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COMPARISON OF RISK INDEX ESTIMATING METHODS ON THE POLISH FINANCIAL MARKET

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Abstract

The purpose of this paper is to determine a practical approach of calculation of the systematic risk of companies in line with the CAPM model. By performing an analysis of the methodology used in practice of determining the beta and review of the literature on the subject the accounting rules that make the best possible impact on the change in the level of risk index are determined. In this work on the Polish financial market are also carried out simulations showing the impact of the change in assumptions on the final amount of beta. Based on the empirical results there is a recommendation formulated as to what method should determine beta for public companies using the CAPM model. These boundary conditions are also possible implementations of the proposed approach and possible desirable solutions, if minimum boundary conditions are not met. The defined scope for the use of the recommended method of calculating the risk index allows us to reduce the error probability of over-or underestimation of the value of the index.

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Introduction

The need to determine the value of a company is almost casual in today's business world (Zadora, 2010, pp. 24-26). Valuation of companies takes place at least for the purpose of sale transactions, privatization, new shares emissions, mergers, acquisitions or divisions.

On the subject of valuation and its aim in current literature (Jajuga, 2011, pp. 335-371) there are a wide variety of valuation methods. However, frequently a recommended approach in the opinion of both practitioners and theorists nearly universally is the discounted cash flow method (Zarzecki, 2008, p. 105). This model can be applied to both the valuation of companies at an early stage of development, or to fully formed companies and businesses with financial problems. A key element to be able to implement this method is to determine the discount rate in each year (Panfil, 2009, pp. 17-22), which is used to determine the present value of projected cash flows. These rates are referred to as cost of capital and are understood as the expected rate of return for the commitment of capital (Duliniec, 2001, p. 13). Theoretical models currently available do not allow us to obtain a clear and compelling set of discounts. Difficulties in calculating the level are due to the problems which arise in determining the so-called cost of equity, which is the interest rate that the investor expects for a commitment of their own resources.

Estimating the cost of equity can be done by using qualitative methods (submission technique) and analytical methods (Byrka-Kita, 2008, p. 29). The most common method of determining the premium for equity commitment according to one study (Brunera, Eadesa, Harrisa & Higginsa, 1998, pp. 13-28) is the pricing model of capital goods CAPM (Capital Asset Pricing Model). This approach was developed simultaneously by J. Lintner 1965, J. Mossin 1966 and W. Sharpe 1664. In the study conducted by Bruner, Eades, Harris and Higgins CAPM was identified as the primary tool for 81% of surveyed CFOs and 80% of financial advisors. This model attempts to explain the capital asset pricing in the context of the risk (Haugen, 1996, pp. 217-243). The CAPM model was also identified as the most popular (85% of respondents) in the study by J. Al.-Aliego and T. Arkwright (Al.-Ali & Arkwright, 2000, pp. 303-319) on the 450 largest groups in terms of trading volume of UK businesses.

However, to be able to use this model in addition to accepting a number of simplifications which are not entirely consistent with reality, and we must make a determination of the so-called systematic risk of the investment. In the CAPM model the risk is formed by dividing the total investment risk (defined as volatility of returns) into two parts: systematic risk and unsystematic risk. According to this approach, non-systematic risk can be reduced and even eliminated by proper diversification. Secondly, risk is, however, associated with investing in the stock market and is incurred without exception by all participants in the financial market. The systematic risk of investment is also often called for short 'beta'. In practice, in the terms of how it should be calculated, there isn't any well-known and accepted approach. Comparison of approaches which are recommended in the literature and proposed by the main international financial agencies to determine the betas will be the main focus of this article.

Theoretical and practical approach to determine the risk index

Despite the fact that the CAPM model is the most widely used approach in practice to determine the cost of equity, which in turn, is necessary to determine the discount rate in the discount valuation methodology, currently there is no compromise on the method of calculating the beta index (Zarzecki, 2008, p. 108, Darmodaran, 2012, p. 3).

The risk index of public companies reflects the volatility of a company against the industry volatility index (the sector in which the company is valued) or on one of the main stock market indexes. The higher the volatility of the share price relative to the market index, the greater the risk, and therefore the higher the beta value. To calculate the beta factor we use the following formula (Szablewski & Tuzimek, 2008, p. 164):

$$\beta = \frac{\operatorname{cov}(r_{it}, r_{m})}{Var[r_{m}]} = \frac{\sum_{i=1}^{n}(r_{m} - \bar{r}_{m})\cdot(r_{t} - \bar{r}_{i})}{\sum_{i=1}^{n}(r_{m} - \bar{r}_{m})^{2}}$$

where: β Beta of the model company[1];

$Cov(r_{it}, r_{m})$ - covariance of shares return with the market return;

1 The company - a model, a company for which we calculate the beta or company reference where the results will form the basis of, for example, the beta for an unquoted company.

$Var(r_m)$ - the variance of the market return;

r_i - rate of return on the shares during the period *t*;

r_m - market rate of return for the period *t*;

t - period, based on the determined rate of return;

$\bar{r}_m$ - average rate of return on the market during the *t*;

$\bar{r}_i$ - average rate of return on the shares of the model company during the *t*;

n - combined length of the time series to determine the beta.

As mentioned earlier, the beta index measures the risk associated with investing in the capital market risk category added in relation to a diversified portfolio of investments[2], rather than the risk of financial exposure. As a result, we can say that beta determines the level of relative risk of a portfolio of assets. The risk index definition is not fixed in the terms of how to determine the market portfolio, which will be compared to the rate of return on investment with the shares of the model company (Darmodaran, 2012, p. 4). One can therefore wonder whether the market portfolio should include other assets outside the stock market.

Confining ourselves to the assumption that the market portfolio will consist solely of shares still does not solve the problem of how to determine the beta index. In practice, there is no index that approximates the behavior of the market. To some extent, there are alternative various types of indices used, and appropriate selections of the market (Lally & Swidler, 2008, pp. 806-807). Before you start calculating the risks specific for a particular company it must still be decided how the stock market index calculations will be performed. The more developed the financial market, the more opportunities to make different choices. In the case of the U.S. financial market, in practice, the most widely used benchmark to determine the beta is the S&P 500. The composition of this index includes 500 public companies with thousands of companies whose shares are traded on the financial markets in the United States. As an index for the behavior of the market portfolio in the U.S. the Dow 30, Wilshire 5000[3] and NYSE Composite[4] are also used. For other, less developed financial markets the disproportion between the number of companies included in the broadest stock market index, and the amount of equity of all companies doing business can be even more pronounced. Moreover, we should solve the problem of narrowing the accounting for assets in the market portfolio only to one country. In practice, an investor can still minimize market risk by diversifying in not only investment in different sectors in one area of the economy, but also in different countries. To include this element in calculating the change in the market risk an index can be determined by using a range of world indexes such as the Morgan Stanley Capital Index, which is calculated as a weighted average combination of the broadest major stock markets indexes in the world.

It turns out that the choice of an index that approximates the rate of return on the market portfolio creates a substantial difference. Table 1 shows beta sets for companies PGE S. A., PZU S. A., BUDIMEX S. A. and WAWEL S. A. to index WIG and WIG 20, in the period of the date of entry of these companies on the stock exchange on March 14, 2013. The risk index was calculated based on daily rate of return calculated on the closing quotations. In both cases, company risk indices are calculated on the basis of a time series with the same number of entries.

Analyzing the results presented in Table 1 shows that the level of risk depends on significant systematic

2 Schematically it should be understood as a portfolio consisting of all shares on the market.

3 The Wilshire 5000 Total Market Index, or more simply the Wilshire 5000, is a market-capitalization-weighted index of the market value of all stocks actively traded in the United States. Currently, the index contains over 4,100 components. The index is intended to measure the performance of most publicly traded companies headquartered in the United States.

4 The NYSE Composite is a stock market index covering all common stock listed on the New York Stock Exchange, including American Depositary Receipts, Real Estate Investment Trusts, tracking stocks, and foreign listings. Over 2,000 stocks are covered in the index, of which over 1,600 are from United States corporations and over 360 are foreign listings; however foreign companies are very prevalent among the largest companies in the index: of the 100 companies in the index having the largest market capitalization

Table 1: the beta value determined by WIG and WIG 20

Company	WIG	WIG 20	change
PGE S. A.	0,94	0,80	17,6%
PZU S. A.	0,84	0,76	10,7%
BUDIMEX S. A.	0,94	1,19	-21,0%
WAWEL S. A.	0,38	0,13	182,2%

Source: Own calculations

dimensions of the base index. It should be noted that the indices adopted to determine the systematic risk for selected public companies do not cover a substantial part of the assets in which we have the opportunity to invest in the Polish market. These are, for example, different types of closed-end investment funds and real estate funds or property. The value of such assets is determined in fewer cycles than a month, so it is impossible to determine the return on such investments more frequently than monthly, and consequently the beta index on calculated rates of return.

The decision on which of these market indicators should be adopted as the benchmark can be made by a so-called market portfolio test (Darmodaran, 2012, p. 7). The rationale of this paradigm is intuitively obvious as it seems natural that the composition of the index, which includes more assets[5] better approximates the volatility of the market. On the other hand, this ratio should be balanced against the individual components, since the change in the value of major assets available on the market has a higher level of influence on the change in its value than other assets. The selected index to determine the beta for the model company should reflect the extent to which it can be diversified by a marginal[6] investor in this market. In this example the WIG should be selected. Its advantage over the WIG 20 is due to the fact that it includes a larger number of assets from the Polish economy. Obtained in this way, the weight change of individual stock prices decreases the correlation of the assets of a single index. Analysis of the correlation between the reference and index company is important, because it may result in a high underestimation of the risk index. This relationship is shown for PGE SA and PZU SA, for which the scope's limit of the index[7] caused a decrease in beta of respectively 17,6% and 10,7%. To sum up, in practice, calculating beta (Kewei, Mathijs & Yinglei, 2012, pp. 504-526; Darmodaran, 2012, p. 7) one should take the widest possible market index, but only for the assets that are taken into account in the determination of each investor.

Another sensitive element that has a significant effect on the level determined in accordance with the beta CAPM model is the time horizon in the calculation. The statistical or mathematical models to calculate the risk index are not recommended as a long time series should be taken into account in the calculation. In practice beta is derived from the historical quotations for 2 to 10 years. Alexander at work: Cost of Capital. The Application of Financial Models to State Aid (Alexander, 1995, pp. 32-34) recommended, however, that the calculation of the risk index should take the longest possible time series of observations. Taking into account in the calculations the older historical data, we expand the test used in the calculations. However, these data may include observations clearly protruding from the current, which could be correct. Analyzing the company over the years of which observations are included in the calculation could definitely change their characteristics[8], which may make the historical observations clearly protrude from the current observations. Taking into consideration that the purpose of the calculation is not carried out for the best possible estimate of the historical beta index, but an attempt to determine its value in the future by specifying the border from which will be taken into account observations on should always pay attention to how this changes over time for the analyzed company. Consequently, for companies that have a stable and unchanging similar profile of activity and economic conditions to calculate the beta a longer time series can be used. Particular attention should be paid to any significant transactions[9]. Table 2 shows how to change the designated risk index WIG index, calculated for the

5 Understood both in terms of shares, mutual funds, as well as specific and transferable interest in real estate
6 Marginal investor in this case is understood in terms of an investor who has no specific additional powers, such as institutional.
7 And, consequently, increase the impact of the volatility of the analyzed companies on the level of the index.
8 By the characteristics of the company is understood the level of operating and financial leverage, and the volume of specific revenues and expenses (Siemińska, 2002, pp. 91 -172).
9 An example of such a transaction may be a takeover (acquisition) of a control packet of another entity, the sale of significant assets, etc.

Table 2: Risk index value depending on the number of observations

Name of the company	Number of observations in days			Change in %		
	715	357	178	"178"/"715"	"178"/"357"	"357"/"715"
PGE S. A.	0,92	0,72	0,72	-21,2%	1,2%	-22,2%
PZU S. A.	0,84	0,80	0,94	11,9%	18,0%	-5,2%
BUDIMEX S. A.	1,24	1,36	1,50	20,5%	10,7%	8,9%
WAWEL S. A.	0,45	0,38	0,62	40,1%	63,9%	-14,5%

Source: Own analysis

daily rate of return.

Changes in the level of beta index depending on the length of the time series which are used for the calculation are significant. Based on the above simulation, it is not possible to verify that the range of data taken for the calculation is correct. An attempt to answer this question will be decided in the third chapter of this work. The level of systematic risk in the CAPM model is also influenced by the base period for which returns are calculated. Their values can be calculated daily, weekly, monthly, quarterly, or even annually. Currently, due to the development of techniques among the daily cycles are those such as every 15 minutes. Increasing the frequency of calculating the rate of return allows us to expand the number of observations that are accounted for the calculations, which may be beneficial in times of constructing a mathematical model. However, it can be a problem in determining the rate of return on assets for a period in which there were no transactions. In practice, this problem is solved by applying one of three approaches. The first method proposes to extend the period for which returns are determined (Darmodaran, 2012, p. 13). In the case of monthly, quarterly, or annual rates of return it is unlikely that there have been no transactions of sale of assets, and thus making it impossible to determine the period for returns. The second method is the addition of missing observations: on daily or weekly basis, assuming that in situations where there was lack of liquidity[10] in a given period, the rate does not change. In calculating the beta index in this case, it is also proposed to shorten the time series of the periods in which there were no transaction, and then perform estimation based on a smaller number of observations, and adjust the result obtained by matching techniques. For example, Scholes-Williams beta is defined as follows:

$$\beta_j = \sum_{k=-1}^{k=+1} \frac{\beta_k}{1+2\rho},$$

where: ρ CRSP is a weighted average level of autocorrelation of daily returns and β_k are the slope coefficients from three separate OLS regressions, $R_{jt} = a_k + \beta_k R_{m,t+k}$ for $k = -1, 0, +1$. This allows the beta estimate to reflect the spill over of returns that often occurs around non-trading.

Comparison of the risk index, depending on the time horizon of returns which are calculated for companies PGE S. A., PZU S. A., BUDIMEX S. A. and WAWEL S. A. were prepared by supplementing the missing observations (periods in which there were no transactions made) with values corresponding to the closing level of the last day on which the transactions were made. Therefore, in periods when the assets were not liquid, the rate of return is 0. Comparison of changes in the level of beta depending on the frequency of determination yields are presented in Table 3.

As you can see from the above the frequency of a changing rate of return calculation in determining the value of beta has very significant impact on the final value of the index. The sample contained a simulation between -13.9% and 61.9%, when rates of return changed from a daily to monthly basis. The theoretical approach recommended is that setting the rates of return to calculate the beta should not be more frequent than weekly (Byrka-Kita, 2008, p. 15). Adopting a longer period to calculate rates of return can reduce the impact on the beta time and unwarranted changes in stock prices[11], as a consequence only of speculation.

Because of the significant differences between the value of systematic risk determined on historical data, we need to pay special attention to the way in which it is set, and one should avoid making changes to the calculation methodology to have comparable results of calculations. Particular attention should be paid from a practical point

10 There has not been for the asset any transaction of sale / purchase.

11 Such a situation can be a sudden couple of percentage increase (decrease) in the share price of the company after informal disclosure of information, such as the planned entry of a new strategic investor, which is then canceled out on consecutive days.

Table 3: Beta levels depending on the frequency determining rates of return

Name of the company	Number of observations in days			Change in %		
	Daily	Weekly	Monthly	"D"/"M"	"D"/"T"	"T"/"M"
PGE S. A.	0,94	0,68	0,51	-45,7%	-25,1%	-27,5%
PZU S. A.	0,84	0,82	0,66	-22,3%	-19,6%	-3,3%
BUDIMEX S. A.	0,94	0,84	0,81	-13,9%	-3,4%	-10,9%
WAWEL S. A.	0,38	0,50	0,61	61,9%	21,6%	33,2%

Source: Own analysis

of view. Changing the method of determining the beta can make a significant change in the discount rate, which is a tool to determine the company's value in the method of income, and thus distort the final level of the valuation. An overview of business valuation reports prepared by 23 major brokerage houses operating in Poland in the years 2001-2012 shows that prepared by the brokerage houses models are very sensitive to the introduction of such changes. In the case of 230 brokerages the recommendation as to the value of more than 138 companies from various industries, the average share of the present value of the residual value was 58.17% in the total valuation of the company. Quartile of the first row in the sample was 46.80%, 54.48% median and the third quartile of the order of 68.46%. The smallest share of the residual value was 18.90%. The biggest turn was 142.73%. The residual value, due to the design, is the most sensitive to changes in the discount rate. Table 4 presents three examples of simulations of changes in the beta choosing different ways of calculation based on historical data. It should be noted, however, that each of these simulations is consistent with the existing theoretical approaches of business valuation and are applied in practice.

In the first simulation, the beta is determined on the daily rates of return and time series containing one year of observation. Systematic risk in the second simulation is designated by the WIG, monthly rates of return and the time series consisting of the maximum number of sightings[12]. In the last study, beta is calculated relative to the WIG 20 for quarterly returns, and the same way as in the second case for all of these trading companies. Beta level changes depending on the assumptions of a pure calculation is very important. It is especially pronounced in the case of BUDIMEX SA, where there is a complete change in the signal, because in the first scenario risk of the company is higher than the market and the situation has been replaced in the second one. Setting the risk index of the pattern one should not forget about the underlying data cleansing – the closing price of disorders resulting from the occurrence of the so-called: planned one-off events. The main events of this type are: splits, dividends and distributions. Lack of clean observations - for example, trading stock split of split-level 10 will decrease the appearance of a high rate of return on shares. Namely, if before a split 10 course that security was 1.000, - pln, after the split only 100, - pln, this causes a (contaminated) rate of return of (-) 90%. In reality, however, the value of assets held by investors before and after the split has not changed.

Simulations and calculations of risk index

The use of the CAPM model in practical terms, despite the above problems occurring in the calculation, is very high. The reason for the frequent use of this model in practice, according to Bartholdy and Peare (Bartholdy & Peare, 2003, p. 70) is its ease of estimation and implementation. Apart from the considerable simplification in CAPM (absence of transaction costs, perfect divisibility of assets and their ability to be sold at any time), according to the study (Bryk-Kita, 2008, p. 15) the risk index determined by the model for the Polish market's instability cannot be used to estimate volatility and risk assets. However, there is the lack of tools to determine beta which would be widely acceptable by practitioners and possible to implement. Therefore, despite the imperfections of the model and to minimize the differences arising from the use of a different approach, it remains in use. Overview of approaches used by major funding agencies in the world to determine the beta does not give a clear answer as to the best way to calculate this index.

In Table 4 are listed the methods of estimating beta index used by the major financial agencies. It confirms earlier observations that the determination methodologies are different. As a result, the various beta

12 Maximum number of observations, i.e. the number of trades since the company's debut on the stock exchange to 14.03.2013 .

Table 4: Simulations of changes in the level of risk index

Name of the company	Sym. I*	Sym. II*	Sym. III*	I/II	II/III	I/III
PGE S. A.	0,74	0,47	0,46	58,6%	0,8%	27,8%
PZU S. A.	0,93	0,45	0,64	108,1%	-30,2%	29,0%
BUDIMEX S. A.	1,50	0,49	0,68	206,3%	-28,1%	82,1%
WAWEL S. A.	0,36	0,77	0,49	-53,9%	56,4%	-13,7%

Source: Own analysis

Table 5: Designation of betas by agencies

Institution	Market index, period, frequency of data	Correction factors
Bloomberg	more than 20 different indexes, as required (usually 2 years), in terms of daily, weekly, monthly or semi-annual	(0,67 • raw beta) + (0,33 • 1,0)
Compustat	S & P 500, 5 years, monthly (min. 24 months),	lack
Ibbotson	S & P 500, 5 years, monthly (min36 months),	beta adjusted in relation to the control group, according to the statistical significance
Value Line	NYSE Composite, 5 years, weekly	0,35 + 0,67 x (raw beta) rounded to the raw beta 0,05

Source: Stocks, Bonds, Bills and Inflation (2003). Yearbook. Valuation Edition. Ibbotson Associates, Chicago 2003, p. 115.

values determined by these agencies, and hence the levels of discount rates also show differences in the final level of valuation of the company. D. Zarzecki (Zarzecki, 2008, p. 108) suggests that the differences resulting from the adoption of a different method of calculating the betas for the U.S. financial markets are very important. For Deere & Co. beta determined according to the methodology Value Line is higher by 94% of the beta calculated in accordance with Compustat's approach.

The test paradigm of the market portfolio (Darmodaran, 2012, p. 7) presented in chapter two does not allow us to indicate which approach should be used. Recommendation of the method which should be used has to be constructed under different criteria. Returning to the definition of the index as a beta level of systematic risk (Zarzecki, 2008, p. 106), we can identify the beta value of the premiums for the risks associated with investing in the chosen value over market risk. According to this definition, if there are for some assets $\beta > 1$, this means that investing in these assets is considered to be riskier than investing in the market. Similarly, if we judged that investing in shares of a company is riskier than investing in the market, then the beta of the company should be higher than 1. In particular, investments in shares of companies that would be insolvent, which would not be able to adjust their obligations, and thus also continue their activities, should be regarded as investments with higher risk than the market. Therefore, in accordance with the bankruptcy and reorganization legal[13] article 10 and 11 the company towards which is commenced bankruptcy or liquidation proceedings shall be regarded as insolvent[14]. It means, therefore, that beta determined for each public company for which there are bankruptcy or liquidation proceedings should be greater.

The Polish financial market in the period from 1 January 2000 to 31 December 2012 saw 41 bankruptcy proceedings initiated (the figure also includes bankruptcy and liquidation, which were finished in that period). Among this group of companies, shares of several, such as PBG S.A. remain publicly traded. The cut-off date of analysis was February 8, 2013. Consequently, we obtain the risk index for these companies determined on observation until the court notice of bankruptcy (or suspension of trading of the shares on the stock exchange) should be higher than one. As an index indicating the volatility of the portfolio underlying the market index, we use the WIG. Calculation of systematic risk by CAPM model for another index at the same time for these companies was not possible, because all the other indices[15] were introduced on the Polish financial market afterwards. Where in the base for determining the rate of return[16] there is no transaction received from the closing price of the last transaction. Table 6 is a list of companies within the analysis.

The calculations, as one might expect, confirm research by Kita K. Bryk: "Verify suitability of the capital asset pricing model in the process of estimating the cost of equity capital in the Polish market" (Byrk-Kita, 2008, pp. 1 - 15). The systematic risk presented above designated for the majority of companies were below the limit, i.e., a value of 1 means that using the CAPM model should not determine the level of beta for companies whose financial situation in time taken into calculation has significantly deteriorated. In the following tables there are presented

13 Law on Bankruptcy and Rehabilitation Journal of Laws of 2012 pos. 1112, read from January 1, 2013.
14 In accordance with the law on bankruptcy and reorganization the court declines a request for a declaration of bankruptcy of the debtor, if the delay in the performance of their obligations is not to exceed three months, a sum of default does not exceed 10% of the debtor's business assets - art.12

15 For example: WIG 20, WIG-BUDOW, WIG-ENERG
16 Considered in the study of the rate of return determined on a daily, weekly and monthly basis.

Table 6: List of entrants for analysis

No.	Name of the company	No.	Name of the company
1	Swarzędz Meble S. A.	21	ABM Solid S. A.
2	Zakłady Lniarskie Orzeł S. A.	22	Advadis S. A.
3	Techmex S. A.	23	Alterco S. A.
4	Huta Szkła Gospodarczego IRENA S. A.	24	Bomi S. A.
5	POLREST S. A.	25	Drewex S. A.
6	Zakłady Naprawcze Taboru Kolejowego w Łapach S. A.	26	Dolnośląskie Surowce Skalne S. A.
7	Krośnieńskie Huty Szkła Krosno S. A.	27	Euromark Polska S. A.
8	Elektrim S. A.	28	Energomontaż-Południe S. A.
9	Toora Poland S. A.	29	Hydrobudowa Polska S. A.
10	Łda Invest S.A.	30	Intakus S. A.
11	Przedsiębiorstwo Produkcyjno-Handlowe Elektromontaż-Export S .A.	31	PBG S. A.
12	Zakłady Mięsne POZMEAT w Poznaniu S.A.	32	Polskie Jadło S. A.
13	Poznańska Korporacja Budowlana PEKABEX S. A.	33	PIA Piasecki S. A.
14	Tonsil S. A.	34	MOSTOSTAL Gdańsk S. A.
15	Bick S. A.	35	Lubelskie Towarzystwo Leasingowe S.A.
16	Wielkopolskie Fabryki Mebli S. A.	36	Łukowskie Zakłady Przemysłu Skórzanego ŁUKBUT S. A.
17	Howell S. A.	37	Beton Stal S. A.
18	Pażur S. A.	38	Leta S. A.
19	Grupa Kapitałowa INWEST S. A.	39	Stgroup S. A.
20	Apexim S. A.	40	Ocean Company S. A.
41	Szczecińskie Przedsiębiorstwo Budownictwa Przemysłowego ESPEBEPE-HOLDING S. A.		

Source: Own

Table 7: Number of companies with β>1 the monthly rate of return

Length of time series	Number of companies with: β>1
2	19
3	17
4	13
5	11
10	15
15	14
20	16
ALL since 02.01.2000	16

Source: Own analysis

the number of companies for which the risk index was higher than 1, depending on the number of observations which are taken for calculation.

Comparing the results, it seems that the rate of return should be calculated on a monthly basis. Only if the risk index is calculated for daily or weekly rates of return, for a period of 15 days to suspend or withdraw the assets from the public market, the number of companies for which the risk index determined by these methods is higher than 1 is greater than that determined by monthly rates of return. Basic statistical measures of the number of companies for which beta calculated from historical data have an accepted value of more than 1 are presented in Table 10.

The study shows that companies that have a stable financial risk index determined by CAPM model return should be calculated on a monthly basis. Deviation may take place only if during the period taken into account for the calculation of beta the financial situation of the analyzed company was decisively deteriorated to a degree that threatens the continued operation of the company. To determine the trend of changes in the company's financial situation in order to determine the approach that should be used, bankruptcy prediction models can be used, widely reported, for example in the work of Thomas Korol "Warning systems business from the risk of bankruptcy" (Korol, 2010, pp. 1 -203).

Table 8: Number of companies with β>1 the weekly rate of return

Length of time series	Number of companies with: β>1
4	16
5	14
10	15
15	13
30	12
40	8
50	8
ALL since 02.01.2000	5

Source: Own analysis

Table 9: Number of companies with β>1 the daily rate of return

Length of time series	Number of companies with: β>1
20	13
30	12
50	13
100	12
150	13
200	10
250	10
ALL since 02.01.2000	8

Source: Own alaysis

Table 10: Statistical information on the number of enterprises β>1

Determining the frequency rate of return	Arithmetic average	The standard deviation	Median
Monthly	15,58	1,21	16
Weekly	6,89	2,52	6
Daily	6,52	2,17	6

Source: Own analysis

Conclusion

Almost every casual business day creates demand to determine the value of companies for the purpose of trading, mergers, acquisitions, etc. This necessity makes financial market practitioners determine the systematic risk even for the purpose of estimating the value of trading companies. As shown previously in the reported studies of Bartholdy and Peare (Bartholdy & Peare, 2003, p. 70), and J. Al-Ali and T. Arkwright (Al-Ali & Arkwright, 2000, pp. 303-319) model CAPM is an essential tool to determine the level of beta index. Therefore, despite the volatility of the risk index assigned by the model (Bryk-Kita, 2008, p. 15) for the Polish market, due to its great practical importance, it should be possible to work out the most efficient and uniform approach in the region of methodical determination of beta. Comparison of the second and third section of this study clearly indicate that the difference in the final result, as a consequence of a different approach in the calculation are very significant. Changing the scenario of calculating risk index strongly affects the final outcome of the estimation. In the case of BUDIMEX SA taking into consideration from Darmodaran[17] the risk premium for the Polish market at the level of 7.3%, changing the way to determine the beta from scenario II to scenario I[18] increases the required rate of return for the company about 15.06%. The results fit in the area of solutions used by major financial agencies, however, clearly indicating the boundary condition, which should change the calculation of beta. This condition limit-ing is a significant change as defined in the category of worsening economic enterprises for whom beta determined. The study continued discussion initiated by Zarzeckiego (Zarzecki, 2008, pp. 104-115) and Darmodarana (Darmodaran, 2012, pp. 1-30). Due to insufficient sample size of public companies listed on the Polish market, which have been or are in the process of bankruptcy, the fraction test cannot be used to check whether the proposed solution improves the accuracy of risk index assessment above the level of statistical significance. This problem will be possible to verify with the development of the Polish financial market. The study also shows clearly that it is necessary to change the way we determine the specific risk of the company, if its financial situation deteriorates. The study also shows that the CAPM model in such cases contains the risk of correctly identifying the direction of only about 43% -53% of the situations. Therefore, it is recommended to determine individual risk investment for these companies on the basis of model predictions of bankruptcy and / or ratio analysis.

17 http://pages.stern.nyu.edu/~adamodar/ access of 19.03.2013 r.

18 Scenarios, which are here referred to are set out in Table 4 of this work

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