Methods for Risk Measurement of Start-Up Firms in the Conditions of Emerging Capital Markets

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Abstract

The aim of this paper is to offer the know-how for quantifying risk, which may reflect the restrictions faced by investors in the conditions of emerging capital markets when they start up a new company. The theoretically suitable risk measurement techniques are subject to empirical testing with finding that methods on financial basis outperform those on the market basis and that the level of risk of the respective companies is particularly dependent on the combined level of operating and financial leverage. This result allowed for the construction of a new risk-quantifying technique for investors with low capital diversification, zero entrepreneurial history and access to capital market data with low information content.[3]

Keywords

Risk measurement, start-up business, emerging capital markets, degree of operating leverage, degree of financial leverage

JEL code

M21, G12

INTRODUCTION

The reason for choosing the subject of quantifying risk and the impact thereof on discount rates for start-up companies subsisted in the repeated occurrence of limits which confront users of traditional techniques for estimating the costs of capital of newly established businesses in the conditions of emerging capital markets. These specific conditions reduce the range of risk measurement techniques due to low information content of market data, zero entrepreneurial history of the new-born firms and low capital diversification of investors.

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Methods for quantifying risk can be divided into two groups, their main difference being the information that they are based on. Either is their basis a comprehensive capital market information, or they use the information from the companies' financial system. The flagship of capital market based techniques is Capital Asset Prising Model. Sharpe (1964) and Lintner (1965) with all coefficient beta modifications (beta on the historical basis, beta determined by analogy (Damodaran, 2009), beta determined by multicriterial correlation analysis (Fama and French, 2012; Womack and Zhang, 2003), followed by Arbitrage Pricing Theory (Ross, 1976), Derivation from the interest rate and Dividend model (Gordon, 1959). The financial techniques are represented especially by Modular model (e.g. Mařík, 2011), Method of Security Equivalents (Ballwieser, 2004), Capital Asset Pricing Model with beta on financial basis (again with different coefficient beta modifications – based on accounting return (e.g. Hill and Stone, 1980), or based on business risk fundamentals (e.g. Li and Henderson, 1991; or Toms, 2012).

The reliability of individual methods for risk quantification depends on factors that characterise the environment where these methods are used. The target group of firms for our research are start-up companies in the conditions of emerging capital markets. The character of the capital market, as well as the character of the newness of the studied sample of firms and undiversified investors, lead to the creation of several limiting factors that prevent the application of a large portion of commonly-used methods The restrictions ensuing from the character of the emerging capital markets and the character of start-up companies affecting the use of methods for quantifying risk can be summarised in the following points:

- lack of reliable data from capital markets,
- lack of any financial history for start-up companies,
- low level of diversification of investors.

The conducted research on risk measurement techniques under these specific conditions is limited. There exist several studies focusing on businesses in particular specific conditions, but their mix is rare.

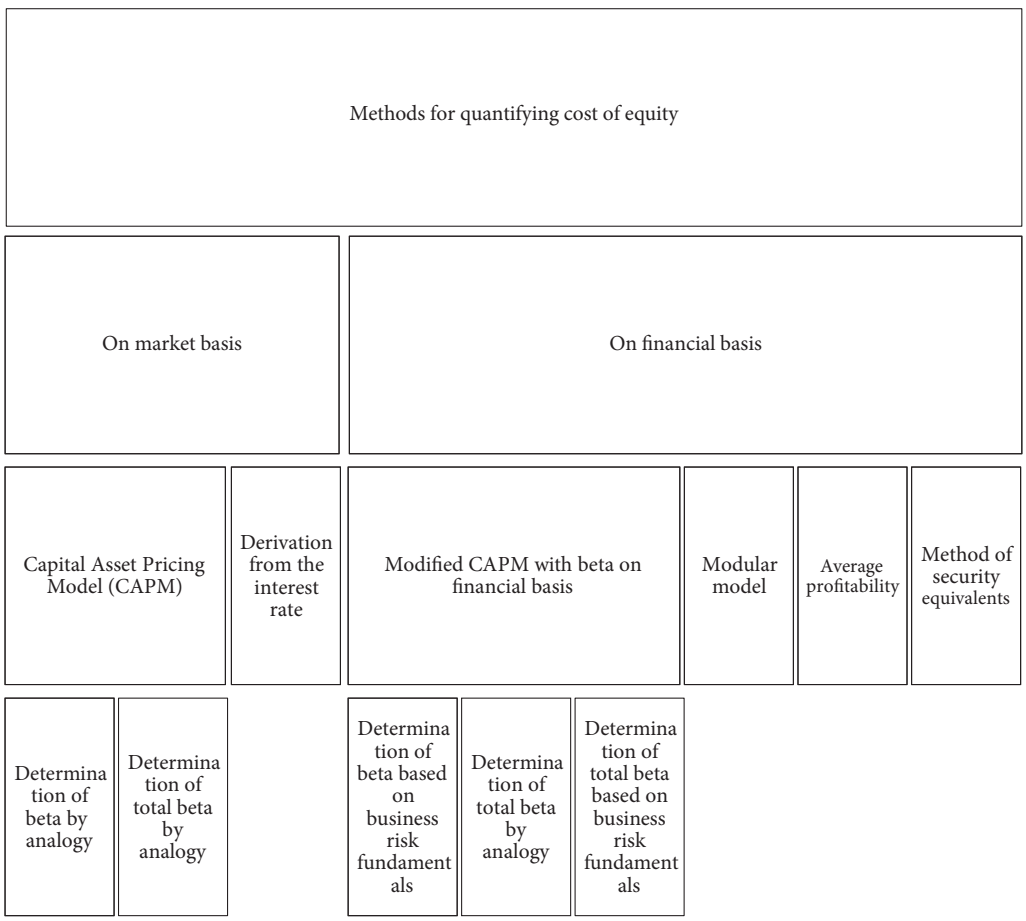
The most frequent limit, that bothers the risk measurement techniques´ applicants, is connected with the capital market imperfections and low data reliability. This is withal the area with the most intensive research. Harvey (1995) in an early research paper finds that in the emerging markets the betas are very low, which underpriceds required returns. Godfrey and Espinosa (1996) propose an adjusted CAPM, where the adjustment can be made by adjusting either beta or risk free rate. Bekaert and Harvey (1995) propose an alternative approach, where the cost of capital is allowed to vary, or to change over time in accordance with the level of market integration. Estrada (2000) proposes adjusting CAPM with downside risk methodology using the semi-standard deviation. Damodaran (2011) suggests to calculate beta using the global market index, which assumes fully integrated markets.

The risk measurement in the start-up phase of a business has attracted the interest of many researchers. Wuermseherb and Cattaneoc (2013) claim that limits resulting from the newness of these firms present an obstacle for the application of the basic forms the modified CAPM, constructed on both market and financial basis. Both forms are built on a regression analysis of return development in the studied company and relevant group of firms. Given that the profitability development of the given project during the last period is unknown, it is not possible to do a regression analysis and so identify the beta coefficient. Damodaran (2009) suggests allowing for a certain degree of generalisation, to eliminate this deficiency via the use of an analogous beta coefficient, i.e. the beta coefficient of an analogous. Baker and English (2011) report that the character of the newness also eliminates the Arbitrage Pricing Theory (APT), which is based on an analysis of the relationship between the profitability development of the given title and the relevant macro-economical quantities. Given the non-existent history of the assessed investment projects, it is impossible to apply this technique. Another method belonging to the market-based group, which is unable to reflect the limits of a non-existent history of this group of companies, is the dividend model. This model's construction is intuitively very straightforward, but it is very exacting on the quality of input data. Garrett and Priestley (2012) claim that discount rate quantification here

is based on estimating the dividend development growth amount and rate, which, as a rule, is based on current company dividend policies. Given these companies' non-existent economic-activity history, this information is unknown when they start up in business and therefore a qualified estimate is impossible.

Another significant specific is the fact that start-up companies' capital is usually in the investors' hands, for whom this investment presents their only, or at least their predominant, personal investment. Analysis of capital structures showed (e.g. Gallo and Vilaseca, 1996) that start-up businesses have low debt-equity levels. This is also in accordance with findings of Chmelíková and Somerlíková (2014) who concluded that 90% of own capital is made up of internal sources. Only 10% comes into start-up companies from external investors, who are usually individual investors (business angels) or investment companies. Both these groups present a type of an investor whose investment capital is usually effectively diversified and it is mainly the systematic part of the risk that is relevant to his decision-making. However, for the prevalent type of investor shares in their own capital are complicated by a low, and in many cases non-existent, diversification of their capital sources. Seeing as a low diversification of their capital may

Figure 1 Methods usable for the quantification of discount rates for start-up companies after a reflection of market limits, a non-existent history and the specifics of non-diversified investors



Source: Own processing

be presumed with this type of an investor, it is necessary to look for methods which produce a quantification of the overall risk, not just of its systematic parts. According to McConaquahy (2008) when quantifying the capital costs of an investment that is not part of a perfectly diversified portfolio, or is in fact held independently, it is necessary to take into account the influence of company-specific factors and reflect them into the required capital costs.

Figure 1 shows an overview of suitable methods for the quantification of the discount rate for the target group of firms –companies who are starting up in the conditions of emerging capital markets.

The aim of this paper is therefore to offer a technique for quantifying risk which can reflect the above-mentioned limits of the target group of companies – the newly established businesses operating in the conditions of developing capital markets.

1 EMPIRICAL VERIFICATION OF RELEVANT TECHNIQUES

1.1 Methods and data

Partial aim of this part is to subject individual relevant (from a theoretical point of view) techniques to an empirical test, which is to verify their practical abilities in the specific conditions of the economy with emerging capital market. Verification is performed on a number of newly established companies in the Czech Republic. Individual techniques are applied retrospectively to a group of specific start-up companies in the Czech Republic resulting in the relevant risk scale at a given moment and using a given technique. This result is then confronted with the real development of the selected start-up companies after the risk evaluation date. The resulting confrontation between the real development after the chosen technique application date and the risk scale values discovered via chosen methods then offers an effective tool for evaluating the effectiveness of individual techniques.

Previous research (e.g. Chmelíková and Somerlíková, 2018) has identified that fluctuation in return to equity (Free Cash Flow to Equity – *FCFE*) is statically significantly associated with high probability of decline and hence serves as an appropriate measure of total riskiness. A retrospective approach based on the retrospective assessment of techniques has been chosen to evaluate the individual techniques devised to quantify risk. In view of the extent of databases available (especially considering the structure of the electronic database of financial statements for Czech companies), the development in *FCFE* can be observed and its fluctuation over a fixed time period in the past, for which the resulting figures are known for the degree of risk as measured by the individual techniques. Because of the mutual comparability of the observed companies and the ability to characterise the average fluctuation of a whole industry, for every company the standard deviation has been relativized by conversion to a coefficient of variation of *FCFE* variation in accordance with Formula (1).

Coefficient of variation of *FCFE* for firm *i*:

$$Coefficient\ of\ variation\ of\ FCFE_i = \frac{\sigma_i}{\mu_i}, \tag{1}$$

where σ_i stands for standard deviation of financial return of a firm *i* in the 4-year time after inception and μ_i represents mean of this variable for the firm *i*.

The reliability of the estimate of probable future risk can therefore be confronted with the actual development after a given point in time.

This empirical test will only be subject to methods which theoretically reflect the limits of the start-up company`s particular character. The theoretical discussion on the ability of individual techniques to incorporate the specifics of new firms in the conditions of emerging capital markets has already been covered in previous part of the paper, resulting in the methods shown in Figure 1. Its empirical evaluation will use the same structure as in Figure 1. The analysis of firm and sector specific variables is based on the data published by Bisnode in the corporate database Albertina – Gold Edition (Bisnode Czech Republic,

2012). 2008 has been chosen as the starting year for evaluating the individual techniques from when the development in *FCFE* has been monitored. The accounts data of all newly-established companies in 2008 to publish their financial statements until 2011 inclusive has been used to calculate the variation coefficient *FCFE* for the individual sections of NACE.[4] There were 2 546 companies incorporated into the researched sample that included newly established firms in the Czech Republic. In contrast to Chmelíková (2014), the weighted average of coefficients of variation for individual NACE sections was used. The weights for particular companies were calculated according to the following formula:

$$w_i = \frac{Total\ Assets_i}{Total\ Assets\ in\ the\ sector}, \tag{2}$$

where $Total\ Assets_i$ stand for total assets of firm *i* in the year of inception and *Total Assets in the sector* represent the sum of *Total assets* of all firms in the respective NACE sector. The figures for the weighted average variation coefficients of *FCFE* for the individual sections of NACE are shown in Table 1.

The table includes the values for the total beta coefficient for CAPM models based on both the market and finance for the beginning of 2008. A mutation of the technique is being considered for both alternatives with an analogical beta coefficient. For the market-based CAPM model, this alternative is necessary especially in the environment of local capital markets, while for finance-based CAPM due to the newness of the company research sample. In order to evaluate the effectiveness of market-based CAPM, the risk coefficient for total beta has been chosen for the European capital market and was taken from the database: The Data Page, Damodaran Online (Damodaran, 2013). In order to evaluate finance-based CAPM, the coefficients of total beta were calculated in the population of existing companies for each company individually as per following formula:

$$Total\beta = \frac{\frac{\mathrm{cov}(ROE_j, ROE_m)}{\sigma^2(ROE_m)}}{\frac{\mathrm{cov}(ROE_j, ROE_m)}{\sigma(ROE_m)\sigma(ROEj)}} = \frac{\sigma(ROE_j)}{\sigma(ROE_m)}, \tag{3}$$

where $cov(ROE_j, ROE_m)$ is the covariance between return on equity of the business j and average market return on equity in the 4-years period before 2008, $\sigma^2(ROE_m)$ is the dispersion of market returns on equity in the 4-years period before 2008, $\sigma(ROEm)$ is the standard deviation of market earnings

Table 1 The values of average total beta coefficients based on the market and finance for the individual sections of economic activity in 2007 (January 2008) and the fluctuation in weighted average coefficient of variation of FCFE for companies established in 2008 in the Czech Republic

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
01	Crop and animal production, hunting and related service activities	3.49	3.586	0.456
02	Forestry and logging	3.27	4.164	0.166

[4] Nomenclature statistique des activités économiques dans la Communauté européenne.

Table 1 (continuation)

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
03	Fishing and aquaculture	N/A	3.049	N/A
05	Mining of coal and lignite	3.11	4.294	0.347
06	Extraction of crude petroleum and natural gas	5.48	4.102	N/A
07	Mining of metal ores	4.48	3.656	N/A
08	Other mining and quarrying	4.67	4.739	0.412
09	Mining support service activities	N/A	4.721	0.376
10	Manufacture of food products	2.89	4.519	0.506
11	Manufacture of beverages	2.63	4.123	0.323
12	Manufacture of tobacco products	1.60	N/A	N/A
13	Manufacture of textiles	3.52	3.033	0.499
14	Manufacture of wearing apparel	3.60	3.870	0.313
15	Manufacture of leather and related products	2.24	3.245	0.167
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3.13	2.447	0.294
17	Manufacture of paper and paper products	3.25	3.247	0.223
18	Printing and reproduction of recorded media	N/A	2.300	0.094

Table 1 (continuation)

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
19	Manufacture of coke and refined petroleum products	2.20	4.250	N/A
20	Manufacture of chemicals and chemical products	3.40	4.998	0.203
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	2.78	3.711	N/A
22	Manufacture of rubber and plastic products	2.79	4.678	0.463
23	Manufacture of other non-metallic mineral products	N/A	4.934	0.485
24	Manufacture of basic metals	4,72	4.171	0.318
25	Manufacture of fabricated metal products, except machinery and equipment	4.39	3.649	0.131
26	Manufacture of computer, electronic and optical products	4.00	3.716	0.186
27	Manufacture of electrical equipment	2.16	3.105	0.218
28	Manufacture of machinery and equipment n.e.c.	3.08	3.871	0.291
29	Manufacture of motor vehicles, trailers and semi-trailers	3.51	4.147	0.428
30	Manufacture of other transport equipment	3.82	4.399	0.360
31	Manufacture of furniture	4.33	3.532	0.258
32	Other manufacturing	N/A	4.295	0.332
33	Repair and installation of machinery and equipment	N/A	1.982	0.010
35	Electricity, gas, steam and air conditioning supply	2.84	2.851	0.201
36	Water collection, treatment and supply	N/A	4.255	0.327

Table 1 (continuation)

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
37	Sewerage	3.46	3.647	0.097
38	Waste collection, treatment and disposal activities; materials recovery	3.33	4.255	0.251
39	Remediation activities and other waste management services	3.55	4.180	0.326
41	Construction of buildings	3.93	4.057	0.336
42	Civil engineering	2.20	2.497	0.111
43	Specialised construction activities	2.94	3.800	0.312
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	3.53	3.248	0.201
46	Wholesale trade, except of motor vehicles and motorcycles	3.43	3.347	0.191
47	Retail trade, except of motor vehicles and motorcycles	2.97	3.809	0.389
49	Land transport and transport via pipelines	3.32	3.702	0.302
50	Water transport	2.48	2.178	0.026
51	Air transport	2.67	3.321	0.365
52	Warehousing and support activities for transportation	3.09	3.826	0.411
53	Postal and courier activities	N/A	3.752	0.359
55	Accommodation	3.31	3.122	0.244
56	Food and beverage service activities	2.95	3.642	0.398
58	Publishing activities	3.42	2.464	0.124

Table 1 (continuation)

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
59	Motion picture, video and television programme production, sound recording and music publishing activities	3.64	3.236	N/A
60	Programming and broadcasting activities	3.58	3.966	N/A
61	Telecommunications	2.14	3.173	0.314
62	Computer programming, consultancy and related activities	3.99	3.407	0.319
63	Information service activities	3.20	3.061	0.204
64	Financial service activities, except insurance and pension funding	3.41	4.819	0.483
65	Insurance, reinsurance and pension funding, except compulsory social security	3.38	N/A	N/A
66	Activities auxiliary to financial services and insurance activities	4.62	3.430	0.402
68	Real estate activities	3.76	2.909	0.337
69	Legal and accounting activities	3.03	4.037	0.397
70	Activities of head offices; management consultancy activities	3.21	3.399	0.132
71	Architectural and engineering activities; technical testing and analysis	3.40	2.061	0.091
72	Scientific research and development	2.76	3.660	0.459
73	Advertising and market research	3.93	3.809	0.399
74	Other professional, scientific and technical activities	N/A	2.763	0.116
75	Veterinary activities	N/A	2.563	0.090
77	Rental and leasing activities	N/A	3.979	0.285

Table 1 (continuation)

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
78	Employment activities	N/A	3.542	0.276
79	Travel agency, tour operator and other reservation service and related activities	N/A	3.146	0.262
80	Security and investigation activities	N/A	2.651	0.148
81	Services to buildings and landscape activities	2.97	4.954	0.167
82	Office administrative, office support and other business support activities	3.12	4.534	0.054
84	Public administration and defence; compulsory social security	N/A	2.706	N/A
85	Education	3.91	4.649	0.301
86	Human health activities	3.44	2.561	0.440
87	Residential care activities	2.99	2.852	N/A
88	Social work activities without accommodation	3.27	3.051	0.164
90	Creative, arts and entertainment activities	3.59	1.972	0.095
91	Libraries, archives, museums and other cultural activities	N/A		0.000
92	Gambling and betting activities	3.34	1.896	0.086
93	Sports activities and amusement and recreation activities	3.23	2.019	0.159
94	Activities of membership organisations	N/A	2.810	0.315
95	Repair of computers and personal and household goods	2.69	4.447	0.316
96	Other personal service activities	N/A	3.588	0.376

Table 1 (continuation)

NACE code	Description	Coefficient total market BETA – Europe 2008	Coefficient total financial BETA – Czech Republic 2008	Weighted average coefficient of variation of FCFE of businesses newly born in 2008
97	Activities of households as employers of domestic personnel	N/A	N/A	N/A
98	Undifferentiated goods- and services-producing activities of private households for own use	3.27	N/A	N/A
99	Activities of extraterritorial organisations and bodies	N/A	N/A	N/A

Note: N/A – not available data.
Source: Own calculation based on data from: <*http://pages.stern.nyu.edu/~adamodar*> (Damodaran, 2013) and Albertina (Bisnode, 2012)

and $\sigma(ROEj)$ is the standard deviation of business´s return on equity both in the 4-years period before 2008. The individual sections are then characterised by the simple arithmetic mean for all the total beta coefficients. The figures shown in the Table 1 represent the average figures of beta coefficients for the individual sections of NACE in the population of all companies in the Czech Republic which published their financial statements in 2004, 2005, 2006 and 2007 in a row.

1.2 Results

A regression analysis has been used as the method to analyse the relationship between FCFE fluctuation for newly-established companies in 2008 and the risk scales for market- and finance-based total beta. First, the normality of the individual files of data was verified, both by using the Kolmogorov-Smirnov normality test and based on a normal probability plot. This was then subject to two regression analyses on the following variables:

- average coefficient of variation of *FCFE* (*VCoFCEF*) companies established in 2004 as independent variable and
- dependant variable *Total Market Beta* (*TMB*).

All variables, including a description of the measures used and their descriptive statistics, are summarized in Table 2.

Table 2 Variable description and summary statistics for Total Market Beta analysis

Variable	Abbreviation	Mean	SD	Min	Max	N
Dependent Variable						
Total Market Beta	*TMB*	3.3567	0.5884	2.14	4.89	58
Independent Variable						
Variation Coefficient of Free Cash Flow to Equity	*VCoFCEF*	0.2787	0.1254	0.0255	0.5059	58

Source: Own calculation based on data from: <*http://pages.stern.nyu.edu/~adamodar*> and Albertina

And

- average coefficient of variation of *FCFE* (*VCoFCEF*) companies established in 2004 as independent variable and
- dependant variable *Total Financial Beta* (*TFB*).

All variables, including a description of the measures used and their descriptive statistics, are summarized in Table 3.

Table 3 Variable description and summary statistics for Total Financial Beta analysis

Variable	Abbreviation	Mean	SD	Min	Max	N
Dependent Variable						
Total Financial Beta	*TFB*	3.5426	0.8115	1.896	4.998	73
Independent Variable						
Variation Coefficient of Free Cash Flow to Equity	*VCoFCEF*	0.2742	0.1266	0.0102	0.5059	73

Source: Own calculation based on data from: <*http://pages.stern.nyu.edu/~adamodar*> and Albertina

The function showing the dependence of the total market beta coefficient on the FCFE average variation coefficient for companies established in 2008 takes the form $TMB' = 2.9145 + 1.5866 \cdot VCoFCEF$, with the correlation coefficient $r = 0.3381$ showing a mostly lower dependence. Therefore, the function $TFB' = 2.5784 + 3.5166 \cdot VCoFCEF$ shows the dependence of the total finance beta coefficient on the average variation coefficient for companies established in 2008. The correlation coefficient $r = 0.5488$ shows medium dependence between the variables monitored. Using the weighted average of FCFE coefficient of variation led to slightly decreased resultant values of the coefficient of correlation than in case of simple average (Chmelíková, 2014). The summary results of statistical analysis are presented in the Table 4.

Table 4 Regression analysis

Independent Variable VCoFCEF	Dependent Variable (Coefficients)	Independent Variable VCoFCEF	Dependent Variable (Coefficients)
Intercept	2.9145 ***	Intercept	2.5784 ***
	(0.0000)		(0.0000)
TMB	1.5866 **	TFB	3.5166 ***
	(0.0094)		(0.0000)
R^2	0.1143	R^2	0.3012
F-test	7.2273	F-test	30.5959
p-value	0.0094	p-value	0.0000
	< 0.001		< 0.001

Note: Standard errors in parentheses ***p<0.001, **p<0.05.
Source: Own calculations (processed in software Unistat)

The results of the correlation analysis for the total beta coefficients connected to the risk criteria chosen pointed to the closer relationship between the fluctuation in free cash flow to equity for start-up

companies and the total beta for financial basis than for the market basis. These findings can be considered significant since the criterium for assessing how good is the forecasting of the individual risk indicators is connected very closely with how probable bankruptcy is for newly-established economic subjects. This is also in line with some empirical tests covering the relationship between finance and market betas. The connection in the figures of both indicators were tested several times in the past, with the individual studies mostly confirming a close interdependence between their figures (e.g. Kulkarni, Powers and Shanon, 1991; or Karels and Sackley, 1993). However, number of results which failed to confirm this close interdependence (e.g. Beaver and Manegold, 1975; or Gonedes, 1973) was presented. The degree of association fluctuated depending on the way the accounting beta indicator was calculated, as well as the length of the trial period.

The discount rates deduced from the costs of debt, the modular model or average profitability, belongs to other methods which are theoretically suitable with the limits drawn from the character of the target group of companies. The idea of a method transferring the costs to own capital from the costs of debt comes from the fact that the owners carry a higher degree of investor risk than the creditors due to the residual requirements when the company is wound up. It is therefore obvious that the earnings demanded by them should be higher than the creditors'. The difference in rates is the subject of an expert estimate. Due to this, it is not possible to verify this method at a common level among the various methods, so it is based on fixing the discount rate for investing in a share of own capital in the company in question based on the average profitability of own capital in the company`s own field. The model faces too big degree of generalising to the level of the industry`s average, which actually presents the same handicap as the other methods built on searching for an analogous firm.

The modular model is a method built on the individual preferences of the investor in the same way as the method of certainty equivalents. The method of certainty equivalents is less demanding on the investor`s knowledge of the risk factors than the modular module. When using the certainty equivalents techniques, the potential investor will 'make do with' the forecast for turnover for various world situations, their probability and the knowledge of his own attitude to risk. The quality of turnover forecast for various circumstances is critical for both determining the discount rate and also evaluating the whole project.

2 LIMITATIONS OF EXISTING TECHNIQUES AND CONSTRUCTING A MODEL SUITABLE FOR RISK ASSESSMENT WITH START-UP COMPANIES

In addition to methods emanating from reflections on the limits of the level of accessibility for information on the capital markets, it is possible to synthesise chosen unsuitable methods with their later amendments on the limiting elements to propose other techniques which will fully reflect the needs of start-up companies in the Czech environment.

The above discussion has shown that the primary requirements for a model suitable for quantifying risk and the following calculation of costs for the capital with start-up companies in transitional economies are as follows:

- an easily-predictable fluctuation rate for future earnings without being tied to the company's past and without using data from the capital market,
- the ability to reflect not only the systematic part of risk, but also its company-specific factors and to honour them accordingly.

Such requirements led to the synthesis of some of the above-mentioned principles. The first of them can be met by using the knowledge of business risk fundamentals. As mentioned above, the primary determinants of business risk include the fluctuations in demand for a company's products, the fluctuation in the end product price, the fluctuation in input prices, the ability to adapt the output price to the varying input price, the ratio of fixed operating costs in the overall cost structure – the operating leverage. Last

but not least, from the business owners´ angle this includes the loading of fixed financial payments on own capital when using foreign capital – the financial leverage.

In short, it can be said that a higher share of fixed costs leads to a higher business risk. The previous empirical test (Chmelíková and Somerlíková, 2018) confirmed this supposition since it was shown that the fluctuation of future free cash flow for the owners is mostly actually explained by the level of operating and financial leverage.

Incorporating these results into CAPM principles makes it possible to produce a method which is not dissimilar to ABRM (Accounting Based Risk Management) models (Toms, 2012). Nevertheless, it will honour the overall risk faced by the owners of the separate investment in shares in own capital of start-up types of companies. As Damodaran (2009) mentioned the absence of diversification could be shown by expanding the scale of systematic risk beta by its specific part by recalculating to the so-called overall beta. In the terminology of market risk scales, the process of transfer is accompanied by separating the market beta by the correlation coefficient of historical earnings of the company and market in question. After applying the relevant mathematical operations, this results in construction of beta which is only dependent on the standard deviations of historical earnings of the market and company independent of their interdependence – see Formula (3). Therefore, the total beta is generally constructed as a ratio of the fluctuation of earnings of the investment in a share of own capital to the fluctuation in earnings of the reference group (the fluctuation in this case is expressed as a standard deviation).

Analogically, a scale for the total investment risk can be devised in compliance with this idea. This scale is connected to the fluctuation of future return for funds invested in own capital. Previous empirical research (Chmelíková and Somerlíková, 2018) showed that the fluctuation in future free cash flows for the owners is very closely connected to the starting burden of company processes by fixed payments. The higher the level of fixed liabilities (whether in the form of past investment, contracts with suppliers or creditors), the lower the ability of the company to react flexibly to changes in demand (real and nominal) and, therefore, in changes in the level of business costs (again real and nominal). The fluctuation in the future return on investment in start-up companies can therefore be simplified into the level of the degree of operating leverage (DOL) and the degree of financial leverage (DFL). The influence of both risks can also be expressed as the degree of combined risk, or degree of leverage (*DL*), which can be characterised as follows:

$$DL = \frac{Net\ profit_t / Net\ profit_{(t-1)}}{Sales_t / Sales_{(t-1)}}. \tag{4}$$

Using the construction from CAPM model for total risk beta, the coefficient of total risk based on the business risk fundamentals can be described as follows:

$$\beta_{DL} = \frac{DL_c}{DL_m}, \tag{5}$$

where β_{DL} represents the coefficient of total risk DL_c refers to the degree of leverage on the intended investment and DL_m to the degree of leverage on the reference group. The idea of constructing this model is similar for the ABRM model, only with the exception that all cases of fixed payments are reflected here (including financial).

In order to identify more clearly the level, the two forms of leverage can be combined, a more detailed description can be used for the degree of leverage, as shown by Grünwald and Holečková (2006):

$$degree\ of\ combined\ leverage = \frac{Q\ (P - VC)}{Q\ (P - VC) - FC\ (including\ interests)}, \tag{6}$$

where Q represents the quantity of production, P is the price of one unit produced, VC are the variable costs and FC are the fixed costs including interest payments. The whole equation can be rewritten in the following form using accounting value added:

$$degree\ of\ combined\ leverage = \frac{accounting\ value\ added}{accounting\ value\ added - FC\ (including\ interests)}, \tag{7}$$

where FC are again fixed costs. To identify the coefficient β_{DL}, the formula for the degree of leverage can be used, while the requirements for the data entered in the model are limited by the very variables entered into the calculation. To calculate the coefficient β_{DL}, it is necessary to have the information available on the company`s planned accounting value added and the planned value of fixed costs for the investment concerned. Moreover, it is important to have the information of the average accounting added value, as well as the level of fixed costs for the reference group of companies. The total result β_{DL} for the investment concerned can then be found using the following formula:

$$\beta_{DL} = \frac{\frac{accounting\ value\ added_c}{accounting\ value\ added_c - FC_c\ (including\ interests)}}{\frac{accounting\ value\ added_m}{accounting\ value\ added_m - FC_m\ (including\ interests)}}, \tag{8}$$

where the lower index c represents data for the investment concerned and the lower index m covers the data from the reference group of companies.

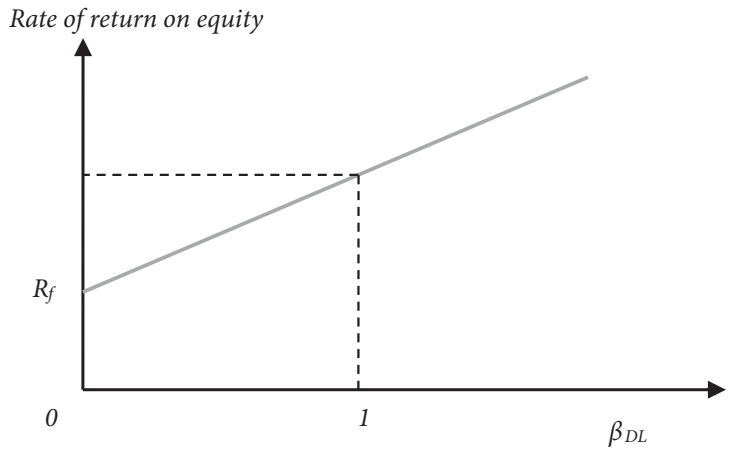
In the analogy with CAPM (the later modified version for total risk) and later with ABRM, the relationship between the total costs for own capital and the degree of combined risk can be written as follows:

$$E(Tr_c) = R_f + \beta_{DL}\ (E(p_m) - R_f), \tag{9}$$

where $E(T_{rc})$ is the total level of return-on-investment required for a share of own capital in the company in question, Rf is the risk-free rate, $E(pm)$ is the expected average profitability of the reference group of companies. The symbol β_{DL} represents the scale of the total risk of the investment.

The mechanism for estimating the total costs for own capital is similar as for the CAPM model. The risk-free rate of return corresponds to the earnings for postponing consumption and only reflects the time value of the money. The average profitability of the reference group is deduced from the nearest superior group of companies (industry, competition, national economy) as an accounting rate of return on the investment into a share for own capital. The difference between the average level of return-on-investment of the reference group of companies and the risk-free rate can be analogically termed in CAPM as the group risk premium. If the figure for the average profitability of the reference group of companies was equal the total of risk-free rate of return and the risk premium, the total risk coefficient β_{DL} for the reference group of companies must be 1. The company to reach a higher level of combined risk measured by financial and operating leverage than is usual in the reference group will look a more risky investment to investors, who can therefore expect a higher return on the money they have invested in the company. The company to reach a lower level of combined risk measured by financial and operating leverage than is usual in the reference group will look a less risky investment to investors, who can therefore expect a lower return on the money they have invested in the company than the average return in the field. The connection can be illustrated (cf. Figure 2) in almost the same way as the market line for securities, where the expected total return-on-investment rate is directly proportional to the total business risk measured by the coefficient β_{DL}.

Figure 2 The dependence of the rate of return on equity on the combination of financial and operating leverage

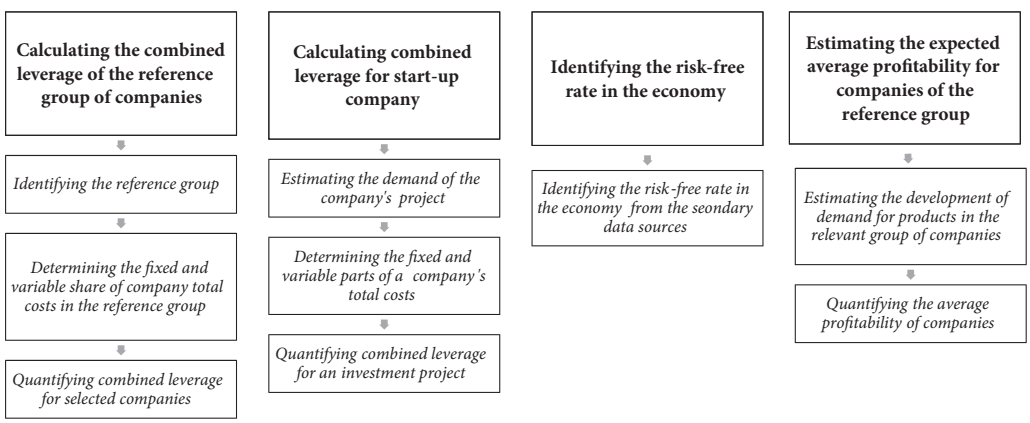


Source: Own processing based on CAPM model

The principle for assessing risk when related to other companies is very similar to the case with CAPM. The relationship between the risk-free rate of return and the average profitability of the reference group shows in the angle of the line on the graph the determining dependence on the changes in the company cost structures. The logic of the model is therefore built on the primary determinants of company risk given from the firm`s technical and financial base.

The above-mentioned connection shows that if a firm had only variable costs, thus perfectly correlated to developments in turnover, the owners would not be subjected to any proper risk with the loss of the funds invested in the company. The company would in extreme cases reach a coefficient β_{DL} of 0 and the owners would have to be content with the reward of delayed consumption.

Figure 3 The process of calculating total costs for the own capital of start-up companies



Source: Own processing based on Chmelíková (2014)

The advantage of such a formulated model for quantifying risk is its relative simplicity for entered data. Investors who use it for determining the discount rate of a start-up company can apply it based on the information they receive when the business plan is created and from publicly-available information about companies in the selected reference group. The process of calculating the discount rate can be sketched in Figure 3.

The proposed technique for quantifying capital costs requires the steps described above to be completed and the figured determined in Formula (9) to be reached. The complicated nature of the data in the individual steps of the above-mentioned technique is in line with common business practice and with the business plan for start-up companies. The individual steps of the proposed technique can be characterised in more detail in the following way.

I Calculating the combined leverage of the reference group of companies

The aim of this step is to identify the level of combined risk for the reference group of companies. This step can be completed using the following particular steps:

a) Identifying the reference group

A benchmark of average risk and profitability should be identified analogically to the CAPM model. Such a group of companies can be made up of direct competitors, similar industries or the whole national economy. The advantage of choosing a reference group extending throughout the national economy is the relative ease at acquiring data since the information on the average degree of combined leverage is available from secondary sources. Even if it is missing, the relative consistency of these figures can be assumed, which implies that it can be used reliably of some of the number of methods predicting future development.

b) Determining the fixed and variable share of company total costs in the reference group

The aim of this step is to identify the future average ratio of the variable to fixed element of total costs for companies in the reference group. The information will be used to quantify the average combined leverage for the reference group and the following calculation of the βDL coefficient. Fixed costs incorporate costs that remain constant during the monitored period despite changes in production levels. An expert analysis can be used to estimate fixed elements, as well as analysing historical costs data and even deducting from the figures for operating and financial leverage. The expert analysis is based on a specific knowledge of operating processes of the firms being researched and is therefore probably not suited to being applied to a large group of companies. An alternative to the expert analysis is to analyse the accounting records of companies, identifying their variable and fixed elements and, consequently, their forecast for the future. The problem with this approach is the difficulties on the border of the impossible to obtain the data for the financial statements, thus making it unsuited for identifying the combined leverage for a large group of firms. The last alternative is to calculate the ratio of the variable element (with up to 100% of total costs added to their fixed element) in line with the model taken from the equation (Grünwald and Holečková, 2006):

$$\frac{Net\ profit_t / Net\ profit_{(t-1)}}{Sales_t / Sales_{(t-1)}} = \frac{Q\ (P - VC)}{Q\ (P - VC) - FC\ (including\ interest\ rates)} = DL\ , \tag{10}$$

where Q represents the amount of production, P is the price for one unit of product, VCs are the individual variable costs and FC are the fixed costs including financial payments and DL is the symbol for the level of combined risk. After mathematical adjustments, the level of variable costs can be expressed in the following formula:

$$VC = Sales - (DL \cdot Net\ profit)\ . \tag{11}$$

The variables entered in the calculation for variable costs are data freely accessible for external users of accounting statements. Therefore, this approach can be applied to identify the variable element both for individual companies and for companies in the reference group.

The future level of combined risk can then be estimated either from past data on splitting costs into variable and fixed, or directly from the level of average past rate of combined risk *DL*, whose calculation is accessible directly in the reports of the accounting statements.

c) Quantifying combined leverage for selected companies

The average level of combined risk for reference group companies can be quantified by using Formula (11) and data received from points Ia and Ib.

II Calculating combined leverage for start-up companies

The aim of this step is to identify the average level of combined risk for the company in question. This can be done with the following particular steps:

a) Estimating the demand of the (company's) investment project

The starting point for quantifying the level of combined risk is a precise estimation on the future sales. A number of approaches can be used to estimate sales. These approaches will not be specified since the issue of forecasting demand and deriving an estimate of earnings from it is an extremely broad issue and its solution lies outside the scope of this article. Nevertheless, it should be mentioned that, from a practical standpoint, it is not an additional task for the owner to apply this method to start-up companies since such information should be part of the firm`s business plan.

b) Determining the fixed and variable parts of a project's total costs

As when estimating the development of sales, the development of planned costs should be part of any well-prepared business plan. To this end, this step for calculating the discount rate using the suggested method should not trouble a start-up businessman with extra data collection.

Cost classification for the volume of outputs performed is usually divided into two cost categories – variable and fixed. According to Popesko (2009), fixed costs can incorporate whatever remains unchanged with a changing amount of production during the time period. These are not only the costs connected with acquiring long-term assets, but also fixed payments connected with contracts with third parties such as creditors, employees and business partners. An example of this type of costs can include depreciation, managers' salaries, interest payments or leasing repayments. Costs which change with a change in output volume can then be termed as variable. Variable costs can include piece-work payments to blue-collar workers, consumption of material or the energy required to operate machinery.

c) Quantifying combined leverage for an investment project

The average level of combined risk for the company in question can be quantified by using Formula (12) and data received from points IIa and IIb.

III Identifying the risk-free rate in the economy

Analogically to the CAPM model, the value of risk-free rate of return enters into the calculation of total capital costs using the suggested technique. According to Mařík (2011), it can be generally said that there is no completely risk-free rate since there are no assets whose earnings would not be subject to risk. Governmental Treasury Bonds are considered to be extremely low risk in the USA in the time period related to the assessed investment.

IV Estimating the expected average profitability for companies of the reference group

a) Estimating the development of demand for products in the relevant group of companies

The performance of the whole reference group of companies should be assessed in order to estimate the development of return on investment in own capital in the reference group. For a short list of samples

(branch, sector), an estimate should be made using methods which are usually applied for this process (expert estimate, trend analysis, etc.). If the whole national economy is included, the macro-economic estimates can be used for aggregate demand and then the whole economic output.

b) Quantifying the average profitability of companies

The last step required for calculating average rates of return on investment in own capital for reference group companies is to estimate future average returns on investment into a share of own capital using predicted figures for turnover. A regression analysis could be a suitable tool to analyse the relationship of the two quantities. This can be used to estimate the figures for average return in the future.

By completing all steps using the procedure recommended and introducing them into the following formula:

$$E(Tr_c) = R_f + \beta_{DL} (E(p_m) - R_f), \tag{12}$$

the investor should be provided with reliable information on the level of return on investment required in the company, or for a project with zero history and an undiversified capital base. The difficulties of the input data are limited to information sources from the publicly-accessible secondary data and the business aims of the protected being assessed. Information from business plans does not present an added burden as far as the difficulties of collating data is concerned since a high-quality business aim is one of the starting points of a start-up company.

CONCLUSIONS

The aim of this paper was to offer a way of quantifying risk for new companies based on conditions in economy with emerging capital market. The point of measuring investment risk is its reflection on required rate of return of the company in question. There are two alternatives how to reflect the level of risk in the evaluation process of investments. The most often-used approach is to incorporate the level of risk in the discount rate, which includes benefits for delayed consumption and the risk undertaken. The second alternative for reflecting the risk level of investment is to adjust earnings by recalculating to the so-called security equivalents. These should then be discounted only by the risk-free part of the discount rate.

In the introduction, the circumstances limiting the application of commonly-used methods for risk quantification by newly established firms in the conditions of emerging capital markets were established. An evaluation was then made of the individual approaches with the attempt to reflect the limitations mentioned from the character of the target group of companies. The most suitable method from the theoretical point of view was discovered the CAPM with analogical total beta on financial basis, however, its application can be complicated from both a data and an algebra point of view.

Another way of applying the total beta coefficient in the real decision-making process of investing in new companies is to understand how it behaves in connection with risk fundamentals. The research question was therefore formulated as to what extend the volatility of returns of start-up companies is caused by the risk fundamentals – operating and financial leverages. Using the data of start-up companies in the Czech Republic we found statistically significant evidence for the dependence of the fluctuation of free cash flow on the combined level of risk – operating and financial leverage. This could have been expected intuitively since both forms of leverage are among the primary determinants of company risk. The factors for the fluctuation in future earnings can actually be divided into two groups. On the one hand, there are factors which affect the level of future profits, such as the level of demand and the development of input prices. On the other hand, there is the company`s ability to adapt to these changes. The ability of the company to adapt to exogenous changes is then determined by the amount it is burdened by fixed payments (operating and also financial from the owners` point of view). The business risk

is therefore partly dependent on the burden of the cost structure with its fixed elements. If there is a high level of fixed costs, even a small fall in demand can cause of large drop in the return-on-investment.

By verifying the dependence of risk on the burdening of the cost structure with fixed elements, it was possible to suggest constructing a model for quantifying the discount rate for start-up companies in the conditions of an economy with emerging capital markets. The construction of this model was described in detail in the final part of this article and offers a benefit in the form of providing a new technique with relatively low demands on input data. Since new companies have an important role in the national economy, this makes it a useful tool enriching the theory which can be used in practice in real-life decision-making.

This paper presents evidence on the link between fixed payments burdening and fluctuations in returns for the owners. Knowledge of this relationship enabled construction of risk measurement technique for specific conditions of new firms in economics with emerging capital market. However, further research is also needed to examine whether or not this technique can be operationalised in real decision making processes.

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