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Cost of equity estimation techniques used by valuation experts

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Cost of Equity Estimation Techniques Used by Valuation Experts

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Abstract:
Cost of equity is crucial information that enters business valuation. Yet, even after decades of academic research, consensus has not been reached regarding the appropriate cost of equity estimation. The aim of our paper is to investigate the cost of equity estimation in practice. In other words, we aim to provide data on the popularity of individual cost of equity models and evidence on what techniques are used for the estimation of parameters entering the models. For this purpose, we use a specifically developed program and obtain a unique dataset of cost of equity values, estimation methods and parameters used by valuation experts in the Czech Republic in the period between 1997 and 2009. Our findings suggest that the most popular model for cost of equity estimation is CAPM, which is followed by the heuristic build up model. In the case of CAPM, risk premiums for unsystematic risks are often applied. Such premiums depend to large extent on expert's own experience and as such are rather qualitative in nature. Overall, in most points of the analysis, our results are consistent with previous, survey-based research on the US and the Western European data.

Keywords: business valuation, cost of equity, CAPM

JEL: G12, G34

1. Introduction

Cost of equity is crucial information that enters valuation and corporate decision-making. The cost of equity on its own or in combination with cost of debt is used as a discount factor with which expected future cash flows are discounted. By discounting future cash flows, present value of an investment is determined. In other words, the value of an investment is derived. Valuation of investments in companies, projects, securities or assets need to be performed for various purposes, e.g., investment decision-making, capital budgeting, litigation issues or regulation requirements. Given the broad range of situations in which present value computation might or needs to be employed, there is also a broad range of situations which require cost of equity application.

The cost of equity can be defined as an opportunity cost equal to a return on alternative investments with similar level of risk (Pratt, 2002). The cost of equity represents an expected return on an investment. As such, it is not directly observable and it needs to be estimated. Finance theory suggests several approaches to cost of equity estimation. Numerous models of cost of equity estimation have been developed, e.g. the asset pricing models, the build up models, and the discounted cash flow ('DCF') implied models (Ibbotson, 2005). All the models translate risk of the investment into the expected returns but each of the models approaches this translation differently. Asset pricing models, which are mainly represented by the Capital Asset Pricing Model ("CAPM"), derive the cost of equity directly from the market by econometric analysis. Build up models are additive heuristic models which determine cost of equity as a sum of risk-free rate and individually estimated risk premiums specific for the particular investment. The DCF implied models compute the cost of equity directly from the market information on prices and expected cash flows (dividends) related to the investment.

The cost of equity and the models used for its estimation have been of interest of academia for decades. Yet, neither finance economists, nor practitioners are unified in terms of cost of equity estimation (Pratt, 2008). Apart from the selection of appropriate cost of equity model, finance practitioners are concerned with how to apply the models practically. Since framework for cost of equity estimation is rather ambiguous in terms of what parameters and techniques to use, its estimation remains one of the most

challenging areas of business valuation. This holds particularly for emerging markets which have generally lower availability of high-quality information (Bruner, *et al*., 2004) and which remain segmented (Bruner, *et al*., 2008). When high-quality market information is not available, capacity to estimate parameters of the models is reduced. Furthermore, when market is segmented, information obtained from other markets with higher informational efficiency can be hardly used as a reference.

Given the variety of cost of equity models and techniques used to estimate their input parameters, cost of equity estimation and its resultant value can vary from one practitioner to another. Several studies have been performed both on the US and the Western European data which investigate what cost of equity estimation techniques are used by practitioners and to what extent the techniques differ across the individual practitioners. All the studies have used survey approach to analysis. Based on responses of samples of practitioners, the most popular model of cost of equity estimation is CAPM, both in the US (Graham and Harvey, 2001) and in the Western Europe (Brounen, Jong and Koedijk, 2004). Corporations and analysts in the US and in the Western Europe vary in terms of what approach they apply when estimating the parameters in the cost of equity calculation (Graham and Harvey, 2001) or (Petersen, Plenborg and Scholler, 2006).

The goal of this paper is similar to that one of the studies just described: to investigate the cost of equity estimation in practice, to provide data on the popularity of individual cost of equity models and to provide evidence on what techniques are used for the estimation of parameters entering the models. Our approach is, however, distinguished from the approach adopted by the other studies. Compared to surveys, which measure believes rather than actions, our approach consists in direct analysis of cost of equity estimation instead of asking valuation practitioners on what they believe they do. Since the conclusions derived by our approach are potentially less biased in this respect, a greater objectivity is achieved.

As a source on information and data for our analysis, we use expert's opinions on company value as prepared by Czech valuation experts for the Commercial Code purposes. The Commercial Code defines several situations for which expert's opinion on a value of company is required and companies are obliged to disclose the expert's

opinions in the Commercial Register. In order to access the expert's opinions in large amount, we use a specifically developed program which generates information on the presence of expert opinions in the Commercial Register. The analysis of each of more than one thousand expert's opinions is then performed.

Empirical studies of the cost of equity estimation in practice are generally aimed at contributing to the discussion on and further development of cost of equity theory and its implications for practice. In the context of Czech expert's opinions, findings of our analysis can also contribute to the discussion related to the level of independence and expertise of Czech valuation experts. In general, experts and expert institutes entitled to perform valuation tasks for Commercial Code purposes can apply any approach to cost of equity estimation which they consider as the most appropriate. This situation as well as methods adopted by experts and expert institutes for cost of equity estimation have been denounced by various groups.[1] To the author's best knowledge, there has not been any thorough empirical analysis of cost of equity practices in the Czech Republic in recent years and our analysis is first of its type performed on the data included in the expert's opinions.

The remainder of the papers is structured as follows. In the second section we present a comprehensive overview of literature dealing with the issue of corporate finance practices of cost of equity estimation. Third section describes the research design and fourth section presents empirical results of the analysis.

[1] For instance, minority shareholders forced to sell their stakes in squeeze-out processes claim a damage of several CZK billions. They claim that the damage resulted from inappropriate valuation methods applied in expert's opinions, which are used to substantiate the compensation (OSMA, 2009). Their key objection refers to cost of capital models commonly used by the experts – they claim that apart from methodology, cost of equity models and parameters used in these models differ from one expert to another and that the resultant cost of equity is subject to experts' manipulation. However, similar claims are supported by poor empirical evidence, if any.

2. Existing Empirical Research

2.1 Cost of Equity Estimation Practices

Since William F. Sharpe wrote his doctoral thesis on what later Eugene Fama called the Capital Asset Pricing Model, there has been a vivid discussion among academia on the validity and appropriateness of the model. Meanwhile, practitioners started to apply CAPM in their day to day activities ranging from capital budgeting to M&A business valuations. A natural question followed. To what extent have professionals adopted the theoretical concepts developed by researchers? In order to investigate the behavior of finance practitioners and compare it to developments in finance theory, in other words to investigate the gap between what academic researchers tell finance practitioners to do and what practitioners really do, several surveys have been conducted. Below we present results of the key surveys on cost of capital estimation in practice. For details on surveys conducted in US and Canada, please refer to Table 1, and for details on surveys among European companies, see Table 2.

The first surveys, which were conducted in the early 80s, focused on US and Canadian firms and their corporate finance practice. Based on a survey conducted among US firms in 1980 by Gitman and Mercurio (1980), CAPM with 36% was the most popular method of cost of capital estimation. Yet, a similar percentage of surveyed practitioners, i.e., 32%, used also dividend discount model. 23% of respondents applied market return adjusted for risk, and E/P ratio and cost of debt adjusted for risk premium of equity was used by 16% and 13% of respondents, respectively.

In order to investigate developments of corporate finance practice in time, Gitman and Vandenberg (2000) replicated the survey seventeen years later and arrived at an almost twice as high percentage of practitioners relying on CAPM. In 1997, 65% of US firms applied CAPM as a method of cost of capital estimation. The increased popularity of CAPM was accompanied by a decrease in use of other techniques, namely the dividend discount model, the E/P ratio, and the market return adjusted for risk. The cost of debt plus a risk premium for equity was, besides CAPM, the only method which increased in popularity.

Table 1. Practices among the US and Canadian Firms

Authors	**Gitman and Mercurio (1980)**	**Gitman and Vandenberg (2000)**	**Bruner, *et al*. (1998)**	**Graham and Harvey (2001)**
Country	*US*	*US*	*US, Canada*	*US, Canada*
CAPM	36%	65%	81%	74%
CAPM including some other risk			4%	34%
APT		1%		
Market return adjusted for risk	23%	14%		
Average historical return				39%
Dividend discount model	32%	14%		16%
Investor expectations				14%
Regulatory decisions				7%
E/P ratio	16%	3%		
Cost of debt + risk premium for equity	13%	17%		
n.a.			15%	
Survey date	*1980*	*1997*	*1998*	*1999*
Sample size	*1,000*	*1,000*	*32*	*4,440*
Number of respondents	*177*	*111*	*27*	*392*
Response rate	*18%*	*11%*	*84%*	*9%*

Also Bruner, *et al*. (1998) showed that despite literature on asset pricing has been suggesting several drawbacks of CAPM, use of CAPM has grown substantially over time. In 1998 they conducted a telephone survey and found out that 81% of respondents used CAPM and 4% relied on CAPM including some other risk. Thus in comparison to Gitman and Mercurio (1980), the percentage of respondents relying on CAPM grew significantly. The comparison of Bruner, *et al*. (1998) findings with results of other studies may be, however, biased as only a small sample of the most financially sophisticated companies was used in their survey. Unlike Bruner, *et al*. (1998), Graham and Harvey (2001) based their analysis on a large sample of 4,440 US and Canadian firms and provided a more reliable evidence of the CAPM popularity. Based on their survey conducted in 1999, 74% of respondents relied on CAPM, 39% used average historical return and 34% used CAPM adjusted for some other risk.

Subsequently, researchers, curious whether existing insights into the finance practice hold also outside the North America, conducted surveys elsewhere as well. In

line with Graham and Harvey survey design, Brounen, *et al*. (2004) replicated the survey on a sample of 2,500 European companies. Out of 313 respondents, there were practitioners from UK, Netherlands, Germany and France. As in case of the US sample, the most popular approach to cost of capital estimation was CAPM. Graham and Harvey (2001) and Brounen, *et al*. (2004) results differ, however, in terms of the size of the CAPM dominance. While in case of the US and Canadian survey 74% of respondents relied on CAPM, in case of European companies only 43% of respondents used CAPM on average. Furthermore, when comparing survey results of the individual countries, German firms preferred investor expectations to CAPM. Except for UK, it was investor expectations which the surveyed companies viewed as the second mostly used approach. In line with the US and Canadian survey results, European firms relied frequently on average historical returns and CAPM including some other risk. Overall, Brounen, *et al*. (2004) provided evidence that despite the dominance of CAPM as an approach to cost of capital estimation among European companies, the approach is relied on by a smaller percentage of respondents than in case of US and Canada.

Table 2. Practices among European Firms

Authors	**McLaney, *et al.* (2004)**	**Brounen, *et al.* (2004)**				**Truong, *et al.* (2008)**
	UK	*UK*	*Netherlands*	*Germany*	*France*	*Australia*
CAPM	47%	47%	56%	34%	45%	72%
CAPM including some other risk		27%	15%	16%	30%	1%
APT						
Market return adjusted for risk						
Average historical return		31%	31%	18%	27%	11%
Dividend discount model	28%	10%	11%	10%	10%	9%
Investor expectations		19%	45%	39%	34%	
Regulatory decisions		16%	4%	0%	16%	4%
E/P ratio	27%					15%
Cost of debt + risk premium for equity						47%
Cost of debt						34%
Survey date	*1997*	*2003*	*2003*	*2003*	*2003*	*2004*
Sample size	*1,292*				*2,500*	*356*
Number of respondents	*193*	*68*	*52*	*132*	*61*	*87*
Response rate	*15%*				*13%*	*24%*

Another European survey was conducted on a sample of UK companies by McLaney, *et al*. (2004). The survey documented that 47% of 193 respondents relied on CAPM which is in line with results derived by Brounen, *et al*. (2004). Overall, European companies appear to prefer CAPM to other approaches to cost of capital estimation, yet to a lesser extent compared to their North American counterparts. There have been many surveys conducted outside the North America and Europe investigating the gap between practice and science in terms of cost of capital estimation. For instance, Truong et al. (2008) conducted a survey among Australian companies and found out that the most popular approach to cost of capital calculation is CAPM with 72% respondents applying it.

All the above mentioned surveys focused mostly on CEOs and CFOs of companies and their techniques to cost of capital estimation. However, there are also other practitioners who need to estimate cost of capital for other than capital budgeting purposes. These include for instance financial advisors, private equity investors or corporate financial investors.

As part of their survey of cost of capital practice, Bruner, *et al*. (1998) conducted also a survey of leading US financial advisors which indicated that CAPM is a dominating approach also among this group of practitioners. Based on the survey, 80% of 10 respondents relied on CAPM and 20% used other techniques including CAPM based ones. This result was in line with the findings based on a sample of US companies. Another survey was conducted by Block (1999) who surveyed 297 financial analysts out of which 31% viewed CAPM as very important or moderately important. Interestingly, 48% of respondents assessed CAPM as not very important and 21% viewed it as unimportant. This result contradicts the findings of Bruner, *et al.* (1998) which suggest high usage of CAPM among financial advisors.[2]

Cost of capital practice among European investors was investigated by Petersen, Plenborg and Scholler (2006). A survey of 42 respondents indicated a relative popularity of CAPM. 71% of surveyed private equity and corporate financial investors adopt CAPM

[2] Difference between the findings of these two surveys could be explained either by different target respondents (10 most active financial advisors in case of Bruner, et al. (1998) versus 297 financial analysts in case of Block (1999)) or by different sets of questions ("what is used" question in case of Bruner at al. (1998) versus "what is important" in case of Block (1999)). However, without detailed knowledge of the surveys design, we are not able to infer from the two surveys that one is more reliable than the other.

and 46% of respondents rely on their experience. Some respondents argued that "common sense approach" is appropriate for smaller firms where reliable beta estimates cannot be obtained easily. Peterson, Plenborg and Scholler (2006) conclude that despite the CAPM popularity, the difference between the two techniques remains insignificant.

Based on the surveys' overview, there is abundant empirical evidence that CAPM is the most popular method of the cost of equity estimation among firms, analysts and investors in the US, Canadian as well as Western European markets. Other commonly used methods include dividend discount model, market return adjusted for risk, average historical return, etc. Our hypothesis concerns the cost of equity estimation techniques among valuation experts.

Hypothesis: *Proportion of valuation experts using CAPM is higher than proportion of experts using other cost of equity estimation methods.*

2.2 Parameters of Cost of Equity Estimation

Based on the surveys as outlined above, we can conclude that CAPM is the most popular approach to cost of capital estimation among practitioners. However, it is not clear if it is applied correctly. In order to understand the way how practitioners derive cost of capital from CAPM, researches have included specific questions on inputs to CAPM. These include risk-free rate, beta and market risk premium estimates.

2.2.1 Risk-Free Rate, Beta Factor and Equity Risk Premium

Bruner, *et al*. (1998) provided evidence that both corporations and advisors in US and Canada preferred yields of long term Treasury bonds to yields of short term Treasury bills as a proxy for risk-free rates. As shown in Table 3, in case of beta estimates both corporations and advisors relied to large extent on a published source rather than own calculations and in case of market risk premiums some fixed rate was mostly chosen.

Table 3. Parameters of Cost of Equity Estimation

Parameters	Estimation					
Risk-free rate	*90-Treasury bill*	*10Y Treasury bond*	*20Y Treasury bonds*	*10-30Y Treasury bonds*	*30Y Treasury bonds*	*Other*
Corporations	4%	33%	4%	33%		26%
Advisors	10%			30%	40%	20%
Beta	*Published source*	*Self calculated*	*Fundamental beta*	*Advisor's estimate*	*Other*	
Corporations	52%	30%		3%	15%	
Advisors	40%	20%	30%		10%	
Risk premium	*Fixed rate*	*Arithmetic mean*	*Geometric mean*	*Arithmetic and geometric*	*Other*	
Corporations	44%	4%	4%	10%	38%	
Advisors	60%	10%			30%	

Source: Bruner, *et al*. (1998)

These finding are consistent with findings of a survey conducted by Truong, *et al*. (2008) on Australian companies in 2004: Australian companies also preferred long term bond yields as a proxy for risk-free rate and used mostly public sources for beta estimates.

2.2.2 Beta Factor in Case of Privately-Held Companies

Peterson, Plenborg and Scholler (2006) focused on inputs for CAPM estimation which are used by private equity and corporate financial investors in Denmark when valuing privately-held companies. Unlike in case of publicly traded companies, betas for privately-held companies cannot be derived from the market directly. Instead, practitioners need to estimate beta based on a peer group betas or using some other methods. Peterson, Plenborg and Scholler (2006) documented that peer group betas are mostly relied on. However, 56% of respondents also mentioned own experience as a way how to estimate betas and 32% derive betas based on fundamental drivers effecting operational and financial risk of a subject company. Since betas derived from a group of comparable companies do not reflect capital structure of a company subject to valuation, they need to be adjusted appropriately. However, 29% of respondents using peer group for beta estimation do not adjust beta for specific capital structure.

2.2.3 Unsystematic Risk

Since owners of privately-held companies are often not well-diversified investors, they should be compensated for some unsystematic risk which is not taken into account by CAPM. Peterson, Plenborg and Scholler (2006) found out that most respondents consider unsystematic risks as irrelevant and only few adjust the cost of capital derived by CAPM for these risks.

This finding is in line with results of Graham and Harvey (2001) and Brounen, *et al*. (2004) who documented a tendency to omit most specific risk factors among surveyed companies in US, Canada and Europe. These specific risk factors are sources of risk other than market risk and range from Fama and French (1991) fundamental factors and Chen, Roll and Ross (1986) economic forces to Jegadeesh and Titman (1993) momentum.

Table 4. Factors in Multibeta CAPM

	Discount rate	Cash flow	Both	Neither
Interest rate risk	15.3%	8.8%	24.7%	51.3%
Foreign exchange risk	10.8%	15.3%	18.8%	55.1%
GDP or business cycle risk	6.8%	18.8%	18.8%	55.6%
Risk of unexpected inflation	11.9%	14.5%	11.9%	61.8%
Size	14.6%	6.0%	13.4%	66.0%
Commodity price risk	2.9%	18.9%	10.9%	67.4%
Term structure risk	8.6%	3.7%	12.6%	75.2%
Distress risk	7.4%	6.3%	4.8%	81.5%
"Market to book" ratio	4.0%	2.0%	7.1%	86.9%
Momentum	3.4%	2.9%	4.9%	88.9%

Source: Graham and Harvey (2001)

Both Graham and Harvey (2001) and Brounen, *et al*. (2004) found that multibeta CAPM, which takes into account also other risks than market risk, is used by many companies. In case of Graham and Harvey (2001) multibeta CAPM was always or almost always used by more than 30% companies (compared to 74% using CAPM). The survey examined risk factors considered by respondents in the mutlibeta CAPM calculation and arrived at findings which are summarized in Table 4. Interest rate risk, size, inflation risk and foreign exchange rate risk are mostly considered by companies when adjusting cost

of capital. Some companies adjust cash flows rather than cost of capital. In that case, the adjustment is often related to commodity price risk, GDP or business cycle risk and foreign exchange risk. Only few companies responded that they take market to book ratio, momentum or distress risk into account as risk factors. Findings of the survey on European companies (Brounen, *et al*. 2004) are consistent with Graham and Harvey (2001) results.

2.3 Methodological note

In the studies described above, researchers have almost exclusively relied on survey-based analysis. As noted by Graham and Harvey (2001), survey approach well complements commonly used large sample studies and less common clinical studies. Application of large sample studies as well as clinical studies has its pros and cons. In case of both the types of empirical analysis, there is a trade-off between statistical power and detail of inference which is provided. While large sample studies are statistically powerful, they do not enable analysis at such a detailed level as clinical studies do. Clinical studies, on the contrary, have very little statistical power but due to qualitative questions are capable of revealing some unique aspects which would most probably be omitted by large sample studies.

Survey-based analysis thus strikes a happy medium. Graham and Harvey (2001) argue that survey can be designed in such a way that sample is of satisfactory size and at the same time qualitative questions are viable. However, even if this is the case, surveys are vulnerable to biases which may be hard to be mitigated. Commonly mentioned biases related to survey approach include selection bias or response bias. Selection bias[3] occurs when sample is not representative of the population and response bias is a result of flawed measurement techniques. Both the selection bias and the response bias can be mitigated to some extent. What cannot be fully mitigated is the very essence of the survey approach: survey-based analysis measures beliefs of respondents rather than their actions.

[3] Non-response bias is one example of selection biases and it appears to be a serious issue in case of the surveys described. Non-response bias occurs when respondents differ in some relevant way from the non-respondents. It can result from the lack of motivation and ability to respond and it can be mitigated by response rate maximization. Response rate in some cases of the cost of equity surveys does not exceed 10 per cent, implying that non-response rate can be a potential problem.

Even though the aim of the surveys on the cost of equity estimation practices is to shed light on what estimation techniques are used in practice, the surveys rather help to investigate what practitioners believe they use or they should use (which does not necessarily coincide with what they use in real).

3. Research Design

3.1 Methodology

We have designed a methodology which is distinguished from the previously applied approach. Given the limitations of survey approach, as discussed above, we develop a methodology design which better suits the needs of our analysis. The key merit of our methodology is that it addresses the practices as they were adopted rather than as they were claimed to be adopted. Instead of surveying finance practitioners and relying on what the respondents claim to do, we analyze what they really do. The population of valuation experts and expert institutes in the Czech Republic appears to be ideal for this purpose given the legal provisions regulating expert's opinions preparation. These provisions include the following:

1. Expert's opinions shall be filed with the registry of the Commercial Register;
2. Expert's opinions shall be publicly available;
3. Expert's opinions shall be filed electronically;
4. Description of valuation methods applied shall be part of an expert's opinion.

Put differently, due to disclosure requirements, electronic availability and required contents of expert's opinions, we can analyze cost of equity estimation practices of the Czech valuation experts by direct analysis of the expert's opinions. Therefore, beliefs versus actions problem present in survey technique is mitigated. In order to collect information on publicly available expert's opinions, we use a unique software program. Based on a sample of retrieved expert's opinions, estimation practices common among valuation experts are examined by analyzing each of the expert's opinions individually. Furthermore, several statistical tests are applied: namely test on difference between proportions and ordinary least squares test ('OLS'). The statistical computing is performed in the R software environment.

3.2 Data Sample

The access to the registry of the Commercial Register on the Ministry of Justice web pages is straightforward. Every single step necessary in order to retrieve a document belonging to a certain company is described in detail in the Appendix 4. Despite relative simplicity of retrieving a specific document, downloading documents regardless the companies they are filed with, based on the documents character only (e.g., annual report, financial statements, expert's opinion) is not possible. There is no list of expert's opinions filed in the Commercial Register and unless a name of a company is known, the registry is not much helpful in collecting a sample of appraisals. As a result, direct download of a sufficiently large sample of expert's opinions cannot be performed.

Instead, a specifically developed program is needed to be employed before the sample of expert's opinions is retrieved. Such a program would search the registry for entries on expert's opinions filings and would create a list of companies' identification numbers for which the filings were found. Programs of such type are today commonly used for various purposes, commercial as well as scientific ones. As an example, we can mention programs developed to collect online data on real estates prices. Such programs need to be tailored to the needs of every data search and as such are demanding in terms of time needed to be developed. For our purposes, however, we can build on a program which was originally developed for a study on disclosure discipline of companies in the Czech Republic (Tomis 2007).

3.2.1 Program Design

The program, as provided by Tomis (2007), is a software robot written in PHP scripting language.[4] The aim of the program is to search the electronic version of the Commercial Register, as available on the Ministry of Justice webste www.justice.cz, for information on documents filed in the registry. After some modifications this robot can be used for our analysis as well. In comparison with the original user, we search for information on the presence of certain filings in the Commercial register as a tool of our analysis rather than the ultimate aim of the analysis. Unlike the original user, who used

[4] Even though PHP is mainly suited for Web development, it can be used for other purposes as well.

the program to perform a quantitative analysis of the disclosure discipline in the Czech Republic, we are interested in cost of equity estimation methods used in the expert's opinions filed with the register. Hence, we adjust the program[5] accordingly and employ it in order to find information on which companies have filed the appraisals electronically.

3.2.2 Program Algorithm

The program replicates steps which would need to be taken by a casual user of the website www.justice.cz in order to find documents filed with a company's entry. The program requires its user to fill in three types of information:

1. Type 1 – company identification number;
2. Type 2 – year of registration;
3. Type 3 – key word.

In order to find the companies' identification numbers, we use Magnus dataset as a sample universe which covers both public and private companies in the Czech Republic. As it covers all business entities registered in the Czech Republic, it has almost half a million entries. Type two input information defines the range of years being examined, in our case period from 1993 to 2009 is considered. Type three input information relates to the very subject of our search. The Commercial Register files expert's opinions under various names. Based on a sample of randomly selected companies we identified a text string which is always present in expert opinion identification: "znal". Therefore, key word in our analysis is "znal".

3.2.3 Sampling Procedure

After retrieving the information related to the expert's opinions in the registry, a sample of expert's opinions may be created. The output of the program provides us with information regarding the documents being filed in the registry. Based on the information, e.g., the 0/1 information on the presence of the document in the registry, and given the identification number of a company with which the document is filed, we can start the downloading process. At this stage of the sample collection, information on the electronic conversion of documents facilitates the downloading process. Since we can

[5] In the process of program modification we were assisted by Mr. Yann Kowalczuk.

separate the converted documents from those which have not been converted yet, we can focus on downloading solely those documents relevant for our analysis, i.e. expert's opinions in the electronic form. Consequently, time needed for the downloading process is reduced substantially.

Expert's opinions are required for various purposes[6] and not necessarily relate to company valuation. For instance, in-kind contribution may be in form of a business unit but also in form of a set of certain tangible assets such as real estate. If that is the case, valuation methodology may differ in some aspects from the company valuation methodology subject to our analysis. Since our aim is to examine the common practice of Czech valuation experts in terms of cost of equity capital estimation in company valuation, our sample should not include expert's opinions with other than company valuation, such as real estate valuation.[7]

Neither should the sample consist of expert's opinions not using income approach to valuation. Based on the Commercial Code methods of valuation shall be described in the expert opinion. According to one interpretation of this provision, plural of the word "methods" implies that more than one method of valuation shall be used for the purpose of a legally required valuation. Given the three approaches to valuation (market, income and asset-based approach) and multitude of valuation methods within each of the approaches, it can be assumed that a significant part of the expert's opinions does not contain income method of valuation in which cost of equity would be estimated. As a result, sorting out just those expert's opinions which use cost of equity estimation can substantially reduce size of the resulting sample. Furthermore, it would be extremely time demanding.

Therefore, an assumption is formulated: solely expert's opinions with more than fifty pages are included in the sample. The rationale behind the assumption is as follows. Expert's opinions shall, as required by the Commercial Code, contain several pieces of information, e.g. macroeconomic analysis, industry analysis, company description, financial analysis, financial projections, methodology description, as well as documents,

[6] Expert's opinions shall be provided in certain situations, as specified by the Commercial Code No. 513/1991 Coll., the Transformation Code No. 125/2008 Coll., and the Mandatory Public Offer Code No. 104/2008 Coll.

[7] The sample should include, however, valuations of subjects which may not be a legal person but which may form separate cash generating unit for which financial plan can be prepared.

e.g., valuation expert certification, valuation expert appointment. Therefore, expert's opinions tend to be voluminous. This holds particular in case that subject of valuation is a company as a broad variety of information needs to be included.

In summary, out of the population of expert's opinions filed in the registry of the Commercial Code a sample of expert's opinions is drawn based on the following: expert's opinions included in the sample are in electronic form, have more than 50 pages and use income approach to company valuation. While the first two conditions can be assessed with help of the program output information, the third condition must be verified individually for every expert's opinion sorted out based on the first two conditions. In the next step, every expert opinion in the sample is analyzed and database containing information on the cost of equity estimation techniques as well as the valuation expert and the purpose of valuation is created.

3.3 Limitations

There are primarily two potential limitations of the methodology which we apply. The first limitation relates to the conversion process of documents filed in the registry. Firms in the Czech Republic have been legally required to provide the registry courts with electronic documents only since 1 January 2007[8]. Before that, documents could have been delivered to registration courts in hard copy format and since 1 July 2005 registration courts have been obliged to convert the newly as well as historically received documents into electronic format[9]. Given the insufficient capacity of registration courts, the conversion process has not been completed yet and there is still a significant number of documents which cannot be accessed online.

The second limitation is due to the poor disclosure discipline of companies in the Czech Republic. Despite the legally defined sanctions for companies not complying with

[8] Bill No. 562/2006 Coll.
[9] Code No. 216/2005

disclosure requirements[10], there is still a large percentage of companies not providing the required documents to respective registration courts[11].

The above mentioned facts imply that the sample of digitalized documents filed in the Commercial Register registry does not represent the whole population of documents which companies are required to disclose. Therefore, sample of expert's opinions used in our analysis represents only a part of the population of all expert's opinions prepared in the Czech Republic.

3.4 Descriptive Statistics

Based on the Magnus database we gathered information on all joint stock companies and limited liability companies registered in the Czech Republic. In total, our dataset includes approximately 340 thousand identification numbers and covers a period of 17 years (1993 to 2009). As a result, the program worked with more than 5.7 million entries to be checked.

Out of this amount of entries, 3,270 were evaluated as positive, meaning that expert's opinions were present in 3,270 cases. However, only 2,699 expert's opinions were in electronic form and thus only these were accessible to us. As defined above, we focused on expert's opinions with more than 50 pages only and based on this assumption we sorted out a sample of 1,031 expert's opinions. One by one, we read through the 1,031 expert's opinions and we selected 278 expert's opinions suitable for our analysis, i.e., legible expert's opinions using income approach to business valuation and containing relevant information. Table 5 gives us overview of the above described procedure.

Taking into consideration number of companies and number of valuation experts and expert institutes in the Czech Republic (as discussed above), the resulting sample

[10] Noncompliance with the disclosure requirements can be interpreted as an economic crime in accordance with Section 125 of the Criminal Law No. 140/1961 Coll. or a fine may be imposed based on Civil Procedure Code No. 99/1963 Coll.

[11] Both the lack of disclosure discipline and the incompleteness of digitalization process can be documented by findings of a study performed by Dun & Bradstreet (2007). According to the results, only less than one third of companies complied with the Commercial Code in a respective year between 2003 and 2006. Furthermore, digitalization of documents was investigated. Documents on economic results were available in electronic form only in case of less than one fifth of the companies in each respective year of the period. Given the change in legislature in 2007, it can be assumed that the digitalization of documents has improved since then at least in terms of the newly filed information.

seems to be rather small. This can be attributed to the poor disclosure discipline of companies registered in the Czech Republic and slow digitalization process of documents filed with the Commercial Register. On the other hand, out of total 256 business valuation experts and 82 business valuation expert institutes, our sample includes expert's opinions prepared by 105 experts and expert institutes which means, in terms of survey-based analyses, a relatively large response rate.

Table 5. Sampling Procedure

Statistics	Total
Companies (joint stock companies, limited liability companies)	340,440
Years	17
Entries checked	5,787,480
Identified expert's opinions	3,270
Digitalized expert's opinions	2,699
Expert's opinions with number of pages greater than 50	1,031
Expert's opinions using income approach*	**278****

*Cost of equity is used only in case of income approach to valuation. Therefore, only expert opinions using income method are selected.
** Excluding duplicates and illegible expert's opinions.
Source: Author, Magnus

Most expert's opinions in our sample come from the last three years, as documented by Figure 1. The oldest expert's opinion dates back to 1996 and the most recent one to 2009. The largest proportion of the sample falls into 2007 – 74 expert's opinions from this year have been analyzed. Almost 90% of the total sample is represented by expert's opinions prepared since 2004.[12] One third of expert's opinions in the sample were prepared for conversion of legal form and more than one fifth for in-kind contribution. Merger and division each are represented by more than 10% of the sample. Other purposes of expert's opinions each represented less than 10% of the sample.

Expert's opinions selected for the sample use income approach to company valuation. The income approach may include various valuation methods ranging from the

[12] The relatively low number of expert's opinions in our sample with year of origin before 2004 can be attributed to several potential factors. First, there might have been less activity in the market and less situations might have required expert's opinions. Second, disclosure discipline was lower resulting in lower percentage of expert's opinions filed with the Commercial Register. Third, digitalization process performed by registration courts is particularly slow in case of documents filed deeper in the history. Fourth, expert's opinions filed in the 1990's and early in the first decade of this century might have been in such a form which did not allow a full legibility of the digitalized files. Fifth, historically expert's opinions prevailingly applied other than income approaches.

DCF to income capitalization method, or residual income method. Based on the sample, majority of experts (73%) preferred DCF, followed by income capitalization method (26%). Use of other than these two income methods of valuation was insignificant. Less than 1% of experts used residual income method or income method in a combination with some other approach to valuation, e.g., asset based approach.

4. Empirical Results

4.1 Cost of Equity Estimation Practices

For the purpose of cost of equity estimation, CAPM (including CAPM based models adjusted for further risk premiums for unsystematic risk) was used by 52% of experts, 36.8% of experts applied build up method and only 11.2% relied on other than CAPM and build up models. These methods included the average of CAPM and build up method, own estimate, cost of debt adjusted for equity risk, interest rate on a bank deposit, or repo rate adjusted for risk.

In order to test whether CAPM is the preferred method of cost of equity estimation, we test whether the proportion of experts using CAPM compared to those using build up method and the proportion of experts using CAPM compared to those using other methods is higher. We employ the test on population proportion and arrive at the results presented in Table 6.

Table 6. Cost of Equity Models

Cost of equity models	Percentage of experts	*p-value*
CAPM	52.0%	
Build up	36.8%	
Other	11.2%	
Test on population proportion (CAPM vs. build up)		*0.04*
Test on population proportion (CAPM vs. other)		*<0.001*

Source: Author

Proportion of experts using CAPM is statistically significantly higher than proportion of experts using build up method (p-value=0.04). Proportion of experts using CAPM is statistically significantly higher than proportion of experts using other than build up methods (p-value<0.001). In other words, our **hypothesis** that CAPM is used by higher proportion of valuation experts compared to other methods of cost of equity estimation is confirmed. These results are consistent with surveys on cost of equity estimation practices as already discussed in previous sections. Also in case of American (Graham and Harvey, 2001) as well as European companies (Brounen, *et al*., 2004) and investors (Peterson, Plenborg and Scholler, 2006), CAPM appears to be preferred method

of cost of equity estimation. The same applies for surveys conducted on European investors, e.g., Peterson, Plenborg and Scholler (2006). However, unlike our results, findings of Peterson, Plenborg and Scholler (2006) do not show a significant difference between CAPM and other methods.

4.2 CAPM Parameters

4.2.1 Risk-Free Rate

As presented in Table 7, in most cases, yield of a government bond with maturity longer than 10 years was used as a risk-free rate (85.2% of observations). Long term government bond with maturity shorter than 10 years was used in 8.6% observations. In some cases, also short term rate PRIBOR or historical average of government bond yields were used.

Table 7. Risk-Free Rate

Bond maturity	Proportion
Longer than 10Y	85.2%
Long term shorter than 10Y	8.6%
Short term	2.5%
Historical long term	1.9%
na	1.9%

Source: Author

In line with most of the valuation literature, e.g., Koller, Goedhart and Wessels (2005), life span of a company subject to valuation should be matched with the maturity/duration of a bond used for risk-free estimation. From this reason, the longest term bonds available are recommended. Findings of our analysis suggest that in most cases this recommendation is followed. Similar evidence was provided by Bruner (1998) who showed that yields of the long term Treasury bonds were favored by US and Canadian corporations and advisors, yet to a lower extent compared to what is showed by our analysis.

As shown in Table 8, in case of 48.1% of observations Czech government bond yields were relied on, followed by US government bond yields with 37%. In some cases also German government bond yields or average of Czech and other government bond

yields was used. In other words, almost in half of the observations, Czech risk-free rate was applied which implies that local or some kind of hybrid CAPM models were used in these cases and that Czech bonds have been viewed as liquid enough to be used as a benchmark for risk-free rate.

Table 8. Risk-Free Rate Geographically

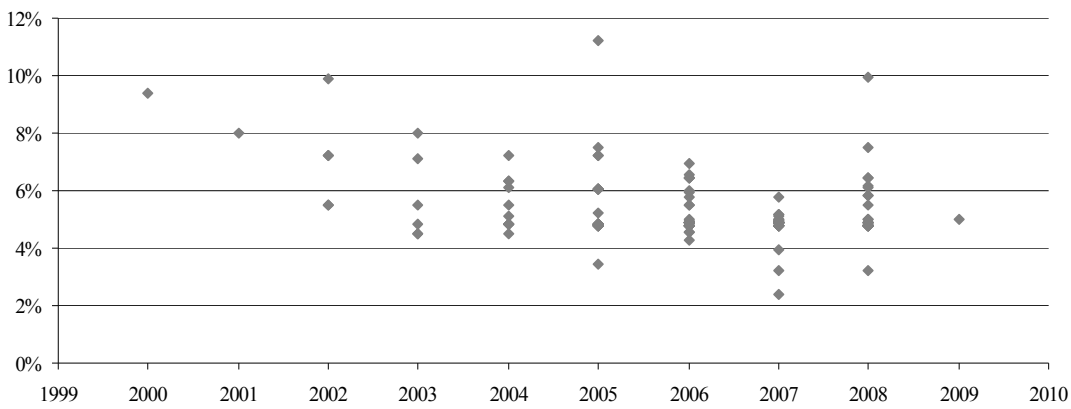
Country	Proportion
CZ	48.1%
US	37.0%
GE	11.1%
Average	1.9%
na	1.9%

Source: Author

4.2.2 Equity Risk Premium

Figure 2 gives us idea of what values equity risk premium in expert's opinions took on.

Figure 1. Equity Risk Premium in Time



Source: Author

As reported in Table 9, equity risk premium ranged from values as low as 2.4% to values as high as 11.2%. The average and median of values equaled to approximately 5%. This variation of equity risk premium is not surprising given the lack of consensus

regarding the appropriate way of its calculation[13] and the fact that equity risk premium is highly sensitive to inputs and methodology used in its estimation.

Table 9. Equity Risk Premium Descriptive Statistics

Equity risk premium	
Min	2.4%
Max	11.2%
Median	4.9%
Average	5.3%
Standard deviation	1.1%

Source: Author

Table 10 reveals that 66% of observed equity risk premiums were computed as geometric average, and only 8% of the observed premiums were derived as arithmetic average. In 26% of observations expert's opinions did not mention the method of averaging. The prevailing application of geometric average is in contrast with findings of Bruner (1998) who reported equal or higher use of arithmetic average by US and Canadian respondents.

Table 10. Method Of Averaging Of Historical Equity Risk Premium

Method of averaging	Proportion
Arithmetic	8%
Geometric	66%
na	26%

Source: Author

Given the character of the Czech stock exchange, it is not surprising that apart from few cases when equity risk premium was estimated by an expert as a guess, most values represent historical equity risk premiums estimated on the US data. The expert's opinions quoted two sources of information on the equity risk premium: Damodaran and Ibbotson. Usually, the longest period of data available was used. Only in case of 7% of observations, which included information on time period covered, shorter period was used. In few cases, instead of a single number, equity risk premiums for different periods were taken and then averaged.

[13] For an overview of equity risk premium calculation, please refer to Ibbotson and Chen (2001).

4.2.3 Beta

Given the character of companies subject to valuation in our sample, i.e. not publicly traded companies, it is not surprising that mostly industry beta was relied on (76% of expert opinions). In 8% of cases beta was derived from company specific factors including operational and financial risk or sensitivity to cycle and proportion of fixed assets. Average of industry betas was used in 7% and other methods such as professional guess in 8% of cases. For overview of the methods used for beta estimation, see Table 11.

Table 11. Methods of Beta Estimation

Beta	Proportion
Industry beta	76%
Risk factors based beta	8%
Average of industry betas	7%
Other	8%

Source: Author

Industry betas were taken from Damodaran, only exceptionally other sources of data occurred (these include Ibbotson and Bloomberg). Only in few cases individual companies of the industry peer group were listed. In all cases, beta was unlevered and then relevered in order to reflect specific capital structure of a company subject to valuation. Average of industry betas included averages of different betas for different industries in case no single industry beta was deemed appropriate by the expert. Also, industry betas were taken from different markets (i.e., US, Europe, emerging markets), depending on availability of relevant data.

In order to compare our results with the findings of previous research, only the analysis of Peterson, Plenborg and Scholler (2006) can be referred to as it is the only analysis focusing on the aspects of valuation of privately-held companies. Also Peterson, Plenborg and Scholler (2006) documented the preference of industry beta rather than risk factors based beta. However, they also reported that 29% respondents did not adjust betas for specific capital structure, which is in contrast with our findings that experts always considered relevering of beta in their valuations.

4.2.4 Country Risk Premium

Results of our analysis, as reported in Table 12, show that CAPM equation was adjusted for country risk premium in 93% of CAPM applications. The adjustment was mostly (in 94% of cases) performed in line with the combined approach to country risk premium as described by Damodaran (2003): both the bond default spread and the relative equity market standard deviation were applied. Mostly, the values were taken from Damodaran.

Table 12. Country Risk Premium

Application of country risk premium	Proportion
CAPM without CRP	7%
CAPM with CRP	93%
CRP as individual component	*66%*
CRP multiplied with beta	*34%*

Source: Author

It is also interesting to address the question of how the country risk premium was accounted for. In 66% of observations, the country risk premium was applied as an individual component of the cost of equity equation. This implies that assumption of equal exposure to country risk across companies was adopted. On the other hand, in 34% of cases, exposure to country risk was presumed to be proportional to exposure to the other market risk and country risk premium was multiplied by beta. The choice of whether to use country risk premium as a separate component of cost of equity or whether to multiply it with beta, can have a significant affect on the value of resultant cost of equity. This holds particularly in case that the beta takes on a value significantly different from one. Therefore, our results suggest that cost of equity for companies of comparable characteristics can vary across experts given the different approaches to country risk premium application in CAPM model.

4.2.5 Size Premium

Size premium was used in almost 40% of observations. As reported in Table 13, the value of size premium ranged from 0.1% to 13% with median near average equal to 3%. In 36% cases Ibbotson was quoted as a source of the size premium applied, in the

rest of cases own estimate was relied on. Given the lack of data on size premiums in local market, it is not surprising that in majority of cases own estimate based on experience of the expert or some benchmark chosen by the expert was used. As a result, however, size premium applied is rather subjective in nature. In other words, applied size premiums for companies of comparable size can vary from one expert to another as majority of experts do rely on own estimate.

Table 13. Size Premium Descriptive Statistics

Size premium	
Min	0.1%
Max	13.0%
Median	3.0%
Average	3.1%
Standard deviation	2.1%

Source: Author

4.2.6 Specific Premium

Specific premium was used in case of 39% of CAPM applications. Specific premium ranged from 0.4% to 16.1% with mean equal to 3.5%, as shown in Table 14. Specific premium was in all expert's opinions estimated based on qualitative analysis including industry risk, management risk, leverage risk, etc.

Table 14. Specific Premium Descriptive Statistics

Specific premium	
Min	0.4%
Max	16.1%
Median	3.0%
Average	3.5%
Standard deviation	2.6%

Source: Author

4.2.7 Premium for Lack of Liquidity

In 22% of expert opinions applying CAPM, premium for lack of liquidity was reflected. As reported in Table 15, lack of liquidity premium ranged from minus 3% to 3.5% with median equal to 1%. Premium for lack of liquidity was in all cases based on expert's estimate and in fact it meant premium for risk related to different factors, e.g., experts applied this premium for illiquidity of shares subject to valuation or illiquidity of

market. In other words, premium for lack of liquidity is highly qualitative in nature and experts apply it referring to different sources of risk. Furthermore, application of the premium for lack of liquidity to cost of equity is rather controversial and it is recommended to reflect illiquidity as a direct discount from the company value rather than in the cost of equity estimation (Pratt, 2002).

Table 15. Lack of Liquidity Premium Descriptive Statistics

Lack of liquidity premium	
Min	-3.0%
Max	3.5%
Median	1.0%
Average	1.5%
Standard deviation	1.2%

Source: Author

4.3 Summary of Empirical Results

We confirmed the hypothesis that CAPM is used by higher proportion of valuation experts compared to other methods of cost of equity estimation Table 16 presents an overview of the specifics of the CAPM parameters estimation as documented by the analysis.

Table 16. Parameters CAPM estimation

Risk-free rate					
Country	*CR*	*US*	*GE*	*Average*	*na*
Percent of experts	48.1%	37.0%	11.1%	1.9%	1.9%
Bond maturity	***> 10Y***	***1Y to 10Y***	***< 1Y***	***Historical long term***	***na***
Percent of experts	85.2%	8.6%	2.5%	1.9%	1.9%
Equity risk premium					
Method of averaging	***Arithmetic***	***Geometric***	***na***		
Percent of experts	7.6%	65.9%	26.5%		
Beta					
Method of estimation	***Industry beta***	***Risk factors based beta***	***Average of industry betas***	***Other***	
Percent of experts	76.3%	8.3%	7.1%	8.3%	
Risk premiums for unsystematic risk					
Application of premiums	***Country risk premium***	***Size premium***	***Specific premium***	***Premium for lack of liquidity***	
Percent of experts	92.5%	39.8%	38.5%	22.4%	

Source: Author

5. Conclusions

The aim of this paper is to shed light on the cost of equity estimation in practice. For this purpose, we examine the cost of equity estimation techniques used by valuation experts in the Czech Republic. By application of a specifically developed program, we obtain a unique dataset of cost of equity values, estimation methods and parameters as used by valuation experts in the Czech Republic in the period between 1997 and 2009. We analyze how parameters entering the cost of equity calculation are estimated.

Our findings suggest that the most popular model used for cost of equity estimation is CAPM (including CAPM with additional risk premiums for unsystematic risk). While CAPM was used by 52% of valuation experts, the second most popular model, the build up model, was used by 36.8% of valuation experts. Other cost of equity models were used only marginally. This finding is in line with previous research which also documents the prevailing use of CAPM. The hypothesis that CAPM is used by higher proportion of valuation experts compared to other methods of cost of equity estimation is confirmed.

Our analysis also investigates the individual parameters entering the cost of equity estimation, particularly CAPM. Consistent with previous research, the risk-free rate used in CAPM was mostly based on long term bond, either of the domestic or foreign government. The equity risk premium was estimated by the historical method on the US data. Valuation experts in the Czech Republic prevailingly preferred the geometric average. This finding is in contrast to previous research which provides evidence of the lack of consensus among practitioners with respect to which method of averaging should be used. In terms of beta factor, valuation experts mostly relied on industry beta. This finding is consistent with results of other research focusing on valuation of privately-held companies. Risk factor based beta, which is rather qualitative in nature, was applied by substantially less valuation experts.

Subsequently, we examine the risk premiums for unsystematic risk used in the cost of equity estimation by CAPM. CAPM is generally perceived as less vulnerable to manipulation compared to the heuristic build up model, however, once risk premiums for unsystematic risks are added to the CAPM calculation, a substantial part of CAPM can

become qualitative in nature rather than market based. The risk premiums, e.g. country risk premium, size premium, specific premium or premium for lack of liquidity, are the most common risk premiums used by the valuation experts.

We find evidence that there is a relative consensus whether country risk premium should be applied or not. Even though 93% of valuation experts used country risk premium, they chose different methods of how to account for it in the CAPM equation. Almost 40% of valuation experts applied size premium and specific premium, both of which were mostly based on the best guess of valuation expert. Almost quarter of valuation experts used risk premium for lack of liquidity, although valuation literature considers the application of this premium as controversial and recommends adjustments of a company value rather than cost of equity.

Overall, we document that the cost of equity estimation techniques applied by Czech valuation experts are in most points consistent with practice prevailing on the US and Western European markets as shown by previous research. As well as the US and Western European finance practitioners, the Czech valuation experts mostly rely on CAPM adjusted for unsystematic risks. Czech valuation experts often apply risk premiums for unsystematic risk which are qualitative in nature and to large extent depend on an expert's own experience.

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