Implied Cost of Capital Based Investment Strategies – Evidence from International Stock Markets♦

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This version: 28.2.2007

Abstract

A new approach to estimate expected stock returns is the so-called implied cost of capital (ICOC). Calculated as the internal rate of return that equates stock price with the present value of expected cash-flows from equity analysts', the ICOC combines expectations on the firms' prospects in one single figure. In this paper we show that a simple portfolio strategy using the ICOC as expected return yields excess returns with respect to several common asset pricing models. Panel regressions demonstrate that adding the expectations-driven ICOC to asset pricing models improves their ability to explain the cross-sectional variation in stock returns significantly.

JEL Classification: G11

Keywords: Implied cost of capital, implied return, asset pricing, portfolio management, expected stock returns, analysts' forecasts

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♦ We are grateful to Jörg Breitung, Guy Laroque, Erik Theissen and seminar participants at CREST and BGSE for helpful comments and suggestions. Moreover, we would like to thank Swisscanto for enabling us to use the data. Earlier versions of this paper circulated under the title "Implied Cost of Capital Based Investment Strategies". Any remaining errors are ours.

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1. Introduction

Financial economists have identified different patterns in average stock returns, which cannot be explained by the fundamental capital asset pricing theory (CAPM) of Sharpe (1964) and Lintner (1965). Prominent examples of such patterns – also called anomalies – are the firm size effect (Banz, 1981), short-term price momentum (Jegadeesh and Titman, 1993), or the ratio of book-to-market value of equity (Basu, 1983). As a result, Fama and French (1992, 1993, 1996) developed the empirically motivated three-factor model by adding firm size and book-to-market ratio to the market beta of the CAPM. The Fama-French model has been shown to perform better in explaining stock returns over different time periods and different geographies.

Still, the Fama-French model has some shortcomings. The primary concern about the three-factor model is the ad-hoc nature of its two firm characteristics B/M-ratio and firm size, since they are neither derived from any fundamental asset pricing theory, nor common valuation analysis. Moreover, the three factors are mostly backward looking. Even though the B/M-ratio contains some information on investors' expectations, the model fails to capture one of the key driving forces of financial markets: explicit expectations about the companies' future dividends and earnings.

More recently, the implied cost of capital (ICOC) has been proposed as a new concept for estimating expected stock returns. Calculated as the internal rate of return[1] that equates share price with discounted future cash-flows, the ICOC combines analysts' expectations about future dividends, earnings, and growth prospects in one single figure. As such, it has two advantages: First, it is completely forward-looking, since it is only relying on available estimates regarding the companies' future prospects and the current share price. Second, it is derived from fundamental valuation analysis, thereby bridging the gap between financial theory and empirical forecasts of expected returns.

The objective of this paper is twofold. On the one hand, we show that a simple portfolio strategy using the ICOC as expected return proxy can yield abnormal returns with respect to several common asset pricing models, such as the CAPM, or the Fama-French three-factor model. Thus,

[1] In this study, the terms *implied cost of capital* (ICOC), *implied return*, and *internal rate of return* refer to the same concept and are used interchangeably.

the ICOC can be conceived as an asset pricing anomaly. On the other hand, we hypothesize that including the expectations-driven ICOC into the aforementioned asset pricing models should improve their ability to explain the cross-sectional variation in stock returns. Indeed, panel regressions across the world's major stock markets demonstrate that the ICOC increases the explained variance of stock returns. Although the ICOC turns out to be partially highly correlated with the Fama-French risk factor B/M ratio (depending on the present value formula to derive it), its coefficients remain significant when added to the standard CAPM or Fama-French determinants of stock returns. Thereby, we confirm the ICOC's additional informational content obtained from equity analysts' forecasts.

The underlying assumption of the implied cost of capital methodology, the equalization of market price and fundamental firm value, can be justified when one accepts market efficiency and negligible arbitrage costs. But even if we allow that price is only a noisy, cointegrated proxy for intrinsic firm value, the ICOC should deliver a fairly good estimate of expected stock returns.

Because of its outright forward-looking perspective, the ICOC got increasingly popular for estimating expected stock returns in both finance literature and active portfolio management. On the one hand for example, Cornell (1999), Claus and Thomas (2001), and Gebhardt et al. (2001) use the ICOC to estimate an equity risk premium by aggregating the implied returns over entire stock markets. On the other hand, Pástor et al. (2006) rely on the implied return as a proxy for expected returns to examine the conditional mean-variance relation of individual stock returns. This literature contrasts to studies that put forward the ICOC's ability to generate excess returns in stock markets. A first application to active portfolio management has been composed by Stotz (2005).

A primary study on the implied cost of capital methodology ifself and its economic foundations is provided by Lee et al. (2003) who analyze the determinants of the ICOC at the firm level. Our paper refers also to the earlier attempts of explaining variations in stock returns by information included in analysts' forecasts. Lee at al. (1999) show that a Price-Value ratio – where the value of a firm is estimated with the help of comparable present value formulas and analyst's forecasts – is related to Dow Jones stock returns.

In spite of its widespread use, a rigorous econometric foundation of employing the implied cost of capital as proxy for expected stock returns at the level of individual firm data is still missing up to date. We hope that this paper contributes to filling this gap. Compared to the existing studies cited above, we use a much broader international set of data by investigating the ICOC concept across the stock markets of all G7 countries. By employing residual income and dividend discount models to derive the ICOC, this paper extents first comparisons of the various ICOC concepts commonly used (Schröder, 2005). In addition to existing valuation models, we present a modified version of the residual income model as proposed by Gebhardt et al. (2001) that is more coherent in the long run than existing formulas. This paper also contributes to the growing literature that employs panel regressions to examine determinants of stock returns, compared to the traditional cross-sectional Fama MacBeth (1973) approach. In fact, this study is one of the very few papers that carry out panel estimation methods on stock returns for a broad data set, comparable to Pandey (2001), or Subrahmanyam (2005). In contrast to these studies, we perform long-horizon regressions using overlapping returns, similar to Bauer et al. (2004).

This paper proceeds as follows. In the next section, we present various estimation approaches of the implied cost of capital, the dividend discount model and the residual income model. Section 3 contains a brief description of our U.S. data sample. In sections 4 and 5, we analyze the U.S. equity markets in detail. By employing a simple portfolio investment strategy that uses the implied cost of capital estimate as stock selection variable, we present evidence that the ICOC can be regarded as a market anomaly. Then we carry out panel regression tests to show that the ICOC adds some explanatory power to existing asset pricing models in describing the cross-sectional variation in stock returns. Finally, in section 6, we extend our study internationally and provide results obtained from six other major capital markets. Section 7 concludes.

2. The Implied Cost of Capital

In this study, expected returns of individual firms are calculated using the methodology of the so-called implied cost of capital. The basic idea of this concept is to estimate the future cost of capital with the help of present value models. More precisely, the cost of equity is computed as the internal rate of return that equates expected discounted payoffs per share to current price, where expected cash flows are taken from equity analysts.

As proxy for expected stock returns, the ICOC has some practical features that make it very attractive compared to other forward-looking valuation concepts, such as the price/value-ratio[2]. First, the implied return is essentially an implied discount factor which has direct and intuitive interpretation as proxy for the shareholder's rate of expected return. As such, it is very easily compared to other common methods to estimate the firm's cost of capital, such as e.g. the CAPM. Second, in contrast to the P/V approach, the ICOC requires no estimate or assumption on the discount factor and hence avoids a potential source of errors. Finally, the ICOC is more prevalent, and thus allowing better comparisons to existing studies.

In the literature, many different versions of the present value model are employed to calculate the implied cost of capital. Given some assumptions such as clean surplus accounting, most of the different approaches should be equivalent in theory (Feltham and Ohlson, 1995). The so-called "clean surplus" relation requires that all gains and losses affecting book value are also included in earnings. In practice, this condition is not always met. For example, stock options and capital increases can affect the book value of equity while leaving earnings unchanged. In addition, limited data availability puts further restrictions on the theoretical equivalence. As a result, the structural assumptions in building a valuation model will significantly prejudice the results as we will show later. In this work, we resort to the models of most prominent studies on the implied cost of capital. On the one hand, we use the dividend discount model (DDM) in the version of Cornell (1999). On the other hand, we rely on the residual income models (RIM) to valuate the firms in our sample. We employ the model of Claus and Thomas (2001), as well as a slightly modified version of Gebhardt et al.'s (2001) approach which uses a more consistent calculation of the terminal value. In the following sections, we describe the models and their implementation in more detail[3].

[2] The price/value ratio (Lee et al., 1999) is the quotient of fundamental company value to market value. Similar to our approach, they derive the fundamental value of firms with the help of present value formulas, and they also use analysts' forecasts as a proxy for expected returns.

[3] Note that we do not present a detailed discussion about theoretical and empirical differences between residual income valuation, and the dividend discount model approach. For a thorough comparison, see for example Penman and Sougiannis (1998), Penman (2001), and Lundholm and O'Keefe (2001a,b). A short analysis of both models in the context of the ICOC approach can be found in Schröder (2005).

2.1. The Dividend Discount Model

The general DDM states that the price of a share should equal the discounted value of future dividend payments, and can be written as follows:

$$P_0 = \sum_{t=1}^{\infty} \frac{E_0[D_t]}{(1+k)^t} \tag{1}$$

where

P_0 = current share price, at the end of year 0,
$E_0[D_t]$ = expected dividends per share at the end of year t,
k = cost of capital or, equivalently, shareholders' expected rate of return.

Since exact predictions of future dividends cannot be made to infinity, one has to make assumptions about expected cash-flows when implementing the DDM in practice. The DDM following Cornell (1999) assumes an initial 5-year phase of high dividend growth, which is followed by a transition phase in which the growth rates decline linearly to a lower, stable growth g_l, which is then maintained ad infinitum. Thus, this model combines the plausible conjecture of a strong growth in the first years with realistic growth rates in the long run.

$$P_0 = \underbrace{\sum_{t=1}^{5} \frac{E_0[D_t]}{(1+k)^t}}_{\text{Growth Period}} + \underbrace{\sum_{t=6}^{20} \frac{E_0[D_t]}{(1+k)^t}}_{\text{Transition Period}} + \underbrace{\frac{E_0[D_{20}](1+g_l)}{(k-g_l)(1+k)^{20}}}_{\text{Stable Growth}} \tag{2}$$

In the initial phase, the dividend growth is assumed to equal the long-term consensus earnings growth rate, obtained from equity analysts[4]. In the stable phase following year 20, the dividend growth rate equals the estimated long-term GDP growth of the economy (Cornell, 1999). In this study, we assume adaptive expectations and calculate the expected GDP growth rate as the

[4]The findings of Elton et al. (1981) suggest that analysts' forecasts are a good surrogate for investor expectations. The consensus growth rate is provided by IBES and is calculated as the median of the expected earnings growth rates of the contributing sell-side equity analysts.

geometric nominal GDP growth rate over the past 5 years. Due to its three-stage structure, we refer to this model as *DDM3* hereafter.

Note that we assume in equation (2), as well as in all subsequent present value formulas, an identical cost of capital k over all time periods. In the view of time-varying equity risk, this might not be an appropriate assumption. However, since the inclusion of a time-varying component usually leads to quite similar results (Claus and Thomas, 2001), we maintain the simple constant discount rate specification.

It is well known that due to conflicts of interest, equity analysts tend to overstate long-term growth projections (see e.g. Chan et al. (2003)), which hence biases the ICOC estimates upwards. Since this study focuses on the analysis of implied costs of capital of individual firms and differences thereof, this bias would only cause problems if there was some systematic relation between the degree of biases and some firm characteristic. We are not aware of any study documenting such a relation.

Note that the DDM requires the annual dividend D_0 which just has been paid out to the shareholders. Based on D_0 it is then possible to calculate the series of future dividend payments, beginning with D_1. In this study, we use the sum of all dividend payments over the last 12 months, also known as 12-month trailing dividends, as D_0. We exclude all observations from the sample, where the 12-month trailing dividend equals 0.[5]

2.2. The Residual Income Model

Another popular valuation formula is the RIM, stating that the value of the company equals the invested capital, plus the expected residual income from its future activities:

$$P_0 = B_0 + \sum_{t=1}^{\infty} \frac{E_0[R_t]}{(1+k)^t} \quad (3)$$

[5] Of course, it would have been possible to include non-dividend paying companies into the sample by making additional assumptions on future dividends with the help or expected earnings and average payout ratios. We discarded this idea since it would have resulted in mixing different valuation indicators (dividends for the DDM vs. earnings and book values for the RIM). Moreover, the information presumably contained in dividend payments cannot be recovered by making assumptions on payout ratios. In an earlier version of this paper, we evaluated also a simpler, two stage dividend discount model as proposed by Damodaran (1999). However, the results were similar to the results of the three stage model, and we will not report the results here. They are available upon request from the authors.

with

$$E_0[R_t] = E_0[E_t] - k(B_{t-1}) = (E_0[roe_t] - k)B_{t-1} \tag{4}$$

$$B_t = B_{t-1} + (1 - p_t)E_0[E_t] \tag{5}$$

where

B_t	= book value of equity per share at the end of year t (B_0 being the current book value),
$E_0[R_t]$	= expected residual income per share in year t,
$E_0[E_t]$	= expected earnings per share in year t,
$E_0[roe_t]$	= expected return on equity in year t,
p_t	= payout ratio in year t.

Similar to the DDM, assumptions about the future growth in residual incomes or earnings have to be made when implementing the model in practice. One rather simple approach is proposed by Claus and Thomas (2001), who consider a two-stage RIM (abbreviated as *RIM2* in the following), assuming an initial phase of high earnings growth rates, followed by a stable growth of residual incomes after year five:

$$P_0 = B_0 + \underbrace{\sum_{t=1}^{5} \frac{E_0[E_t] - k(B_{t-1})}{(1+k)^t}}_{\text{Growth Period}} + \underbrace{\frac{E_0[R_5](1+g_l)}{(k-g_l)(1+k)^5}}_{\text{Stable Growth}} \tag{6}$$

Expected earnings for the first three years are taken from analysts forecasts, also provided by IBES. Earnings after year 3 are estimated by applying the IBES consensus long-term earnings growth rate to the expected earnings of year 3.[6] The growth rate in the second phase is presumed to equal the expected inflation rate calculated as the prevailing interest rate on 10-year treasury bonds less the assumed real-rate of three percent (Claus and Thomas, 2001, p. 1640). Future expected book values of equity are calculated using equation (5). To that end, we have to make assumptions regarding future payout ratios. In a slight variation to the methodology of Claus and Thomas (2001), we let the current payout ratio geometrically converge towards 50% over the growth period instead of using this ratio from the first prospective year on to project future book values. This approach seemed more realistic to us. Current payout rations are calculated by dividing the 12-month trailing dividends by the 12-month trailing earnings per share. This method ensures that the payments refer to the same time period as the earnings. Payout ratios above 1 are set to 1 in the first year, negative payout ratios are set to 0. If the payout ratio was missing due to missing dividend payments over the last 12 months, we equally set the payout ratio of year t=1 to 0.

Gebhardt et al. (2001) rely also on the RIM to calculate the implied cost of capital. However, in contrast to Claus and Thomas (2001), they focus their assumptions not on future residual incomes, but more directly on the future return on equity (*roe* - see equation (4)), which they assume to converge to the industry median. More formally:

$$P_0 = B_0 + \underbrace{\sum_{t=1}^{3} \frac{E_0[roe_t] - k}{(1+k)^t} B_{t-1}}_{\text{Explicit Forecasts}} + \underbrace{\sum_{t=4}^{T} \frac{E_0[roe_t] - k}{(1+k)^t} B_{t-1}}_{\text{Transition Period}} + \underbrace{\frac{E_0[iroe_T] - k}{k(1+k)^{T-1}} B_{T-1}}_{\text{Terminal Value}} \quad (7)$$

where

T = is the forecast horizon of the transition period (9 years)

$E_0[iroe_T]$ = expected industry return on equity from period T onwards.

[6] In the case where the expected earnings estimate of year 3 was missing, we also generated earnings in year 3 by applying the long-term consensus growth rate to expected earnings of year 2. If the projected earnings in year three were negative, we dropped the observation from the sample.

Similar to Gebhardt et al. (2001) we use explicit forecasts to calculate the expected return on equity for the next three years. Then we fade the *roe* to over $T - 3$ years to the industry *roe*. This industry *roe* is calculated as the median of all (positive) realized *roe* across all companies of the respective sector, over the preceding 60 months. We use the industry sector codes of the GICS classification for sorting the companies[7]. While the use of industry averages for the long-term return on equity has some appeal due to the findings of empirical analysis (Nissim and Penman, 2001; Soliman, 2004), the assumptions in the literature regarding the payout ratios to construct future book values of equity seem somewhat arbitrary to us. As a consequence, we consider a slightly modified version of the three-stage RIM that avoids relying on assumptions on future payout ratios. Following the literature of sustainable growth rates, we use the following identity between payout ratio *p*, return on equity *roe* and the growth rate of the company g_l:

$$g_l \cdot roe = 1 - p$$
$$p = 1 - \frac{g_l}{roe} \tag{8}$$

In order to estimate the future development of a company, one has to make assumptions for two out of the three parameters. Instead of assuming the long-run payout ratio *p*, we opt to fix the long-term growth rate of the company g_l. By setting g_l equal to the expected GDP growth rate of the economy as in the earlier model, we ensure that no company will persistently grow faster than the whole economy and eventually exceed it.

Hence, we calculate the RIM following Gebhardt et al. (2001) as presented in equation (7), but using different projected payout ratios for each industry sector. For each sector, we calculate the long-term industry payout ratio using the relation (8), given the expected GDP growth of the economy and the industry *roe*. In the transition period, we then fade both payout ratio and return on equity towards their long-term levels. Since this model is basically a three-stage RIM, we denote it by the abbreviation *RIM3*.[8]

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[7] In our standard implementation we fix *T*=9. Instead of using the GICS classification, Gebhardt et al. (2001) rely on the 48 Fama and French (1997) industry classifications. We also tested other, more precise classifications such as the GICS Industry Group segmentation, or the Industry segmentation, but the results were much the same.

[8] In practice, our RIM3 specification does not diverge substantially from the model as proposed by Gebhardt et al. (2001). The correlation of the ICOC estimates obtained from both models is with 0.99 very high for the United States data.

2.3. Empirical Implementation

To calculate the implied cost of capital for the firms using the equations above, we employ the last available information as required by the formulas at the end of each calendar month. Firms with an incomplete data set, i.e. one or more missing input variables where we could not resort to approximations as explained above, have been ignored[9]. The solution of the equations is straightforward, since they are monotone in k, and can be solved iteratively.

3. Data

In our detailed analysis in sections 4 and 5, we focus on companies in the United States covered by MSCI over a time period from January 1990 to February 2006. The monthly data for prices, total returns, book values and dividends per share, market capitalization, and returns on equity are taken from MSCI. All market capitalization data are free float adjusted. The earnings estimates as well as the long-term growth rate are taken from IBES median estimates. Time series data of national accounts to calculate the expected nominal GDP growth rate is obtained from Eurostat. Stock indices to derive market betas and deflate firm size data are taken from Datastream.

The data set contains 1,507 companies and over 122,000 monthly observations. We use the first five years to calculate the industry *roe* and calculate the first expected returns starting January 1995, leaving us with roughly 11 years of data. The number of observations for the DDM3 and RIM2 ICOC is constrained by the availability of the IBES long-term growth rate and the payout ratio. For the following analysis, we will use only the overlapping data set of 50,402 observations. However, using the more complete data set would result in the same results in most cases. Since the number of companies included in the study changes over time, we have an unbalanced panel data set[10].

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[9] Note that we do not carry out any time adjustment procedures similar to other studies on the implied cost of capital. Since we use a monthly data set, such adjustments would require the exact dividend payout dates and book value adjustments for all companies since 1995. Such data is not easy to get hold of nor it is reliable.

[10] The available panel data set starts in 1995 with 334 monthly observations, reaches its maximum in June 2005 with 507 companies, and finally contains in February 2006 501 companies.

In the U.S., as table 1 shows, the average expected return is fairly well clustered between 8% and 9% with the RIM3 having the lowest average expected return at 8.18% and the RIM2 having the highest at 9.19%. However, the standard deviation is the highest for the RIM3 model with 2.72%. The standard deviation is somewhat lower for the RIM2 model at 2.31% and the DDM3 as the lowest standard deviation at 2.04%.

As was to be expected, the correlations between the similar models RIM2 and RIM3 are rather high at around 63% as can be seen in table 2. On the other hand, the correlations between the DDM and the RIM ICOCs are very low - generally below 30%. There is little correlation with either the book yield or the market capitalization with the exception of the RIM3 specification which exhibits a very high correlation of 80% with the book yield. Given the predominant role of book value of equity in both RIM formulas, this high correlation is in line with our expectations.

4. Tests on Implied Cost of Capital-based Investment Portfolios

If stock prices do not fully reflect at all times the fundamental value of the companies as derived from analysts' forecasts (and assuming that these forecasts are a good proxy for the average investor's expectations), then there will exist profitable investment strategies based on the companies' ICOC estimate. Since – other things equal – stocks with high implied returns are likely to trade on average below their true value, a portfolio of high-ICOC companies should outperform an investment in low-ICOC stocks.

This section investigates such strategies, and analyses their ability to generate risk-adjusted excess returns with respect to common asset pricing models. Thus, this is a test of the joint hypothesis of efficient markets and the asset pricing models employed. In principle, this chapter follows other well-known studies on profitable trading strategies such as the work on price momentum strategies by Jegadeesh and Titman (1993).

4.1. Portfolio Formation

At the end of each month, we rank all stocks in our sample based on their implied-cost-of-capital estimates. Then we group them into 8 equally weighted portfolios based on these rankings. Finally, we examine subsequent total returns, i.e. capital gains and dividend payments, over periods from 1 to 24 months. When a company drops out of the sample during the holding period, we replace its return by the market return over the period. This procedure aims to avoid a forecast bias. Similar to comparable studies, we use overlapping holding periods to increase the power of the analysis. When we consider for instance a twelve-month holding period, we use all possible portfolios that could be formed, such as those from January 1995 to January 1996, from February 1995 to February 1996, and so on (see section 5.1 for more discussion).

4.2. Evaluation of Investment Strategies

First, we compare the profitability of investment strategies based on the various ICOC approaches as presented in section 2. We analyze these trading strategies over different time horizons, and investigate their relation to common risk factors.

In table 3 we present the mean ICOC estimates of each portfolio, the portfolio returns, and their risk characteristics. Portfolio 1 compromises the stocks with the lowest implied cost of capital estimate, and portfolio 8 consists of the high ICOC stocks. Panel A reports returns and firm characteristics of the DDM3 ICOC portfolios, panel B information on the RIM2 ICOC portfolios and panel information on the RIM3 ICOC investments.

The return of each portfolio is calculated as the equally weighted buy-and-hold return with a holding period of twelve months, using overlapping intervals. In this section, we neglect possible transaction costs. As for the portfolio risk variables, we present the mean B/M ratio, the median firm size, average market beta, and average price momentum for each of the 8 portfolios. Price momentum is calculated as change in share prices over the past six months[11].

The two rows at the bottom of each panel show the overall averages (or medians, respectively) over the whole sample size and the average difference in returns and firm characteristics between the two extreme portfolios (P8-P1).[12] More precisely, the return column indicates the average return that could have been generated by an investment strategy consisting in a short position of the low-ICOC portfolio P1 and a long position in the high-ICOC portfolio P8 (along with their t-statistics, which are corrected for autocorrelation resulting from using overlapping periods). In

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[11] The inclusion of price momentum as risk variable has been proposed by Carhart (1997). This work attempts to explain mutual fund performance by employing a four-factor model by adding price momentum to the standard three-factor Fama-French model, since the latter cannot explain short-term price momentum (Fama and French, 1996).

[12] The average market beta lies with 0.852 below the theoretical value of 1. This can be partly explained by the fact that due to missing long-term growth rates, our sample contains on average more large companies than the overall market, which usually tend to have lower beta values. From a practical perspective, it is not the average firm beta that is important, but the market beta of each portfolio, since individual correlations with the market might cancel out when pooling them into portfolios. However, estimates for portfolio betas did not differ significantly from the average firm beta of each portfolio.

order to allow for a comparison of the ICOC approaches, we include only observations where we have ICOC estimates for all selected approaches.

In direct comparison, we see that there is a huge discrepancy between the models' ability to predict subsequent stock returns: Whereas the difference in returns between the two extreme ICOC portfolios obtained from the DDM3 attains only a mere 0.6% p.a., both RIM approaches are able to generate a yield of 8% to 10% when employing a long-short investment strategy. Moreover, the differences P8-P1 are significant at the 5% level for both residual income ICOCs[13]. When comparing to the average stock returns over the sample period (14.1%), we can see that both the long side (around 20%) and the short side (around 10%) of the investment contribute to this return.

The profitability of ICOC-based investment strategies over time is displayed in figures 1a-1c. These graphs show the evolution of the difference between the returns of the extreme portfolios (P8-P1), where the buy-and-hold returns are calculated over twelve months. All figures show that this spread varies quite significantly, and is in many periods even below 0, i.e. the P1 performs better than the P8 portfolio. Compared to the RIM ICOC, the DDM-based approach is slightly less volatile at the cost of lower average returns. It is interesting to note that the profitability of ICOC strategies is particularly high during extreme stock market movements (record-highs in 2000, record-lows in 2003). The explanation for this pattern is straightforward: during periods that are marked by high volatility and partly exaggerated stock price movements, the divergence between fundamental firm value (derived from analysts' forecasts) and market valuation is more pronounced. Since the ICOC captures just this discrepancy, the investment strategies are getting more profitable. Another conclusion out of the figures is that the long-short strategy has increased its profitability over time. The average P8-P1 spreads in the sub sample from 2000 until 2006 are much higher compared to the overall sample: The RIM3 P8-P1 difference attains 20.3% p.a., the RIM2 difference reaches 15.1%, the spread for the DDM3 approach lies at 7.3%. Hence, most of the positive results over the whole period originate from the good performance in the post 2000 period. In this sense, the results are not robust to the examined time period.

[13] When using five portfolios instead of eight (similar to the analysis of many other capital markets investigated in the international section), both the spreads between the extreme portfolios and their significance reduce slightly. For example, the P5-P1 difference attains 7.3% for the RIM3 approach, and 6.2% for the RIM2 ICOC.

Unfortunately, there is not sufficiently data of analysts' forecasts to extend the study to earlier time periods. Still, the averages are not significantly negative in the first sub period.

We now vary the buy-and-hold periods of the ICOC investment portfolios to see how their profitability changes with the investment horizon. Table 4 shows the average returns of the high (P8) and low (P1) ICOC portfolios, together with their average difference (P8-P1) and the t-stat thereof with holding periods of 1, 3, 6, 12, 18, and 24 months. The last two lines give the number of observations (decreasing with growing investment horizon) and the equally weighted return of the whole sample.

The results essentially confirm our earlier results. The ICOC calculated by the RIM yields positive portfolio returns regardless of the buy-and-hold period used. In contrast, the DDM3-based investment strategy attains a mere 2.2% yield over a period of 24 months. Interestingly, the average monthly return increases with the investment horizon: over two years the p.a. return amounts to 11.5% which compares to 10% over 12 months (RIM3). Similarly, the statistical significance of a P8-P1 (RIM2) investment strategy does increase over time. This is actually good news for real-life investors who have to care about transaction costs.

4.3. Portfolio Risk

4.3.1. Firm Characteristics

It can be easily seen in table 3 that all ICOC approaches are related to standard firm-risk variables. There is a fairly close inverse relation between the ICOC and both past price momentum and firm size, and a positive relation to B/M ratio. Large firms, as well as firms that have seen a good share price performance over the last six months have on average smaller ICOC estimates. Growth firms, i.e. with a low B/M ratio, provide also lower implied returns. Especially the RIM3 seems most sensitive to the risk factors. The difference in the book yield between the portfolio with the highest ICOC as calculated by RIM3 and the lowest ICOC is three times as large as for the other models. The difference in normalized market capitalization is 1.5 and seven times larger than the RIM2 and DDM model respectively. As far as market beta is concerned, the

DDM ICOC exhibits a negative relation to the implied return portfolios, whereas the RIM approaches provide a weak positive relationship.

The relation of implied returns with B/M ratio and firm size is in line with the findings of Fama and French (1992, 1993) that have detected both variables as priced risk factors. Consequently, these results underline the standard rule that higher stock returns only come at the cost of increased portfolio risk. The association with past price momentum can be explained by the nature of the present value formula: since current share price enters the equation, companies that have experienced a rise in share prices, have ceteris paribus a lower internal rate of return. The negative relation of the DDM ICOC to market beta is somewhat unexpected. This counter-theoretical finding adds some doubts on the DDM ICOC's validity as proxy for expected returns.

4.3.2. Risk adjusted portfolio returns

Now we check whether the ICOC investment strategies still generate excess returns after controlling for portfolio risk. As seen in the previous section, long or the long-short investments are exposed both to B/M and size risk effects. This observation casts doubts over the ICOC's intrinsic ability to explain stock returns, since its relation to subsequent returns might have its origin in the ICOC's relation to underlying risk factors.

The standard methodology to control portfolio returns for their inherent risk positions is to calculate their portfolio alphas with respect to common asset pricing models. In table 5, we report the results from time-series regressions based on the CAPM and the Fama and French (1993) three-factor model. More precisely, we regress the portfolio excess returns over the risk-free rate on the market excess return and the Fama-French factors:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i (r_{m,t} - r_{f,t}) + \gamma_i SMB_t + \delta_i HML_t + \varepsilon_{i,t} \tag{9}$$

where $r_{i,t}$ is the 12-month return of portfolio i; $r_{f,t}$ is the risk-free rate and $r_{m,t}$ the market return over the same time period; SMB_t is the Fama-French small firm factor, and HML_t is the book-to-market factor. Since we use overlapping periods, we use Newey-West HAC standard errors to calculate the t-statistics.

In panel B and C, the CAPM alpha of the long-short P8-P1 portfolio are both significantly positive, providing a risk-adjusted portfolio return of 7.6% for the RIM2, and 11.5% for the

RIM3, respectively. When adopting the three-factor model by Fama-French, and thereby also controlling for average size and B/M ratio of the portfolios, the long-short investment of both extreme portfolios remain positive, in the case of the RIM3 even highly significant, attaining a risk adjusted annual return of 6.2%. Both RIM measures of the ICOC display significant factor loadings for B/M ratio, but not to firm size. Again, the DDM3 ICOC provides no abnormal returns with respect to both asset pricing models, although the returns are significantly related to all risk factors[14].

The overall conclusion from table 5 is that a risk adjustment for the three Fama-French factors makes at least the RIM3 ICOC effect to appear even more in conflict with the joint hypothesis of market efficiency and both the Fama-French model and CAPM theory. Consequently, the implied costs of capital cannot be regarded as a mere transformation of the risk factors B/M ratio and firm size, but rather as a pricing anomaly with respect to these commonly used asset pricing models.

4.4. Feasible Investment Strategies

The previous analysis makes a case for investing according to the ICOC as stock selection principle. However, all presented results are based on two assumptions that are opposed to actual investment strategies. First, the – statistically significant – difference between the two extreme portfolios is calculated on the basis of overlapping holding periods. While the implementation of such a strategy is of course not per se impossible, they are generally not feasible or very difficult to implement for an investor. Second, and more important, the regular portfolio adjustments do not come for free, but give rise to transaction costs.

Hence, we examine the return on non-overlapping investment strategies, and correct the realized return by the transaction costs that occur at each portfolios re-balancing date. In order to include the costs induced by portfolio rebalancing, we calculate the turnover ratio of both extreme portfolios (P1 and P8). Both the RIM3 and DDM3 ICOC strategies exhibit a replacement ratio of around 50% per year, the RIM2 portfolio requires a turnover ratio of around 60% using a twelve month holding period.

We start our non-overlapping investments in January 1995 and analyze the return over the following 11 years up to January 2006, rebalancing the investment in January 1996 for the first

[14] It is important to note that these findings are robust to changes in the holding period of the portfolios. Especially regression test on non-overlapping monthly portfolio returns yield similar estimation results.

time[15]. We consider two alternative investment strategies. One approach examines the previously cited long-short investment (P8-P1), the other one consists just in holding a long position in the high ICOC portfolio (P8). The long-short investment strategy based on the RIM3 implied return performs at a CAGR of 10.8%, the RIM2 strategy yields 5.8%, which compares to the DDM3 based approach which yields even a negative return. The long-only investments perform better: The RIM3 long-only strategy yields an annualized 19.8% return, which compares – not surprisingly – to a lower 14.5% p.a. for the DDM3. As a benchmark, the equally weighted return of the whole U.S. market is 12.29% p.a. over the same time horizon, without considering transaction costs. Hence, even when considering a feasible investment strategy, long-only implied cost of capital based strategies clearly outperforms the market.

5. The Cross-Sectional Variation in Stock Returns

In this chapter we use regression analysis to take more general look at the relation between the implied cost of capital and subsequent stock returns. In a first step we investigate the ICOC's direct ability to predict stock returns by regressing multiperiod stock returns on the current firm's ICOC estimate, similar to the approach of Fama and French (1988), Chan et al. (1996), or Lee et al. (1999).

Then we extend the scope and look at the more fundamental relation between implied return and cross-sectional variation in stock returns within the Fama-French asset pricing framework. Following the evidence in section 4 that the ICOC effect persists after controlling for risk factors of the Fama-French model, we investigate whether it is possible to increase the explanatory power of asset pricing models by adding the ICOC as explanatory variable to the regressors. Given that expectations are the driving force of any financial market, the ICOC should improve existing asset pricing models due to its inherent forward-looking perspective.

To achieve this goal, we expand the pure forecasting regressions to include the firm's market factor loading and the Fama-French risk variables, similar to Fama and French (1992), or Brennan et al. (1998). Thus, this approach allows us to disentangle the predictive power of ICOC estimates and risk factors to explain the variation in stock returns. If the Fama-French model is valid, joint regression tests of stock returns on a set of risk factors and the ICOC estimate should result in insignificant ICOC coefficients – a significant coefficient would thus underline the

[15] Of course, the average return over the time period from 1995 to 2006 depends crucially on the starting month, which could range from January 1995 to December 1995. Launching the investment in different months has an impact on the realized returns. However, the resulting returns are not structurally different than the results discussed.

ICOC's additional informational content. Finally, this methodology allows us to double-check whether the ICOC effect detected in the last section is also persistent at the firm level, and not an artifact of the portfolio strategy employed.

In the literature, there are two common econometric approaches to carry out regression tests on stock returns. Researchers either employ the Fama-MacBeth (1973) cross-sectional regressions, or they rely on the panel regression approach. Especially in asset pricing studies the Fama-MacBeth (1973) cross-sectional regressions are the predominant way to perform stock return regressions, such as in the papers of Fama and French (1992) or Chan et al. (1996). Some recent studies however point out some possible weaknesses of this popular estimation method. Usually the Fama-MacBeth regressions are carried out not on individual firm-level data, but on previously constructed portfolios according to some exogenously specified sorting-variable. This raises the issue which sorting variable to select. Brennan et al. (1998) argue that selecting some out of many possible explanatory variables creates a "data-snooping bias that is inherent in all portfolio based approaches", since the selection of the sorting variable as well the sorting order can influence the results significantly. Especially the common practice to construct portfolios according to B/M ratio and size is likely to overestimate the regression results (Lewellen et al., 2005). To avoid such a bias, one could use many different firm characteristics and risk factors to construct the portfolios. But as Bauer et al. (2004) emphasize, the number of portfolios needed increases exponentially with the number of firm characteristics examined. With 5 groups for 5 different characteristics e.g., we would need 5^5 portfolios. Given our data, many of them would contain none or few stocks.

To avoid the problems that are inherent in the portfolio regression approach some researchers carry out the cross-sectional regressions on individual firm data, such as e.g. Chan et al. (1996), or Subrahmanyam (2005). In general however, these regressions have very low power and insignificant coefficient estimates because of a rather short time-dimension of the examined data sets, i.e. the average slope coefficients are small compared to their standard errors[16]. Since the

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[16] Many empirical studies relying on cross-sectional regressions on individual firm data achieve only very low or even insignificant t-statistics for market beta, firm size, or B/M-ratio, e.g. Chan et al. (1996) or Lee et al. (2003). The latter try to overcome the problem of insignificant beta coefficients by forming country-industry portfolios to estimate a country-industry beta, thereby hoping to increase the accuracy of the beta estimate. Then they run individual firm regressions but include the industry beta as a proxy for the company beta as explaining variable. Fama and French (1992) rely on this procedure as well.

results of the Fama-MacBeth stock return regressions for our data seta are equally little meaningful, we relegate the description and results of this approach to the appendix.

Presumably because of theses shortcomings of the Fama-MacBeth methodology, many researchers have shifted their focus on performing panel regressions of individual firm data when examining determinants of stock returns (Pandey, 2001; Subrahmanyam, 2005). The main advantage of the panel regression methodology is its ability to use the whole information conveyed in the data in one regression step. Thus, panel analysis usually provides more significant coefficient estimates (Baltagi, 2005) without imposing a data-snooping bias through the construction of portfolios[17]. Given the rather poor results of the Fama-MacBeth approach, we adopt the panel approach in our study.

5.1. The Panel Regression Methodology

Our panel regression approach corresponds the natural extension of the Fama and MacBeth (1973) cross-sectional regressions to multiple time periods. Instead of regressing each cross-section individually, we combine all monthly cross-sections to estimate the model (pooled time-series cross-section). In analogy to Fama and French (1992), we regress the firm's individual stock return $r_{i,t}$ on its ICOC estimate $k_{i,t}$, the market beta $\beta_{i,t.}$ (the firm's factor loading on the market excess return), and firm characteristics $X_{i,t}$ that have been identified as risk-factor in the literature:

$$r_{i,t} = \alpha + \delta k_{i,t} + \varphi d_t \beta_{i,t} + \gamma' X_{i,t} + u_{i,t} \tag{10}$$

where the subscript i denotes the company (cross-section dimension) and t denotes the time period of the observation (time-series dimension) [18]. The subsequent total stock return measured over 12 months after having observed the risk-factors and firm characteristics. The variable d_t is a dummy for the *ex post* observed market risk premium (i.e. the difference between the market return and the risk-free rate), having a value of 1 when the market risk premium is positive during the holing period, and –1 if it is negative. This dummy is necessary to account for the fact that

[17] For a detailed comparison of the Fama-MacBeth (1973) and panel regression methods, see Petersen (2004).

[18] For similar regressions, see Brennan et al. (1998), or Lee et al. (1999, 2003). The use of the firm characteristics size and B/M ratio instead of the respective factor loadings is motivated by the work of Daniel and Titman (1997) who argue that it is rather the characteristics than the covariance structure that explains the variation in stock returns.

during periods when the realized market return is less than the risk-free rate, the relationship between predicted return and beta is inversed. More precisely, high-beta stocks should have *lower* returns when the ex post risk premium is negative (Pettengill et al., 1995).

This general specification is known as pooled data set. In many cases however, the underlying assumption (when estimating the pooled data set by standard OLS) that the observation of a company at time *t* is independent an observation of the same company at a different point in time *s* is not met. Hence, the regression equation is modified to allow for individual effects for each company. This individual effect can account for firm characteristics that are not included in the regression equations such as the industry sector, or unobservable factors. This model is known as the one-way individual effects model:

$$r_{i,t} = \alpha_i + \delta k_{i,t} + \varphi d_t \beta_{i,t} + \gamma' X_{i,t} + u_{i,t} \tag{11}$$

One of the most common approaches to estimate such an individual effects model is to assume that the individual effect α_i of each firm is constant over time. Relying on such a one-way fixed effect (FE) model hence implies that the returns of some companies are on average higher than the return of the market, whereas some other companies under perform the market on average. Another variant of the one-way individual effects model is the random-effects (RE) model, that similarly assumes that the individual effects α_i are constant, but that these individual effects are distributed randomly across firms with a zero mean: $\alpha_i \sim N(0, \sigma_\alpha^2)$.

To detect which model is appropriate for out data set, we carry out the several common statistical tests. First we rely on an F-test to see whether the estimated fixed effects are jointly significantly different from zero. If the H_0 (no significance of the individual fixed effects) is rejected, we can conclude that a fixed-effect model is preferred to the simple pooled OLS estimation. Second, we perform a Breusch-Pagan test on the random effects model, to see whether the random effects are significantly different from zero. If the H_0 (no significance of individual random effects) is rejected, we can conclude that a random-effect model is preferred to the simple pooled OLS estimation. Third, we conduct a Hausmann specification test, to see whether the coefficients of the FE and RE estimation differ significantly from each other. If the H_0 (no significant difference between the estimated coefficients) is rejected, we can conclude that a fixed-effect model is preferred to the random effects estimation[19]. Note that we carry out these specification tests on non-overlapping data sets since the tests (F-test, Breusch-Pagan test, and Hausmann test) implemented by statistical packages do not correct for autocorrelation[20]. The test results of all samples showed that the fixed effects model is the preferred approach to estimate the panel regressions. We hence present only the results of the FE-panel regressions.

The twelve-month stock return regressions may be carried out using either overlapping observations or non-overlapping observations. Since Campbell (2001) shows that the use of overlapping observations increases the power of the regression, it is standard to run the regression over the whole overlapping data set[21]. Fama and French (1988) or Chan et al. (1996) rely on the same approach. To correct for the so introduced serial correlation in the regression residuals, we calculate the t-statistics of the coefficient estimates using the FE, heteroskedasticity robust and autocorrelated-adjusted standard errors following Rogers (1993).

5.2. Results of the One-way Fixed Effects Panel Regressions

Table 6 presents the regression estimates and t-statistics for the one-way fixed firm effects model of equation (11). The explained variance of each the model is given in the last line.

When taking the ICOC estimates as the only explaining variable for stock returns – i.e. the pure ICOC forecasting regression – all coefficients are highly significant, thereby confirming the relationship between ICOC and subsequent stock returns. The use of the implied return as proxy for expected stock returns seems to be valid. The power of these regressions is rather small, attaining a maximal R^2 of 8% in the RIM3 specification. However, this low explained variance must be put in perspective, since regressions on each of the Fama-French factors result as well only in R^2 values of around 8%.

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[19] Fixed-effects estimates are always consistent, but random-effects estimates might be more efficient.

[20] We conduct these tests for all possible non-overlapping panel data sets. In most cases however, the results do not differ across the various non-overlapping panels and lead to the same conclusion of employing a one-way fixed effects model.

[21] The increased power stems mainly from two sources: the average return over a longer horizon provides a better proxy of conditional expected returns than short-period returns, and the regression standard errors get smaller because of the negative correlation between future expected returns and current unexpected stock returns (for more details, please refer to Campbell (2001)). However, the results presented below are robust to changes in the subsequent stock return period. Regression tests on non-overlapping monthly stock returns yield similar estimation results – the significance of the ICOC estimates even increase considerably.

Next, we include the Fama-French risk factors into the regression equation. The first column of the table gives the standard Fama-French regression specification without the ICOC as explanatory variable. All risk factors prove to be highly significant. Market beta, B/M-ratio, and price moment are positively related to stock returns, whereas firm size exhibits the usual negative relationship to stock returns. The explained variance of the standard specifications reaches 18%. When adding the ICOC to the risk-adjusted regression equation, the ICOC coefficients loose some of their explanatory power, but remain significant, i.e. the ICOC is robust to the risk-correction, and the R^2 increases slightly to 20%.

The highly significant coefficients of the Fama-French factors are not surprising, as asset pricing theory indicates that excess returns do not come for free, but only at the cost of higher non-diversifiable risk exposure. However, if one is to believe in the Fama-French model, the coefficients of ICOC estimates should be close to zero. Hence, the highly significant RIM ICOC coefficients indicate very clearly that the implied return contains some important additional information for explaining the variation in stock returns.

It is not only striking that the RIM ICOC coefficients are significantly positive, but that they are more important in tracking stock returns than the B/M ratio as can be inferred from the t-statistics. When comparing for example the RIM3 ICOC regressions with the pure Fama-French specification of the first column, it is interesting to see that the B/M-ratio has a lower explanatory power when adding the ICOC variable. Apparently, the RIM3 implied return captures some of the informational content of the B/M ratio. To see why, it is important to note that the correlation between the two explaining variables implied return and B/M ratio is very high at around 81% (see table 2). Hence, the regressions face a multicollinearity problem: B/M and the implied return contain essentially rather identical information. The last column of table 6 leaves out the B/M ratio from the model specification, but includes the ICOC. Compared to the complete specification, the significance of the implied return coefficient increases sharply, and the R^2 augments compared to the pure Fama-French regression. Or, put differently, by omitting B/M ratio from the set of explanatory variables, no information is lost.

In a more general perspective, the significant ICOC coefficients question again the joint hypothesis of efficient markets and the validity of the Fama-French model. Moreover, this finding might indicate that the implied return obtained from the RIM approach might be a suitable candidate to replace the B/M ratio in risk-return considerations, since it is slightly better in tracking stock returns and has a stronger, expectation-driven foundation.

6. The International Implied Cost of Capital

In this section, we investigate the performance of the ICOC effect at an international level across other large equity markets. We repeat both the portfolio study and the more general regression analysis for all capital markets of the other G7 countries, i.e. Canada, France, Germany, Italy, Japan, and the U.K.

As with the U.S. data, monthly data for prices, total returns, book values per share, dividends per share, market capitalization, and returns on equity are taken from MSCI. Earnings estimates as well as the long-term growth rate are taken from IBES median estimates. The time series data of national accounts to calculate the expected nominal GDP growth rate is obtained from Eurostat again[22]. All data are denoted in local currency. If quoted in deviant currencies, data is converted into the local currency, where the conversion is accomplished by using the WM Company exchange rate as of the date of the data. With over 100,000 monthly observations, our data sample is the largest for the Japan, and the smallest for Italy, with just over 22,000 monthly observations.

The concept of the implied cost of capital should work equally well in all equity markets. Therefore, we would expect similar results among all G7 countries. However, there are large differences in data availability and the underlying economies across the various markets. First, the seven countries exhibit considerable discrepancies in performance over the sample period from 1995 to 2006, such as the long-lasting recession in Japan or the stock market bubble in the western countries. A second source of possible divergence is the availability of IBES data. The two-stage RIM as well as the DDM rely heavily on the long-term consensus growth rate of equity analysts. Estimating such growth rates has a long tradition in the U.S., but not in European countries, where analysts have rarely published such forecasts over the early years in our study period and have concentrated instead on explicit earnings forecasts for the next years. Hence, the implementation of these models in European (and the Japanese) markets leads to a considerable

[22] Due to the long-lasting recession in Japan, the geometric nominal GDP growth rate over the past 5 years (used as a proxy of the expected GDP growth), is not always positive. In order to ensure the existence of a positive root of the present value formulas, we replaced negative geometric nominal GDP growth rates by an expectation of 1%.

decrease in the available data set. Finally, deviating accounting standards for book value of equity across the countries considered add some uncertainty to the implied returns derived from the RIMs.

6.1. Tests on Implied Cost of Capital-based Investment Portfolios

First, we replicate the portfolio analysis as presented in section 4 for the six other capital markets. The portfolio formation is carried out as for the U.S. data sample. Table 7 reports the average total returns of the low-ICOC and high-ICOC portfolios, together with their average difference. The rebalancing interval is again twelve months. Note that because of smaller data sets, we reduced the number of portfolios for Canada, France, Germany, and Italy to 5. In addition, we report in table 7 the portfolio alphas for a long-short strategy corrected for risk exposures using the Fama-French model, similar to table 5. The last two lines give the number of observations and the equally weighted return of the whole sample[23].

When looking at the raw-returns, i.e. returns not corrected for their respective risk exposure, we can detect large differences across countries and ICOC approaches. In Germany, the ICOC effect is insignificant or even negative, in Canada, the U.K., and especially in Japan, the ICOC effect is highly significant, attaining a yield up to 25.3% p.a. for the RIM2 in Japan. Interestingly, in the continental European countries the ICOC obtained from the dividend discount model causes larger returns of long-short investments compared to their RIM counterparts. This difference between both ICOC approaches becomes even more apparent when adjusting the portfolio returns for risk exposure using the Fama-French factors. Risk-adjusted returns obtained from the DDM ICOC are significant in all countries, yielding 5%-16% of excess returns annually. Compared to this, the ICOC of the RIM3 model – performing well in the U.S. – is only statistically different from 0 in France with a long-short return of around 5%. The RIM2 ICOC yields variable returns, exhibiting large differences across countries: a mere 3% abnormal return in Germany to more than 17% in Japan.

[23] We can give only a summary of the main findings here. We refrain from displaying portfolio characteristics, neither we show the returns of investment strategies using different holding periods.

The results indicate that the ICOC effect is not limited to the U.S. capital market, but is also present in all important stock markets. In addition, the international analysis shows that in many countries this stock market anomaly with respect to the Fama-French model is even more pronounced than in the U.S, at least when referring to the DDM-based ICOC. The fact that the efficacy of the ICOC effect is not equally strong in all stock markets should not be too surprising: varying accounting standards and large differences in the availability of IBES data is certainly contributing to some of the discrepancies. Furthermore, it seems that in continental European countries, the dividend policy conveys more information about future profits (see e.g. Nissim and Ziv (2001)) than in the U.S. Consequently, such a difference could explain the better performance of DDM-based strategies in these countries. Moreover, the low correlation between DDM-ICOC and risk factors (in all countries) results in a rather low risk-exposure of the respective investment portfolios, whereas the RIM portfolios have rather high risk loadings.

6.2. The Cross-Sectional Variation in Stock Returns

Next, we turn to panel regressions tests, where we want to explain the cross-sectional variation in stock returns using the implied return as proxy for expected stock returns. Again, this approach enables us to disentangle the relation of the implied return from other priced firm-risk, and to see whether the ICOC can add explanatory power to the pricing models across the largest stock markets in the world. This analysis follows the same methodology as the regression tests of the U.S. data sample.

Table 8 shows the regression estimates and t-statistics for the one-way fixed effects model in equation (11) for the non-US G7 countries. Panel A displays the regression results when using the ICOC as the only explaining variable. Panel B includes market beta, B/M ratio, firm size, and price momentum as independent variables to control for firm-risk. The regressions are carried out using twelve-month stock returns over whole overlapping panel data set. The explained variance of each the model is given in the last line.

When abstracting from the standard risk-return relation (panel A), the ICOC proves again to be a good explanatory variable for stock returns across all countries. The ICOC coefficient is always positive and highly significant. However, the explained variance (R^2) of all models is generally rather low, especially for the DDM approach. Only in the U.K. and the Japanese market, the

RIM-based ICOC seem to capture a good part of the variation of stock returns over the whole data panel, resulting in rather high t-statistics as well.

In panel B we report the results of the panel regressions when we control for the influence of firm-specific risk factors. Compared to panel A, the ICOC coefficients loose some of their explanatory power but remain significant in many countries and ICOC approaches. Especially the coefficients of the RIM2 implied return are highly significant, and thus increase the explained variance of stock returns (R^2 increases compared to regression specifications without the ICOC estimate – not shown). The DDM3 ICOC is weaker related to stock returns after controlling for risk. With the exception of Germany, the effect is not significant at the 5% level. The results for the RIM3 ICOC regressions are mixed: it seems to depend very much on the capital market whether this expected return proxy is adding some additional positive power to explain stock returns. Either the ICOC is highly significant, or not related to stock returns, as in the case of Germany and Italy.

As far as the Fama-French risk factors are concerned, the coefficients exhibit mostly their expected relation to stock returns: Market beta and B/M ratio are positively related to stock returns, whereas firm size exhibits the usual negative relationship to stock returns. In many cases these relations are highly significant. In this international setting, price momentum seems not to be a very important variable to explain stock returns, at least when compared to common studies on momentum strategies (Chan et al., 1996). The explained variance of the specifications that controls for firm risk reaches 16%-36%. In essence, this international analysis confirms the outcome of the U.S. data sample: significant ICOC coefficients present evidence that the implied return is contributing some explanatory power for stock returns that goes beyond the standard risk-return relation captured by the Fama-French factors.

The estimation results of the RIM3 regressions have again a somewhat peculiar feature: Either the ICOC coefficient *or* the B/M ratio is significant (only in Canada, both variables are statistically significant from zero). Moreover, if not significant, the coefficients are often negative, which is opposite to the theoretical prediction of both variables. In fact, these regression specifications exhibit the same multicollinearity problem as the U.S. regressions: Since B/M and the RIM3 ICOC are highly correlated (up to 90%, depending on the country), they contain essentially identical information. The negative coefficients result from this high correlation. Since one variable is sufficient to capture almost all of the explanatory power, the other variable captures then the remaining (negative) effects. The interpretation of this pattern is not obvious. If one is to accept the Fama-French model a priori, these results challenge the RIM3 approach as independent factor to explain stock returns since the regressions basically indicate that the implied return owes its positive relation to stock returns only due to its close relation to the B/M ratio. On the other hand, at the aggregate of this international extension, the additional explanatory power of the implied cost of capital for stock returns is still evident. What is more, in the largest stock markets apart from the U.S. (France, Japan, and the United Kingdom) the RIM3 implied return even subsumes the B/M effect. Since – as mentioned earlier – the ICOC has a broad theoretical foundation as compared to the B/M ratio, the implied cost of capital might be a potential replacement for the B/M ratio as risk factor in these markets.

7. Conclusion

The recently developed concept of the implied cost of capital has become a popular tool for estimating expected stock returns both in academia and practice. By aggregating individual stock returns over the entire market, this approach is used extensively in economic research to derive a forward-looking equity risk premium estimate. Fund managers try to exploit the so-obtained expected returns to improve the performance of their investment portfolios.

Surprisingly, a sound econometric foundation of this methodology at the level of individual firm data is still missing. In this paper, we employ portfolio analysis and regression tests to answer the question whether the use of the implied cost of capital as proxy for expected stock returns can be substantiated by econometric evidence. In addition, we address the problems associated with implementing this concept in practice, given usual constraints such as limited data availability. We calculated the implied return for three different specifications of the implied return and test their efficacy in generating risk-adjusted excess returns.

This international analysis documents the validity of the implied cost of capital as proxy for expected stock returns. Even though the ICOC is related to common firm risk variables, such as B/M ratio, we show that a simple portfolio strategy can yield excess returns with respect to several common asset pricing theories, such as the CAPM or the Fama-French model. Although the magnitude of the ICOC effect varies across present value models employed and capital markets examined, the observed stock returns are inconsistent with the joint hypothesis of efficient markets and standard asset pricing models.

This study presents also evidence that the expectations-driven ICOC improves the ability of common asset pricing models in explaining the cross-sectional variation of stock returns. Although being highly correlated with the Fama-French risk factor B/M when derived from the residual income model, panel regressions of stock returns show that the implied cost of capital remains significant even after controlling for other firm-risk factors. Thereby, we confirm the ICOC's additional informational content obtained from equity analysts' forecasts. Moreover, in some important stock markets, the ICOC even subsumes the B/M effect, suggesting considering the implied return as a candidate to replace the B/M ratio in risk-return consideration in these countries, given its stronger fundamental foundation.

Our results have also important practical implications for managers. On the one hand, this study shows that the implied cost of capital offers indeed a powerful tool to estimate the firm's cost of equity, at least if taken jointly with other common risk factors. For portfolio mangers, on the other hand, this paper puts forward empirical evidence for the profitability of ICOC-based investment strategies. Still, large discrepancies between the models underpin the importance to carefully select the right approach.

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Table 1: Descriptive Statistics – United States

This table reports the number of available observations as well as the mean implied return, standard deviation, together with the minimal and maximal observation derived for the different valuation models. For the calculation of the mean, standard deviation, min, and max, only observations with values for all four models were used (50,402 observations).

	Number of available observations	Mean	Standard Deviation	Min	Max
DDM3	68,759	8.87%	2.04%	4.68%	43.42%
RIM2	87,390	9.19%	2.31%	1.07%	51.10%
RIM3	69,175	8.18%	2.72%	1.00%	38.76%
All	50,402				

Table 2: Correlations of Expected Returns and Fama-French Factors – United States

This table reports the correlations of expected returns and the Fama-French factors B/M ratio and size (MCAP) across the different valuation models using data over all years. Only observations with data for all valuation models were used (50,402 observations).

	DDM3	RIM2	RIM3	MCAP	B/M
DDM3	1.000				
RIM2	0.2930	1.000			
RIM3	0.1903	0.6313	1.000		
MCAP	-0.0284	-0.1342	-0.2254	1.000	
B/M	0.2356	0.3144	0.8062	-0.2272	1.000

Table 3: Returns and Firm Characteristics of Buy-and-Hold Portfolios – United States

This table presents, along with the mean ICOC estimates and portfolio returns, the characteristics of the different portfolios. The portfolios are constructed using various ICOC approaches as sorting variable where portfolio 1 (P1) compromises the stocks with the lowest implied cost of capital estimate, and portfolio 8 (P8) consists of the high ICOC stocks. Panel A reports returns and firm characteristics of the DDM3 ICOC portfolios, panel B information on the RIM2 ICOC portfolios and panel information on the RIM3 ICOC investment portfolios.
The return of each portfolio is calculated as the equally weighted buy-and-hold return with a holding period of twelve months, using overlapping intervals. B/M is the mean book yield of the companies in a portfolio, SIZE is the median firm market capitalization (calculated as the log of the market capitalization divided by the level of the stock market index), BETA is the average five year regressed sensitivity on the market portfolio, and MOMENTUM is the average historical six-month price return. All firm characteristics are measured as of the portfolio formation date.
The two rows at the bottom of each panel show the overall averages (or medians, respectively) over the whole sample size and the average difference in returns and firm characteristics between the two extreme portfolios (P8-P1). More precisely, the return column indicates the average return that could have been generated by an investment strategy consisting in a short position of the low-ICOC portfolio P1 and a long position in the high-ICOC portfolio P8 (along with their t-statistic, which is calculated using Newey-West HAC standard errors using a lag length of 11 months). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level. The sample period is from January 1995 to February 2006. Country: United States. Observations: 40,158.

Portfolio	ICOC	Return	Beta	B/M ratio	Size	Momentum
			Panel A: DDM3 ICOC			
P1	6.33%	14.34%	1.002	0.361	8.925	7.49%
P2	7.43%	14.18%	0.962	0.369	8.893	7.61%
P3	8.11%	13.32%	0.926	0.375	8.999	5.19%
P4	8.66%	15.01%	0.848	0.369	9.179	4.57%
P5	9.20%	14.24%	0.824	0.384	9.164	3.06%
P6	9.76%	13.33%	0.786	0.410	9.093	1.67%
P7	10.47%	13.42%	0.709	0.459	8.987	0.82%
P8	12.30%	14.94%	0.752	0.568	8.679	-3.90%
Average	9.02%	14.10%	0.852	0.412	8.982	3.34%
P8-P1	5.98%	0.60%	-0.249	0.206	-0.245	-11.39%
t-stat		(0.16)				
			Panel B: RIM2 ICOC			
P1	6.36%	10.26%	0.846	0.344	9.450	7.66%
P2	7.65%	12.54%	0.794	0.307	9.407	7.27%
P3	8.27%	12.22%	0.809	0.340	9.178	6.23%
P4	8.82%	13.82%	0.791	0.376	9.070	4.89%
P5	9.38%	15.05%	0.813	0.416	8.903	3.26%
P6	10.05%	15.13%	0.863	0.445	8.839	1.86%
P7	10.93%	15.32%	0.928	0.484	8.721	-0.03%
P8	13.10%	18.60%	0.972	0.588	8.478	-4.68%
Average	9.30%	14.10%	0.852	0.412	8.982	3.34%
P8-P1	6.75%	8.33%**	0.126	0.244	-0.972	-12.34%
t-stat		(2.09)				
			Panel C: RIM3 ICOC			
P1	4.60%	9.80%	0.845	0.166	9.858	6.81%
P2	5.93%	12.83%	0.857	0.222	9.473	6.52%
P3	6.83%	12.98%	0.822	0.280	9.191	5.67%
P4	7.63%	13.53%	0.796	0.342	8.997	5.21%
P5	8.40%	14.53%	0.813	0.408	8.916	3.66%
P6	9.23%	14.39%	0.851	0.485	8.773	2.07%
P7	10.39%	15.08%	0.901	0.571	8.657	0.10%
P8	13.11%	19.80%	0.931	0.831	8.398	-3.52%
Average	8.25%	14.10%	0.852	0.412	8.982	3.34%
P8-P1	8.51%	10.00%**	0.086	0.666	-1.460	-10.32%
t-stat		(2.16)				

Table 4: Returns from Buy-and-Hold Portfolios with different Holding Periods – United States

This table reports the average, equally weighted buy-and-hold returns of the high (P8) and low (P1) ICOC portfolios, together with their average difference (P8-P1) and the t-stat thereof over holding periods of 1, 3, 6, 12, 18, and 24 months. The t-statistic is calculated using Newey-West HAC standard errors, using a lag-length corresponding the holding period minus 1. The last two lines give the number of observations (decreasing with growing investment horizon) and the equally weighted return of the whole sample. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level. The sample period is from January 1995 to February 2006. Country: United States.

	Months	1	3	6	12	18	24
DDM3	P1	1.3%	4.0%	7.6%	14.3%	21.4%	28.7%
	P8	1.5%	4.1%	7.8%	14.9%	23.1%	30.9%
	P8-P1	0.2%	0.2%	0.2%	0.6%	1.7%	2.2%
	t-stat	(0.64)	(0.18)	(0.08)	(0.16)	(0.36)	(0.44)
RIM2	P1	0.8%	2.7%	5.3%	10.3%	14.4%	18.1%
	P8	1.8%	5.0%	9.4%	18.6%	27.9%	36.4%
	P8-P1	1.0%**	2.4%**	4.0%*	8.3%**	13.5%**	18.3%***
	t-stat	(2.53)	(2.31)	(1.90)	(2.09)	(2.56)	(3.35)
RIM3	P1	0.8%	2.6%	5.2%	9.8%	13.7%	17.3%
	P8	1.8%	5.0%	9.9%	19.8%	30.2%	40.4%
	P8-P1	1.0%**	2.3%**	4.7%**	10.0%**	16.4%**	23.1%***
	t-stat	(2.38)	(2.02)	(1.99)	(2.16)	(2.52)	(2.66)
Observations		44,989	44,032	42,734	40,158	37,814	35,470
EWA		1.3%	3.7%	7.2%	14.1%	21.1%	28.4%

Since it is known that the Newey-West correction for autocorrelated standard errors is likely not to be sufficient, we also calculated the t-statistics of the long-short portfolio (P8-P1) with the double lag-length. For short holding periods (up to six months), the t-statistics decrease slightly, for longer horizons, the t-statistics increase. Basically, the main picture remains unchanged since the significance levels do not change.

Table 5: Risk-Adjusted Excess Returns – United States

This table reports the results from time-series regressions based on the CAPM and the Fama and French (1993) three-factor model. We regress the portfolio excess returns (over the U.S. risk-free rate) of the low-ICOC portfolio P1, the high-ICOC portfolio P8, and the long-short investment (P8-P1) on the market excess return and the Fama-French factors:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i (r_{m,t} - r_{f,t}) + \gamma_i SMB_t + \delta_i HML_t + \varepsilon_{i,t}$$

where $r_{i,t}$ is the 12-month return of portfolio i; $r_{f,t}$ is the U.S. risk-free rate and $r_{m,t}$ the market return (Standards&Poor's stock index)over the same time period; SMB_t is the Fama-French small firm factor (the excess return of a portfolio of small firms over a portfolio of large stocks), and HML_t is the book-to-market factor (the excess return of a portfolio of high-value firms over a portfolio of low-value firms).

SMB is constructed by ranking all stocks in ascending order on market equity value at the beginning of the twelve-month period. The stocks below the median size end up in the portfolio S, the stock above the median in B. Similarly, *HML* is formed by ranking all stocks in ascending order on book value of equity divided by its market value at the beginning of the twelve-month period. The stocks below the median end up in the portfolio L, the stock above the median in H. For details on portfolio construction, see Fama and French (1993).

The analysis is carried out over whole overlapping data set. Thus, the t-statistics are calculated using Newey-West HAC standard errors. The sample period is from January 1995 to February 2006. Country: United States. Observations: 40,158.

Portfolio	α	$t(\alpha)$	β	$t(\beta)$	γ	$t(\gamma)$	δ	$t(\delta)$
Panel A: ICOC: DDM3								
P1 (low ICOC)	6.2%	2.69	0.79	9.10				
P8 (high ICOC)	9.2%	2.37	0.38	1.64				
P8-P1	3.0%	0.82	-0.41	-2.15				
P1 (low ICOC)	5.9%	3.00	0.77	13.69	0.43	3.71	0.06	0.84
P8 (high ICOC)	5.0%	3.16	0.49	6.24	0.07	0.44	0.73	5.18
P8-P1	-0.9%	-0.35	-0.32	-3.48	-0.37	-3.05	0.67	5.40
Panel B: ICOC: RIM2								
P1 (low ICOC)	2.3%	1.32	0.77	12.19				
P8 (high ICOC)	9.9%	2.17	0.69	2.67				
P8-P1	7.6%	1.68	-0.08	-0.30				
P1 (low ICOC)	2.3%	1.20	0.75	15.53	0.24	1.49	0.01	0.04
P8 (high ICOC)	5.2%	3.12	0.76	8.33	0.30	1.16	0.84	4.96
P8-P1	2.9%	1.27	0.00	0.03	0.06	0.21	0.83	3.82
Panel C: ICOC: RIM3								
P1 (low ICOC)	1.0%	0.80	0.83	15.16				
P8 (high ICOC)	12.5%	2.66	0.59	2.14				
P8-P1	11.5%	2.24	-0.24	-0.77				
P1 (low ICOC)	1.3%	1.03	0.82	16.55	0.01	0.12	-0.05	-0.56
P8 (high ICOC)	7.5%	4.70	0.67	8.64	0.23	1.13	0.88	4.94
P8-P1	6.2%	3.03	-0.16	-1.38	0.22	0.87	0.93	4.13

Table 6: Panel Regressions with One-Way Fixed Effects – United States

This table presents the regression estimates and t-statistics for the one-way fixed firm effects model:

$$r_{i,t} = \alpha_i + \delta_t k_{i,t} + \varphi d_t \beta_{i,t} + \gamma' X_{i,t} + u_{i,t}$$

where the subscript *i* denotes the company (cross-section dimension) and *t* denotes the time period of the observation (time-series dimension). The subsequent total stock return measured over 12 months after having observed the risk-factors is denoted by $r_{i,t}$. The ICOC estimate is denoted by $k_{i,t}$, and the market beta estimate by $\beta_{i,t}$. The variable d_t is a dummy for the *ex post* observed market risk premium (i.e. the difference between the market return and the risk-free rate), having a value of 1 when the market risk premium is positive during the holing period, and –1 if it is negative. This dummy is necessary to account for the fact that returns of stocks with rather high betas should have *rather low* returns during periods when the market under performs the risk-free rate of return. Finally, $X_{i,t}$ is a vector of firm characteristics that have been identified as risk-factors, and $u_{i,t}$ is the error term.
The fist column reports the results of the standard Fama and French (1992) regression specification without the implied cost of capital. Then, for each valuation model, three different regression specifications are estimated; including different risk factors regressed on the subsequent stock return using overlapping periods. The first specification regresses only the internal rate of return (ICOC) on the subsequent total stock return. The second specification uses in addition the three Fama-French factors, B/M being the book yield, SIZE (calculated as the log of the market capitalization divided by the level of the stock market index), and BETA, the five year regressed sensitivity on the market portfolio. The last model adds the historical six-month price return (MOM). The explained variance of each the model is given in the last line.

The regressions are carried out over whole overlapping panel data set. The t-statistic is calculated on the basis of heteroskedasticity- and autocorrelation-consistent (HAC) standard errors following Rogers (1993). The regressions are run over the full cross-section of companies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level. The sample period is from January 1995 to February 2006. Country: United States. Observations: 38,676.

	Fama/French	DDM3			RIM2			RIM3			
ICOC		4.23***	1.31*	1.37**	4.32***	2.80***	2.96***	5.32***	2.67***	2.83***	4.17***
t-stat		(6.19)	(1.90)	(1.98)	(13.15)	(7.29)	(7.39)	(14.45)	(4.27)	(4.40)	(10.18)
BETA	0.10***		0.10***	0.10***		0.10***	0.10***		0.11***	0.11***	0.11***
t-stat	(14.41)		(14.47)	(14.56)		(14.69)	(14.70)		(15.44)	(15.50)	(15.96)
B/M	0.35***		0.32***	0.32***		0.29***	0.30***		0.17**	0.17**	
t-stat	(6.66)		(5.75)	(5.77)		(5.17)	(5.19)		(2.52)	(2.49)	
SIZE	-0.21***		-0.20***	-0.20***		-0.19***	-0.19***		-0.19***	-0.19***	-0.19***
t-stat	(-9.13)		(-8.69)	(-8.69)		(-8.10)	(-8.11)		(-8.18)	(-8.19)	(-8.62)
MOM	0.00			0.01			0.05***			0.03*	0.03**
t-stat	(0.01)			(0.91)			(2.87)			(1.88)	(2.07)
R-squared	0.18	0.02	0.18	0.18	0.05	0.20	0.20	0.08	0.19	0.19	0.19

Table 7: Raw returns and risk-adjusted excess returns from Buy-and-Hold Portfolios – International Analysis

This table reports the average, equally weighted buy-and-hold returns of the high and low ICOC portfolios, together with their average difference and t-stat thereof for the other G7 stock markets: Canada, France, Germany, Italy, Japan, and the U.K. The holding period of the portfolios is twelve months. The averages are calculated using overlapping observations. Hence, the t-statistic of the difference is calculated using Newey-West HAC standard errors. In addition, we also report the portfolio alphas for a long-short investment strategy with respect to the Fama-French model to examine the ICOC effect when correcting for portfolio risk, using the same regression methodology as for the U.S. data (see table 5 for a detailed explanation). The last three lines give the number of portfolios employed to sort the companies in (8 for Japan and the U.K., otherwise 5), the number of the overall observations available for each market and the equally weighted return over the whole sample. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level. The sample period is from January 1995 to February 2006.

	Country	CA	FR	GE	IT	JP	UK
DDM3	P-Low	7.9%	14.9%	8.2%	15.9%	3.1%	6.6%
	P-High	19.5%	23.6%	13.2%	31.1%	16.0%	12.9%
	Difference	11.7%**	8.7%***	5.0%*	15.1%**	12.8%***	6.3%*
	t-stat	2.40	2.71	1.69	2.12	7.31	1.80
	FF-alpha	11.8%***	8.9%***	5.0%***	16.8%***	12.2%**	7.4%*
	t-stat	3.39	6.96	3.12	3.29	4.84	1.93
RIM2	P-Low	8.6%	13.7%	10.2%	13.3%	-2.0%	7.0%
	P-High	17.2%	20.0%	14.0%	22.4%	23.3%	20.0%
	Difference	8.6%*	6.3%	3.7%	9.1%	25.3%***	13.9%***
	t-stat	1.88	1.27	0.97	1.49	5.61	3.36
	FF-alpha	5.0%*	6.6%***	3.0%	4.1%	17.5%***	10.0%**
	t-stat	1.84	2.60	1.03	1.16	4.74	2.21
RIM3	P-Low	10.9%	15.2%	13.6%	14.5%	0.2%	6.1%
	P-High	20.8%	22.0%	13.0%	26.3%	15.3%	21.2%
	Difference	9.9%*	6.8%	-0.6%	11.7%	15.1%***	15.1%***
	t-stat	1.93	0.89	-0.12	1.13	3.85	2.89
	FF-alpha	2.8%	5.1%*	3.0%	5.0%	4.0%	5.3%
	t-stat	0.62	1.79	0.69	0.76	1.27	1.21
Portfolios		5	5	5	5	8	8
Observations		5,030	8,580	6,485	2,926	16,713	13,768
EWA		15.7%	17.8%	12.9%	18.6%	8.5%	11.5%

Table 8: Panel Regressions with One-Way Fixed Effects – International Analysis

This table presents the regression estimates and t-statistics for the one-way fixed firm effects model estimated for the other six G7 countries, i.e. Canada, France, Germany, Italy, Japan, and the U.K.:

$$r_{i,t} = \alpha_i + \delta_t k_{i,t} + \varphi d_t \beta_{i,t} + \gamma' X_{i,t} + u_{i,t}$$

where the subscript *i* denotes the company (cross-section dimension) and *t* denotes the time period of the observation (time-series dimension). The subsequent total stock return measured over 12 months after having observed the risk-factors is denoted by $r_{i,t}$. The ICOC estimate is denoted by $k_{i,t}$, and the market beta estimate by $\beta_{i,t}$. The variable d_t is a dummy for the *ex post* observed market risk premium (i.e. the difference between the market return and the risk-free rate), having a value of 1 when the market risk premium is positive during the holing period, and –1 if it is negative. This dummy is necessary to account for the fact that returns of stocks with rather high betas should have *rather low* returns during periods when the market under performs the risk-free rate of return. Finally, $X_{i,t}$ is a vector of firm characteristics that have been identified as risk-factors, and $u_{i,t}$ is the error term.

For each valuation model, two different regression specifications are estimated. Panel A displays the regression estimates when explaining subsequent twelve-month total stock returns by the internal rate of return (ICOC) only. The second specification (panel B) uses in addition the three Fama-French factors, B/M being the book yield, SIZE (calculated as the log of the market capitalization divided by the level of the stock market index), BETA, the five year regressed sensitivity on the market portfolio, as well as the historical six-month price return (MOM) as explaining variables. The explained variance of each the model is given in the last line.

The regressions are carried out over whole overlapping panel data set. The t-statistics are calculated on the basis of heteroskedasticity- and autocorrelation-consistent (HAC) standard errors following Rogers (1993). The regressions are run over the full cross-section of companies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level. The sample period is from January 1995 to February 2006.

Panel A: One-way FE regression tests on ICOC variables only

	Country	CA	FR	GE	IT	JP	UK
DDM3	ICOC	1.20**	0.79**	1.45***	1.36**	0.82***	1.55***
	t-stat	2.46	2.05	2.84	2.20	3.52	2.94
	R-squared	0.01	0.01	0.02	0.01	0.01	0.03
RIM2	ICOC	2.98***	2.38***	2.82***	5.18***	5.78***	4.23***
	t-stat	5.08	3.27	3.52	4.16	12.72	7.03
	R-squared	0.04	0.02	0.03	0.04	0.10	0.09
RIM3	ICOC	5.24***	4.27***	3.32***	7.66***	17.31***	4.52***
	t-stat	4.61	5.23	5.50	3.14	18.10	8.19
	R-squared	0.06	0.05	0.05	0.08	0.19	0.10
Observations		4,816	8,252	6,294	2,758	16,560	13,155

Panel B: One-way FE regression test including other firm characteristics (market beta, B/M ratio, firm size, and price momentum) to control for firm-risk.

	Country	CA	FR	GE	IT	JP	UK
DDM3	ICOC	0.79	0.61	0.94**	1.00*	0.31	0.62*
	t-stat	1.47	1.55	2.23	1.85	1.39	1.79
	BETA	0.10***	0.16***	0.20***	0.16***	0.15***	0.10***
	t-stat	4.09	11.64	13.58	8.18	14.28	14.50
	B/M	0.29***	0.09	0.17**	0.38**	0.29***	0.21***
	t-stat	4.08	1.54	2.63	2.10	6.56	3.24
	SIZE	-0.14**	-0.21***	-0.27***	-0.18	-0.25***	-0.23***
	t-stat	-2.52	-5.92	-5.25	-1.47	-8.39	-8.25
	MOM	0.05	-0.00	-0.02	0.04	-0.00**	-0.02
	t-stat	1.21	-0.03	-0.72	1.05	-2.46	-0.61
	R-squared	0.16	0.21	0.29	0.22	0.34	0.24
RIM2	ICOC	2.06***	1.86***	0.39	3.25***	3.01***	2.28***
	t-stat	3.35	3.84	0.58	2.91	7.18	3.95
	BETA	0.10***	0.16***	0.20***	0.16***	0.14***	0.09***
	t-stat	3.93	12.27	14.20	8.82	13.94	14.21
	B/M	0.30***	0.09*	0.17**	0.37**	0.23***	0.20***
	t-stat	4.33	1.69	2.57	2.15	5.23	2.84
	SIZE	-0.13**	-0.20***	-0.26***	-0.15	-0.26***	-0.21***
	t-stat	-2.31	-5.99	-5.22	-1.39	-9.06	-8.01
	MOM	0.06	0.03	-0.03	0.06	-0.00***	0.02
	t-stat	1.51	0.72	-1.12	1.42	-2.95	0.56
	R-squared	0.17	0.22	0.28	0.23	0.36	0.26
RIM3	ICOC	2.94**	2.01**	-0.96	-1.71	8.82***	3.30***
	t-stat	2.02	2.44	-1.38	-0.82	4.76	3.64
	BETA	0.10***	0.16***	0.20***	0.16***	0.14***	0.10***
	t-stat	4.25	11.58	14.08	8.84	13.45	15.50
	B/M	0.18**	-0.01	0.24***	0.48***	0.02	-0.04
	t-stat	2.03	-0.02	3.79	2.64	0.25	-0.39
	SIZE	-0.13**	-0.20***	-0.27***	-0.19	-0.25***	-0.22***
	t-stat	-2.35	-5.85	-5.23	-1.48	-8.64	-8.06
	MOM	0.08*	0.02	-0.05	0.03	-0.00***	0.02
	t-stat	1.73	0.40	-1.61	0.85	-2.70	0.54
	R-squared	0.16	0.21	0.28	0.22	0.35	0.25
Observations		4,816	8,252	6,294	2,758	16,560	13,155

Figure 1: Returns of Implied Cost of Capital Based Investment Strategies over Time – United States

The subsequent figures 1a – 1c display the difference between returns of the high ICOC portfolio (P8) and the low ICOC portfolio (P1) over time. The returns are buy-and-hold total returns with a holding period of twelve months. Country: United States. The sample period is from January 1995 to February 2006.

Figure 1a: DDM3

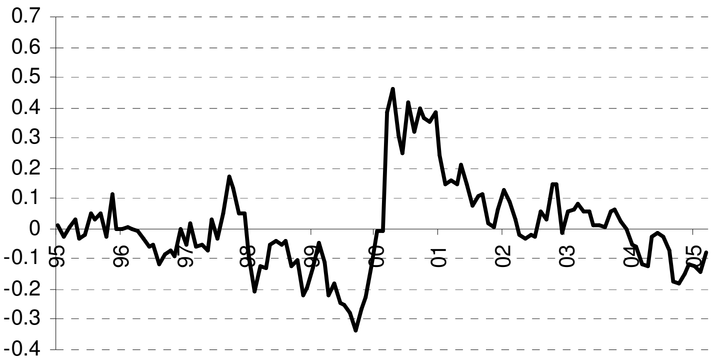


Figure 1b: RIM2

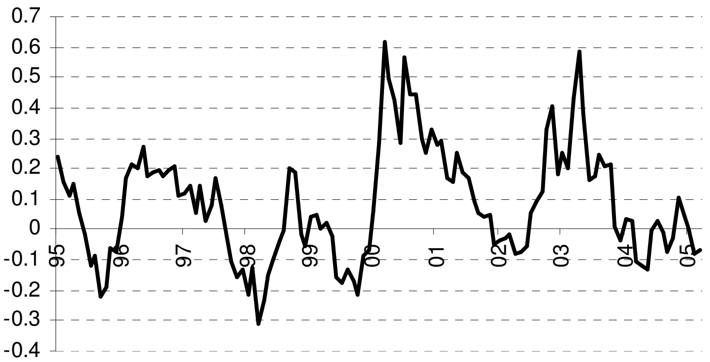
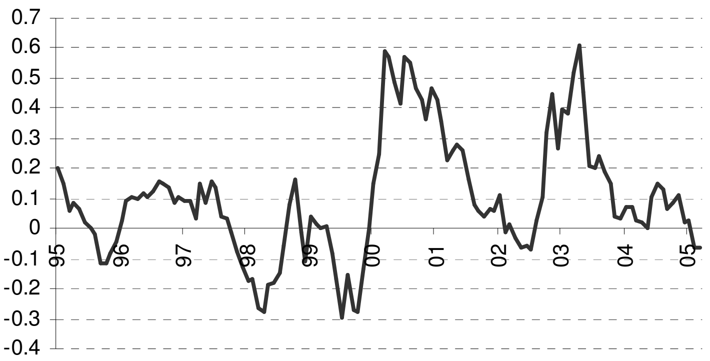


Figure 1c: RIM3



Appendix A: Fama-MacBeth Regressions

In addition to the panel regressions displayed in the paper, we present here methodology and results of the Fama-MacBeth regressions, since they are very common in the empirical finance literature.

Methodology

For each month, we first regress each month the firm's individual stock return on its ICOC estimate and firm-specific risk factors, similar to Fama and French (1992):

$$r_i = \alpha + \delta k_i + \varphi d \beta_i + \gamma' X_i + u_i \qquad (12)$$

where r_i is the subsequent total stock return measured over 12 months after having measured the ICOC estimate (denoted by k_i), the market beta estimate β_i, the vector of firm characteristics that have been identified as risk-factors X_i. Finally, u_i is the error term. Again, the variable d_t is a dummy for the *ex post* observed market risk premium (i.e. the difference between the market return and the risk-free rate), having a value of 1 when the market risk premium is positive during the holing period, and –1 if it is negative (see section 5.1 for more details).
In the next step, we then test whether the average coefficient estimates δ, φ, and γ' are significantly different from zero. The t-statistics are calculated by regressing the time series of the coefficient estimates on a constant. Since we use again overlapping data, the t-statistic is calculated on the basis of heteroskedasticity- and autocorrelation-consistent (HAC) standard errors (Newey-West, 1987) with 11 lags. In line with our discussion in section 5, we refrain from sorting the companies into portfolios before carrying out the Fama-MacBeth regressions, using individual firm data instead.

Results

Table A1 reports the time-series averages of the slope coefficients of the monthly cross-sectional regressions, along with their t-statistics.

The first column gives the standard Fama-French (1992) regression (only the ex post risk premium dummy is added) without the ICOC. Besides market beta, none of the explanatory variables is significant. This rather poor result is however in accordance with many studies using Fama-MacBeth regressions with individual data, e.g. Chan et al. (1996), or Subrahmanyam (2005). When using the ICOC as only explanatory variable, only the RIM2 ICOC is weakly related to stock returns. However, after for controlling for the Fama-French factors and the short-term price momentum, the ICOC is no longer significant. Interestingly, besides market beta, only price momentum is related to stock returns.

Table A1: Results of Cross-sectional Fama-MacBeth Regressions (1973) – United States

This table shows the results of different Fama-MacBeth regressions, i.e. the average slope coefficient of the cross-sectional regressions along with their t-statistics. For each valuation model, three different regression specifications are estimated; including different risk factors regressed on the subsequent twelve-month total stock return using overlapping periods. The first specification regresses the return only on the internal rate of return (ICOC). The second specification uses in addition the three Fama-French factors, B/M being the book yield, SIZE (calculated as the log of the market capitalization divided by the level of the stock market index), and BETA, the five year regressed sensitivity on the market portfolio. The last model adds the historical six-month price return (MOM) to the explanatory variables. The t-statistic is calculated on the basis of heteroskedasticity- and autocorrelation-consistent (HAC) standard errors following Newey-West (1987). The regressions are run over the full cross-section of companies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level. The sample period is from January 1995 to February 2006. Country: United States.

	Fama/French	DDM3			RIM2			RIM3		
ICOC		-0.20	-0.49	-0.45	1.04*	0.45	0.53	0.70	0.64	0.70
t-stat		(-0.32)	(-1.15)	(-1.17)	(1.72)	(0.98)	(1.23)	(1.37)	(0.87)	(1.00)
BETA	0.06***		0.06***	0.05***		0.07***	0.06***		0.07***	0.06***
t-stat	(3.71)		(3.41)	(3.26)		(3.95)	(3.78)		(3.60)	(3.47)
B/M	0.03		0.03	0.03		0.02	0.03		-0.01	-0.01
t-stat	(0.96)		(1.00)	(1.11)		(0.74)	(0.89)		(-0.19)	(-0.23)
MCAP	-0.00		-0.00	-0.00		-0.00	-0.00		-0.00	-0.00
t-stat	(-0.26)		(-0.31)	(-0.23)		(-0.21)	(-0.14)		(-0.24)	(-0.18)
MOM	0.04			0.03			0.05*			0.05*
t-stat	(1.21)			(1.08)			(1.95)			(1.66)