is actually caused by the phenomenon of interest and not by other firm risk, industry or country factors. I control for firm size, leverage, profitability, investment intensity, the book-to-market ratio and long-term growth expectations. Firm size, which is often related to the degree of corporate diversification, is measured as the logarithm of total assets. Financial leverage, a factor directly related to a firm's level of risk, is measured as the ratio of total liabilities to total assets. Profitability is measured as the ratio of earnings before interest and taxes (EBIT) to sales. The investment level is measured by the ratio of capital expenditures (capex) to total sales. The book-to-market ratio is calculated as the book value of common equity over the market value of equity. In addition, I include long-term growth as a control variable, because of its documented influence on the ICC (Hughes et al., 2009). Long-term growth expectations are proxied by the I/B/E/S five-year-ahead EPS growth forecast.[6] I also use the firm itself as its own control with the help of a firm fixed effect regression. Industry and country fixed effects are included in the regression models without firm fixed effects to control for

[6]If the long-term growth forecast is missing in the I/B/E/S database, the growth rate between the two-year- and three-year-ahead EPS forecasts is used instead.

cost of capital differences caused by industry membership (Gebhardt et al., 2001) or disparities in economic and institutional environments (Hail and Leuz, 2006). Finally, since the analysis spans from 1993 to 2010, year dummies are included in the regressions to control for intertemporal variations in the capital market environment.

The data requirements on the diversification, ICC, integration and control variables result in a final sample of 14,794 firm-year observations in the period from 1993 to 2010. Following Hann et al. (2013), the timeline of the measurement of all variables is shown in the Appendix.

Table 5.1 reports information on the sample composition and descriptive statistics on the cost of capital estimates, diversification measures and control variables for the full sample and four categories of diversification: Single-segment and domestic, multi-segment and domestic, single-segment and international, and multi-segment and international. The majority of the 14,794 firm-year observations fall into the category multi-segment and international, while only 1,085 firm-year observations are classified as single-segment and domestic. The average ICC over all firms and all observation years amounts to 12.86%.[7] Geographically diversified firms show a slightly higher cost of equity capital than firms generating more than 90% of their sales in the domestic market. This result is consistent with Reeb et al. (1998), who find that multinational corporations have higher systematic risk than domestic firms. The opposite tendency is observable for single-segment versus multi-segment firms. Single-segment firms have a slightly higher cost of equity capital than their diversified counterparts. The mean ICCs of the three categories containing diversified firms are, however, not significantly different from the mean ICC of the single-segment domestic fraction.

The table reports two measures for industrial diversification, a Herfindahl-type index and the number of business segments, as well as the foreign sales ratio to measure geographical diversification. Geographic segment data provided in Worldscope lacks a uniform aggregation level. A geographic segment reported in the database can represent one country, a number of countries, a whole continent, or even the rest of the world.[8]

[7] Deviations from the equally weighted results in Subsection 3.5.1 are due to the exclusion of firms without segment data, a slightly different observation period and the yearly assignment of estimates.

[8] This is similar in the Compustat's Geographic Segment File, as noted by Denis et al. (2002).

Table 5.1: Descriptive statistics for diversification, ICC and control variables

	Single-segment domestic		Multi-segment domestic		Single-segment international		Multi-segment international		Full sample	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
ICC (%)	12.95	11.54	12.56	11.65	13.07	11.68	12.85	11.70	12.86	11.67
Berry-Herfindahl index	0.03	0.00	0.47	0.48	0.04	0.00	0.52	0.52	0.40	0.46
No. of business segments	1.55	1.00	3.24	3.00	1.53	1.00	3.36	3.00	2.91	3.00
Foreign sales ratio (%)	1.63	0.00	2.38	0.00	55.03	53.93	55.99	55.75	45.96	47.21
Leverage (%)	55.00	53.88	56.69	57.35	53.06	54.45	58.29	59.70	57.00	58.41
Size (EURm)	990	193	1,603	236	2,482	321	4,377	629	3,507	448
Profitability (%)	15.58	9.52	11.23	7.67	11.06	9.17	8.28	7.46	9.60	7.80
Capex ratio (%)	17.34	3.52	10.91	3.96	11.17	4.02	6.23	3.96	8.39	3.96
Book-to-market ratio	0.69	0.53	0.72	0.52	0.69	0.48	0.69	0.52	0.69	0.52
Long-term growth (%)	18.28	12.00	21.07	13.51	22.47	13.50	20.12	12.82	20.48	13.00
N	1,085		1,623		2,473		9,613		14,794	

The table presents the mean and median on various firm characteristics for the observation period from 1993 to 2010. The sample is divided into four categories on the basis of a firm's level of industrial and geographical diversification. I classify firms as being multi-segment firms if more than 10% of sales are generated outside the first business segment. International firms comprise all firms with foreign sales ratios larger than 10%. The ICC is calculated as the mean from the CT, GLS, OJ and MPEG models averaged over the months +7 to +12 after the fiscal year-end. The Berry-Herfindahl index is calculated as one minus the sum of the squared sales proportions generated in different business segments. The number of business segments is measured by counting the segments in Worldscope with positive reported sales. The foreign sales ratio is measured as the fraction of total sales generated from foreign operations. Size is proxied by total assets. Leverage is measured as the ratio of total liabilities to total assets. Profitability is calculated as EBIT divided by total sales. The capex ratio is capital expenditures scaled by total sales. The book-to-market ratio is the book value divided by the market value of equity. Long-term growth is proxied by the I/B/E/S five-year-ahead EPS growth forecast.

Thus, counting the number of geographic segments as a measure for the degree of geographical diversification can be misleading. Even though the reporting of business segments in Worldscope is more meaningful through the assignment of unambiguous SIC codes, the maximum limit of 10 business segments can produce a downward bias for the number of business segments as a measure of industrial diversification.

The sample exhibits an overall Berry-Herfindahl index of 0.40, while the score is 0.47 among only industrially diversified firms and 0.52 among industrially and geographically diversified firms. The average number of business segments is 2.91 overall, 3.24 in the only industrially diversified fraction of observations and 3.36 in the category of multi-segment and international firms. The mentioned statistics indicate that firms with international operations also exhibit a higher distribution of firm sales across different business segments. On average, firms generate 45.96% of their sales in countries other than their home market. The figure is 55.03% for single-segment firms operating internationally and 55.99% for multi-segment firms with international activities.

With regards to leverage, industrially diversified firms have, on average, the highest total debt to total assets ratio with 56.69% for multi-segment domestic firms and 58.29% for multi-segment international firms. The mean differences to single-segment domestic firms are significant at the 1% level. To compare these leverage statistics with the conflicting results in former studies on capital structure and diversification, one would need to differentiate between related and unrelated industrial diversification and take into account the interaction effect between geographical and industrial diversification. Multinationals that operate in different business segments are by far the largest firms in terms of total assets. Clearly diversification in both dimensions is associated with firm size. The average size is significantly different from the mean of the single-segment domestic category at the 1% level for all forms of diversification. Given the findings of other studies like Denis et al. (2002), who measure size in terms of market value and report the by far highest mean and median values for multi-segment international firms, this distribution is not surprising. However, an overall average size of EUR 3,507 million suggests that, due to the filter and data requirement criteria, the sample comprises already mostly large firms. Domestic single-segment firms have the highest profitability with 15.58%, followed by multi-segment domestic firms with 11.23%. The lowest profitability of 8.28% can be found in the international multi-segment subsample. The difference in means between diversified and undiversified firms is significant at the 1% level for all categories. In addition, the capital expenditure to sales ratio is substantially higher for non-diversified firms, suggesting that geographically or industrially diversified firms may either be benefiting from economies of scale or suffering from a lack of investment opportunities. Again this difference is significant at the 1% level for all diversification categories. Mean and median book-to-market ratios are rather similar across groups and show no noticeable pattern with respect to different dimensions of corporate diversification, as confirmed by the t-values. As for long-term growth, the four subsamples are ranked as single-segment international, multi-segment domestic, multi-segment international, and single-segment domestic, indicating that one dimension of corporate diversification can enhance earnings growth opportunities, while diversification along both dimensions is less beneficial. The difference in means is significant at the 1% level.

Overall, the comparison of the four subsamples with respect to key firm characteristics shows that controlling for those differences in the regression analysis is of major importance.

Next, I follow Denis et al. (2002) in showing the evolution of the diversification measures over time. Table 5.2 reports the fraction of firms industrially and geographically diversified by year. In addition, quantitative measures for the average degree of industrial and geographical diversification among the diversified subsamples are presented. The proportion of sample firms that are industrially diversified increases to its peak of 82% in 2000 and then declines to 71% until 2008. In 2009 and 2010 a slight rebound to 76% is observable. Among those firms that are industrially diversified, the average firm has 3.57 business segments in 1993 but only 3.20 in 2010. Likewise, the mean value for the Berry-Herfindahl index decreases from 0.53 to 0.51 over the 18 years period. These findings confirm and extend the results of Denis et al. (2002), who provide evidence for a significant decrease in the average degree of industrial diversification for U.S. conglomerates over the period from 1984 to 1997.

The fraction of geographically diversified firms, on the other hand, increases from 71% in

Table 5.2: Development of diversification measures over time

		Industrial diversification			Geographical diversification	
Year	N	Fraction diversified	Berry-Herfindahl index	No. of business segments	Fraction diversified	Foreign sales ratio (%)
1993	574	0.77	0.53	3.57	0.71	0.52
1994	664	0.78	0.53	3.56	0.71	0.52
1995	734	0.77	0.54	3.58	0.72	0.53
1996	803	0.76	0.52	3.49	0.70	0.53
1997	810	0.77	0.52	3.47	0.73	0.55
1998	804	0.78	0.52	3.50	0.73	0.55
1999	672	0.78	0.52	3.52	0.76	0.57
2000	780	0.82	0.52	3.53	0.85	0.56
2001	752	0.79	0.52	3.47	0.86	0.56
2002	785	0.77	0.51	3.35	0.87	0.56
2003	791	0.76	0.50	3.30	0.88	0.55
2004	827	0.74	0.51	3.29	0.85	0.56
2005	998	0.75	0.50	3.19	0.85	0.54
2006	1,035	0.72	0.49	3.12	0.86	0.55
2007	1,000	0.72	0.50	3.17	0.88	0.56
2008	840	0.71	0.50	3.08	0.87	0.56
2009	957	0.75	0.51	3.12	0.87	0.60
2010	968	0.76	0.51	3.20	0.86	0.62

The table presents the evolution of the fraction of firms that diversify industrially and geographically and the evolution of the degree of diversification among the diversified firms. Firms are classified as being industrially diversified if more than 10% of sales are generated outside the first business segment. Firms are classified as geographically diversified if more than 10% of sales are generated outside the domestic market. The Berry-Herfindahl index is calculated as one minus the sum of the squared sales proportions generated in different business segments. The foreign sales ratio is measured as the fraction of total sales generated from foreign operations.

1993 to 86% in 2010. The average geographically diversified firm exhibits a foreign sales ratio of 52% in 1993. The figure increases to 62% until 2010. Again, this development is consistent with the findings of Denis et al. (2002), who document a positive trend in the fraction of geographically diversified firms and an increase in the level of diversification within this subsample.

Overall, the reported diversification trend characteristics could be evidence for a change in corporate diversification strategies. However, given the increasing number of firm-year observations, the results should be interpreted with caution. I cannot rule out a certain downward bias in the fraction of diversified firms due to new companies entering the sample, who are less likely to be diversified in the beginning of their corporate activity.[9]

5.5 Empirical results

5.5.1 Corporate diversification and the ICC

To examine the effects of industrial and geographical diversification on a firm's cost of equity capital, I estimate the following multivariate regression equation:

$$\begin{aligned} ICC_{it} = \alpha_0 + \alpha_1 DIV_{it} + \alpha_2 SIZE_{it} + \alpha_3 LEV_{it} + \alpha_4 PROFIT_{it} + \alpha_5 CAPEX_{it} + \\ + \alpha_6 BM_{it} + \alpha_7 LTG_{it} + \sum_{t=1}^{T} \alpha_t YearControls_t + \\ + \sum_{j=1}^{J} \alpha_j IndustryControls_i + \sum_{k=1}^{K} \alpha_k CountryControls_i + e_{it}, \end{aligned} \tag{5.2}$$

where ICC_{it} is a firm's ICC in year t, calculated as the average of the CT, GLS, OJ and MPEG model estimates. DIV_{it} is a firm's level of either industrial or geographical diversification measured by the Berry-Herfindahl index or the foreign sales ratio, respectively. I control for other possible determinants of a firm's cost of equity capital, including firm size ($SIZE_{it}$), financial leverage (LEV_{it}), profitability ($PROFIT_{it}$), investment intensity ($CAPEX_{it}$), book-to-market (BM_{it}) and long-term growth prospects (LTG_{it}). In

[9]The use of a balanced panel is unfeasible due to data availability issues.

addition, year, industry and country fixed effects are incorporated into the regression estimation.

To mitigate concerns about the omission of a key covariate that could significantly influence the level of the ICC, I also estimate regressions with firm fixed effects:

$$ICC_{it} = \alpha_i + \alpha_1 DIV_{it} + \alpha_2 SIZE_{it} + \alpha_3 LEV_{it} + \alpha_4 PROFIT_{it} + \alpha_5 CAPEX_{it} + \\ + \alpha_6 BM_{it} + \alpha_7 LTG_{it} + \sum_{t=1}^{T} \alpha_t YearControls_t + e_{it}, \tag{5.3}$$

where α_i refers to the firm-specific intercept in this model. Country and industry fixed effects are eliminated in this specification. Given the criticism in the diversification literature that diversified firms may fundamentally differ from non-diversified firms leading to selection bias, I apply the firm fixed effects model as a primary specification.

The first set of results shows the relationship between the ICC and both dimensions of corporate diversification. In Table 5.3, I report the results of the regression analysis showing coefficients, heteroscedasticity and autocorrelation robust t-statistics and R-squares. Standard errors are clustered by firm and year.[10]

The first estimation is a regression linking the ICC only to the foreign sales ratio. In the pooled regression framework, the foreign sales ratio exhibits only an insignificant neutral coefficient estimate. This finding is somewhat surprising, given the fact that the majority of previous research documents a negative association between total value and international activity. When accounting for omitted variables in column (2), the sign of the coefficient estimate for the relationship between the share of foreign sales and a firm's cost of equity capital turns positive. The positive coefficient estimate for the foreign sales ratio is significantly different from zero at the 1% level. This result is consistent with the findings of Reeb et al. (1998), who report a positive association between systematic risk and internationalization. The coefficient estimate of 0.015 suggests that a 10% increase in the foreign sales ratio is accompanied by a rise in the cost of equity capital of 0.15%.

[10] In addition, I follow Hail and Leuz (2009) in clustering standard errors in the firm fixed effect regression by country and industry. Results for this analysis are not reported but major inferences are not materially different.

Table 5.3: Panel regression results for the influence of corporate diversification on the ICC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	0.129***		0.110***		0.131***		0.110***		0.110***	
	(95.065)		(12.482)		(84.806)		(12.559)		(12.361)	
FSR	0.000	0.015***	0.001	0.004					0.001	0.004
	(-0.216)	(4.407)	(0.484)	(1.472)					(0.485)	(1.434)
HERF					-0.006**	0.008*	0.000	0.000	0.000	0.000
					(-2.108)	(1.850)	(0.120)	(-0.098)	(0.061)	(-0.149)
$FSR \cdot HERF$									0.005	0.003
									(0.736)	(0.432)
LEV			0.049***	0.032***			0.049***	0.032***	0.049***	0.032***
			(10.524)	(5.152)			(10.570)	(5.210)	(10.551)	(5.196)
SIZE			-0.005***	0.003**			-0.005***	0.003**	-0.005***	0.003**
			(-14.774)	(2.072)			(-14.821)	(2.219)	(-14.525)	(2.064)
PROFIT			-0.049***	-0.039**			-0.049***	-0.039**	-0.049***	-0.039**
			(-3.726)	(-2.319)			(-3.691)	(-2.318)	(-3.693)	(-2.318)
CAPEX			0.005	0.005			0.005	0.005	0.005	0.005
			(1.477)	(1.440)			(1.482)	(1.432)	(1.477)	(1.437)
LTG			0.084***	0.068***			0.084***	0.068***	0.084***	0.068***
			(27.491)	(24.358)			(27.561)	(24.335)	(27.480)	(24.357)
BM			0.017***	0.014***			0.017***	0.014***	0.017***	0.014***
			(4.367)	(2.832)			(4.368)	(2.834)	(4.368)	(2.836)
N	14,794	14,794	14,794	14,794	14,794	14,794	14,794	14,794	14,794	14,794
Fixed Effects										
Firm		included		included		included		included		included
Year			included	included			included	included	included	included
Country & industry			included				included		included	
Adjusted R^2	0.000	0.002	0.414	0.241	0.001	0.000	0.414	0.241	0.414	0.241

The table reports panel regressions that relate the ICC estimates to levels of industrial and geographical diversification. The sample period spans from 1993 to 2010. The dependent variable, the ICC, is calculated as the mean from the CT, GLS, OJ and MPEG models averaged over the months +7 to +12 after the fiscal year-end. The Herfindahl index is calculated as the sum of the squared sales proportions generated in different business segments. HERF represents the Berry-Herfindahl index or 1-Herfindahl index. The foreign sales ratio (FSR) is measured as the percentage of total sales generated from foreign operations. Size (SIZE) is proxied by the logarithm of total assets. Leverage (LEV) is measured as the ratio of total liabilities to total assets. Profitability (PROFIT) is measured as the percentage of EBIT to total sales. The investment intensity (CAPEX) is measured as the ratio of capital expenditures to total sales. The book-to-market ratio (BM) is the book value divided by the market value of equity. Long-term growth (LTG) is proxied by the I/B/E/S five-year-ahead EPS growth forecast. The table reports estimated coefficients, heteroscedasticity and autocorrelation robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Including control variables in the third and fourth specification, the positive coefficient of the foreign sales ratio decreases and turns insignificant, suggesting that the result in column (2) is driven by variation in other firm-specific variables.

The coefficient estimates for the control variables are similar to those reported in prior research. As expected, financial leverage measured as the ratio of total debt to total assets has a significant positive relation to the ICC in both the pooled and firm fixed effect specifications. Profitability, calculated as EBIT divided by total sales, has a significant negative influence, while investment intensity, proxied as the ratio between capital expenditures and total sales, shows no significant relationship. Long-term growth, derived from the I/B/E/S consensus forecasts, is positively associated with the ICC. This result is in line with theory on the relation between the ICC and cash flow growth (Hughes et al., 2009) as well as prior empirical evidence from Gode and Mohanram (2003) and Hail and Leuz (2009). The book-to-market ratio also shows a significantly positive association with the implied cost of capital. Surprisingly, the relationship between the ICC and firm size is changing from the pooled to the fixed effects regression framework. The switch in the sign of the coefficient estimates for firm size could be driven by the fact that changes across time are less important than the cross-sectional variance, which in the second specification is already captured by the firm fixed effects structure.

The fifth to eighth columns of Table 5.3 present the results for industrial diversification measured in terms of the Berry-Herfindahl index. The pooled regression without control variables reveals a negative relationship between the Berry-Herfindahl index and the ICC, while the coefficient for the fixed effect model is positive at the 10% significance level. Including firm control variables in columns (7) and (8) the relationship in both specifications turns neutral and insignificant.

Taking into account both dimensions of diversification as well as their centered interaction effect in column (9) and (10), none of the coefficients for the diversification variables is significant. Given the fact that many conglomerates diversify across industries and geographies, failure to account for both dimensions of diversification in the regression analysis is likely to cause misleading results. As opposed to previous research, including Kim and Mathur (2008), who document a statistically significant value-enhancing interaction effect between industrial and geographical diversification, in this study the coefficient estimate of the interaction term between both dimensions of diversification only exhibits an insignificant coefficient with an even positive sign.

To sum up, as expected, I fail to find a significant relationship between both geographical and industrial diversification and a firm's cost of equity capital.

5.5.2 Financial integration, corporate diversification and the ICC

Another major objective of the analysis is to investigate whether the degree of financial integration has a significant impact on the link between corporate diversification and a firm's expected return. To identify the influence of financial integration, I include interaction terms between the diversification and integration variables. First, I use country-specific interest rate differentials as well as exchange rate return correlations to proxy for the integration process initiated by the introduction of a common currency. A rising short-term interest rate differential is associated with a lower degree of financial market integration, while a high average exchange rate return correlation reveals strong financial linkages with the remaining European countries.

Second, to evaluate the influence of the harmonization of accounting standards, I use the IFRS adoption rate across Europe. A higher adoption rate is assumed to be associated with increased financial reporting transparency and comparability leading to a higher degree of capital market integration.

Based on the hypothesis that firms, which diversify their operations across industries and countries, offer a valuable service to investors in segmented markets, I expect the coefficient on the interaction variable between the interest rate differential and diversification to be negative and the coefficient on the interaction term between the exchange rate return correlation and diversification to be positive. Likewise, I expect the interaction term between the IFRS adoption rate and diversification to be positive. To test these hypotheses, I estimate the following multivariate regression using firm fixed effects:

$$ICC_{it} = \alpha_i + \alpha_1 DIV_{it} + \alpha_2 INT_{it} + \alpha_3 DIV_{it} \cdot INT_{it} + \alpha_4 SIZE_{it} + \\ + \alpha_5 LEV_{it} + \alpha_6 PROFIT_{it} + \alpha_7 CAPEX_{it} + \alpha_8 BM_{it} + \\ + \alpha_9 LTG_{it} + \sum_{t=1}^{T} \alpha_t YearControls_t + e_{it}, \tag{5.4}$$

where INT_{it} is a financial integration variable measured by the short-term interest rate differential, the exchange rate return correlation, or the IFRS adoption rate[11] and $DIV_{it} \cdot INT_{it}$ is the interaction effect between the level of capital market integration and corporate diversification across industries or geographies, respectively.[12]

First, I obtain regression results for the foreign sales ratio, representing the degree of geographical diversification. The results in columns (1) to (4) of Table 5.4 reveal significant relationships between the ICC and both measures of nominal convergence. Firms operating in highly financially integrated markets, as measured by a low short-term interest differential and a high exchange rate return correlation, exhibit significantly lower expected returns in comparison to firms based in segmented markets.

More interestingly, the coefficient estimates for both interaction terms with geographical diversification are highly significant and show the predicted signs. Thus, the nature of the relationship between geographical diversification and the ICC varies depending on the value of the integration variables. The positive sign of the $FSR_{it} \cdot FXcor_{it}$ coefficient and the negative sign of the $FSR_{it} \cdot IRdif_{it}$ coefficient imply that the higher the level of financial integration, the less beneficial is geographical diversification in reducing a firm's ICC.

The coefficient estimate for the component term foreign sales ratio has a different meaning in the specifications including interaction terms as compared to Table 5.3.

[11] Because the IFRS adoption rate is equal for all firms within a certain year, the firm index i becomes redundant. Additionally, year controls drop out when the IFRS adoption rate is included.

[12] To avoid multicollinearity among the regressors, I center the interaction terms by deducting the sample mean of each of the two variables.

Table 5.4: Panel regression results for the influence of corporate geographical diversification and financial integration on the ICC

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.134***		0.108***		0.110***	
	(13.626)		(12.238)		(11.967)	
FSR	0.002	0.004*	0.001	0.005*	0.004*	0.008***
	(0.771)	(1.651)	(0.644)	(1.650)	(1.729)	(2.683)
HERF	0.001	0.000	0.001	0.000	-0.001	0.001
	(0.269)	(-0.015)	(0.270)	(0.106)	(-0.274)	(0.288)
FXcor	-0.026***	-0.024***				
	(-7.285)	(-7.040)				
IRdif			0.210***	0.308***		
			(3.201)	(4.593)		
IFRS					-0.006	-0.011***
					(-1.437)	(-3.254)
$FSR \cdot FXcor$	0.041***	0.041***				
	(4.636)	(4.900)				
$FSR \cdot IRdif$			-0.560***	-0.478***		
			(-3.530)	(-3.058)		
$FSR \cdot IFRS$					-0.002	0.001
					(-0.551)	(0.275)
LEV	0.049***	0.032***	0.049***	0.032***	0.047***	0.028***
	(10.610)	(5.182)	(10.616)	(5.152)	(9.722)	(4.347)
SIZE	-0.005***	0.003*	-0.005***	0.003*	-0.005***	0.008***
	(-14.485)	(1.948)	(-14.481)	(1.850)	(-13.051)	(5.429)
PROFIT	-0.049***	-0.038**	-0.049***	-0.039**	-0.050***	-0.040**
	(-3.695)	(-2.304)	(-3.689)	(-2.317)	(-3.818)	(-2.413)
CAPEX	0.004	0.005	0.004	0.005	0.005*	0.006*
	(1.437)	(1.597)	(1.478)	(1.519)	(1.718)	(1.852)
LTG	0.083***	0.068***	0.084***	0.068***	0.085***	0.069***
	(27.409)	(24.324)	(27.471)	(24.421)	(26.952)	(23.877)

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)
BM	0.017***	0.014***	0.017***	0.014***	0.018***	0.016***
	(4.386)	(2.836)	(4.379)	(2.830)	(4.447)	(2.961)
ACST					0.009**	0.005
					(2.533)	(1.547)
N	14,794	14,794	14,794	14,794	14,756	14,756
Fixed Effects						
Firm		included		included		included
Year	included	included	included	included		
Country & industry	included		included		included	
Adjusted R^2	0.418	0.245	0.415	0.243	0.365	0.174

The table reports panel regressions that relate the ICC estimates to levels of geographical diversification as well as variables for nominal and financial reporting convergence. The sample period spans from 1993 to 2010. The dependent variable, the ICC, is calculated as the mean estimate from the CT, GLS, OJ and MPEG models. The foreign sales ratio (FSR) is measured as the percentage of total sales generated from foreign operations. The Berry-Herfindahl index (HERF) is calculated as one minus the sum of the squared sales proportions generated in different business segments. Size (SIZE) is proxied by the logarithm of total assets. Leverage (LEV) is measured as the ratio of total liabilities to total assets. Profitability (PROFIT) is measured as the percentage of EBIT to total sales. The investment intensity (CAPEX) is measured as the ratio of capital expenditures to total sales. The book-to-market ratio (BM) is the book value divided by the market value of equity. Long-term growth (LTG) is proxied by the I/B/E/S five-year-ahead EPS growth forecast. Accounting standard (ACST) is a dummy variable that equals one for firms applying IFRS in their financial report and zero otherwise. Interest rate deviation (IRdif) is measured as the difference between the monthly local short-term interest rate and the average short-term interest rate over all sample countries. Exchange rate risk (FXcor) is proxied as the average correlation of the monthly exchange rate return towards the U.S. dollar. The IFRS adoption rate (IFRS) is measured as the percentage of firms preparing financial reports applying IFRS within a certain year. The table reports estimated coefficients, heteroscedasticity and autocorrelation robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

In the model with only main effects, the coefficient estimates the general effect of the level of geographical diversification on the cost of capital taking into account each level of financial integration. In the model including the interaction term, the coefficient reflects a conditional relationship between the level of geographical diversification and the cost of capital depending on the value of the integration variable. In the formulation of columns (1) and (2), the coefficient for the foreign sales ratio estimates the effect of geographical diversification on the ICC when the exchange rate return correlation is equal to its mean level. Assuming a fully segmented market in terms of zero exchange rate return correlation with the remaining European countries, a one percentage point increase in the foreign sales ratio is accompanied by a 0.031 percentage point decrease in the cost of capital in the fixed effect specification of column (2). On the other hand, assuming an exchange rate return correlation of one at the maximum level of financial integration, the cost of capital rises by 0.010 percentage points for every percentage point increase in the foreign sales ratio.

With respect to the specifications in columns (3) and (4) including the interest rate differential and its interaction effect with the foreign sales ratio, the coefficient estimate for the foreign sales ratio can be interpreted as the effect of geographical diversification on the ICC under the condition that the short-term interest rate differential equals its sample mean level. Using firm fixed effects, an increase of the foreign sales ratio by one percentage point leads to an increase of the ICC of 0.008 percentage points if the interest rate differential is zero. The slope coefficient declines to -0.013 for the maximum difference between the local interest rate and the average European interest rate, indicating that geographical diversification provides greater benefits for firms that operate in financial markets that are less integrated in terms of monetary policy.

Columns (5) and (6) show the relationship between geographical diversification and the cost of equity capital, when the convergence of financial reporting is taken into account. To separate the influence of an increase in firm-specific information quality due to the adoption of international accounting standards, I additionally include a dummy variable that equals one if a firm prepares its financial report according to IFRS and zero otherwise. If the application of IFRS is associated with higher quality financial reporting and a reduction of information asymmetry and information risk, it should be accompanied by a lower cost of equity capital. Daske (2006), however, documents a positive or at best no relationship between the adoption of IFRS and the ICC when using a large sample of German firms that pre-adopted international standards. Indeed, the coefficient of the accounting standard dummy variable in column (5) and (6) is positive. This result may be driven by investors' perception of a decrease in financial reporting quality, possibly due to a failure of an adequate reflection of regional differences within these uniform standards. Additionally, the costs of transition and implementation may exceed the mentioned benefits.[13] The aggregate adoption rate of the IFRS accounting standards, however, has a significantly negative association with the ICC.[14] As expected, a higher level of capital market integration in the form of uniform accounting rules is associated with a decrease in the cost of capital as indicated by the negative sign of the coefficient for the IFRS adoption rate. A uniform set of accounting rules makes it easier for investors to compare firms' financial performances and positions across countries, and therefore, lowers information costs (Armstrong et al., 2008). The interaction term between the IFRS adoption rate and the foreign sales ratio is insignificant in both the pooled and fixed effect specification. The hypothesis that greater financial reporting convergence lowers the value of geographical diversification cannot be confirmed.

The last set of results in Table 5.5 investigates whether the degree of financial market integration also affects the relationship between industrial diversification and expected returns. The main coefficients of interest are the interaction terms between the Berry-Herfindahl index and the three integration variables. The coefficient estimates for the terms $HERF_{it} \cdot FXcor_{it}$ and $HERF_{it} \cdot IRdif_{it}$ show the predicted signs, suggesting that the effect of industrial diversification on the ICC is affected by the degree of financial integration. As opposed to the results for geographical diversification, the coefficient estimates of the interaction variables are only significant at the 5% level for the interest rate differential in the fixed effect specification.

[13] See Armstrong et al. (2008) for a detailed discussion of potential benefits and drawbacks of the IFRS mandatory adoption.

[14] Clustering standard errors by country and industry reduces the t-value to -1.838.

Table 5.5: Panel regression results for the influence of corporate industrial diversification and financial integration on the ICC

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.134***		0.108***		0.112***	
	(13.707)		(12.148)		(12.280)	
HERF	0.000	0.000	0.000	0.000	0.000	0.001
	(0.185)	(-0.068)	(0.206)	(0.117)	(-0.153)	(0.256)
FSR	0.001	0.004	0.001	0.005		0.008***
	(0.604)	(1.595)	(0.560)	(1.640)		(2.669)
FXcor	-0.028***	-0.026***				
	(-7.647)	(-7.227)				
IRdif			0.249***	0.337***		
			(3.653)	(4.853)		
IFRS					-0.006	-0.011***
					(-1.383)	(-3.283)
$HERF \cdot FXcor$	0.019*	0.017				
	(1.671)	(1.504)				
$HERF \cdot IRdif$			-0.279	-0.488**		
			(-1.334)	(-2.247)		
$HERF \cdot IFRS$					-0.002	0.003
					(-0.404)	(0.603)
LEV	0.049***	0.032***	0.049***	0.031***	0.046***	0.028***
	(10.609)	(5.159)	(10.552)	(5.103)	(9.718)	(4.374)
SIZE	-0.005***	0.003**	-0.005***	0.003*	-0.004***	0.008***
	(-14.514)	(1.983)	(-14.445)	(1.951)	(-13.100)	(5.384)
PROFIT	-0.049***	-0.038**	-0.049***	-0.038**	-0.050***	-0.040**
	(-3.692)	(-2.290)	(-3.698)	(-2.312)	(-3.836)	(-2.411)
CAPEX	0.004	0.005	0.004	0.005	0.005*	0.006*
	(1.398)	(1.479)	(1.459)	(1.469)	(1.694)	(1.854)
LTG	0.083***	0.068***	0.084***	0.068***	0.085***	0.069***
	(27.416)	(24.360)	(27.450)	(24.391)	(27.087)	(23.882)

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)
BM	0.017***	0.014***	0.017***	0.014***	0.018***	0.016***
	(4.377)	(2.839)	(4.367)	(2.826)	(4.447)	(2.963)
ACST					0.009**	0.005
					(2.502)	(1.542)
N	14,794	14,794	14,794	14,794	14,756	14,756
Fixed Effects						
Firm		included		included		included
Year	included	included	included	included		
Country & industry	included		included		included	
Adjusted R^2	0.416	0.244	0.414	0.243	0.365	0.174

The table reports panel regressions that relate the ICC estimates to levels of industrial diversification as well as variables for nominal and financial reporting convergence. The sample period spans from 1993 to 2010. The dependent variable, the ICC, is calculated as the mean estimate from the CT, GLS, OJ and MPEG models. The Herfindahl index is calculated as the sum of the squared sales proportions generated in different business segments. HERF represents the Berry-Herfindahl index or 1-Herfindahl index. The foreign sales ratio (FSR) is measured as the percentage of total sales generated from foreign operations. Size (SIZE) is proxied by the logarithm of total assets. Leverage (LEV) is measured as the ratio of total liabilities to total assets. Profitability (PROFIT) is measured as the percentage of EBIT to total sales. The investment intensity (CAPEX) is measured as the ratio of capital expenditures to total sales. The book-to-market ratio (BM) is the book value divided by the market value of equity. Long-term growth (LTG) is proxied by the I/B/E/S five-year-ahead EPS growth forecast. Accounting standard (ACST) is a dummy variable that equals one for firms applying IFRS in their financial report and zero otherwise. Interest rate deviation (IRdif) is measured as the difference between the monthly local short-term interest rate and the average short-term interest rate over all sample countries. Exchange rate risk (FXcor) is proxied as the average correlation of the monthly exchange rate return towards the U.S. dollar. The IFRS adoption rate (IFRS) is measured as the percentage of firms preparing financial reports applying IFRS within a certain year. The table reports estimated coefficients, heteroscedasticity and autocorrelation robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The sign of the coefficient indicates that the expected return benefits from industrial diversification are stronger for firms operating in markets with a highly diverging monetary policy. This finding is in line with the results presented by Fauver et al. (2003), suggesting that cross-country variations in the value of diversification vary with the level of capital market integration.

Given an interest rate differential of zero, an increase in the Berry-Herfindahl index by 0.01 is accompanied by a rise in the cost of equity capital of 0.004 percentage points, whereas the influence is -0.018 percentage points if the firm operates in a market less financially integrated, as expressed by a maximum interest differential. The results in columns (5) and (6) indicate no influence of the IFRS adoption process on the relationship between industrial diversification and the ICC.

Overall, the results provide evidence for a varying relationship between corporate geographical diversification and the ICC, depending on the level of financial market integration with respect to currency and interest rate convergence. The net costs of diversification are highest for firms operating in highly integrated financial markets as measured by a low interest rate differential and a high exchange rate return correlation. Firms based in a country with less strong exchange rate and interest rate linkages to the other European markets, however, are delivering a valuable service for investors by spreading their operations across different countries. Thus, they are compensated with a significantly lower required rate of return. The relationship holds only weakly for industrial diversification. I do not find evidence for a differing relationship between corporate diversification and the ICC with respect to the European convergence of financial reporting standards. The risk component of investing into a broadly geographically diversified portfolio apparently plays a more important role for investors than the aspect of information asymmetry.

5.6 Sensitivity analysis

In this section, I evaluate the impact of certain assumptions and data selection criteria on the results. I repeat the multivariate analysis to check the robustness of the results in terms of the following influences: (1) The loss of firm-year observations resulting from the use of the mean ICC of the four different models, (2) the impact of a potential forecast bias and (3) the choice of the diversification measures.

5.6.1 GLS estimates

I begin by analyzing the influence of the data requirements for the individual methods to estimate the ICC. When using mean values, a firm-year observation is excluded if one of the four models does not deliver a numerical result. The different data requirements of the four models result in very different numbers of observations for each individual model (cf. Section 3.5.2). While the CT and GLS models only demand the availability of one-year and two-year-ahead earnings forecasts as well as a growth rate thereafter, the OJ and MPEG models require the one-year-ahead forecast to be positive. Therefore, I cannot rule out that the final sample is biased towards better performing firms. To address this issue, I re-estimate the regressions using the ICC derived from the GLS method only instead of the average from the four models. The GLS model has the lowest number of missing values of all four models, leading to an increase in the sample size from 14,794 to 16,111 firm-year observations.

Table 5.6 documents the results for the ICC from the GLS model as the dependent variable. The signs and significance levels of the coefficients indicate that the results and inferences are not materially affected by the use of the GLS estimate instead of the mean ICC. The foreign sales ratio and the Berry-Herfindahl index themselves have no significant influence on the GLS estimate.

In the interaction with foreign exchange rate return correlation and short-term interest rate differential, however, there is a significant association with the ICC. Also the interaction term between industrial diversification and the exchange rate return correlation becomes significant at the 5% level when using solely the GLS model to estimate the expected return on equity.

Table 5.6: Panel regression results using the ICC derived from the GLS model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FSR	0.002		0.002	0.002	0.007**	0.002	0.002	0.007**
	(0.584)		(0.686)	(0.670)	(2.475)	(0.708)	(0.675)	(2.375)
HERF		0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(-0.088)	(-0.053)	(0.044)	(-0.050)	(-0.072)	(0.043)	(-0.068)
FXcor			-0.029***			-0.030***		
			(-9.736)			(-9.860)		
IRdif				0.212***			0.235***	
				(3.498)			(3.793)	
IFRS					-0.002			-0.003
					(-0.776)			(-1.159)
$FSR \cdot FXcor$			0.029***					
			(3.848)					
$FSR \cdot IRdif$				-0.403***				
				(-2.751)				
$FSR \cdot IFRS$					-0.007*			
					(-1.787)			
$HERF \cdot FXcor$						0.020**		
						(2.050)		
$HERF \cdot IRdif$							-0.479**	
							(-2.021)	
$HERF \cdot IFRS$								0.005
								(1.072)
LEV	0.003	0.003	0.003	0.003	-0.002	0.003	0.003	-0.001
	(0.579)	(0.596)	(0.523)	(0.554)	(-0.355)	(0.526)	(0.513)	(-0.227)
SIZE	0.007***	0.007***	0.007***	0.007***	0.017***	0.007***	0.007***	0.017***
	(4.811)	(4.945)	(4.613)	(4.621)	(11.392)	(4.663)	(4.730)	(11.548)
PROFIT	-0.011**	-0.011**	-0.011**	-0.011**	-0.014**	-0.011**	-0.011**	-0.014**
	(-2.037)	(-2.041)	(-2.008)	(-2.036)	(-2.368)	(-1.974)	(-2.006)	(-2.371)

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CAPEX	0.004**	0.004**	0.004**	0.004**	0.005***	0.004**	0.004**	0.005***
	(1.999)	(1.994)	(2.207)	(2.091)	(2.719)	(2.064)	(2.042)	(2.720)
LTG	0.005***	0.005***	0.005***	0.006***	0.005**	0.005***	0.006***	0.005**
	(2.866)	(2.856)	(2.813)	(2.902)	(2.573)	(2.819)	(2.909)	(2.547)
BM	0.007**	0.007**	0.007**	0.007**	0.009**	0.007**	0.007**	0.009**
	(2.525)	(2.525)	(2.542)	(2.534)	(2.568)	(2.542)	(2.533)	(2.564)
ACST					0.001			0.001
					(0.285)			(0.317)
N	16,111	16,111	16,111	16,111	16,073	16,111	16,111	16,073
Adjusted R^2	0.230	0.230	0.236	0.231	0.096	0.235	0.231	0.096

The table reports panel regressions that relate the ICC estimates to levels of industrial and geographical diversification as well as variables for nominal and financial reporting convergence. The sample period spans from 1993 to 2010. The dependent variable, the ICC, is calculated using the GLS model. The foreign sales ratio (FSR) is measured as the percentage of total sales generated from foreign operations. The Berry-Herfindahl index (HERF) is calculated as one minus the sum of the squared sales proportions generated in different business segments. Size (SIZE) is proxied by the logarithm of total assets. Leverage (LEV) is measured as the ratio of total liabilities to total assets. Profitability (PROFIT) is measured as the percentage of EBIT to total sales. The investment intensity (CAPEX) is measured as the ratio of capital expenditures to total sales. The book-to-market ratio (BM) is the book value divided by the market value of equity. Long-term growth (LTG) is proxied by the I/B/E/S five-year-ahead EPS growth forecast. Accounting standard (ACST) is a dummy variable that equals one for firms applying IFRS in their financial report and zero otherwise. Interest rate deviation (IRdif) is measured as the difference between the monthly local short-term interest rate and the average short-term interest rate over all sample countries. Exchange rate risk (FXcor) is proxied as the average correlation of the monthly exchange rate return towards the U.S. dollar. The IFRS adoption rate (IFRS) is measured as the percentage of firms preparing financial reports applying IFRS within a certain year. The table reports results for a firm fixed effect regression including year effects in the form of estimated coefficients, heteroscedasticity and autocorrelation robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The coefficient for the influence of the IFRS implementation on the ICC turns insignificant, but the interaction term between geographical diversification and the IFRS adoption rate across Europe becomes slightly significant but with a negative sign. This even suggests a negative influence of accounting convergence across Europe on the relationship between corporate geographical diversification and the cost of equity capital. The result for the interaction between IFRS adoption and industrial diversification remains insignificant.

5.6.2 Analyst forecast bias

The purpose of the next robustness check is to investigate whether the findings of the previous chapter are biased by analysts' optimism or general analysts' misjudgment. Several authors argue that analysts' forecasts exhibit systematic bias (Guay et al., 2011; Easton and Sommers, 2007) and recommend a cautious use of ICCs incorporating these forecasts. Analyst bias is not per se problematic for the results, as long as its magnitude is not systematically associated with a firm's level of diversification or the degree of financial integration. Byard et al. (2011) and Tan et al. (2011) find that analysts' absolute forecast errors and forecast dispersion decrease for mandatory IFRS adopters, especially with respect to foreign analysts. To discard any concerns about the influence of biased forecasts, I repeat the multivariate analysis including forecast error as an additional control variable. A firm's yearly forecast error is measured as the difference between forecasted one-year-ahead EPS and actual realized EPS scaled by total assets (cf. Hail and Leuz, 2009). The lag in the availability of realized earnings reduces the sample size to 12,736 observations.

Table 5.7 shows that the previously reported relations between corporate diversification and the ICC do not materially change by the inclusion of forecast error as a control variable. Furthermore, the coefficient estimates and significance levels for the interaction terms are similar as in Tables 5.4 and 5.5. As expected and documented by previous research (Botosan and Plumlee, 2005; Hail and Leuz, 2009), forecast bias shows a significant positive relationship to the ICC.

Table 5.7: Panel regression results including analyst forecast bias as an additional control variable

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FSR	0.004		0.005	0.005	0.007**	0.005	0.005	0.007**
	(1.355)		(1.538)	(1.592)	(2.139)	(1.520)	(1.486)	(2.117)
HERF		-0.001	-0.001	0.000	0.000	-0.001	0.000	0.000
		(-0.271)	(-0.252)	(-0.102)	(0.066)	(-0.276)	(-0.020)	(0.078)
FXcor			-0.027***			-0.030***		
			(-6.822)			(-7.332)		
IRdif				0.296***			0.333***	
				(4.275)			(4.634)	
IFRS					-0.009***			-0.009***
					(-2.731)			(-2.853)
$FSR \cdot FXcor$			0.034***					
			(3.722)					
$FSR \cdot IRdif$				-0.638***				
				(-4.037)				
$FSR \cdot IFRS$					-0.001			
					(-0.311)			
$HERF \cdot FXcor$						0.016		
						(1.410)		
$HERF \cdot IRdif$							-0.597***	
							(-2.634)	
$HERF \cdot IFRS$								0.003
								(0.652)
LEV	0.027***	0.028***	0.027***	0.027***	0.025***	0.027***	0.027***	0.026***
	(3.983)	(4.03)	(3.987)	(3.958)	(3.426)	(3.967)	(3.931)	(3.463)
SIZE	0.002	0.003*	0.002	0.002	0.008***	0.002	0.002	0.008***
	(1.626)	(1.786)	(1.501)	(1.465)	(4.568)	(1.483)	(1.583)	(4.561)
PROFIT	-0.015***	-0.015***	-0.015***	-0.015***	-0.017***	-0.015***	-0.015***	-0.017***
	(-2.663)	(-2.680)	(-2.674)	(-2.680)	(-2.598)	(-2.634)	(-2.648)	(-2.595)

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CAPEX	0.004	0.004	0.005	0.005	0.006*	0.005	0.004	0.006*
	(1.329)	(1.312)	(1.464)	(1.408)	(1.749)	(1.366)	(1.339)	(1.749)
LTG	0.061***	0.061***	0.061***	0.061***	0.061***	0.061***	0.061***	0.061***
	(20.499)	(20.490)	(20.501)	(20.564)	(19.945)	(20.523)	(20.546)	(19.936)
BM	0.014**	0.014**	0.014**	0.014**	0.017**	0.014**	0.014**	0.017**
	(2.320)	(2.322)	(2.325)	(2.318)	(2.434)	(2.327)	(2.315)	(2.436)
ACST					0.001			0.001
					(0.508)			(0.519)
FERROR	0.004**	0.004**	0.004**	0.004**	0.004*	0.004**	0.004**	0.004*
	(2.174)	(2.175)	(2.416)	(2.315)	(1.944)	(2.352)	(2.225)	(1.941)
N	12,736	12,736	12,736	12,736	12,698	12,736	12,736	12,698
Adjusted R^2	0.236	0.236	0.241	0.239	0.161	0.240	0.238	0.161

The table reports panel regressions that relate the ICC estimates to levels of industrial and geographical diversification as well as variables for nominal and financial reporting convergence. The sample period spans from 1993 to 2010. The dependent variable, the ICC, is calculated as the mean estimate from the CT, GLS, OJ and MPEG models. The foreign sales ratio (FSR) is measured as the percentage of total sales generated from foreign operations. The Berry-Herfindahl index (HERF) is calculated as one minus the sum of the squared sales proportions generated in different business segments. Size (SIZE) is proxied by the logarithm of total assets. Leverage (LEV) is measured as the ratio of total liabilities to total assets. Profitability (PROFIT) is measured as the percentage of EBIT to total sales. The investment intensity (CAPEX) is measured as the ratio of capital expenditures to total sales. The book-to-market ratio (BM) is the book value divided by the market value of equity. Long-term growth (LTG) is proxied by the I/B/E/S five-year-ahead EPS growth forecast. Accounting standard (ACST) is a dummy variable that equals one for firms applying IFRS in their financial report and zero otherwise. Forecast bias (FERROR) is measured as the difference between forecasted one-year-ahead EPS and actual EPS scaled by total assets. Interest rate deviation (IRdif) is measured as the difference between the monthly local short-term interest rate and the average short-term interest rate over all sample countries. Exchange rate risk (FXcor) is proxied as the average correlation of the monthly exchange rate return towards the U.S. dollar. The IFRS adoption rate (IFRS) is measured as the percentage of firms preparing financial reports applying IFRS within a certain year. The table reports results for a firm fixed effect regression including year effects in the form of estimated coefficients, heteroscedasticity and autocorrelation robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

5.6.3 Diversification dummy variables

Finally, to investigate the robustness of the results with respect to the choice of the diversification variables, I re-estimate the regressions replacing the Berry-Herfindahl index and the foreign sales ratio with alternative measures for diversification. More specifically, I use bivariate dummy variables for industrial and geographical diversification instead of the quantitative measures. Firms are classified as being industrially diversified if more than 10% of sales are generated outside the first business segment. Likewise, firms are categorized as being geographically diversified if their foreign sales ratios exceed 10%.

The results are reported in Table 5.8. The interaction variables between corporate diversification and financial integration show the predicted signs with significant t-statistics as before. The interaction term between diversification and the IFRS adoption rate remains positive but insignificant. The interpretation of the results is somewhat different compared to the use of continuous measures for corporate diversification. The coefficient estimates for the diversification dummies in column (1) and (2) express the mean difference in the ICC between domestic and international firms, and single-segment and multi-segment firms, respectively.

Including the interaction effects in column (3) to (8), the coefficients of the main components indicate the difference in means between diversified and undiversified firms, conditional on the integration variable equaling its mean level. Assuming an exchange rate return correlation of zero, the benefits of operating internationally amount to a reduction of the cost of equity capital by, on average, 2.2%. If the exchange rate return correlation is 100%, the decision to diversify geographically, however, is accompanied by a rise in the ICC of 0.8%. Assuming a fully harmonized monetary policy, the difference in the mean ICC between internationally diversified and domestic firms amounts to 0.6%, whereas the difference in means measures -1.2% in an environment of a maximum interest rate differential. Likewise, industrially diversified firms show 0.2% higher expected returns when the interest rate differential is zero, and 1.5% lower expected equity returns when the interest rate differential rises to its maximum.

Table 5.8: Panel regression results using bivariate corporate diversification variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GD	0.002		0.003*	0.003*	0.003*	0.002	0.003	0.003
	(1.123)		(1.768)	(1.647)	(1.709)	(1.280)	(1.377)	(1.553)
PD		-0.001	-0.001	-0.001	0.000	-0.001	0.000	0.000
		(-0.582)	(-0.570)	(-0.427)	(-0.110)	(-0.603)	(-0.307)	(-0.135)
FXcor			-0.047***			-0.034***		
			(-7.667)			(-5.732)		
IRdif				0.613***			0.594***	
				(5.330)			(5.215)	
IFRS					-0.015***			-0.012***
					(-3.414)			(-3.207)
$GD \cdot FXcor$			0.030***					
			(4.642)					
$GD \cdot IRdif$				-0.405***				
				(-3.393)				
$GD \cdot IFRS$					0.005			
					(1.454)			
$PD \cdot FXcor$						0.012*		
						(1.919)		
$PD \cdot IRdif$							-0.371***	
							(-3.108)	
$PD \cdot IFRS$								0.002
								(0.642)
LEV	0.032***	0.032***	0.032***	0.032***	0.028***	0.031***	0.031***	0.028***
	(5.150)	(5.199)	(5.153)	(5.118)	(4.412)	(5.120)	(5.053)	(4.338)
SIZE	0.003**	0.003**	0.003**	0.003*	0.008***	0.003**	0.003**	0.008***
	(2.121)	(2.242)	(2.042)	(1.957)	(5.663)	(2.050)	(2.061)	(5.599)
PROFIT	-0.038**	-0.039**	-0.038**	-0.039**	-0.041**	-0.038**	-0.039**	-0.041**
	(-2.312)	(-2.325)	(-2.311)	(-2.316)	(-2.418)	(-2.294)	(-2.316)	(-2.414)

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CAPEX	0.005	0.005	0.005	0.005	0.006*	0.005	0.005	0.006*
	(1.430)	(1.428)	(1.564)	(1.503)	(1.827)	(1.450)	(1.427)	(1.826)
LTG	0.068***	0.068***	0.068***	0.068***	0.069***	0.068***	0.068***	0.069***
	(24.342)	(24.336)	(24.345)	(24.385)	(23.901)	(24.351)	(24.407)	(23.898)
BM	0.014***	0.014***	0.014***	0.014***	0.016***	0.014***	0.014***	0.016***
	(2.832)	(2.836)	(2.837)	(2.829)	(2.962)	(2.838)	(2.826)	(2.963)
ACST					0.005			0.005
					(1.527)			(1.556)
N	14,794	14,794	14,794	14,794	14,756	14,794	14,794	14,756
Adjusted R^2	0.241	0.241	0.245	0.243	0.174	0.244	0.243	0.174

The table reports panel regressions that relate the ICC estimates to dummy variables for industrial and geographical diversification as well as continuous variables for nominal and financial reporting convergence. The sample period spans from 1993 to 2010. The dependent variable, the ICC, is calculated as the mean estimate from the CT, GLS, OJ and MPEG models. The geographical diversification dummy variable (GD) equals zero for firms with a foreign sales ratio smaller than 10% and one for firms generating more than 10% of their sales outside the domestic market. The industrial diversification dummy variable (PD) equals one if more than 10% of sales are generated outside the first business segment and zero otherwise. Size (SIZE) is proxied by the logarithm of total assets. Leverage (LEV) is measured as the ratio of total liabilities to total assets. Profitability (PROFIT) is measured as the percentage of EBIT to total sales. The investment intensity (CAPEX) is measured as the ratio of capital expenditures to total sales. The book-to-market ratio (BM) is the book value divided by the market value of equity. Long-term growth (LTG) is proxied by the I/B/E/S five-year-ahead EPS growth forecast. Accounting standard (ACST) is a dummy variable that equals one for firms applying IFRS in their financial report and zero otherwise. Interest rate deviation (IRdif) is measured as the difference between the monthly local short-term interest rate and the average short-term interest rate over all sample countries. Exchange rate risk (FXcor) is proxied as the average correlation of the monthly exchange rate return towards the U.S. dollar. The IFRS adoption rate (IFRS) is measured as the percentage of firms preparing financial reports applying IFRS within a certain year. The table reports results for a firm fixed effect regression including year effects in the form of estimated coefficients, heteroscedasticity and autocorrelation robust t-statistics in parentheses and adjusted R-squares. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

To sum up, the results of the previous section do not appear to be driven by either the construction of the ICC estimate, measurement error induced by forecast bias, or the choice of the diversification variables.

5.7 Limitations

The general criticism of the ICC approach applies to my findings. The calculations are based on the assumption that the ICC is indeed a good proxy for the cost of equity capital. Next to the criticism of potentially distorted estimates through the use of biased analyst forecasts, the ICC has the major problem of only being available since 1994 for European countries when using I/B/E/S forecasts. Due to the fact that the introduction of the euro was already initiated in February 1992 by the Maastricht Treaty, I cannot rule out that I miss a critical time frame of nominal convergence.

In addition, my results are based on the underlying assumption that the exchange rate return correlation and the short-term interest rate differential are indeed good proxies for nominal or monetary convergence and are not measuring something else. Similarly, the IFRS adoption rate is assumed to be a good proxy for the convergence in accounting standards and the reduction of information asymmetry. However, if variation in the implementation and enforcement of IFRS standards, for instance, counteracted the comparability of the financial reporting of firms across different countries, the IFRS adoption rate may not be a valid proxy. Moreover, I cannot rule out that the IFRS implementation influences the way firms report their segment data. This may result in a higher or lower measure of diversification that does not reflect a real change in organizational structure.

Furthermore, I am exposed to similar caveats of the multivariate analysis framework as other authors, who apply the ICC to measure the effect of a certain firm characteristic of interest (cf., e.g., Hail and Leuz, 2009; Francis et al., 2005). To isolate the effects of the diversification and integration variables, I include a number of firm-specific controls. I followed the ICC as well as the diversification literature in choosing these variables but cannot be sure to have identified all relevant variables. My results may yield spurious inferences due to a correlated omitted variable.

When measuring the effect of diversification, I am also exposed to the general criticism that there may be a certain self-selection of diversifying firms. Using the firm fixed effect regression model, I tried to control for unobservable differences between diversified and focused firms. The firm fixed effect structure, however, has the disadvantage that cross-sectional differences cannot be exploited for the analysis. Organizational structure is a long-term strategic decision, resulting in a low variation over time within firms. This could make it difficult to discover an empirical relationship to expected returns over a 18 years long sample period. For instance, an interesting extension of my analysis would be to look at diversifying M&A activity within an event study research design.

Finally, while I interpret my results as indicating that corporate diversification has an influence on the ICC, inference in the opposite direction cannot be ruled out. Reversed causality would mean that firms choose to diversify after experiencing a decrease in their ICC. Also, there may be a complex interdependency between a firm's cost of capital, its level of diversification and a market's level of financial integration, which is hard to capture. Therefore, results should be interpreted with caution.

6 Conclusion

6.1 Summary and implications

In this thesis, I apply an alternative approach to estimate expected stock returns, which does not rely on noisy realized returns or the specification of an asset pricing model. Equity return expectations are derived from the ICC approach using current market prices, accounting numbers and earnings forecasts. Employing reverse-engineered equity valuation models, the ICC is defined as the discount rate, which equates the current market price to the present value of expected future cash flows. In contrast to historical returns, which are by definition backward-looking, the ICC is conditional on the information available to investors at each point in time. Revisions in cash flow expectations are directly taken into account. Therefore, the use of the approach to estimate firm and portfolio level expected equity returns offers several advantages over the use of realized returns, which are empirically proven and exploited in different applications.

After Chapter 1 introduces the motivation, contribution and structure of the thesis, Chapter 2 provides an overview of the theory underlying the ICC and summarizes relevant literature in the field. The variety of different model specifications, the voluminous research on their performance evaluation and their widespread applications within the accounting, corporate finance and asset pricing literature confirm the popularity of the ICC approach.

Chapter 3 describes the empirical implementation of four commonly used ICC models based on Claus and Thomas (2001), Gebhardt et al. (2001), Ohlson and Juettner-Nauroth (2005) and Easton (2004) for a sample of European firms over the period from January 1994 to December 2011. The generated estimates also provide the data basis for Chapters 4 and 5. Results are presented on a country and industry portfolio level.

First, I show that market risk premium estimates for the 15 countries lie between 4.83% for Italy and 7.48% for Ireland. The low volatility of the estimates and the rarity of negative values in comparison to historical premiums emphasize the advantages of the approach. Furthermore, the results show strong evidence of a changing equity premium over time. Short-term variations from the mean level seem to be closely linked to the state of the economy. The financial crisis, in particular, provides a perfect example for the speed and amplitude of adjustments in investors' risk perception. Allowing risk premiums to be conditional on the current economic climate and varying risk perceptions also creates space for fundamental changes in the implied equity risk premium. The findings clearly show evidence of an increase in the implied market risk premium over time. The rise is closely linked to the decline in government bond yields. The finding indicates that investors may expect much more a stable absolute return on equity than a constant risk premium above the risk-free rate. This suggests a higher stability of the required absolute return than assumed by traditional asset pricing models, such as the CAPM. The upward trend is also able to explain differences in the estimates compared to the findings in previous studies. The existence of such a trend would have substantial ramifications for practitioners using market risk premiums in their valuation models. If there are structural shifts in markets with long-lasting effects on the perception of risk, premiums used in valuation models would necessarily need to be adjusted. Since the common practice of firms, analysts and investors is to use current risk-free rates derived from government bond yields, the use of a constant historical premium is inconsistent and particularly problematic if the two measures are not independent.

In a second step, I estimate implied industry risk premiums and industry beta factors. Employing the ICC approach, beta coefficients can be calculated at each point in time without the requirement for a return history of a certain length. As expected, the financial services industry shows the highest beta factor beginning in 2007 until the end of the observation period.

To test the robustness of the results, I conduct extensive sensitivity analyses. The results suggest that the weighting procedure, the choice of the estimation method and the assumed risk-free rates have a considerable influence on the absolute level of the results but less on the time-series characteristics. While the impact of the growth rate assumption and analyst forecast error is less substantial in absolute terms, the fact that deviations are systematically related to certain market phases makes those influences not less critical. An understanding of the sensitivity of the estimates towards these assumptions is crucial for their subsequent use in other applications.

The presented results provide an adequate range of values for country and industry risk premiums as well as implied beta factors, which are based on current market prices and cash flow expectations. Those estimates should be of particular interest to both practitioners and researchers, who require a valid proxy for the expected risk premium of equities.

The main purpose of Chapter 4 is to investigate the relative importance of industry and country effects in determining a stock's expected return within the EMU equity markets. The process of economic, fiscal and especially monetary policy harmonization with the crowning flourish of the euro introduction on 1 January 1999 aimed to promote financial integration among the EMU member countries. Therefore, I pay particular attention to the advent of the euro in 1999. Using firm level ICC data for a sample of 19 industries in 11 EMU countries, covering the period from January 1994 to November 2011, I apply the Heston-Rouwenhorst model to evaluate the importance of country and industry effects within expected returns.

Over the full observation period my results suggest that, while country effects still play a role in determining a stock's implied risk premium, the industry has a similar influence. The results also provide evidence that pure country effects clearly decreased after the introduction of the euro in January 1999, while pure industry effects and the sum of industry effects within implied country risk premiums gained significant importance. The drop in the average influence of country-specific effects is mainly attributable to the countries with weaker pre-EMU economic linkages, like Greece, Portugal, or Italy. The effect is even stronger if I include other non-EMU European countries in the sample, suggesting that some integration with outside EMU countries took place. For the non-EMU countries, however, my results do not show any signs of a reduction in pure country effect variance. The recent eurozone crisis has led to a new peak in the country effect for Greece but left the other countries almost unaffected.

The results are robust to the use of absolute ICCs, rather than implied risk premiums and the omission of the technology, media and telecommunications as well as the banks, financial services and real estate sectors. In addition, I find a weaker but still substantial reversal in the importance of country and industry effects when using realized earnings instead of I/B/E/S forecasted earnings, suggesting that the results are not driven by analyst forecast bias.

A final regression analysis rules out other explanations for the evolution of the country to industry effect ratio. The pure effect ratio is, indeed, significantly associated with the introduction of the common currency and financial integration, as measured by a country's openness in capital account transactions. The reduction of cross-sectional variance in interest and exchange rates, real convergence variables and the mandatory IFRS adoption show only weak explanatory power for the relative importance of country and industry factors.

The results suggest that, even though, investors still price risks differently depending on the home market of a stock, the expected return of a stock is predominantly driven by its industry. While the convergence of monetary policies within the EMU and the adoption of the single currency definitely increased financial integration, the participating countries have not yet achieved full integration. Several frictions, such as differences in local economic policies, taxes and legal systems as well as certain psychological barriers, such as home bias, may prevent the EMU markets from becoming fully integrated.

The presented results should be of particular interest to portfolio managers and policymakers but also to households and corporations (see Baele et al., 2004). If country effects still play a substantial role, this has important implications for investment managers, who need to understand the forces driving the pricing mechanism of stocks to be able to generate the greatest diversification benefits possible. Policymakers, on the other hand, require an adequate picture of the current level of financial integration to decide about policy initiatives to further mitigate barriers to cross-border investments within the EMU. This implies that corporations have access to a much larger pool of capital. But also households benefit from greater risk-sharing opportunities, which allow them to smooth consumption even if their domestic market becomes increasingly specialized. Finally, for academic research the study provides new insights on how economic relations become much clearer when using implied returns instead of noisy realized returns. The approach enables researchers to distinguish financial integration, reflecting convergence in discount rates, from economic integration, which affects firms' cash flows.

Chapter 5 aims to investigate the relationship between corporate diversification and a firm's expected return as proxied by the ICC, as well as the influence of the degree of financial integration on this relationship. Assuming that investors can achieve an optimal risk-return profile by acquiring broadly diversified stock portfolios, firms should not enjoy a lower cost of equity capital by spreading their operations across different business segments or geographies. However, I argue that if market frictions restrict the access to the full spectrum of diversification opportunities, investors will be thankful to receive a superior risk-return profile from diversified firms.

Using firm level data for all 15 European sample countries, covering the period from 1993 to 2010, I find that the foreign sales ratio and thereby the level of diversification across different regions has substantially increased over the observation period. Diversification in terms of different business segments measured by the Berry-Herfindahl index, on the other hand, has declined over the last 18 years. Next, investigating the general relationship between each individual dimension of diversification and the ICC using firm fixed effect regressions, I find that an increase in the foreign sales ratio or the Berry-Herfindahl index have no significant impact on the required rate of return. Taking into account both dimensions of diversification and their interaction does not change this inference.

More interestingly, including three variables for financial integration and their interaction effects with corporate diversification, I document a varying relationship between the ICC and corporate diversification, conditional on the degree of financial market integration. The results indicate that benefits of geographical or industrial diversification are higher for firms operating in a less financially integrated market with respect to major monetary variables. While spreading firm operations across different industries or countries is associated with a higher cost of equity capital in markets with little exchange rate risk and coordinated monetary policy, diversified firms are rewarded with a lower cost of equity capital in less financially integrated markets. The findings are highly significant for geographical diversification but only weakly for industrial diversification. My third integration variable measures the convergence in financial reporting standards across the sample countries through the IFRS adoption rate. The results fail to provide evidence for a varying relationship between diversification and the expected return on equity depending on the level of accounting standards assimilation.

I perform several sensitivity tests to examine the robustness of the results with respect to the choice or construction of the ICC and diversification variables as well as the inclusion of forecast error as an additional control. The similarity of the results indicates that the inferences are not materially affected by alternative specifications.

The presented results should be of major relevance for managers, who want to evaluate their firms' organizational structure in terms of its impact on the cost of equity capital. In a broader academic research context, the study provides an example on how to measure the impact of a corporate finance phenomenon of interest on a firm's cost of equity capital. The ICC approach enables the researcher to differentiate between the cash flow effect and the discount effect of the phenomenon. Questions that so far were addressed from a total value or realized return perspective, can be re-examined using the ICC.

Collectively, all individual parts of the thesis support the use of the ICC approach as an alternative measure for the expected rate of return on equity capital on an aggregate country or industry level as well as for individual firms. The level of risk aversion of investors conditional on the current economic situation is clearly better measurable with a proxy that includes information available to investors at each point in time. Additionally, ICC estimates directly take into account changes in cash flow expectations and thereby eliminate volatility caused by cash flow surprises, resulting in a much lower total volatility than observed for realized returns. The isolation of discount rate effects is also a valuable feature of the ICC that makes it suitable for a number of different applications. Research questions within the asset pricing and corporate finance fields can be illuminated from a new angle using the ICC.

6.2 Outlook

The thesis advocates the ICC as a measure for expected equity returns. Even though, I perform an extensive set of sensitivity tests within each chapter, the use of the approach is not unassailable but subject to several challenges and caveats. These give rise to interesting areas of future research.

The ICC approach assumes both market efficiency and accuracy of the used forecasts for earnings expectations. Derivations from both assumptions challenge the appropriateness of the estimates. While research paid particular attention to the accuracy of analyst forecasts, the issue of market efficiency within the ICC approach has gained less attention so far.

A growing body of literature mentions the possibility of spurious results caused by the use of biased analyst forecasts (e.g., Guay et al., 2011; Easton and Sommers, 2007). I performed several robustness tests to analyze the influence of biased forecasts, by comparing estimates using ex post realized earnings as well as including analyst forecast error as an additional control variable. Nevertheless, the impact is far from being negligible. Even though, the influence of inaccurate earnings forecasts on the ICC has been analyzed in several studies (cf., for instance, Easton and Monahan, 2005; Easton and Sommers, 2007; Guay et al., 2011; Mohanram and Gode, 2013), a further understanding of the cross-sectional and time-series variations in forecast bias would be helpful. Furthermore, methods that remove predictable analysts' forecast errors to improve the properties of the ICC estimates, proposed by Mohanram and Gode (2013) and Guay et al. (2011), have not been widely applied yet. Testing these adjusted forecasts within the context of the research questions investigated within this thesis, would be interesting.

Another major problem of analyst forecasts is their limited cross-sectional and time-series coverage. Analysts generally focus on larger firms, which leads to an underrepresentation of smaller firms in the sample. In addition, I/B/E/S forecasts are not available before the year 1976 and data provided for European countries seems unreliable before 1994. This limits my analysis to a 18 year period from 1994 to 2011. It will be interesting to see if the inferences of the results change when a larger cross-section of firms and a longer time-series is included. This would, for example, be possible if the cross-sectional regressions from Hou et al. (2012) are used to generate earnings forecasts.

Probably the most critical point about the ICC is the substantial variation in the results when using different estimation models. I avoided a decision for a certain model by averaging four commonly applied methods in the hope of reducing the possibility of spurious estimates resulting from outliers of any individual model. The decision for the superiority of a certain model and the improvement of the existing methods is certainly withheld by limitations of the evaluation frameworks. True expected returns are not observable and all assessment attempts are only as good as their underlying assumptions on what makes an estimate a valid expected return proxy. Further progress on the evaluation of the reliability of different proxies is definitely desirable.

In addition, the reliability of the application of the ICC approach for the estimation of firm level expected returns may be questionable. Especially the CT and OJ models apply the same growth rate assumption to all companies within a country, which is a rather rough guess for the true growth of firm-specific residual earnings. Easton (2007) points out that an expected return estimate that is based on an undifferentiated growth rate assumption after an only short detail forecast horizon is unlikely to be reliable at the firm level. But also the assumption within the GLS model that the ROE fades to the industry median is questionable. First, why should a certain industry constantly perform better than others in the long-run? Second, are firms within one industry cluster with a classification based on a firm's first-segment SIC code really comparable? Next to the issue that industry clusters may be too broad, in the sense that, e.g., firms of the tobacco industry are not comparable with beverage producers, differences in size or organizational structure may also drive the rate of return. The investigation of the appropriateness of these assumptions, improvements of the methods for firm-specific estimation and their performance evaluation could be areas for future research.

Apart from the further development of individual models, the improvement in the used earnings forecasts, or the enhanced performance evaluation, further applications of the ICC approach provide opportunities for future research. Given the coincidence of rising implied risk premiums and falling risk-free rates, an investigation of a potential relationship between these two variables would be of major interest. Other macroeconomic explanatory variables should also be included into such an analysis. While there is numerous research on firm characteristics that are systematically related to firm-specific ICC estimates, studies on the association between the aggregate market risk premium and certain country characteristics are rare. An investigation might also be interesting for industry portfolio risk premiums.

Within the field of financial integration, the comparison between realized returns and implied returns could give an indication for the contribution of financial versus economic convergence within the total European integration process. Also, it would be interesting to further research about the underlying drivers of financial integration and to understand what keeps European markets from becoming fully integrated. Also the Heston-Rouwenhorst model with implied returns could be applied to a larger set of countries to assess the level of financial integration on a global scale.

An extended sample of countries would also be valuable for the investigation of the impact of financial integration on the relationship between diversification and the cost of capital. Furthermore, the inclusion of additional integration variables could provide a deeper understanding of the drivers underlying cross-country variations in the value of diversification. The differentiation between related and unrelated industrial diversification, as well as a more precise measure for geographical diversification, could help to gain further insights on the cost of capital impact of different kinds of diversification. Perhaps the general impact of diversification on the ICC is rendered insignificant by contradictory results for different types of diversification.

Outside the research areas examined within this thesis, many further applications of the ICC approach are conceivable. The methodology for investigating the impact of a certain phenomenon of interest on the ICC can be adopted to many further research questions. The ICC provides a valuable alternative to the use of realized returns or certain value or performance variables, such as Tobin's q or ROE. Examples for such applications include but are not limited to the impact of corporate governance, opacity, financial flexibility, hedging strategies or M&A on the ICC. Within the area of asset pricing, the ICC can be used to test and perhaps even improve existing asset pricing models. Also the investigation of the predictive power of the ICC estimates for future market returns is of major interest. While the aggregate ICC was already implemented as an additional forecasting variable into the predictive regression framework, cross-sectional variations may be worth exploiting.

To conclude, this thesis provided further insights on the ICC approach for measuring expected equity returns. Aside from an implementation of the approach for the European stock markets, the aim was to illustrate the suitability of the approach for a broad set of finance questions. I hope that the insights from this study encourage other researchers to approach asset pricing, accounting and corporate finance topics from a different perspective. Results from previous research using other proxies for expected equity returns can be challenged and enriching new evidence can be provided.

Appendix

Monthly estimation procedure

Daske et al. (2006) modify the method introduced by Gebhardt et al. (2001) for daily estimation of the ICC using all available information at the estimation date.

The authors compute a virtual book value at the intra-year estimation date, under the assumption that earnings accrue evenly over the year:

$$bv_t = bv_0 \cdot (1 + ROE_1)^{\frac{\text{days(fiscal year-end 0, t)}}{365}},$$

where bv_t denotes their adjusted book value at the estimation date t, bv_0 is the accounting book value at the beginning of the period and ROE_1 is the forecasted ROE for period one.

To proxy for the interest compounded from the last fiscal year-end until the estimation date, Daske et al. (2006) use the forecasted ROE. The expected ROE for period one ist calculated using the one-year-ahead earnings forecast and the last fiscal year book value of equity:

$$ROE_1 = \frac{e_1}{bv_0},$$

where e_1 is the EPS forecast for period one. The share of one-year-ahead earnings, which has already been implicitly added to the book value as compounded interest, has to be deducted from the earnings forecast that forms the basis of the residual income calculation for period one. The adjusted earnings forecast for the current period at the estimation date t can be calculated as:

$$e_t = e_1 - (bv_t - bv_0).$$

This adjusted earnings figure is used for the residual earnings computation of period one. Accordingly, only the share of compounded interest on the adjusted book value for the remainder of the year has to be deducted. Residual earnings for the following periods are calculated as usual, only with daily discounting as:

$$\begin{aligned} p_t =& bv_t + \frac{e_t - [(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}} - 1] \cdot bv_t}{(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}}} + \\ &+ \sum_{s=2}^{T-1} \frac{(ROE_s - r_E) \cdot bv_{s-1}}{(1+r_E)^{\frac{\text{days(t, fiscal year-end s)}}{365}}} + \frac{(ROE_T - r_E) \cdot bv_{T-1}}{r_E \cdot (1+r_E)^{\frac{\text{days(t, fiscal year-end T-1)}}{365}}}, \end{aligned}$$

where p_t is the stock price at date t and r_E is the ICC estimate, derived from the model.

To align prices, book values and earnings forecasts, it is either possible to adjust book values and earnings as in Daske et al. (2006)'s approach or to simply impute a time equivalent synthetic price into the model, as mentioned by Easton (2007). I want to show that this modification is equal to the procedure suggested by Daske et al. (2006).

Inserting the relation for e_t into the residual income formula yields:

$$\begin{aligned} p_t =& bv_t + \frac{e_1 - (bv_t - bv_0) - [(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}} - 1] \cdot bv_t}{(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}}} + \\ &+ \sum_{s=2}^{T-1} \frac{(ROE_s - r_E) \cdot bv_{s-1}}{(1+r_E)^{\frac{\text{days(t, fiscal year-end s)}}{365}}} + \frac{(ROE_T - r_E) \cdot bv_{T-1}}{r_E \cdot (1+r_E)^{\frac{\text{days(t, fiscal year-end T-1)}}{365}}}. \end{aligned}$$

Then, the equation can be re-writen to:

$$
\begin{aligned}
p_t =& \frac{bv_t \cdot (1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}}}{(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}}} + \\
&+ \frac{e_1 - bv_t + bv_0 - bv_t \cdot (1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}} + bv_t}{(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}}} + \\
&+ \sum_{s=2}^{T-1} \frac{(ROE_s - r_E) \cdot bv_{s-1}}{(1+r_E)^{\frac{\text{days(t, fiscal year-end s)}}{365}}} + \frac{(ROE_T - r_E) \cdot bv_{T-1}}{r_E \cdot (1+r_E)^{\frac{\text{days(t, fiscal year-end T-1)}}{365}}}.
\end{aligned}
$$

It follows:

$$
\begin{aligned}
p_t =& \frac{e_1 + bv_0}{(1+r_E)^{\frac{\text{days(t, fiscal year-end 1)}}{365}}} + \sum_{s=2}^{T-1} \frac{(ROE_s - r_E) \cdot bv_{s-1}}{(1+r_E)^{\frac{\text{days(t, fiscal year-end s)}}{365}}} + \\
&+ \frac{(ROE_T - r_E) \cdot bv_{T-1}}{r_E \cdot (1+r_E)^{\frac{\text{days(t, fiscal year-end T-1)}}{365}}}.
\end{aligned}
$$

Re-arranging and expanding the equation yields:

$$
\begin{aligned}
p_t =& (1+r_E)^{\frac{\text{days(fiscal year-end 0, t)}}{365}} \cdot \Bigg(\frac{e_1 + bv_0 + (1+r_E) \cdot bv_0 - (1+r_E) \cdot bv_0}{(1+r_E)} + \\
&+ \sum_{s=2}^{T-1} \frac{(ROE_s - r_E) \cdot bv_{s-1}}{(1+r_E)^s} + \frac{(ROE_T - r_E) \cdot bv_{T-1}}{r_E \cdot (1+r_E)^{T-1}} \Bigg).
\end{aligned}
$$

In a last step, I can re-write the equation to the applied formula:

$$
\begin{aligned}
\frac{p_t}{(1+r_E)^{\frac{\text{days(fiscal year-end 0, t)}}{365}}} =& bv_0 + \sum_{s=1}^{T-1} \frac{(ROE_s - r_E) \cdot bv_{s-1}}{(1+r_E)^s} + \\
&+ \frac{(ROE_T - r_E) \cdot bv_{T-1}}{r_E \cdot (1+r_E)^{T-1}}.
\end{aligned}
$$

Definition of input parameters

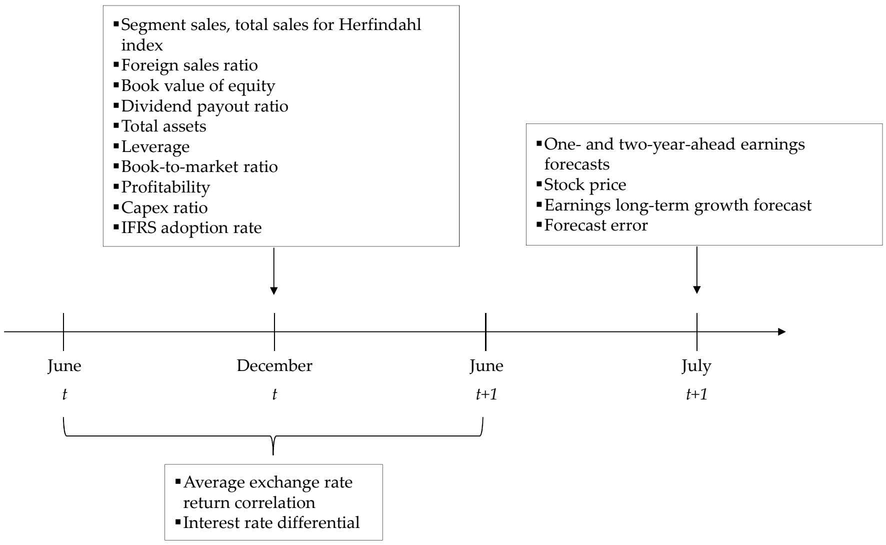
Table Appendix: Definition of input parameters

Input Parameter	Data Source	Symbol
Fiscal period end date	WS fiscal year-end date	
Book value of common equity	WS total common equity	
Total assets	WS total assets	
Industry	WS primary SIC code	
Latest reported EPS	WS EPS	e_t
Latest reported DPS	WS DPS	d_t
ROE	WS ROE	
Earnings release date	I/B/E/S EPS actual report date	
Share price	I/B/E/S price close	p_t
Number of shares outstanding	I/B/E/S shares outstanding	
Forecasted EPS for period t	I/B/E/S EPS median estimate	e_t
Long-term growth forecast	I/B/E/S EPS median long-term growth estimate	
Risk-free rate	DS yield on 10-year government bond	r_f
Realized return	DS MSCI total return indices	

The table lists the used input parameters, their source and the symbol used when referring to the data. WS stands for the Thomson Reuters Worldscope database, I/B/E/S for the Institutional Brokers' Estimate System and DS for the Thomson Reuters Datastream database.

Timeline of variable measurement

Figure Appendix: Timeline of variable measurement



The figure shows the timeline of the measurement of the different variables entering the analysis. Fiscal year-end is assumed to be in December.

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