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Estimating the Expected Cost of Equity Capital Using Consensus Forecasts

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ABSTRACT

In this study, we develop a technique for estimating a firm's *expected* cost of equity capital derived from analyst consensus forecasts and stock prices. Building on the work of Gebhardt/Lee/-Swaminathan (2001) and Easton/Taylor/Shroff/Sougiannis (2002), our approach allows daily estimation, using only publicly available information at that date. We then estimate the expected cost of equity capital at the market, industry and individual firm level using historical German data from 1989-2002 and examine firm characteristics which are systematically related to these estimates. Finally, we demonstrate the applicability of the concept in a contemporary case study for DaimlerChrysler and the European automobile industry.

1. Introduction

Sound estimates of the cost of capital are crucial for the evaluation of investments and for corporate valuation. Current state of the art methods of estimating the cost of equity capital, such as the CAPM or the Fama/French Three-Factor Model, however, not only have produced disappointing results empirically (Fama/French 1997; 2003). They also are questionable in that they use average realized returns instead of measures of expected returns for which the underlying theories on asset pricing call for.

Recently, Claus/Thomas (2001), Gebhardt/Lee/Swaminathan (2001) and Easton/Taylor/Shroff/-Sougiannis (2002) have proposed an alternative approach of estimating a firm's expected cost of equity capital that does not rely on realized returns or specific asset pricing models. Their idea is to use a model of corporate valuation to generate a market implied cost of equity capital for a particular firm, defined as the internal rate of return that equates the current stock price to the present value of the market's expected future residual flows to common shareholders as approximated by observable consensus analyst forecasts.

These estimates of implied cost of equity capital have been proposed for application in capital budgeting and investment decisions (Gebhardt/Lee/Swaminathan 2001, Easton 2003). However, several shortcomings for application of this concept exist which we address in this paper:

(1) Companies should be able to estimate their expected cost of equity capital at any date of their own choice during the financial year. The approach taken in former related papers allow estimation only at a specific point in time predetermined by the disclosure of financial results once a year (typically April or June). In addition, they match at that date input variables which reflect information at different points in time. For example, Claus/Thomas (2001) use share prices and book values of equity as of December 31 each year but earnings forecasts as of April 30 of the following year which means that information flows into the estimation as of December 31 which will be available only at the end of April.

We extend on previous approaches applying the residual income valuation framework in a way that allows daily estimation at any day in the fiscal year, using data which are currently and publicly available. We calculate book value of equity at the estimation date by adding to last year's book value the intra-year profit accumulated until that date, utilizing the expected Return on Equity (RoE) of next period implied in one-year ahead analysts forecasts. We also adjust that period's earnings forecast (FEPS1) and use daily discounting (Actual/365) for discounting future residual income to the valuation date. We implement daily estimation both in the estimation method assuming long-term growth of residual income in terminal value estimation (method I; Claus/Thomas 2001; Gebhardt/Lee/Swaminathan 2001) as well as in the portfolio-approach estimating expected cost of equity capital and infinite growth of residual earnings simultaneously (method II; Easton/Taylor/-Shroff/Sougiannis 2002).

(2) International evidence for market implied cost of equity capital estimates is available only for the market risk premium (see Claus/Thomas 2001), but not on the industry or individual firm level. We estimate the expected cost of equity capital and risk premia at the market, industry and individual firm level using our proposed methodology and historical data from 1989-2002 for German companies. We further examine firm characteristics which are systematically related to our estimates of ex-ante cost of capital. This supplements prior findings for the U.S. stock market in a major European financial market which has been characterized as distinct from the U.S. in its institutional setting (see Franke/Gebhardt/Krahnen 2002) and also helps to understand the fundamental drivers of the expected cost of capital of German companies.

We find that the average expected cost of equity capital during the 1989-2002 period in Germany under estimation method I (II) was 10.0% (11.2%) and the average expected market risk premium was 3.9% (5.2%). Under both methods a clear trend of a rising market risk premium is observable over time which has not been documented by the corresponding U.S. literature covering only periods before 1999. We also document significant industry effects as the market assigns higher discount rates to specific industries such as the information technology and service sectors and lower rates to sectors such as utilities, real estate or food&beverage. At the firm level, we find reasonable results for individual companies and present the distribution of expected cost of equity capital estimates.

When we examine the cross-sectional relation between expected risk premia and several firm characteristics, the book-to-market ratio and the industry membership prove to be the most important factors. In a multifactor model, the traditional beta factor seems to be important only in the Fama/French Three-Factor Model context, but looses explanatory power as soon as additional factors are included.

(3) Finally, we present a case study for DaimlerChrysler and the EU automobile industry using current data in which we demonstrate the process of estimating the implied cost of equity capital and discuss issues of practical implementation. Those include the usage of spreadsheet software, an analysis of the sensitivity of the cost of equity capital estimates to a variation of key input factors as well as a discussion the pro’s and con’s of the new approach.

The remainder of the paper is organized as follows: Section 2.1 motivates the new approach and outlines limitations of the traditional approaches. Section 2.2 explains the estimation procedure. Section 3 summarizes the findings of our empirical analysis of the expected cost of equity capital and its determinants using historical German data, while section 4 presents the results of a case study using current data for DaimlerChrysler and the European car industry. Section 5 concludes.

2. Concepts of Estimating the Expected Cost of Equity Capital

2.1. Motivation and Limitations of Traditional Methods

When firms evaluate investments, techniques using the Net Present Value (NPV) or the Internal Rate of Return (IRR) criteria are standard in theory and capital budgeting practice (see Graham/-Harvey 2001). Crucial in that process is the estimation of the cost of capital, in particular the cost of equity capital.

The cost of equity capital is the rate of return investors require for an equity investment in the firm. It represents the opportunity costs that could have been earned on alternative investments at an equivalent level of risk. Since investing is forward looking, the cost of capital represents investors' expectations about (ex-ante) future returns, not (ex-post) realized returns on a particular project. Expected returns reflect expected inflation, the time value of money, and the compensation for risk taking on a particular investment[1]:

(1) $$(1 + E_t[r^{EK}]) = (1 + E_t[r^{infl}]) \cdot (1 + E_t[r_f^{real}]) \cdot (1 + E_t[r^{risk}])$$

where			
	$E_t[\bullet]$	=	Expectation based on information available at time t
	r^{EK}	=	Cost of Equity Capital
	r^{infl}	=	Inflation rate
	r_f^{real}	=	Risk-free real rate of return
	r^{risk}	=	Risk premium

While the expected inflation and the risk free rate of return are directly observable from current capital market data, the measurement and quantification of the risk premium in equation (1) has been long on the agenda of academic research. In the CAPM as the „standard model" in financial economics, the expected return on stock *i*, or, equivalently, the cost of equity capital for firm *i* is defined as:

[1] See Pratt (1998), p.5, Penman (2004), p. 105-108.

(2) $$E_t[r_i] = r_f + b_i \cdot E_t[r_m - r_f]$$

mit	$E_t[\bullet]$	=	Expectation based on information available at time t
	r_i	=	Return of stock i
	$ß_i$	=	Beta: CAPM measure of risk of stock i
	r_m	=	Return of the value-weighted market portfolio
	r_f	=	Risk-free rate of return

More recent asset pricing models utilize additional risk factors such as the Fama/French (1993) Three-Factor Model which includes firm size and book-to-market ratio or the Arbitrage Pricing Theory (APT) by Ross (1976).[2] All models require expected returns as input factors, but in practical applications realized returns are used as best estimates for the "unobservable" expected returns, based on the assumption that "in the long run we should get what we expect" (Elton 1999).

However, when using historical returns for determining the input factors of the CAPM, there is no guidance on how to calculate the $ß_i$-factor or the market risk premium $E_t[r_m - r_f]$. Open questions to be answered include:

- Length of the historical return measurement period
- Frequency of return measurement (daily, weekly, monthly)
- Method of return measurement (arithmetic average, geometric average)
- Choice of market index as proxy for market portfolio
- Proxy for risk-less rate of return

For example the beta-factor for DaimlerChrysler varied from 0.87 (Yahoo! Finanzen) to 1.52 (Reuters) on the same day depending on the information source used (see Table 1). Further, market risk premia from 3% to 9% have been proposed for the German capital market, depending on the time period and measurement methods applied.[3]

While Fama/French (1997) summarize that the traditional cost of capital estimates used to discount cash flows are "unavoidably imprecise", the same authors conclude more recently that "the CAPM's empirical problems probably invalidate its use in applications" (Fama/French 2003). Despite these issues, the CAPM remains the most frequently used technique to estimate the required rate of return on equity capital in practice (see Graham/Harvey 2001).

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[2] For an overview of multifactor models and the Arbitrage Pricing Theory, see e.g. Elton/Gruber (1995), pp. 368-404.
[3] See the overviews by Ballwieser (2002), p. 739 or Drukarczyk (2003), p. 366.

The most important limitation, however, which applies to all "traditional" approaches, is the use of realized returns while conceptually valuations are forward looking and call for measures of expected returns. The issue then becomes how to operationalize return expectations.

2.2. The Estimation Procedure

The basic idea of ex-ante cost of capital models is to use forward-looking data instead of historical return realizations (see Claus/Thomas 2001; Gebhardt, Lee, Swanminathan 2001). The expected cost of equity capital is estimated from observable analyst consensus forecasts about a firm's future residual flows and its market price: Building on models of corporate valuation, the expected cost of equity capital is estimated by equating the current market price with the intrinsic value of the firm and by solving for the internal rate of return. In equilibrium, the same information is reflected in the stock price on the left side and in the consensus forecasts on the right side of the equation. Therefore, the internal rate of return reflects the cost of equity capital that the market applies to expected future cash flows of the firm (Mehra 2002).

2.2.1. Valuation Concepts and Model Selection

Models of Corporate Valuation

Typically in neoclassical models of security valuation, a stock's intrinsic value is defined as the present value of its expected future free cash flows to equity and according to the *dividend discount model* (DDM), assuming a flat term-structure of discount rates, can be stated as:[4]

(3) $$p_t = \sum_{\tau=1}^{\infty} \frac{E_t(D_{t+\tau})}{\left(1+r^{EK}\right)^{\tau}}$$

where:			
	$E_t[\bullet]$	=	Expectation based on information available at time t
	p_t	=	Price per share at time t
	D_t	=	Net distributions to stockholders per share at time t
	r^{EK}	=	Cost of equity capital

[4] See e.g. Ross/Westerfield/Jaffe (2003), pp. 108-121 or Penman (2004), pp. 89-91.

Under the assumption that "clean-surplus" accounting (Lücke-Theorem) holds in expectations, that is all changes in book value net of cash flows to/from equity holders are included in earnings:

(4) $$bvps_t = bvps_{t-1} + eps_t - dps_t,$$

where:	$bvps_t$	=	Book value per share at time t
	eps_t	=	Earnings per share at time t
	dps_t	=	Dividends per share at time t

the stock's value in equation (3) can also be expressed in terms of book value of equity plus the present value of residual earnings under the *residual income valuation model* (RIV):[5]

(5) $$p_t = bvps_t + \sum_{t=1}^{\infty} \frac{E_t\left[eps_{t+t} - r^{EK} \cdot bvps_{t+t-1}\right]}{\left(1+r^{EK}\right)^t}$$

where:	$E_t[\bullet]$	=	Expectation based on information available at time t
	p_t	=	Price per share at time t
	$bvps_t$	=	Book value per share at time t
	eps_t	=	Earnings per share at time t
	r^{EK}	=	Cost of equity capital

This equation expresses firm value in terms of accounting numbers instead of cash flows.

Specific Choice and Implementation of Valuation Model

Based on the same theory, all models of corporate valuation lead to identical results under consistent assumptions.[6] However, for practical reasons, the residual income valuation model appears to be the most reasonable to implement.

In several studies which evaluate the models' ability to explain cross-sectional stock prices, the RIV model has shown to have higher accuracy empirically than cash flow-oriented methods (DDM, DCF).[7] This result can be explained by the fact that in RIV large parts of firm value are determined by available data such as the book value of equity and short-horizon analyst earnings forecasts.

[5] The residual income valuation model is often labeled "Edwards-Bell-Ohlson" or "EBO" in the related U.S. literature. In the German speaking environment, it is named after Lücke (1958). See also Peasnell (1982) and Ohlson (1995). For an overview, see Copeland/Coller/Murrin (2000), pp. 143-146 or Penman (2004), pp. 145-157.
[6] See e.g. Gebhardt (2003), pp. 68-73.
[7] See Penman/Sougiannis (1998), Frankel/Lee (1998), Francis/Olsson/Oswald (2000).

Valuation based on cash flows or dividends is very sensitive to crucial terminal value assumptions (Claus/Thomas 2001).

In addition, earnings forecasts by analysts are available in I/B/E/S for international data since 1987, whereas cash flow and dividend forecasts have become available only very recently.[8] Since RIV „focus[es] on value creation (earnings) rather than value distribution (dividends)"[9], it is also used in performance evaluation in value based management and particularly known in the financial community under the label *Economic Value Added (EVA)* by Stern Stewart&Co.[10]

As such, the RIV model appears to be more easily accepted by practitioners than the recent Earnings Capitalization Model by Ohlson/Juettner-Nauroth (2000) which can in alternative be applied in the – rare – cases in which the clean-surplus principle is violated ex-ante on a per share basis (Ohlson 2000). Also, the RIV model can cope with any earnings forecast, whereas cost of capital estimations building on the Ohlson/Juettner-Nauroth (2000) model are restricted to the subgroup of firms with positive earnings forecasts only (see Gode/Mohanram 2002, Easton 2004).

The application of the residual income valuation model yields the expected cost of equity capital via the Internal Rate of Return (IRR) method. A nominal rate of return is obtained which refers to a period of one year (p.a.). All relations are expressed on a per share basis due to the type of analyst forecast data available.

Since value estimates obtained in any valuation model are sensitive to the choice of the growth rate for residual flows in the terminal value calculation, we use two different estimation methods. Method I uses economically plausible assumptions and can be applied to a single firm; method II simultaneously estimates the expected cost of equity capital and the long-term growth rate in residual earnings in a portfolio and thus can only be applied to a set of companies.

Lastly, for applicability at the firm level, it is essential that the estimation can be performed at any date during the financial year: companies usually adjust the rates of return they require from their investments at specific dates during the fiscal year when decisions on budgets and medium or long-term plans are made as well as at dates when major investment decisions are taken. Those dates will differ from firm to firm. Consequently, both estimation method I and II should allow daily estimation.

[8] See Thomson Financial (2003), Glossary I/B/E/S Summary History.
[9] See Gode/Mohanram (2002), p. 1.
[10] See e.g. Al Ehrbar (1998), Young/O'Byrne (2001) and O'Hanlon/Peasnell (1998).

2.2.2. Method I: Assuming Long-term Growth

Three-Phase Valuation Model

Our estimation method I is a modification of the approach proposed by Gebhardt/Lee/Swaminathan (2001). For practical implementation of the residual income model, we divide the infinite forecast horizon into three stages: (a) the explicit forecast period, (b) the fading period, and (c) the terminal value:

$$
\begin{aligned}
p_t = E\left(bvps_A\right) &+ \frac{feps'_A - \left[\left(1+r^{EK}\right)^{\frac{days\,(estimation\,date\,,\,year(1))}{365}} - 1\right]\times bvps_A}{\left(1+r^{EK}\right)^{\frac{days\,(estimation\,date,\,year(1))}{365}}} \\
&+ \sum_{n=2}^{5} \frac{feps_{t+n} - r^{EK}\times bvps_{t+n-1}}{\left(1+r^{EK}\right)^{\frac{days\,(estimation\,date,\,year(n))}{365}}} \qquad \text{(a) Explicit forecast} \\
&+ \sum_{n=6}^{11} \frac{\left(FROE_{t+n} - r^{EK}\right)\times bvps_{t+n-1}}{\left(1+r^{EK}\right)^{\frac{days\,(estimation\,date,\,year(n))}{365}}} \qquad \text{(b) Fading period} \\
&+ \frac{E\left(RI_{12}\right)}{r^{EK}\left(1+r^{EK}\right)^{\frac{days\,(estimation\,date,\,year(11))}{365}}} \qquad \text{(c) Terminal Value}
\end{aligned}
\tag{6}
$$

where:			
	E(.)	=	Expectation based on information available at time t
	p_t	=	Price per share at time t
	$bvps_A$	=	Book value per share at estimation date A
	RI_t	=	Residual income per share at time t
	r^{EK}	=	Cost of equity capital
	days	=	Number of days between estimation date and fiscal year end n.

(a) The *explicit forecast period* covers the next five financial years of detailed analyst consensus earnings forecasts, the maximum future period for which historical data is potentially available in the large databases such as I/B/E/S. The "consensus" earnings estimates are hereby calculated as median EPS-forecast of all individual analysts included in the database. We require consensus earnings forecast at least for the next three financial years following the estimation date. In case there are less than five future years of forecast data, but (instead) a consensus estimate of the long-term growth rate of earnings applying to the period from the last detailed EPS-forecast until year 5[11],

[11] See Gordon/Gordon (1997), p. 53; Thomson Financial (2003), Glossary I/B/E/S Summary History, p. 13.

we estimate the missing forecasts for years +4 and/or +5 as $feps_{t+1} = feps_t(1+g^l)$. If the consensus growth rate is not available, we approximate these forecasts by applying an artificial growth rate of earnings implicit in the available previous period forecasts calculated as the mean absolute change in earnings:[12]

(7) $$feps_4 = feps_3 + \frac{(feps_3 - feps_1)}{2}$$

$$feps_5 = feps_4 + \frac{(feps_4 - feps_1)}{3}$$

where:	$feps_t$	=	Forecasted earnings per share at time t
	g^l	=	Forecasted growth rate of earnings for the next business-cycle (5 years)

The earnings forecast, the assumption of a constant dividend payout-ratio and the current book value of equity allow to calculate expected future book values of equity[13] and finally the expected residual income for the next five future periods starting from the estimation date:

(8) $$E_t(RI_n) = feps_n - r^{EK} \times E(bvps_{n-1})$$

where:	$E_t[RI_n]$	=	Expected residual income per share for period n at time t
	r^{EK}	=	Cost of equity capital
	$E_t[bvps_n]$	=	Expected book value per share in period n

(b) During the *fading period*, forecasted earnings are calculated by multiplying the return on equity (RoE), defined as the ratio of earnings at this fiscal year end and the book value of equity of last fiscal year's end. Starting from the RoE at the end of explicit forecast period 5, the RoE is then assumed to fade straight-line in the following years to the expected target-RoE of the industry in period 12. Accordingly, expected earnings are calculated for fiscal years 6 to 12 as:

[12] Gebhardt/Lee/Swaminathan (2001) use the mean percentage change (as apposed to the absolute change) in earnings over the periods available. Such an approach has severe disadvantages (e.g. an hockey-stick-effekt).

[13] The clean-surplus relation in equation (4) assumes that dividends are payed at the fiscal year end date. In German practice, dividends are usually payed out once a year immediately after the annual shareholders meeting, see e.g. Heiden (2002), pp. 5-10.

(9) $$feps_n = FROE_n \times bvps_{n-1}$$

where:	$FROE_n$	=	Forecasted (book-) return on equity at the end of period n
	$feps_n$	=	Forecasted earnings per share at the end of period n
	$bvps_{n-1}$	=	Book value per share at the end of period n-1

This method implies that no individual firm is able to earn abnormal profits beyond a certain period of time due to the dynamics of market competition and will be tending towards their industry peers. Absent a data-base which collects analyst expectations beyond period 5, we have to determine the target-RoE of the various industries as in Gebhardt/Lee/Swanminathan (2001): All firms are grouped into the various industry peers as in Fama/French (1997) and then the median RoE's over the past 5 years are calculated for each group as proxy for expected RoE.

(c) The *terminal value* after year 12 is finally estimated by computing the present value of residual income in period 12, which is assumed to be earned as constant rent in perpetuity. This implies that any growth in earnings after year 12 is value neutral.[14]. Alternatively, other studies assume a moderate growth rate of residual income.[15] We discuss the implication of this assumption in a sensitivity test for our case study firms in section 4.1.

Estimation Date

For practical implementation, it is crucial to have the flexibility to estimate the expected cost of equity capital potentially *at any date* of choice during the fiscal year, using input-variables which *consistently* reflect *only currently available information* at that estimation date. Prior studies frequently do not follow these requirements in the one or other way:

(1) Availability of input-variables: Easton/Taylor/Shroff/Sougiannis (2002) perform their estimation for December 31 each year only for firms with fiscal years equal to the calendar year. They use book value of equity, although this number becomes available (even to insiders in the company) only later in the next fiscal year. Such information is available only in retrospective to a researcher, but not contemporaneously to a practitioner. In addition, few decisions will be taken around New Year's evening.

[14] See Gebhardt/Lee/Swaminathan (2001), p. 142.
[15] See Claus/Thomas (2001), p. 1636.

(2) Information consistent matching of input-variables: The variables which have to be used in a residual income valuation framework often reflect the level of information at different points in time. Claus/Thomas (2001) use share prices and book values of equity as of December 31st, but forecasts as of April 30 of the following year. Similarly, Gebhardt/Lee/Swaminathan (2001) use share prices and forecasts at June 30, but book values as of December 31. This implies that information flows into the estimation as of December 31 which will be available only at the end of April or June, respectively.

(3) Estimation yearly/monthly: All previous studies calculate the rate of return only once a year at a specific predetermined date (April 30[16]/June 30[17]/December 31[18]). Lee/Myers/Swaminathan (1999) use a residual income valuation model to estimate the intrinsic value of a firm monthly.

When introducing the flexibility to estimate the expected cost of equity capital at any date of choice, one has to move to daily discounting. Selecting among the various methods used in financial practice of measuring the range between two points in time ("*day count conventions")*, we use the method "act/365". This method computes the actual number of days between the two dates and divides this number by 365 and can be considered standard in the financial industry internationally.[19]

[Insert figure 1 about here]

In order to match the input variables reflecting currently available information at the estimation date, we adjust the accounting data referring to the fiscal year end dates (book value of equity, earnings forecasts) as displayed in figure 1, Panel A1. We compute a book value of equity at any intra year estimation date A ($bvps_A$) under the assumption that book value of equity is growing steadily over the fiscal year. Using this assumption, we calculate the $bvps_A$ as:

$$(10) \qquad bvps_A = bvps_0 \times (1 + FROE_1)^{\frac{days(estimation\,date,\,year(1))}{365}}$$

where:	$bvps_A$	=	Book value per share at the estimation date A
	$bvps_0$	=	Book value per share at the previous fiscal year end date 0
	$FROE_1$	=	Forecasted (book-) return on equity for the next (unpublished) fiscal year

[16] See Claus/Thomas (2001), p. 1637-1638.
[17] See Gebhardt/Lee/Swaminathan (2001), p. 145.
[18] See Easton/Taylor/Shroff/Sougiannis (2002), p. 664.
[19] See Harter/Franke/Hogrefe/Seger (1993), p. 290; Eller (2001), p. 3-28, also Pratt (1998), p. 31 (mid-year convention).

Into this calculation flows the expected RoE for the financial year which is used to calculate the interest compound up to that estimation date A. The expected RoE applied is calculated according to the information perspective by using the most recent explicit analyst consensus earnings forecast referring to that next fiscal year end:

(11) $$FROE_1 = \frac{feps_1}{bvps_0}$$

where:	$feps_1$	=	Forecasted earnings per share for the next (unpublished) fiscal year
	$bvps_0$	=	Book value per share at the previous fiscal year end date 0
	$FROE_1$	=	Forecasted (book-) return on equity for the following fiscal year

Adding compound interest to last fiscal year book value of equity ($bvps_0$) is a proxy for earnings realized from last fiscal year end up to the estimation date A. This in turn means that the expected earnings from estimation date A to next fiscal year end have to be calculated using the definition of earnings as a change in shareholders equity[20]:

(12) $$feps'_A = feps_1 - [bvps_A - bvps_0]$$

where:	$feps'_A$	=	Forecasted earnings per share for the time between the estimation date A and the next (unpublished) fiscal year end
	$feps_1$	=	Forecasted earnings per share for the next (unpublished) fiscal year end
	$bvps_A$	=	Book value per share at the estimation date A
	$bvps_0$	=	Book value per share at the previous fiscal year end date 0

The earnings estimate $feps'_A$ according to formula (9) then forms the basis for calculating the first residual income number in the explicit forecast period $E_t[RI_1]$ in equation (6):

(13) $$E_t[RI_1] = feps'_A - \left[\left(1 + r^{EK}\right)^{\frac{days(estimation\,date,\,year(1))}{365}} - 1 \right] \times bvps_A$$

[20] See e.g. Coenenberg (2003), p. 6-8.

The projected residual incomes of the following periods (2, 3, 4, 5) are always referring to a full fiscal year and are discounted to the estimation date under the daily conventions (formula 6).

Historical and Future Estimators

So far, the underlying premise was that all analyst forecasts refer to future fiscal year end dates ("future estimators"). However, there are also cases in which the estimator for the first future period (FY1) refers to a past date ("historical estimator"). This can occur when the fiscal year end date has already passed, but the annual report has not yet been published. In such a case, the first earnings estimator e.g. in I/B/E/S refers to that past fiscal year end date. This can best be illustrated by an example:

> A firm with fiscal year end of December 31, 2002 was publishing its financial results for that year on March 26, 2003. I/B/E/S as the leading data-base covering analyst forecast data is fixing once each month (at the third Thursday) its consensus forecasts. Earnings projections for the next period FY1 thus refer at Thursday, march 20, 2003 to the fiscal year ending December 31, 2002 since earnings for that financial year have not been published. From Thursday April 17, 2003 I/B/E/S includes the actual result for 2002 and rolls-over the FY1 forecast indicator which than refer to the next fiscal year, ending December 31, 2003. Hence, for the estimation dates between the December 31, 2002 and April 17, 2003, the consensus earnings estimates from I/B/E/S are "historical estimators", whereas after that date the FY1 estimator is a labeled „future estimator".

If the first estimator is a "historical estimator" and refers to the past, the starting input $bvps_0$ is not available yet and has to be calculated via the clean surplus relation using the previous year's book value of equity $bvps_{-1}$, payout-ratio and the earnings forecast for FY1. Since this results in a loss of one earnings estimator, the maximum number of explicit forecasts in the detailed planning period is accordingly reduced to 4 years. In this case, we extend the fading period by one additional year.[21] The procedure is presented in figure 1, Panel A2.

[21] A similar approach is taken by Gebhardt/Lee/Swaminathan (2001), p.143. However, it does not become clear how they compensate for the loss of an estimator.

Estimation Example

Appendix A demonstrates the calculation of the expected cost of equity capital and risk premium for DaimlerChrysler (DCX) as of August, 7th 2003 under method I. It reflects the situation of the "future" first estimator as the annual report for the last fiscal year 2002 has already been published and the first forecast FY1 refers to the fiscal year ending December 31, 2003. The procedure yields an expected cost of equity capital (risk premium) of 12.91% (8,57 %) for DaimlerChrysler.

2.2.3. Method II: Simultaneous Estimation of Expected Cost of Equity Capital and Long-term Growth

Our estimation method II is a modification of the Easton/Taylor/Shroff/Sougiannis (2002) approach which requires no explicit assumption about the long-term growth of residual income. Expected cost of equity capital and the growth rate of residual income are estimated simultaneously in a regression framework. Therefore, this approach can estimate the expected cost of equity capital only at a portfolio level, but not for individual companies.

One-Phase Valuation Model

Under estimation method II, the infinite forecast horizon is covered in one single stage. Under the "traditional" single-stage perpetuity method using the Gordon-growth formula, the present value of all future residual income is computed as residual income of next period divided by the cost of equity capital minus the growth rate of residual income:

(14) $$p_t = bvps_t + \frac{feps_{t+1} - r^{EK} \times bvps_t}{r^{EK} - g^{ri}}$$

where:

where:	p_t	=	Price per share at time t
	$bvps_t$	=	Book value per share at time t
	g^{ri}	=	Infinite growth rate of residual income
	r^{EK}	=	Cost of equity capital
	$feps_{t+1}$	=	Forecasted earnings per share of the next period

[Insert figure 2, Panel A about here]

However, this specification would disregard the information available about the forecasted analyst consensus estimates of the following periods. Therefore, under method II, projected earnings are cumulated over the period of four future years as aggregate earnings as displayed in figure 2.[22] Note that when computing aggregate earnings over a period over several fiscal years, one has to assume that dividends are reinvested in the firm at the expected cost of equity capital and to include earnings from those reinvestments:[23]

(15)
$$
\begin{aligned}
x_{cT} = {} & feps'_A + feps_{t+2} + feps_{t+3} + feps_{t+4} + feps'_P \\
& + dps_{t+1} \times \left[\left(1 + r^{EK}\right)^{\frac{days(\,fiscal\ year\,end\,(1), end\,date\,of\ period\,P)}{365}} - 1 \right] \\
& + dps_{t+2} \times \left[\left(1 + r^{EK}\right)^{\frac{days(\,fiscal\ year\,end\,(2), end\,date\,of\ period\,P)}{365}} - 1 \right] \\
& + dps_{t+3} \times \left[\left(1 + r^{EK}\right)^{\frac{days(\,fiscal\ year\,end\,(3), end\,date\,of\ period\,P)}{365}} - 1 \right] \\
& + dps_{t+4} \times \left[\left(1 + r^{EK}\right)^{\frac{days(\,fiscal\ year\,end\,(4), end\,date\,of\ period\,P)}{365}} - 1 \right]
\end{aligned}
$$

where:	X_{cT}	=	Aggregate earnings over 4 years (including interest on reinvested dividends)
	dps_t	=	Dividends per share at time t
	r^{EK}	=	Cost of equity capital
	$feps_t$	=	Forecasted earnings per share at time t

In formula (15) a future period is thus not one year, but a four-year period. The fundamental value of a firm using a four year aggregate earnings approach including all the available forecast information is then estimated as:

(16)
$$
p_t = bvps_t + \frac{x_{cT} - \left[\left(1 + r^{EK}\right)^4 - 1\right] \times bvps_t}{\left(1 + r^{EK}\right)^4 - \left(1 + g^{ri}\right)^4}
$$

where:	X_{cT}	=	Aggregate earnings over 4 years incl. interest of reinvested dividends
	p_t	=	Price per share at time t
	g^{ri}	=	Infinite growth rate of residual income
	r^{EK}	=	Cost of equity capital
	$bvps_t$	=	Book value per share at time t

[22] Similar to the aggregation of quarterly earnings to the fiscal year earnings, one can aggregate the earnings of several financial years to an e.g. four year aggregate earnings figure, see Easton/Taylor/Shroff/Sougiannis (2002), p. 660 or Easton/Harris/Ohlson (1992), p. 122-128.

[23] The reinvestments are accordingly assumed to be value neutral. Again, one has to assume in addition that the dividend payments are due at the fiscal year end.

This equation can be applied to a firm, however, it cannot be solved for the two unknown variables to be estimated (r^{EK} and g^{ri}). This problem is addressed by adding similar firms to a portfolio (e.g. firms from the same industry) and therefore increasing the number of equations. By further assuming a linear relationship between the cost of equity capital and price to book-ratio, the following regression function is obtained after rearrangements:[24]

(17) $$\frac{x_{cT\ j,t}}{bvps_{j,t}} = a + b \times \left(\frac{p_{j,t}}{bvps_{j,t}} \right) + e_{j,t}$$

where:

where:	$x_{cT\ j,t}$	=	Aggregate 4-years earnings of firm j at time t
	$bvps\ j_{,t}$	=	Book value per share of firm j at time t
	$p_{\ j,t}$	=	Price per share of firm j at time t
	$e_{\ j,t}$	=	Error term of the linear regression

and $a = (1 + g^{ri})^4 - 1$

and $b = (1 + r^{EK})^4 - (1 + g^{ri})^4$

The regression coefficients *a* and *ß* represent the average expected cost of equity capital and the average infinite growth rate of residual income for the firms included in the portfolio and determine a combination of r^{EK} and g^{ri}:

(18)
$$g^{ri} = \sqrt[4]{(1 + a)} - 1$$

$$r^{EK} = \sqrt[4]{\left(b + (1 + g^{ri})^4\right)} - 1$$

When solving for the regression-function, a circularity problem exists as the solution to be found (r^{EK}) is also needed as input parameter into the regression through equation (15). This issue is resolved by an iterative process: Starting from an initial arbitrary value of r^{EK} = 12%, we find a first solution of r^{EK} running the regression which then enters into a second-stage regression as starting value. This is repeated until the difference between starting value and solution converges to zero.

[24] For details, see Easton/Taylor/Shroff/Sougiannis (2002), p. 660-663.

Estimation Date

Similar to the requirements for method I, we implement daily estimation in the original approach of Easton/Taylor/Shroff/Sougiannis (2002). Thus, we are able to include firms with different fiscal year ends in the portfolio, whereas the original study includes only December fiscal year end firms.

[Insert figure 2, Panel B about here]

Figure 2, Panel B1 ("Future Estimator") and Panel B2 ("Historical Estimator") illustrates method II graphically. As in method I, we calculate a starting book value of equity for each firm at the estimation date by adding compound interest to the last fiscal year's shareholder equity and we reduce the expected earnings for FY1 by the same amount. Since we keep the length of earnings aggregation over a four year window constant (from starting, estimation date A to ending date P), we also have to perform a similar adjustment at the ending date P for the calculation of total aggregate earnings, again assuming the dividends are paid out at the fiscal year end dates. In the case of a "future estimator", the projected last earnings forecast used is calculated as:

(19) $$feps'_p = bvps_4 \times [(1+ froe_5)^{\frac{days(year(4), end\ date\ of\ \ period\ P)}{365}} - 1]$$

We use the four year window as in the original Easton/Taylor/Shroff/Sougiannis (2002) study in order to include the maximum number of detailed analyst consensus forecasts available. In case not all necessary future earnings estimates are available, we approximate these forecasts by applying an artificial growth rate of earnings implicit in the available (at least 3 years) previous period earnings forecasts as under method I (see equation (7)).

Estimation Example

Appendix B provides a case study of the simultaneous estimation of the expected cost of equity capital and the risk premium for a peer group of nine European firms in the automobile industry as of August 7th, 2003. The procedure yields a current expected cost of equity capital of 10.92% and an infinite growth in residual income of 3.92%.

3. Results for German Companies

In this section, we estimate and analyze the expected cost of equity capital and risk premia for a large sample of German listed companies using data over the period 1989 to 2002. We report two sets of results under both estimation methods I and II: (a) The expected cost of equity capital and risk premia at the market, industry, and firm level, and (b) the relationship between the expected risk premium and various firm characteristics as potential determinants for such premia.

3.1. Data

Table 2 lists the input variables for our estimations and the data sources. We use the *IBES Summary History File – Version 2.0* as of January 2003 for analyst consensus earnings forecasts, the number of shares outstanding and stock prices. Data on book value of equity, payout-ratio, industry classification as well as the industry target-RoE come from the *Thomson Financial Analytics – Worldscope* database. Finally, our proxy for the risk-free rate is the 10 year REX-return collected from *Datastream*.

[Insert table 2 about here]

Data availability in I/B/E/S on analyst forecast data limits our analysis to the period from January 1989 to December 2002. The initial number of 69.785 earnings forecast observations in I/B/E/S on German companies was reduced by:

[Insert table 3 about here]

(1) Financial data missing after merging databases on shares outstanding, share price, accounting data and target-RoE resulted in a loss of 17.37% of total observations.

(2) The market's consensus earnings forecasts are a key determinant of our estimation procedure. In order to ensure that our inputs really measure market expectations over the relevant forecast horizon, we require from each observation either at least consensus EPS-forecasts for the next 3 periods (out of a theoretically maximum of 5 periods available in I/B/E/S) or consensus EPS forecasts for the next 2 periods and a long-term growth rate (applying to periods 3 to 5). This represents in our view the best trade-off between extracting market expectations on the one hand and a representative sample size including also smaller, less covered firms on the other. We lost another 35.77% of the initial observations for which we had only FY1 or FY1 and FY2 forecasts.

(3) Finally, we try to minimize data errors by deleting forecast data of questionable quality: This included (a) stacked forecasts (4.72%) and (b) insolvency forecasts (0.74%).

a. Stacked forecasts: According to § 325(1) HGB, annual reports should be available within nine month after the end of the fiscal year. Accordingly, we delete all forecasts which refer to a fiscal year-end longer than 9 months ago and most probably have not been updated in-time by the database.

b. Insolvency forecasts: In some special cases analysts estimate losses which would result in a negative book value of equity in a future period and thus would lead to the firm's insolvency if no additional equity capital will be provided. We delete such observations as not representative.

It is further important to note that *I/B/E/S* requires from analysts to report their earnings estimates for German companies according to the DVFA/SG rules, and not under local or international GAAP under which the companies report their results.[25] Further, *Worldscope* adjusts as reported book value of equity figure in order to make accounting numbers more comparable internationally.[26] We therefore have both to assume that analysts prepared their earnings forecasts according to the clean-surplus principle and that the Worldscope adjustments did not introduce any (further) violations when applying our residual-income based estimation framework.

Table 3 summarizes our sample selection procedure: Our final sample consists of 28.893 observations pooled across all estimation months. Since we estimate the expected cost of equity capital and risk premia monthly, our data-set is comparable in size with the previous US-studies.[27]

[25] See the Thomson Financial (2003), Glossary I/B/E/S Summary History. For an overview of the DVFA/SG concept of "core earnings", see Busse v. Colbe/Becker/Berndt/Geiger/Haase/Schellmoser/Schmitt/Seeberg/v. Wysocki (2000).
[26] See the Glossary on Thomson Financial Worldscope.
[27] Gebhardt/Lee/Swaminathan (2001) use 18.615, Claus/Thomas (2001) use 33.389 and Easton/Taylor/Shroff/-Sougiannis (2002) use 26.561 total observations in their analysis.

The total number of firms per month in our sample varies from around 100 in 1989 to around 350 in 2002 as the number of listings in Germany increased considerably over the last decade.[28]

3.2. Expected Cost of Capital and Risk Premia

In this subsection, we estimate the expected cost of equity capital and risk premia (a) at the market, (b) at the industry, and (c) at the firm level. While the aggregation at the market level can be useful in the traditional CAPM context for identifying the market risk premium $[E(r_m)-r_f]$, the industry and individual firm level estimate the expected cost of equity capital and risk premium directly and thus can be seen as substitutes of the traditional approach.

3.2.1. Market Level

Under method I, the equally-weighted mean of all estimates per firm of the cost of equity capital and risk premium was calculated monthly. Under method II, we pool all observations in a portfolio per month and estimate the corresponding market cost of equity capital, the risk premium and the infinite growth rate of residual income using regression equation (17).

[Insert table 4 about here]

Table 4 reports the mean monthly expected cost of equity capital and risk premia in Germany under method I and II summarized as averages per year. Pooled over our total sample period, the average expected cost of equity capital in Germany is 10.0% under method I and 11.2% under method II. The average expected market risk premium is 3.9% (5.2%) under method I (II). Under both methods, a clear trend of rising market risk premia is observable over time. Particularly interesting is the increase in the expected market cost of equity capital and risk premia starting 1999. Excluding the recent periods from 1999 to 2002, the average market risk premium is significantly lower with 1,6% (2,6%) and is comparable to Claus/Thomas (2001), who report an average expected market risk premium of 2,02% for Germany from 1988 to 1997 using a comparable approach. With respect to the discussion on the "equity premium puzzle" (see e.g. Mehra/Prescott

[28] See DAI-Factbook (2002), p. 03-8-b.

1985, Claus/Thomas 2001, Fama/French 2002), our ex-ante risk premia are within the range of evidence reported for the magnitude of ex-post realized premia in Germany[29].

Figure 3 displays the monthly risk premia in Germany under both method I and II. The estimates of method II are more volatile over time given the sensitivity of the regression approach to outliers. The comparatively high volatility of both time-series at the beginning of our sample period is mainly due to the lower number of observations available from 1989 to 1991. In the following years, the number of firms increases substantially and thus reflects the market overall reasonably well. We observe a sharp increase of the risk premia at the end of our estimation period, a phase in which stock market participants appeared to be particularly euphoric about expected returns of their investments. These high growth expectations are also documented in Table 4 as average expected growth of residual income exceeds 10 percent under method II for the years 1999-2001. This fact is only in part attributable to the increasing number of newly listed "growth companies" in our sample during that time period. When comparing our two approaches, method I reacted less volatile during this period because the overoptimistic expectations were smoothed out through the fading period, whereas under method II, those expectations were extracted fully into the future. However, when expectations fell at the beginning of 2001, method II returns more quickly to more reasonable levels of around 10%.

[Insert figure 2 about here]

Overall, a trend of increasing expected risk premia over time is clearly visible and is independent of the method applied. The expected market risk premium rises from around 0% at the end of the 80s to around 14% (7%) under method I (II) at the end of 2002. This rising trend has not been documented in the related US-studies which cover sample periods ending before 1999.[30] It further contradicts Stulz (1999) who provides arguments that the increased globalization will cause the equity premia to decline in financial markets globally.

[29] See Ballwieser (2002), p. 739 or Drukarczyk (2003), p. 366.
[30] The sample period of Gebhardt/Lee/Swaminathan (2001), Claus/Thomas (2001) and Easton/Taylor/Shroff/Sougiannis (2002) end in 1995, 1998 and 1998.

3.2.2. Industry Level

At the industry level, we do not have enough observations for an analysis of each of the 168 month and 22 industry combinations. We require a minimum of 10 firms per month/industry for estimation in order to generate representative results which are not driven by some individual firms. We further delete the top and bottom 1% in each month/industry subset when running the regressions of method II. In order to make method I and II more comparable we then calculate for the same set of firms our industry results under method I by simply averaging all its individual estimations.

[Insert table 5 about here]

Table 5 presents the implied cost of equity capital and risk premia for 22 industry group classifications as in Fama/French (1997) relying on the primary SIC-classification in Worldscope. The industries with the lowest expected risk premia are traditional low risk sectors such as Utilities (-0.5%; 1.9%), Real Estate (1.8%; 2.1%) or Food & Beverage (1.5%; 0.1%), but also Banking (0.9%; 1.9%) and Insurance (2.2%; 5.9%). Investors demand the highest implied risk premia for the Information Technology and Service sectors, including Computers (15.7%; 11.4%), Business Services (13.4%; 15.9%), and Trading (10.4%; 14.6%). The rankings from the lowest (Rank 1) to the highest (Rank 20) expected rates of return per industry for each estimation method are presented in the last two columns of table 5. The rank correlation between the two methods is 0.6721. The medium risk premia are plotted for both methods in figure 4 that illustrates graphically the differences in the magnitude of the estimation under the two approaches (I, II).

[Insert figure 4 about here]

3.2.3. Firm Level

Table 6 reports the distribution parameters of expected cost of equity capital and risk premia at the firm level. Since method II is only applicable for a portfolio of stocks, we estimate each observation on the (next higher) industry level and present the distribution of these estimates which apply to each firm included in that industry portfolio (1.189 monthly regressions on total).

[Insert table 6 about here]

As we propose the ex-ante concept for practical application, it is important to demonstrate that the estimates of expected cost of equity and risk premium are reasonable. Since there is no true benchmark of expected cost of equity capital against which to compare our estimates and even average realized ex-post returns for stocks do not necessarily reflect former ex-ante expected returns even over the long run (see Miller 1977, Elton 1999), we concentrate on the cases with either negative expected cost of equity capital or negative risk premium. Such estimates are difficult to reconcile with traditional capital market theory.[31] In our sample, the number of observations with negative cost of equity capital estimates is zero, but the percentage of firms with negative expected risk premia is 17.2% (12.03%) of the full sample under method I (II). Guay/Kothari/Shu (2003) report a comparable percentage of negative risk premium firms using the Fama-French Three Factor Model as a current state-of-the-art approach in the financial economics literature utilizing historical stock returns.[32]

3.3. Determinants of Expected Cost of Capital and Risk Premia

We now turn to the analysis of determinants of expected cost of equity capital and risk premia. The cross-sectional relationship between our estimates and various firm characteristics affecting such estimates is interesting for two reasons: Firstly, systematic relationships between implied estimates and variables which have been found in prior literature to capture the riskiness of firm could rationalize or justify this measure. Secondly, financial managers will be interested in understanding the market perception of risk and which of their firm's characteristics affect the cost of equity capital. Since we are interested in the determinants on the individual firm level, we can use only method I in this section. We also concentrate on explaining the risk premia and analyze the following explanatory variables:[33]

(a) Systematic and Unsystematic Risk

Since the development of the Capital Asset Pricing Models (CAPM), the beta-factor has taken a central role in capital market theory and valuation practice.[34] The CAPM predicts a positive linear association between a firm's measure of systematic risk (beta) and its expected risk premium. As

[31] In decision-theory, a negative risk premium can be explained by risk loving investors willing to pay for taking on additional risk (see e.g. Eisenführ/Weber 2003, pp. 222-255). In capital market theory and CAPM context, a negative risk premium can be reconciled with a negative beta of a stock (see e.g. Ross/Westerfield/Jaffe 2002, pp. 272-275).

[32] See Guay/Kothari/Shu (2003), p. 13.

[33] See also Gebhardt/Lee/Swaminathan (2001) and Gode/Mohanram (2002). We do not analyse aspects of corporate disclosure or regulation in this paper, see Hail (2002) or Hail/Leuz (2003) for such an analysis.

[34] See e.g. Ross/Westerfield/Jaffe (2002), pp. 242-284; Brealy/Myers (2003), pp. 194-204.

common in the literature, we estimate the market beta of each stock based on a five-year rolling regression using monthly returns and the value-weighted Composite DAX (CDAX) index as market proxy.[35]

Prior studies have also documented a positive relationship between a stock's volatility as measure for unsystematic risk and its future returns (Malkiel 1997). We measure volatility as annualized standard deviation from previous year's daily discrete stock returns, assuming 250 trading days in a year.[36]

$$Vola_i = \frac{1}{n-1}\sqrt{\sum_{t=1}^{250}\left(r_{i,t} - E[r_i]\right)^2} \times \sqrt{250} \quad (17)$$

where	$Vola_i$	=	Volatility of stock i
	n	=	Number of returns (250)
	$r_{i,t}$	=	Discrete daily returns of stock i at date t
	$E[r_i]$	=	Mean of discrete daily stock returns over the past 250 trading days

(b) Financial Leverage

According to financial theory, a firm's cost of equity capital should be an increasing function of the debt-to-equity ratio. Empirically, Fama/French (1992) document a positive relationship between market leverage and realized stock returns. Although one could either measure book or market leverage, we apply the latter defined as ratio of long-term debt to the market value of equity at fiscal year end. Modigliani/Miller (1958) base their theory on market leverage, not book leverage.

(c) Information Environment

Corporate disclosure and additional information created by financial intermediaries can lower the information asymmetry between a firm and its investors, and thus lower the risk premium required (see Diamond/Verrecchia 1991). While empirical research has applied many proxies for measuring the information environment including trading volume, bid-ask spreads, institutional investment, firm size and the number of analysts following, these variables often show to be highly correlated (see Gode/Mohanram 2002). We use the number of analyst following a firm and firm size (the log market capitalization of equity) as proxies for the information environment, hypothesizing that the risk premium is lower for firms with more analysts following or of larger size.

[35] We require at least 24 data-points (monthly returns) for an estimation. The CDAX includes about 750 listed stocks traded on the official market and proxies the German stock market.

[36] See e.g. Steiner/Bruns (2000), pp. 57 – 59.

(d) Earnings Volatility

One rational for earnings management taking the form of smoothing income over time is the notion that firms with stable and increasing earnings trends would have lower risk premia over time.[37] In fact, recent research has documented a valuation premium for such firms (Barth/Elliott/Finn 1999). We measure earnings variability as the standard deviation of one-year ahead analyst earnings forecasts by I/B/E/S (Std_FEPS1).

(e) Stock Market Anomalies

Increasingly, empirical studies have documented variables which have no explicit foundation in theory, but which have been shown to be statistically associated with historically realized returns (see Elton/Gruber 1995 for an overview). The book-to-market ratio (B/M) is among the most prominent of those variables and included in the Fama/French Three Factor model (Fama/French 1992). These authors show that high B/M firms earn higher returns ex-post than do low B/M firms. Similarly, firms with high (low) long-term growth earnings expectations earn lower (higher) subsequent year returns (La Porta 1996). We examine whether such "anomalies" in realized returns can also be found in expected returns.

(f) Industry Membership

Firms in a specific industry share similar business risks and often similar financial accounting choices. Estimations of the cost of equity capital using realized returns have often been performed at the industry, rather than at the individual firm level. Gebhardt/Lee/Swaminathan (2001) find that industry effects explain much of the cross-sectional variation in expected risk premia. We control for industry effects by including the average industry expected risk premium of the previous year in our analysis.

(g) Time

Absent a theoretical background, but given the obvious (increasing) trend of expected risk premia in figure 2, we control in our pooled regressions for time by including a monthly count variable, beginning in January 1989 (=1) and ending in December 2002 (=14).

Table 7 lists and describes all variables together with the sources of data. We winsorize each variable by the top and bottom 1% observations. Panel A presents the mean, standard deviation, and

[37] See e.g. Ronen/Sadan (1981), pp. 7-8 for an overview.

the range of the dependent and explanatory variables, Panel B displays the non-parametric Spearman rank correlations between these variables.

Univariate Results

The signs of all correlations in table 7, Panel B are in line with expectations: Risk premia are negatively correlated with the information environment variables, number of analyst following and firm size, but positively correlated with all other variables. The beta-factor from the CAPM is not highly correlated with any of the other explanatory variables, the rank correlation with the implied risk premium is very low. However, we do not find a negative statistical relationship between the two variables contrary to the theory as in Gebhardt/Lee/Swaminathan (2001).

In order to reduce measurement errors[38] we pool observations as of March each year,[39] form five equally-sized portfolios (quintiles) based on each firm characteristic and calculate the mean and median expected risk premium for the firms in each portfolio. We then test for the differences in risk premia across the two extreme portfolios, Q1 and Q5 (parametric t-test, non-parametric Wilcoxon Z-test) and across the portfolios the ANOVA using F-tests.

Table 8 presents the results. The relationship between Beta and Vola and the expected risk premium is not monotonically increasing from the lowest to the largest portfolio of Beta or Vola. For Beta, the difference from the largest portfolio Q5 to the lowest portfolio Q1 is significant only at the 10% level using the t-test, whereas the non-parametric test and the ANOVA is insignificant. In the case of Vola, the mean (median) difference from Q5 to the Q1 is highly statistically significant with 2.19% (1.31%) as well as the ANOVA F-Stats across the five portfolios.

[Insert table 8 about here]

Except for the long-term growth variable, all other explanatory variables in table 8 show continuously decreasing or increasing expected risk premia across the different portfolio levels in line with expectations. Test statistics are significant. The size variable turns out to have the highest negative impact on expected returns as the mean (median) difference in expected return between the largest (Q5) and smallest (Q1) firm portfolios amounts to -6.08% (-4.74%). For the industry risk

[38] See e.g. Neubauer (1994), pp. 272-277.

[39] We chose the month of march each year for several reasons: First, the maximum number of observations per month in our sample is available in march. Second, most of the financial results for the majority of firms with a fiscal year end in December, 31, are already available at that date. Accordingly, more "future estimators" for the FY1 are available, in which case one is gaining an additional earnings forecast relative to the "historical estimator". Third, it is important to include each firm only once in the sample for this analysis, which would be violated by a monthly analysis.

premium of the previous period (5.55%), the book-to-market ratio (5.71%) and the time variable (9.58%) mean differences in expected cost of equity capital between the largest and smallest magnitude of independent variable portfolios (Q5-Q1) are particularly high as are the related test statistics and significance levels. These univariate results appear to be stronger than in Gebhardt-/Lee/Swaminathan (2001).

Multivariate Results

We analyze the multivariate relationship between the implied risk premia and the various firm characteristics performing both a pooled linear cross-sectional regression assuming a constant relationship between the factors during our investigation period (Table 9, Panel A) and standardized annual cross-sectional regressions in the line of Fama-McBeth (1973) which accounts for intertemporal stability of the relationship between the variables (Table 9, Panel B). Because of a standardization of the variables to a mean of zero and a standard deviation of one, this approach also allows to measure the relative influence of each explanatory variable on the dependent variable.[40] Each panel of Table 9 reports results for four different model specifications.

[Insert table 9 about here]

Model 1 in Panel A and B is based on the variables in the Fama/French (1992) Three Factor Model. The explanatory power of the pooled regression version is relatively high (41.73%), but lower than the standardized Fama/McBeth approach with 50.53%. All three independent variables (beta, size, book-to-market ratio) are highly significant and signs are in the predicted direction. Comparing the estimated coefficients in the standardized regression in Panel B shows that the variation of the book-to-market ratio has the highest impact on the variation of expected returns (0.5400), followed by the size variable with a regression coefficient of -0.2166. Beta is the least important variable in this model (0.0950).

Model 2 includes all independent variables, except the number of analyst following and the debt-to-market ratio; the former variable is highly correlated with size (0.67) and the latter with the book-to-market ratio (0.62), respectively (Table 7, Panel B). The overall explanatory power of the model is similar in both panels (76.78% vs. 72.03%). All variables except the systematic and unsystematic risk measures as well as the standard deviation of analyst earnings forecasts are highly significant. The influence of the lagged industry risk premium variable is remarkable: In the pooled regression

[40] See Neubauer (1994), p. 250; Gujarati (2003), p. 174. and similarily Gebhardt/Lee/Swaminathan (2001), p. 164.

in Panel A, an increase of the industry risk premium by 100 basis points would lead on average to an increase of the firm's expected risk premium of 53 basis points. This confirms the conclusion of Gebhardt/Lee/Swaminathan (2001) that "industry membership should be an important characteristic in cost of capital estimation" (p. 138). It also provides a rational for estimation method II which allows determining an industry risk premium only.

Model 3 replaces the highly correlated variables and includes the number of analyst following (No) instead of Size and the debt-to-market ratio as an alternative for the book-to-market ratio. The explanatory power in both regression declines noticeably, but is still above 50%. The change in variables causes the Vola variable to be now statistically significant at the 1% level, but only in the pooled regression case. Beta gains significance at the weak 10% level – with the sign not in the predicted direction.

Model 4 reconstructs Gebhardt/Lee/Swaminathan's (2001) model with the highest explanatory power and gains an adjusted R^2 of 73,25/71,35% which is even higher than in the original study. The variables B/M, LTG and RP_lag are of similar significance as in Gebhardt/Lee/Swaminathan (2001), however, the variation in short-term analyst earnings forecasts is of minor importance in our study. In addition, leverage and firm size appear to be more important in the German capital market.

To sum up, the historical Beta, Vola and the variation in short-term analyst earnings forecasts do not contribute much to the explanation of expected risk premia. Beta looses explanatory power as soon as additional variables are added to the Three Factor Model approach. Variables most important for explaining the variation of expected risk premia are in particular the lagged industry risk premium and the book-to-market ratio.

4. Applying the Expected Cost of Equity Capital

After the broad sample based evidence using historical data in the previous section, we next turn to a contemporary case study using current data in order to the show and discuss the potential applicability of the concept. Estimates of contemporary expected cost of equity capital could be used for value based management and for investment decisions, as they reveal to financial managers the market participants' current expected rate of return for the provision of equity capital. As such, financial managers could estimate their individual firm's expected cost of capital as well as compare its magnitude relative to its industries' average. In such a comparison an analysis of the different level of risk factors as described in the former section within an industry could also prove to be useful.

Contemporary data on stock prices and accounting data for a company is available through the various information providers. While analyst earnings forecasts of the next two future periods are available through multiple sources including the internet[41], the data on longer time horizon forecasts are less widespread in the databases: Forecast for the next four years from I/B/E/S are available through the *Bloomberg Financial System*; forecasts from Multex are available from *Reuters 3000 Xtra* for the next three years. For an individual company, one could also calculate consensus estimates as the mean or median of all analysts' individual forecasts for any future time horizon. Lists of analysts covering a specific firm are available e.g. through the internet (see e.g. Yahoo!Finanzen) or *Reuters 3000 Xtra*. Analyst reports could either be collected by contacting the covering financial institution/the individual analyst directly or alternatively by downloading such reports from the *Thomson Financial Research*, a comprehensive database collecting analyst reports.
The estimation procedures as described in section 2.2. can easily be implemented in spread-sheet software such as e.g. MS-Excel, using the solver-parameter and the regression function (RGP). In large data-sets, the estimation procedure can be automated by VBA-programming. Such tools are also used when implementing traditional cost of capital estimation methods.[42]

4.1. Case Study: DaimlerChrysler and the European Automobile Industry

We illustrate the estimation of expected cost of equity capital and risk premia in case studies for DaimlerChrysler (DCX) and for the Automobile Industry in the EURO-zone.[43] We perform the analysis using our methods I and II as of the estimation date 7th of August 2003. All data came from the Bloomberg Financial System. We also relied on Bloomberg for the selection of firms in the automobile peer group.
Our results are in table 10, Panel A. The average expected cost of equity capital (risk premium) for the European Car industry is 12.01% (7.68%) under method I and 10.79% (6.46%) under method II. The results appear to be reasonably close to each other. Under method II, an average infinite growth rate of residual income of 3.35% is estimated simultaneously, which transforms into an average yearly expected growth rate of earnings of 9.01% for the industry.[44] The expected cost of equity

[41] See Easton/Monahan (2003), p. 16, Easton (2003); for the internet e.g. www. http://de.finance.yahoo.com/.
[42] See Benninga (2000), pp. 27-55, Pratt (1998), pp. 55-127.
[43] By focusing on the EURO-zone, we disregard aspects of curreny differences in expected future earnings.
[44] See Easton/Taylor/Shroff/Sougiannis (2002), pp. 674-675.

capital ranges from 6.83% for Italdesign to 15.43% for Volkswagen (VW). The individual estimation of the cost of equity capital for DaimlerChrysler is 12.91%.[45]

[Insert table 10 about here]

Table 10, Panel A further documents the different phases of fundamental value creation as calculated by our residual income model for our sample firms. The book value of equity shows to be the dominant part of fundamental value in the industry, especially for the large firms. For the companies with a Price-to-Book ratio of less than one (e.g. DCX) the market expects a reduction of value in the future periods. The importance of the detailed planning period (including analyst consensus earnings projections) shows to depend very much on the firm analyzed as it ranges from 4.64% of value for Renault to -66.75% for Fiat. Further, one can observe that the importance of the terminal value is decreased by the inclusion of the fading period in our three phase valuation model. Finally, table 10, Panel B documents the sensitivity of our expected cost of equity capital, risk premium and growth rate estimates for the automobile industry to the variation of important input parameters. Starting with the original "base-case" results from Panel A, we vary the following input variables in our residual-income based valuation methods: (1) earnings forecasts over the next 5 years, (2) book value of equity, (3) share price, (4) payout ratio, and (5) target RoE of the industry.

(1) We first simulate an increase of analyst earnings forecasts over the next 5 periods of +/-10% annually. All else equal, this leads to an increase/decrease in the expected risk premium of 69/65 basis-point under method I. As expected, method II reacts more sensitive to the shift in earnings projections with a change of +/-112 basis points.
(2) If we next assume for the moment a change of the book value of equity of +/-15% ceteris-paribus (and thus a violation of the clean-surplus principle), the expected risk premium increases/decreases with 45/47 basis-points (method I). Surprisingly, method II reacts in the opposite direction with 33/47 basis-points. Still, given the severe change in shareholders equity of 15%, and despite the fact of the book value of equity's dominant part in fundamental value, the magnitude of the change in expected rates of return appear to be rather low.
(3) The change in share price of +/-10% in our sample has a high impact with a change of around -65/+78 basis-points under both methods.

[45] This rate can be compared to the rate of return DaimlerChrysler uses internally estimated via the CAPM: Before 2002, DaimlerChrysler estimated their cost of equity capital at 11.6%; after 2002, they adjusted their estimates and only publish their WACC (weighted avergage cost of capital) at 8% after tax. See http://www.daimlerchrysler.com.

(4) Further, for testing the sensitivity to changes in the payout ratio, we vary the average payout-ratio over the next four periods as in Bloomberg by +/-20% (alternatively set to 0% or 50%). Again, table 10, Panel B shows that method II reacts more sensitive to a variation of this input variable than method I. Overall changes in the payout-ratio account only for minor changes in the implied risk premia.

(5) The expected cost of equity capital estimation finally shows to be very sensitive to a variation in the target RoE of the industry (the only historical estimate or alternatively to be labeled future assumption under method I): The target RoE of the automobile industry calculated as 5 year historical average ranges in our historical estimation period from 1989 to 2002 between 7.9% and 18.11%. A change of +/-5% in target RoE, however, implies a change in expected cost of equity capital of +240/-288 basis points. This result further underlines the importance of an exact derivation of the expected industry (book) rate of return. Best, this rate would not be calculated as historical average, but instead be determined as average analyst long-term expectations[46]. Such market expectations are not available in the databases in Europe, however, they can be (hand-) collected from individual analyst reports. Again, method II does not need this assumption.

4.2. Discussion of Pro's and Con's

Finally, we list and briefly discuss key advantages and disadvantages of the new approach to be considered for the application in practice:[47]

Pro:

A major argument supporting the implied approach is its consistency with asset pricing theory calling for measures of expected returns – whereas traditional approaches have generally used ex post realized returns. It derives its estimates from currently available stock market data, but bypasses the crucial implementation issues inherent in the traditional CAPM approach for which no ultimately convincing solution has been put on the table up to date – despite the CAPM's common application in investment practice.

The advantage of not relying on historical returns is of special relevance to newly listed companies or firms which experience a major structural change such as an M&A- or restructuring activity (e.g.

[46] See also Botosan/Plumlee (2001). They observe long-term market expectation directly in Value-Line analyst forecasts. Unfortunately, such long-term market expectations are not available in the large public databases for Europe.

[47] See also Gebhardt/Lee/Swaminathan (2001), pp. 167-172 and Guay/Kothari/Shu (2003).

Daimler-Benz after its merger with Chrysler). For such companies, information in historical returns might be even less useful for projections into the future than for other firms.
Last, the communication process between stock market participants and firms could be enhanced by questioning the underlying reasons for diverging expectations about future returns of the firm, especially in cases in which the implied cost of equity capital estimates derived from current market data do not yield values that are economically plausible.

Con:

The conceptual disadvantages of the new concept for the application in capital budgeting decisions is common to all market oriented approaches, namely, the issue whether the project has the same systematic risk as the firm as a whole for which the implied cost of capital was calculated. In such a case, one could also compute the expected cost of capital for one or more listed and covered pure play firms that are comparable to the specific project.
Further, the concept presented calculates only one discount rate to be applied upon all future periods and does not incorporate time-varying discount rates. While it is conceptually possible to determine discount rates which vary over future periods based on the term-structure of risk-free rates of return, one has to introduce an additional assumption about the development of the risk premium over time (see Claus/Thomas 2001).
Another key issue to be considered is data availability and quality. While the concept applies only to listed companies covered by analysts, the question always to be raised is how well the consensus earnings projections available reflect the true market expectations of future earnings on which the stock price formation is build on. The forecast data used for estimation is based on sell side analysts and not on the buy side analysts who are actually trading, moreover, both groups of analyst might have diverging incentives when forming their earnings expectations. Further, it has been well documented in the related literature[48] that analyst earnings forecasts are subject to bias and timeliness problems which might affect the accuracy of implied cost of capital estimates. Such problems include the optimistic bias of analysts across the financial year (e.g. Brown 1993), their tendency to be guided by companies and their investor relations departments towards results achievable at the financial year end (e.g. Matsumoto 2002) and the analysts' sluggishness to react to changes in information in stock prices (e.g. Abarbanell 1991). While these issues in analyst forecasts are well documented, only the very recent research has tried to adjust for such biases when estimating an implied cost of capital (see Guay/Kothari/Shu 2003).

[48] There are several reviews on the financial analyst literature, see e.g. Kothari (2001) or Healy and Palepu (2001).

Particularly in Germany, most analyst earnings forecasts are formed according to the joint guidelines of the German financial analyst society, Deutsche Vereinigung für Finanzanalyse (DVFA), and the Schmalenbach Gesellschaft für Betriebswirtschaft (SG). These guidelines are designed to bring about more consistency in earnings forecasts among companies preparing their financial reports according to different sets of accounting standards (HGB, IAS/IFRS or US-GAAP)[49], an option which was legalized in 1998 in Germany after the introduction of §292a HGB in German company law. How well analysts cope with the total of more than 100 proposed adjustments under the DVFA/SG-earnings and the within country accounting diversity in general has not been documented yet, however, analyst forecast accuracy has declined in recent years in Germany (see Daske 2004). Also, whether the required ex-ante clean-surplus condition under residual income valuation is fully considered when analysts prepare their forecasts of earnings and book values under the DVFA/SG adjustments remains on open issue on top.

Finally, potential inconsistencies between analyst forecasts and stock prices which flow into the intrinsic value calculation manifest themselves in inplausible cost of equity capital estimates, which take the form of extremely high values or negative risk premia. Only very recent studies have tried to evaluate the values of the implied cost of capital estimates on the basis of their ability to explain cross-sectional variation in future stock returns (see Guay/Kothari/Shu 2003, Easton/Monahan 2003).

5. Conclusions

In this study, we present an alternative prospective method of estimating expected returns on investments by equity holders. This concept does not rely on realized returns when estimating a firm's cost of equity capital, but applies only current data or market expectations using the stock price, accounting data and the capital market's consensus earnings forecasts.

We propose the concept for practical application at the firm level in value based management and investment decisions. Our modification of the estimation procedure allows the calculation of expected cost of equity capital at any date of the firm's choice during its fiscal year. The two complementing estimation procedures, both conceptually based on the residual income model, were shown to be easily implementable using spreadsheet software tools such as MS-Excel. Given the readily available data needed through the various information sources, the new concept has the potential to replace methods using realized returns in the near future.

[49] See Busse v. Colbe/Becker/Berndt/Geiger/Haase/Schellmoser/Schmitt/Seeberg/v. Wysoki (2000), p. 3-5.

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TABLE 1

Contemporary Beta-Estimation of Financial Service Providers for DaimlerChrysler

Source	Beta	Page
Internet Access		
Yahoo! Finance	1.43	http://biz.yahoo.com/p/d/dcx.html
Yahoo! Finanzen	0.87	http://de.biz.yahoo.com/tech/d/dcx.html
Bloomberg	1.06	http://quote.bloomberg.com/apps/quote?ticker=DCX:GR
CNN Money	1.43	http://cnnfn.multexinvestor.com/StockOverview.aspx?ticker=DCX&target=quickinfo%2fstockoverview
Restricted Access		
Reuters	1,52	
Datastream	1,01	

Information on pages as of 22.05.2003.

TABLE 2

Definition of Variables and Data Sources

Input Variable	Description in Database	Symbol
Forecasted EPS	I/B/E/S *Median EPS Estimate*	$feps_{t+n}$ mit n=1,2,3,4,5
Long term growth LTG	I/B/E/S *Long Term Growth*	g^{ltg}
Book value of equity (BVE)	WORLDSCOPE *Total Common Equity*	BV_t
No. of shares outstanding	I/B/E/S *Shares Outstanding (in Mio.)*	
BVE per share		$bvps_n$
Payout ratio	WORLDSCOPE *Div Payout Ratio*	k
Share price	I/B/E/S *Price*	p_t
Target-RoE	Median of Industry RoE over the past 5 years	
Industry	WORLDSCOPE *SIC Code*	
Estimation Date	Estimation date, one per month	t
Risk free rate of return	DATASTREAM *REX BOND SUB INDEX CURRENT,10 YRS – R.Y.*	r^f

TABLE 3

Sample Selection

Description	No.	Percent
I/B/E/S Dataset	69.785	100.00%
Shares outstanding data missing	(594)	0.85%
Share price data missing	(690)	0.99%
Accounting data missing	(10.019)	14.36%
Target RoE data missing	(814)	1.17%
At least 3 future EPS-estimators or 2 future EPS-estimats and LTG	(24.963)	35.77%
Stacked forecasts	(3.295)	4.72%
Insolvency estimates	(517)	0.74%
Final Dataset	28.893	41.40%

TABLE 4

Expected Cost of Equity Capital and Risk Premia – Market Level

	Number of observations N		Risk-free rate r^f	Cost of Equity Capital r^{EK}		Risk Premium r^{EK} - r^f		(Implied) Growth rate g^{RI}	Denominator in (14) r^{EK} -g^{RI}
Method	I	II		I	II	I	II	II	II
Year									
1989	581	541	6.9%	7.9%	10.7%	0.9%	3.6%	7.3%	3.4%
1990	826	772	8.6%	7.4%	10.5%	-1.5%	1.6%	8.2%	2.3%
1991	1,125	1,065	8.4%	7.8%	8.2%	-0.8%	-0.4%	5.1%	3.1%
1992	1,530	1,453	7.8%	8.2%	8.3%	0.2%	0.3%	4.2%	4.0%
1993	1,588	1,499	6.5%	7.8%	7.9%	1.5%	1.6%	4.5%	3.4%
1994	1,618	1,549	6.9%	7.6%	8.1%	1.1%	1.5%	4.0%	4.1%
1995	1,862	1,779	6.8%	8.4%	9.3%	2.0%	2.9%	4.4%	4.9%
1996	2,038	1,954	6.3%	9.1%	9.0%	3.5%	3.4%	3.8%	5.2%
1997	2,220	2,135	5.7%	8.9%	9.0%	3.8%	3.9%	5.2%	3.8%
1998	2,576	2,488	4.6%	9.9%	11.7%	5.6%	7.3%	9.2%	2.5%
1999	3,021	2,915	4.6%	11.6%	15.6%	7.4%	11.4%	13.9%	1.7%
2000	3,219	3,089	5.3%	11.6%	22.1%	6.4%	16.8%	21.2%	0.9%
2001	3,306	3,166	4.9%	15.6%	14.8%	11.0%	10.2%	12.1%	2.7%
2002	3,383	3,231	4.8%	17.5%	12.3%	13.0%	7.9%	8.0%	4.3%
All	28,893	27,636	6.3%	10.0%	11.2%	3.9%	5.2%	7.9%	3.3%

TABLE 5

Expected Cost of Equity Capital and Risk Premia – Industry Level

	Number of observations N		Cost of Equity Capital r^{EK}		Risk Premium r^{EK} - r^f		Ranking of Industries	
Method	I	II	I	II	I	II	I	II
Industry								
Utilities	355	336	6,0 %	8,5 %	-0,5 %	1,9 %	1	7
Banking	432	370	6,7 %	8,6 %	0,9 %	1,9 %	2	8
Food & Beverages	40	33	6,8 %	6,8 %	1,5 %	0,1 %	3	1
Real Estate	55	51	6,2 %	8,7 %	1,8 %	2,1 %	4	9
Insurance	646	582	7,1 %	12,6 %	2,2 %	5,9 %	5	15
Retail & Wholesale	3.604	3.452	9,5 %	10,3 %	3,6 %	3,7 %	6	10
Construction	464	389	9,3 %	8,2 %	4,2 %	1,6 %	7	6
Consumer Goods	601	524	10,2 %	8,1 %	4,4 %	1,4 %	8	4
Construction Materials	1.319	1.223	10,5 %	8,1 %	4,5 %	1,4 %	9	3
Machinery	2.862	2.690	10,7 %	10,4 %	4,8 %	3,8 %	10	11
Communications	152	110	9,9 %	8,2 %	4,8 %	1,5 %	11	5
Health	738	695	10,2 %	7,5 %	5,5 %	0,9 %	12	2
Chemicals	564	500	11,1 %	11,1 %	6,1 %	4,5 %	13	13
Automobiles	974	870	11,4 %	11,8 %	6,4 %	5,2 %	14	14
Electrical Equipment	555	502	11,6 %	13,3 %	6,8 %	6,7 %	15	16
Textiles	325	293	12,2 %	10,8 %	7,4 %	4,1 %	16	12
Recreation	405	361	14,1 %	18,7 %	9,4 %	12,0 %	17	18
Trading	258	221	15,1 %	21,3 %	10,4 %	14,6 %	18	19
Business Services	2.453	2.388	18,1 %	22,5 %	13,4 %	15,9 %	19	20
Computers	602	561	20,5 %	18,0 %	15,7 %	11,4 %	20	17

TABLE 6

Expected Cost of Equity Capital and Risk Premia – Firm Level

	Cost of Equity Capital r^{EK}		Risk Premium $r^{EK} - r^{f}$	
	Method I	Method II	Method I	Method II
Mean	11.07%	11.27%	5.53%	4.62%
Median	9.49%	10.09%	3.99%	3.44%
5% Quantil	4.32%	5.63%	-2.35%	-1.03%
95% Quantil	23.17%	19.18%	18.55%	12.52%
No.	28.893	1.187	28.893	1.187
No.<0	0	0	4.964	143
%<0	(0%)	(0%)	(17.2%)	(12.05%)

TABLE 7

Panel A: Descriptive Statistics for Expected Risk Premia and Firm Characteristics

Variable	N	Mean	StDev	Min	Q1	Median	Q3	Max
RP	2,545	4.74%	5.68%	-4.60%	0.74%	3.56%	7.43%	28.74%
CoC	2,545	10.44%	5.09%	2.58%	6.96%	9.21%	12.49%	33.42%
Rex	2,645	5.69%	1.36%	3.73%	4.64%	5.20%	6.35%	9.06%
Beta	1,721	0.936	0.516	-0.029	0.611	0.877	1.160	3.520
Vola	1,959	0.255	0.225	0.024	0.068	0.208	0.342	1.180
DM	2,395	1.637	2.007	0.004	0.385	0.967	2.093	14.388
No	2,633	13.805	10.781	1.000	4.000	11.000	21.000	43.000
ln_size	2,599	5.931	1.805	2.060	4.604	5.726	7.216	10.695
Std_FEPS1	2,535	0.704	1.406	0.000	0.100	0.200	0.550	12.400
BM	2,545	0.718	0.640	0.009	0.319	0.536	0.879	4.317
LTG	1,285	0.119	0.098	0.010	0.065	0.095	0.140	0.760
RP_Lag	2,516	4.59%	4.53%	-3.88%	1.38%	3.65%	7.36%	16.93%

Panel B: Spearman-Correlations for Expected Risk Premia and Firm Characteristics

	RP	CoC	Rex	Beta	Vola	DM	No	ln_ size	Std_ FEP S1	LTG	BM	RP_ Lag	year
RP	1.000	**0.945**	**-0.598**	0.020	0.254	0.120	-0.342	**-0.528**	0.007	0.138	**0.417**	**0.727**	**0.651**
CoC		1.000	-0.368	0.060	0.221	0.193	-0.332	**-0.552**	0.020	0.099	**0.507**	**0.611**	**0.479**
Rex			1.000	0.056	-0.222	0.144	0.222	0.182	0.093	-0.122	0.012	**-0.626**	**-0.773**
Beta				1.000	0.156	0.072	0.156	0.035	0.107	0.198	-0.017	-0.004	-0.007
Vola					1.000	-0.091	-0.173	-0.244	0.032	0.077	0.038	0.290	0.277
DM						1.000	0.214	-0.056	0.318	**-0.063**	**0.622**	-0.242	-0.227
No							1.000	**0.670**	0.106	0.092	-0.059	-0.345	-0.319
ln_size								1.000	-0.065	0.050	-0.360	-0.342	-0.258
Std_FEPS 1									1.000	0.113	0.216	-0.129	-0.122
LTG										1.000	-0.139	0.164	0.226
BM											1.000	0.069	0.036
RP_Lag												1.000	**0.809**
Time													1.000

Description of Variables

Variable	Description (Source)
CoC	Cost of equity capital computed using Estimation Method I
RP	Risk premium where r_f is the yield on the REX-Index
Rex	Return of r_f proxied by the REX-Index return
Beta	Five year rolling over market beta, monthly returns, against CDAX-Market Index (Datastream)
Vola	Standard deviation of the previous years daily returns, measure over 250 trading days (Datastream)
DM	Ratio of long-term debt to market capitalization (Worldscope, Datastream)
No	Number of analyst following (I/B/E/S)
ln_size	Natural Log of firm size in millions € (I/B/E/S)
Std_FEPS1	Dispersion of one-year ahead analyst earnings per share forecasts (I/B/E/S)
BM	Book to market value of equity (Worldscope, I/B/E/S)
LTG	Consensus long-term growth earnings estimate (I/B/E/S)
RP_Lag	Previous years risk premium of the firm's industry (based on estimation using method I)
Time	Count variable, from 1989 (=1) and to 2002 (=14).

TABLE 8

Expected Risk Premia and Firm Characteristics: Univariate Analysis

Ranked by:	Smallest Q1	Q2	Q3	Q4	Largest Q5	Q5-Q1	t-Stats/ Z-Stats	ANOVA F-Stats
Beta								
Mean Exp. Risk Premium	3.66%	4.04%	3.99%	4.45%	4.52%	0.86%	2.66*	1.43
Median Exp. Risk Premium	2.88%	2.74%	3.28%	2.92%	3.00%	0.12%	-1.13	
Vola								
Mean Exp. Risk Premium	3.70%	5.46%	4.64%	4.22%	5.89%	2.19%	5.85***	9.22***
Median Exp. Risk Premium	2.93%	3.88%	3.21%	3.25%	4.24%	1.31%	4.30***	
DM								
Mean Exp. Risk Premium	3.32%	4.10%	4.74%	5.47%	7.31%	3.99%	12.29***	34.71***
Median Exp. Risk Premium	2.11%	2.97%	3.81%	4.32%	6.66%	4.55%	11.09***	
No								
Mean Exp. Risk Premium	5.88%	5.65%	5.19%	4.10%	3.07%	-2.81%	-8.89***	22.40***
Median Exp. Risk Premium	4.31%	4.55%	4.17%	3.26%	2.61%	-1.70%	-5.86***	
ln_size								
Mean Exp. Risk Premium	8.37%	5.98%	4.35%	2.81%	2.29%	-6.08%	-18.88***	112.41***
Median Exp. Risk Premium	6.92%	5.23%	3.70%	2.21%	2.17%	-4.74%	-14.40***	
Std_FEPS1								
Mean Exp. Risk Premium	3.93%	4.02%	4.43%	5.25%	5.37%	1.44%	4.31***	7.29***
Median Exp. Risk Premium	2.91%	3.06%	3.61%	4.06%	3.95%	1.04%	3.15***	
LTG								
Mean Exp. Risk Premium	2.61%	2.14%	2.08%	2.78%	2.74%	0.13%	0.60	1.82
Median Exp. Risk Premium	1.95%	1.33%	1.44%	2.10%	2.53%	0.58%	-0.67	
BM								
Mean Exp. Risk Premium	2.60%	2.91%	3.74%	5.75%	8.31%	5.71%	19.07***	107.48***
Median Exp. Risk Premium	1.56%	2.10%	3.07%	4.44%	7.04%	5.48%	15.69***	
RP_Lag								
Mean Exp. Risk Premium	2.04%	3.75%	4.76%	6.26%	7.59%	5.55%	17.62***	80.35***
Median Exp. Risk Premium	1.28%	2.99%	3.93%	5.11%	5.95%	4.67%	14.98***	
Year								
Mean Exp. Risk Premium	0.14%	2.20%	4.29%	6.67%	9.72%	9.58%	23.31***	383.84***
Median Exp. Risk Premium	-0.28%	1.93%	3.90%	6.24%	8.57%	8.85%	25.68***	

***, **, * Significantly different from zero at significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 9

Expected Risk Premia and Firm Characteristics: Multivariate Analysis

	a	Beta	ln_size	BM	Vola	Std_FEPS1	No	LTG	DM	RP_Lag	year	Adj-R^2
Hypotheses		+	-	+	+	+	-	+	+	+	o	o
Panel A: Pooled Cross-Sectional Regression												
(1)	0.0520***	0.0151***	-0.0088***	0.0417***								41.73%
	(10.64)	(7.81)	(-15.09)	(20.92)								
(2)	-4.3525***	0.0005	-0.0018***	0.0395***	0.0058	-0.0003		0.0297***		0.5320***	0.0022***	76.78%
	(-8.03)	(0.28)	(-4.30)	(24.60)	(1.34)	(-0.71)		(4.06)		(18.46)	(8.00)	
(3)	-3.2401***	-0.0040*			0.0224***	-0.0014**	-0.0004***	0.0198**	0.0082***	0.6351***	0.0016***	66.85%
	(-4.32)	(-1.69)			(4.04)	(-2.29)	(-4.44)	(2.15)	(16.14)	(16.25)	(4.31)	
(4)	-0.0104**	-0.0019	-0.0012***	0.0336***		-0.0005		0.0211***	0.0019***	0.7122***		73.25%
	(-2.43)	(-1.04)	(-2.43)	(14.66)		(-0.99)		(2.74)	(3.38)	(33.65)		
Panel B: Standardized Annual Cross-Sectional Regressions (Fama-McBeth Approach)												
(1)	0.0000	0.0950***	-0.2166***	0.5400***								50.53%
	(1.44)	(3.02)	(-2.85)	(7.23)								
(2)	0.0000	-0.0216	-0.0553	0.5503***	0.0363	0.0088		0.1700***		0.4233***		72.03%
	(-1.36)	(-0.05)	(-1.24)	(8.75)	(0.90)	(1.30)		(4.61)		(17.84)		
(3)	0.0000	-0.0767			0.0704	-0.0298	-0.0476	0.1393**	0.3835***	0.4926***		52.95%
	(-1.00)	(-1.58)			(1.38)	(0.95)	(-0.49)	(1.99)	(4.80)	(14.88)		
(4)	0.0000*	-0.0135	-0.0303	0.5733***		-0.0100		0.1689***	0.0313	0.3750***		71.35%
	(-1.87)	(-0.13)	(-0.89)	(8.34)		(0.42)		(3.68)	(0.46)	(17.02)		

***, **, * Significantly different from zero at significance levels of 0.01, 0.05, and 0.10 respectively.

TABLE 10

Case Study DaimlerChrysler / European Automobile Industry at 7. August 2003

Panel A: Cost of Equity Capital Estimates and Value Derminantes

		Estimation Procedure					Value Determinantes under method I			
Name	Bloomberg Ticker	Cost of Equity Capital		Risk Premium		Growth Rate g^{RI}	Book-Value of Equity	Detail Period	Fading Period	Terminal Value
		I	II	I	II					
BMW	BMW	10.69%	-	6.36%	-	-	67.32%	8.37%	7.14%	17.17%
Daimler-Chrysler	DCX	12.91%	-	8.58%	-	-	116.30%	-13.55%	-5.10%	2.35%
Fiat	F	13.75%	-	9.41%	-	-	179.36%	-66.75%	-11.50%	-1.11%
Italdesign	GIU	6.83%	-	2.49%	-	-	33.23%	17.70%	18.10%	30.98%
Peugeot	UG	15.37%	-	11.04%	-	-	126.53%	-6.18%	-10.26%	-10.09%
Pininfarina	PINF	11.12%	-	6.78%	-	-	91.64%	-7.65%	1.17%	14.85%
Porsche	POR3	10.44%	-	6.10%	-	-	33.31%	26.71%	20.81%	19.17%
Renault	RNO	11.56%	-	7.22%	-	-	95.45%	4.64%	-10.84%	10.75%
VW	VOW	15.43%	-	11.09%	-	-	161.77%	-32.32%	-19.37%	-10.09%
Mean		12.01%	10.79%	7.68%	6.46%	3.35%	100.54%	-7.67%	-1.10%	8.22%

Panel B: Sensitivity Analysis

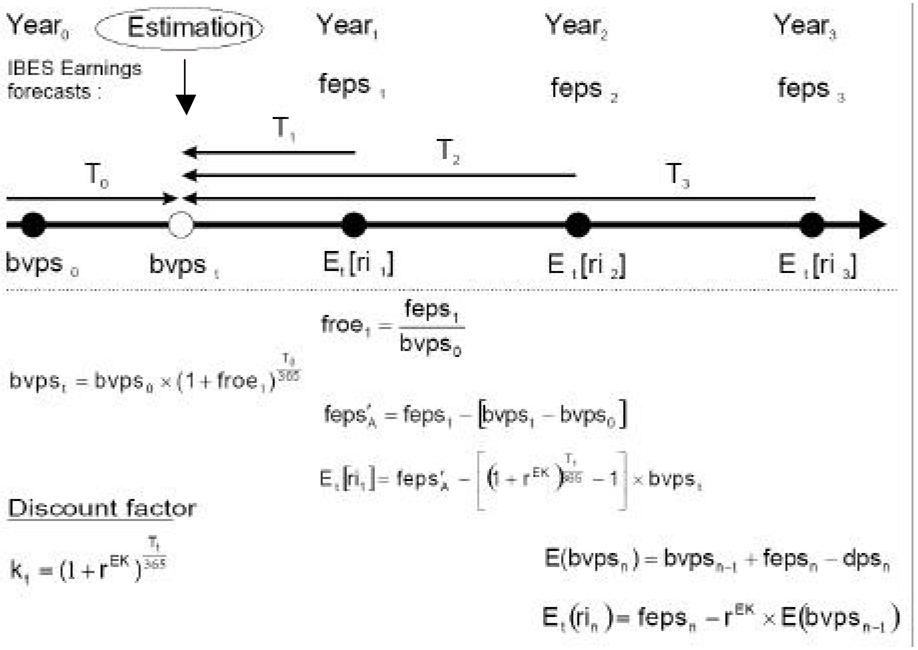
	Method I			Method II			
	R. Premium	Cost of Equity Capital	? rp	R. Premium	Cost of Equity Capital	? rp	Ø-g^{ri}
Base Case	7.68%	12.01%		6.46%	10.79%		3.35%
Earnings +10%	8.36%	12.70%	0.69%	7.58%	11.92%	1.12%	3.81%
Earnings -10%	7.02%	11.36%	-0.65%	5.34%	9.68%	-1.12%	2.93%
bvps +15%	8.12%	12.46%	0.45%	6.12%	10.46%	-0.33%	2.87%
bvps -15%	7.20%	11.54%	-0.47%	6.93%	11.26%	0.47%	4.03%
Stock Price +10%	7.01%	11.35%	-0.66%	5.81%	10.14%	-0.65%	3.34%
Stock Price -10%	8.45%	12.78%	0.77%	7.24%	11.58%	0.79%	3.37%
Payout +20%	7.57%	11.91%	-0.10%	6.74%	11.08%	0.28%	3.44%
Payout -20%	7.77%	12.10%	0.09%	6.24%	10.58%	-0.22%	3.29%
Payout all 0%	7.61%	11.94%	-0.07%	6.12%	10.46%	-0.33%	3.31%
Payout all 50%	7.92%	12.25%	0.24%	6.78%	11.12%	0.32%	3.48%
ROE +5%	10.07%	14.41%	2.40%	-	-	-	-
ROE -5%	4.79%	9.13%	-2.88%				

FIGURE 1

Estimation of Expected Cost of Equity Capital and Risk Premia at a specific Date: Method I

Panel A1: Method I: "Future Estimator" FEPS1	**Panel A2: Method I: "Historical Estimator" FEPS1**

Panel A1: Method I: "Future Estimator" FEPS1



Panel A2: Method I: "Historical Estimator" FEPS1

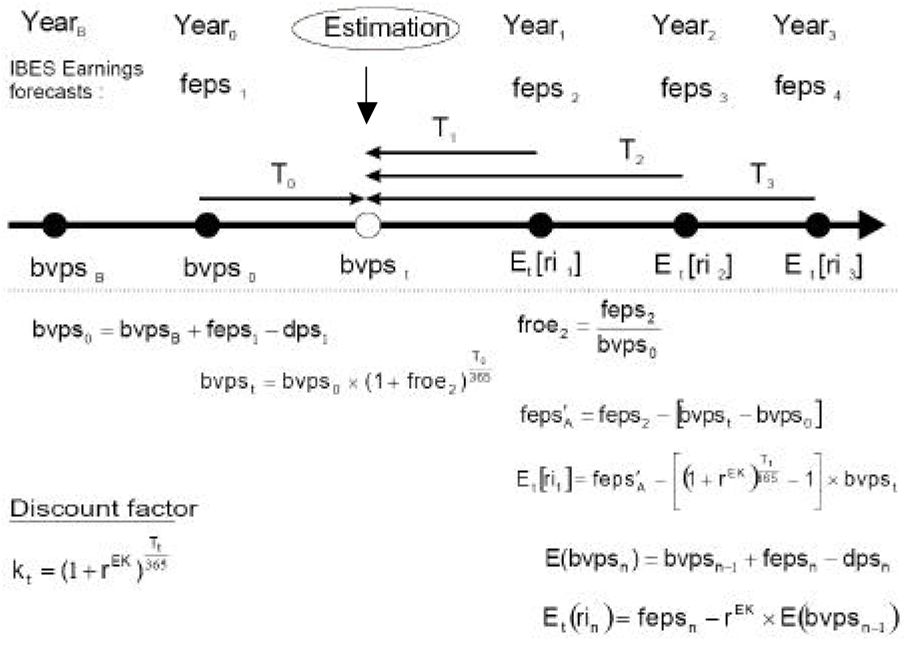


FIGURE 2

Estimation of Expected Cost of Equity Capital and Risk Premia at a specific Date: Method II

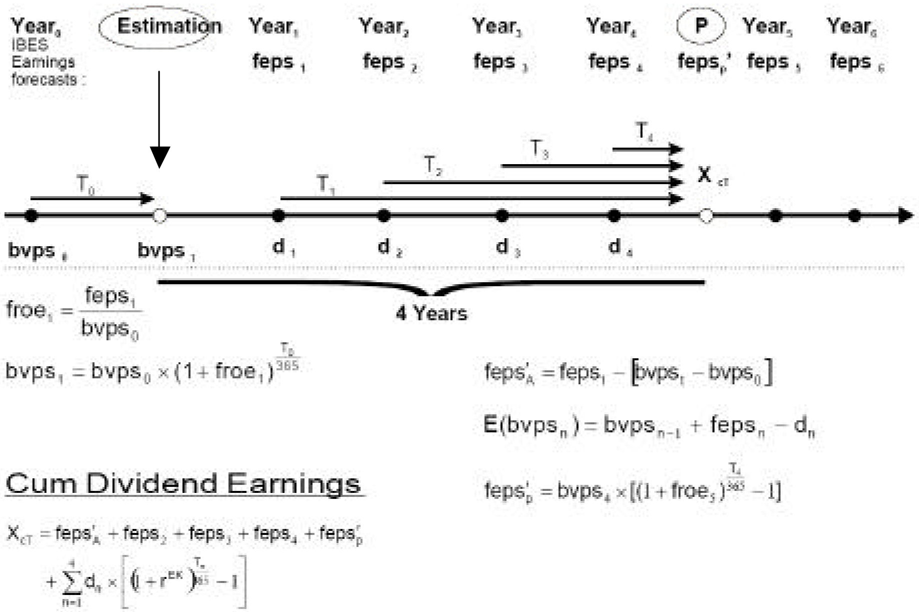
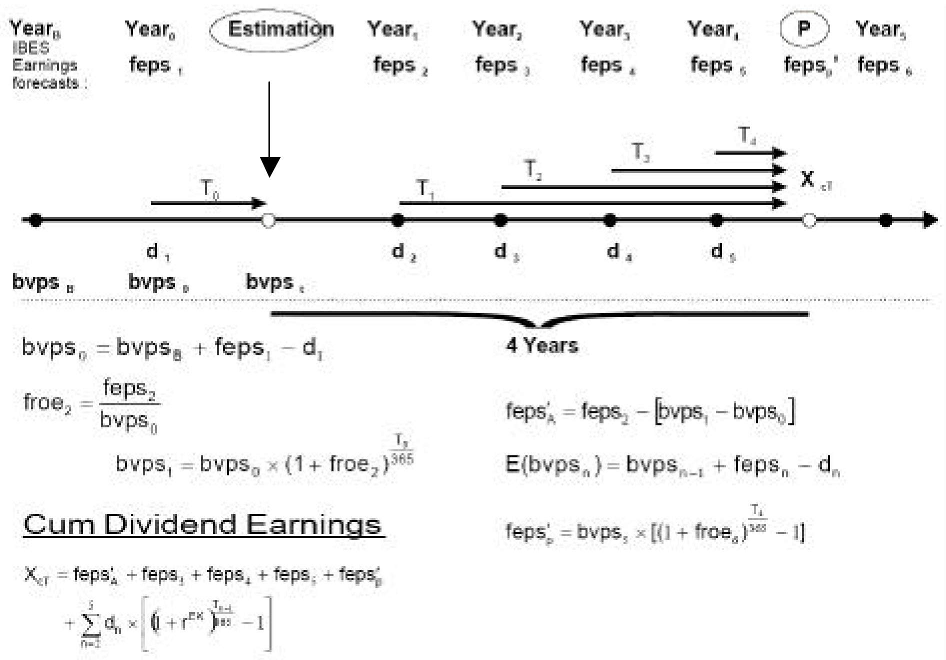
Panel B1: Method II: "Future Estimator" FEPS1	Panel B2: Method II: "Historical Estimator" FEPS1
	

FIGURE 3

Expected Risk Premium across Time

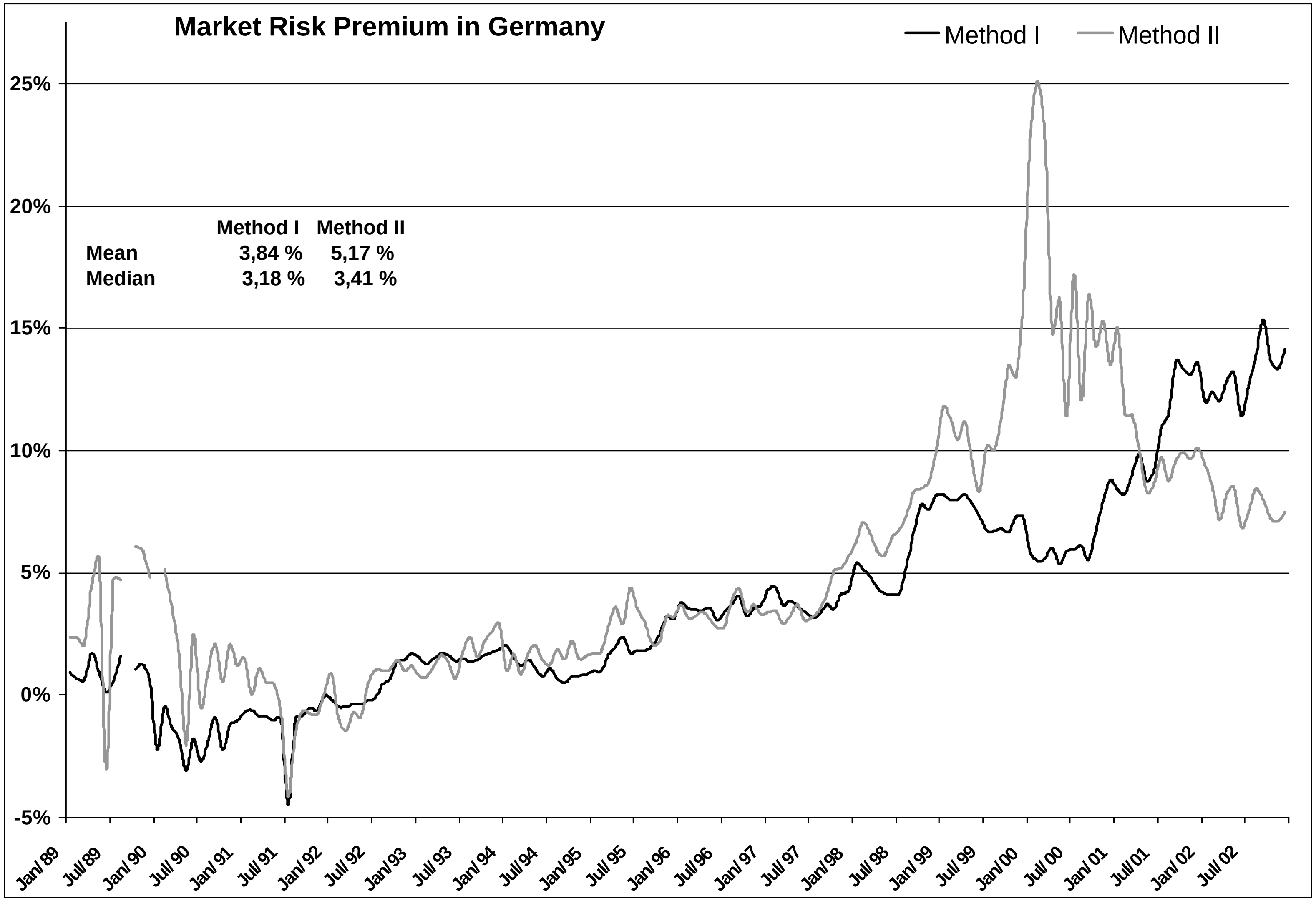
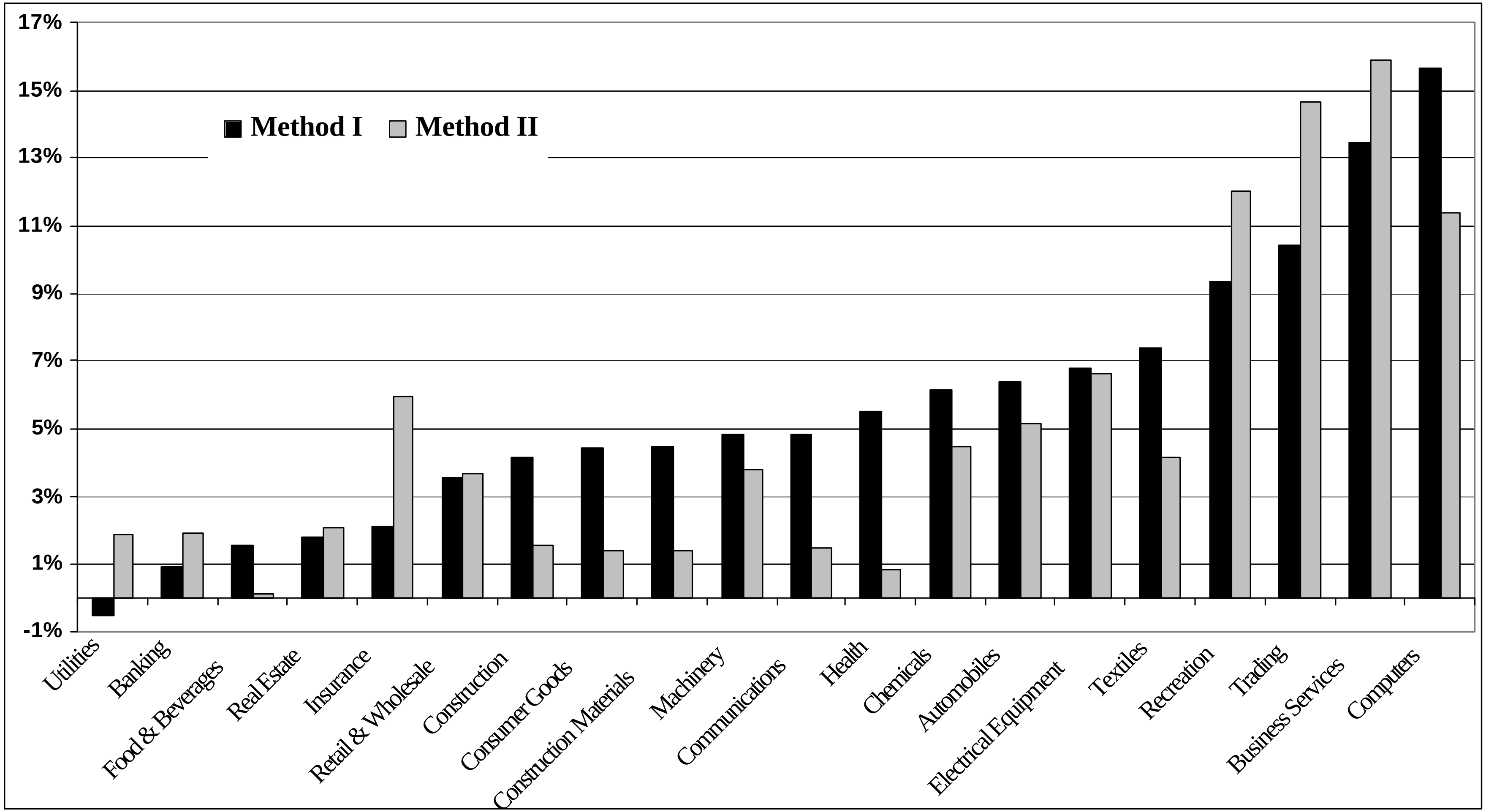


FIGURE 4

Expected Industry Cost of Equity Capital and Risk Premia



APPENDIX A

Estimating the Expected Cost of Equity Capital for DaimlerChrysler assuming Long-Term Growth

This appendix provides as an example the calculation of the expected cost of equity capital and risk premium for DaimlerChrysler (DCX) as of August, 7th 2003. Key input parameters are taken from last year's annual report as of December 31, 2002; analysts' mean EPS and DPS forecast for the next four years from Bloomberg, and the target ROE for the automobile industry 13.50%. To compute the expected cost of equity capital, we adjust the implied discount rate in the residual income valuation model until the fundamental price of the model is equal to the current market price. This is done by using the MS-Excel Solver function. The process yields a current expected cost of equity capital of 12.91%.

DAIMLERCHRYSLER (DCX) **8/7/2003**

ANNUAL REPORT 12/31/2002	12/31/2002	12/31/2003	12/31/2004	12/31/2005	12/31/2006	12/31/2007
Earnings	4,718 €					
Dividends Payed	1,015 €					
Book Value of Equity	34,914 €					
Total Assets	187,327 €					
Number of Shares Outstanding	1,012.80 €					

INPUT PARAMETERS PER SHARE				Forecasts		
BVPS as of 31.12.2002	34.47 €					
BVPS as of 07.08.2003	35.82 €	*Assumption of linear increase of equity over the year*				
EPS Forecasts	4.66 €	2.28 €	3.33 €	4.02 €	3.53 €	3.94 €
DPS Forecasts	1.00 €	1.49 €	1.67 €	1.78 €	2.03 €	
Share price as of 07.08.2003	30.80 €					
Dividend Payout Ratio	57.66%	*As of 31.12.2006*				
Target ROE	13.50%	*Median over the last 5 years of the automobile industry*				
Riskless Rate	4.34%	*Return of 10 year Government Zero-Bond REX*				

ESTIMATION	1	2	3	4	5	6	7	8	9	10	11	12
			Forecast Period					**Fading Period**				**Terminal Value**
	12/31/2003	**12/31/2004**	**12/31/2005**	**12/31/2006**	**12/31/2007**	**12/31/2008**	**12/31/2009**	**12/31/2010**	**12/31/2011**	**12/31/2012**	**12/31/2013**	**12/31/2014**
FEPS	2.28 €	3.33 €	4.02 €	3.53 €	3.94 €	4.33 €	4.76 €	5.23 €	5.74 €	6.31 €	6.93 €	7.62 €
FDPS	1.49 €	1.67 €	1.78 €	2.03 €	2.27 €	2.50 €	2.74 €	3.01 €	3.31 €	3.64 €	3.99 €	4.39 €
FBVPS	35.26 €	36.92 €	39.16 €	40.65 €	42.32 €	44.15 €	46.17 €	48.38 €	50.81 €	53.48 €	56.42 €	59.64 €
FROE	6.62%	9.46%	10.89%	9.01%	9.70%	10.24%	10.78%	11.33%	11.87%	12.41%	12.95%	13.50%
Residual Return (ROE-r_{EK})	-6.29%	-3.45%	-2.02%	-3.91%	-3.22%	-2.67%	-2.13%	-1.59%	-1.04%	-0.50%	0.04%	0.59%
Discounted Residual Income	- 0.85 €	- 1.22 €	- 0.75 €	- 1.53 €	- 1.31 €	- 1.13 €	- 0.94 €	- 0.73 €	- 0.50 €	- 0.25 €	0.02 €	2.57 €
Discount factor	0.95	0.84	0.75	0.66	0.59	0.52	0.46	0.41	0.36	0.32	0.28	
PV of residual income as of 07.08.2003	- 0.81 €	- 1.03 €	- 0.56 €	- 1.01 €	- 0.77 €	- 0.59 €	- 0.43 €	- 0.30 €	- 0.18 €	- 0.08 €	0.01 €	0.73 €
Sum of Residual Income	- 5.02 €											
Fundamental Value of Residual Income Model as of 07.08.2003	30.80 €											

Cost of Equity Capital (r_{EK})	12.91%
Risk Premium (r_{EK} -riskfree rate of return)	8.57%

APPENDIX B

Estimating the Expected Cost of Equity Capital and Long-Term Growth simultaneously in an Industry-Portfolio of stocks

This appendix demonstrates the simultaneous estimation of the expected cost of equity capital and the risk premium for the European automobile industry as of August, 7th 2003. Key input parameters are taken from last year's annual reports, analysts' mean EPS and DPS forecast for the next 4 years are from Bloomberg. The expected cost of equity capital is estimated through a linear regression of the ratio of aggregate earnings-to-book value on the ratio of price-to-book value. The process yields a current expected cost of equity capital of 10.92% and an growth in residual income of 3.92%.

AUTOMOBILE INDUSTRY EU		DCX	BMW	Renault	VW	Peugeot	Fiat	Italdesign	Pininfarina	Porsche
BVPS last reporting date (FY0)		34.47 €	20.59 €	41.58 €	57.89 €	45.03 €	11.53 €	1.31 €	17.87 €	83.79 €
Adj. BVPS as of 31.12.2002		34.47 €	20.59 €	41.58 €	57.89 €	45.03 €	11.53 €	1.31 €	17.87 €	110.65 €
Adj. BVPS as of 07.08.2003	*bvps* $_t$	35.82 €	22.34 €	46.29 €	60.31 €	48.78 €	10.74 €	1.46 €	18.69 €	130.94 €
Payout Ratio		57.66%	20.71%	38.10%	24.86%	19.02%	53.91%	60.61%	19.03%	15.89%
FEPS as of:	12/31/2003	2.28 €	3.00 €	8.15 €	4.09 €	6.42 € -	1.28 €	0.26 €	1.40 €	35.86 €
	12/31/2004	**3.33 €**	3.59 €	9.13 €	5.58 €	7.27 € -	0.22 €	0.30 €	1.58 €	38.13 €
	12/31/2005	**4.02 €**	3.94 €	10.24 €	6.56 €	8.15 €	0.35 €	0.31 €	1.79 €	41.93 €
	12/31/2006	**3.53 €**	3.61 €	4.46 €	6.64 €	8.41 €	0.35 €	0.33 €	1.98 €	45.37 €
	12/31/2007	3.94 €	3.81 €	3.23 €	7.49 €	9.07 €	0.89 €	0.35 €	2.18 €	48.81 €
Adj. EPS as of FY1 (*feps'* $_1$)		**0.93 €**	1.25 €	3.43 €	1.67 €	2.67 € -	0.49 €	0.11 €	0.57 €	15.56 €
Adj. EPS as of period end (*feps'* $_p$)		**2.32 €**	2.24 €	1.92 €	4.41 €	5.31 €	0.52 €	0.20 €	1.28 €	28.24 €
FDPS as of:	12/31/2003	1.494 €	0.548 €	1.229 €	1.305 €	1.406 €	0.109 €	0.160 €	0.370 €	4.743 €
	12/31/2004	1.673 €	0.611 €	1.367 €	1.381 €	1.510 €	0.167 €	0.200 €	0.357 €	4.392 €
	12/31/2005	1.784 €	0.674 €	1.428 €	1.437 €	1.646 €	0.305 €	0.200 €	0.340 €	4.235 €
	12/31/2006	2.033 €	0.748 €	1.700 €	1.650 €	1.600 €	0.186 €	0.200 €	0.377 €	6.662 €
Interest on reinvested Dividends										
DPS_1		**0.677 €**	0.248 €	0.557 €	0.591 €	0.637 €	0.049 €	0.072 €	0.168 €	2.148 €
DPS_2		**0.518 €**	0.189 €	0.423 €	0.427 €	0.467 €	0.052 €	0.062 €	0.110 €	1.359 €
DPS_3		**0.322 €**	0.122 €	0.258 €	0.259 €	0.297 €	0.055 €	0.036 €	0.061 €	0.764 €
DPS_4		**0.130 €**	0.048 €	0.109 €	0.106 €	0.103 €	0.012 €	0.013 €	0.024 €	0.428 €
Agg. Earnings and Interest on Dividends	XcT	**15.78 €**	15.24 €	30.54 €	26.24 €	33.31 €	0.68 €	1.43 €	7.57 €	173.92 €
Share price as of 07.08.2003		30.80 €	33.19 €	48.50 €	37.28 €	38.55 €	5.99 €	4.40 €	20.40 €	334.00 €
Ratio of Share Price / Adj. BVPS	X	0.86	1.49	1.05	0.62	0.79	0.56	3.01	1.09	2.52
Ratio of agg. Earnings cum Div. / Adj. BVPS	Y	0.44	0.68	0.66	0.44	0.68	0.06	0.98	0.41	1.31

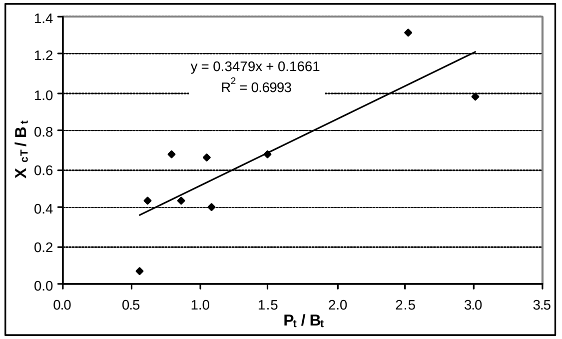
Regression Parameters	Estimate	t-Value
Alpha	0.166	1.23
Beta	0.348	4.04
Adj. R-squared	69.90%	

Formulas

$$g^{ri} = \sqrt[4]{(1+a)} - 1$$

$$r^{EK} = \sqrt[4]{\left(b + \left(1+g^{ri}\right)^4\right)} - 1$$

Calculated Results	
Expected Cost of Equity Capital	10.92%
Expected Risk Premium	6.59%
Growth in Residual Income	3.92%



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