Business Valuation of the Companies Listed on the Prague Stock Exchange and V4 Countries

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Doctoral Thesis Summary

Tomas Bata University in Zlín

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Faculty of Management and Economics

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Oceňování podniků na Burze cenných papírů Praha a zemích V4

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Abstract

The work primarily estimates the intrinsic value of the companies listed on the Prague Stock Exchange as an important price signals delivered in the stock market. Determining the estimated intrinsic value of the companies listed in the stock exchanges is essential evidence not just for mergers and acquisition, but also for banks, suppliers, customers, investors, shareholders and employees on the current and future outlook of the company. There are many unclear inputs standing on the general theoretical concepts and practical applications that lie within the valuation of publicly listed companies. The results of the study try to give small indications on an overall complex issue of the valuation process. The first aim of the work determines if the companies listed on the PSE (Prague Stock Exchange) might be undervalued or overvalued. The second aim of work indicates factors affecting deviation of the stock market prices from the intrinsic value to the market prices. The third aim of the work will define the risk level when Prague Stock Exchange join the other stock markets of the Visegrad countries. Results of the work confirm that average stock price of the Czech listed companies in 2017 deviate from their estimated intrinsic value in the range of 58% while international companies in the range of 301%. Moreover, from the 10 selected companies within the Prague Stock Exchange, average deviation within estimated intrinsic value and average market price was 180 % in 2017. The companies that had very low deviation within estimated intrinsic value and average market price in 2017, were: CEZ, Kofola Ceskoslovensko, Unipetrol Orlen Group, Moneta Bank and Stock Spirit PLC. Results of the third aim show that risk level of the PSE would have been 17.5% lower if it would operate under hypothetical Visegrad Stock Exchange. Moreover, the risk level of the PSE would have declined within the hypothetical Visegrad Stock Exchange from σ=1.28 to the σ=1.09. However, average risk level from 2009 till 2017 of the individual Visegrad stock exchanges, was as follows: Budapest Stock Exchange contained the lowest risk, followed by Prague Stock Exchange, Warsaw Stock Exchange and Bratislava Stock Exchange.

Abstrakt

Práce se primárně zabývá oceňováním společností obchodovaných na Burze cenných papírů Praha (BCPP), následně se zaměřuje na další visegradské země. Oceňování společností je důležitým prvkem cenových signálů, které jsou trhem poskytovány. Určení vnitřní hodnoty společností je důležitým prvkem nejen pro fúze a akvizice, ale také pro banky, dodavatele, zákazníky a zaměstnance ve vztahu k současnému a budoucímu vývoji společností. V současné době existuje mnoho nejasností v teoretických koncepcích a praktických aplikacích týkajících se oceňování obchodovaných společností. Výsledky předkládané disertační práce jsou zaměřeny na komplexní otázku procesu oceňování společností. První část práce bude zaměřena na vyřešení otázky, zda jsou společnosti obchodované na BCPP podhodnoceny, nadhodnoceny nebo řádně oceněny. Druhým cílem práce bude identifikace faktorů, které ovlivňují odchylku tržních cen na BCPP od jejich vnitřní hodnoty. Třetí cíl práce se zaměřuje na získání odpovědi, zda je výhodnější, aby se BCPP připojila k ostatním akciovým trhům v rámci zemí visegrádské skupiny. Výsledky disertační práce potvrzují, že průměrná cena akcií českých kótovaných společností se v roce 2017 odchyluje od jejich vnitřní hodnoty o 58 %, zatímco u mezinárodních společností činí odchylka 301 %. Průměrná odchylka odhadované vnitřní hodnoty a průměrné tržní ceny u vybraných 10 společností obchodovaných na BCPP činila v roce 2017 180 %. Společnosti, které měly v roce 2017 velmi nízkou odchylku vnitřní ceny od průměrné tržní ceny, byly: Kofola Československo, Unipetrol Orlen Group, Moneta Bank a Stock Spirit PLC. Výsledky třetího cíle ukazují, že úroveň rizika BCPP by byla o 17,5 % nižší, kdyby se připojila k akciovým trhům visegrádských zemí. Úroveň rizika BCPP by navíc poklesla z σ=1.28 na σ=1.09. Průměrná míra rizika od roku 2009 do roku 2017 na jednotlivých burzách V4 byla následující: Burza cenných papírů Budapešť měla nejnižší riziko, následovala Burza cenných papírů Praha, Burza cenných papírů Varšava a nejvyšší riziko vykazovala Burza cenných papírů Bratislava.

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1. INTRODUCTION

Company valuation is a significant feature of the management performance that reflects underlying settings of the company. Moreover, company value depends on two inputs that are negatively related within them, such as: risk and returns. Returns are detected through cash flows that the company generates. Risk is shown on the cost of equity and cost of debt which are involved within the discount rate (Damodaran, 2005). Different scholars apply the diverse methodology on the valuation process. Valuation of the company is an important outcome in reflecting the existing situation of the company as far as it delivers information on future and the current prospect of assets, debt, equity, cash flow and so on. The book value of the equity represents historical registrations of the difference between assets and debts. The equity value gained from balance sheet does not reflect the current state of the assets. Market value reveals the truthful company position. Market prices are determined by market forces such as: demand, supply, macro factors, firm specific factors etc. Fama (1968) considers that stock market prices adjust toward the intrinsic value of the company. In contrast, Shiller (2000) confirms that stock markets most of the time are leaded from euphoria, driven by psychological factors. Moreover, Harry Markowitz (1952, 1959), established the first modern concepts that risk exposure within stock markets can be eliminated through diversification.

The study conducted by Jensen (2005) confirms that firms with overvalued shares engage in a different activity to keep their shares overvalued. Uncertainties are imposed on the beta coefficient, which captures the overall risk level within and outside the company. Beta coefficient is an integral part of the Capital Asset Pricing Model (CAPM) which is the main element in determining the value of the companies listed on the stock market. The risk level of the public companies is measured through linear relationship within stock market returns and individual security returns, named as beta coefficient (Chen, 2003; Tofallis, 2008). Beta coefficient is an important element within the CAPM. According to Roll (1977), CAPM will never be a testable theory since we do not know the configuration of the market portfolio. There are many uncertainties associated with valuation of companies. Fernandez and Bilan (2015) consider these uncertainties as errors linked to the valuation process. Moreover, using incorrect inputs in the valuation process, is a central issue for misleading results (Fernandez and Bilan, 2015). Fundamentally, the company is being valued for its future prospect rather than its current steady state (Damodaran, 2012). Moreover, Kaplan and Ruback (1995) performed a study with 51 highly leveraged companies using discounted cash

flow (DCF) and comparable multiple method. However, they did not come up with a concrete suggestion, which of the two methods are more appropriate in the valuation process. However, there is a true intrinsic value which can only be estimated.

Still there is no accordance among scholars which is the appropriate method to value public companies. Different methods use diverse financial inputs and stand on different assumptions. The financial crisis of 2008 proved that stock prices does not always reflect the real value of the listed stocks. Moreover, Koeplin et al. (2000) compared the valuation ratios for private and public companies, percentage difference between the two was the discount rate. Their findings show that US companies are acquired at 20-30% lower discount rate relative to public companies, while non-US companies are acquired at 40-50% lower discount rate. Discount rate (cost of equity and cost of debt), starts with the internal risk of the company and ends up with the general risk of the economy. This method has basic assumptions to be followed during the valuation process. Hence, these assumptions will necessarily affect the value of the company (Steiger, 2008).

The work intents capturing the estimated intrinsic value of the company not the market price. To the best knowledge, there is no scientific work that measures position of the companies listed in PSE based on the valuation methods. Additional dimension of the work tends to observe influential factors that deviate prices from intrinsic value to market prices. Furthermore, the results of the work provide signals for financial investors not only if the shares in the PSE are correctly priced, but also generates outlook on the factors that deviates the prices from intrinsic value. Additional aim of the work tends to observe risk outcomes when PSE joins with the other stock markets of the Visegrad countries.

1.2 Problem statement

Prices are important signals for the recourse allocation. Fama (1968) claims that stock prices always adjust toward equilibrium (intrinsic value). Efficient market hypothesis considers that stock prices reflect all available information, public and private. The stock markets of the Eastern Europe are characterized from a small number of the listed companies and inefficiency. Previous works were mainly focused on the factors influencing stock prices in the Prague Stock Market. However, results of my work confirms the reasons and the magnitude of deviation of the stock prices in the PSE from their intrinsic value (equilibrium). Moreover, the work identifies, risk benefits for the PSE when it operates jointly with the stock markets of the other Visegrad countries.

1.3 Objectives of the thesis

Risk is a crucial component linked with the uncertainties of the stock markets. The first objective of the work tends to capture, if the companies listed in the PSE are undervalued overvalued or properly valued. The results of the first objective will identify the current position of the listed companies in the PSE. Second objective will be based on the factors influencing deviation of stock prices from estimated intrinsic value. Moreover, the third objective identifies overall risk of the PSE based on the portfolio diversification. Standing on this argument, objectives are set up, such as:

Specification of objectives:

O1: To examine the estimated intrinsic value of the companies listed on the Prague Stock Exchange (PSE). If the companies are undervalued, properly valued or overvalued.

O2: To conduct a critical analysis of factors influencing deviation of estimated prices to market prices.

O3: To examine the general risk level of the PSE based on the portfolio diversification (if the risk level of the PSE would decline when it joins stock markets of the other Visegrad countries).

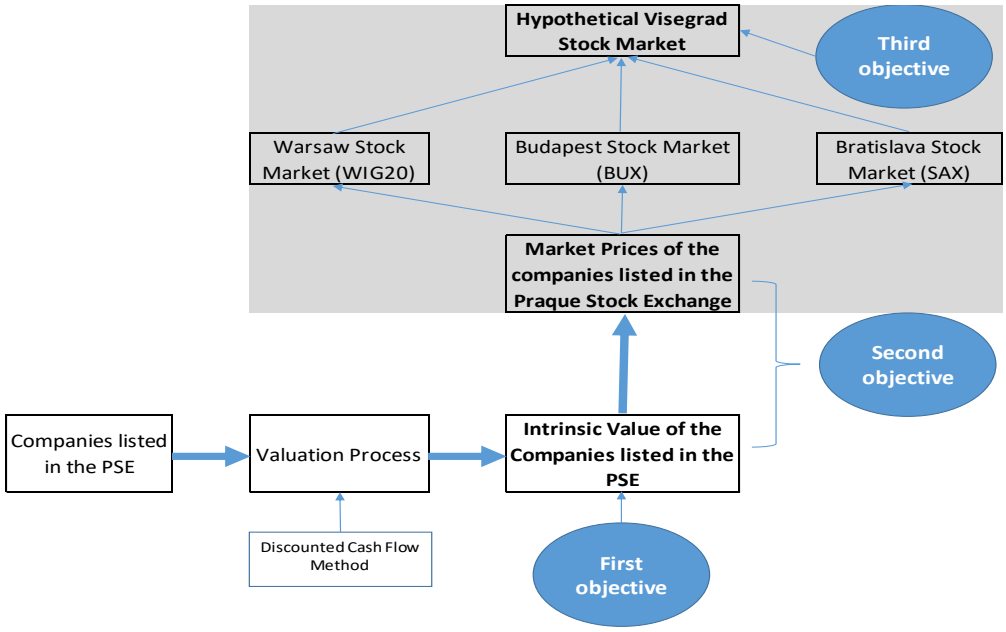

Figure 1

Schematic diagram of the research work (Source: Authors own elaboration)

Figure 1 shows the research process standing on four objectives. The first objective detects estimated intrinsic value of the companies listed within the PSE. The second objective detects factors that push prices to deviate from intrinsic

value to market prices. The third objective observes risk benefits of the Prague Stock Exchange (PSE) by joining the other stock markets of the Visegrad countries.

1.4 Research questions developments

This section indicates developments of the research questions. Standing on the problem identification and the literature review, five main research questions are set up.

The five main research questions are explained and below.

1.4.1 Research questions regarding the estimated intrinsic value of the listed companies in the PSE

O1Q1: What is the estimated intrinsic value of the companies listed on the Prague Stock Exchange?

O2Q2: Which are the factors that deviate prices from estimated intrinsic value to market prices?

1.4.2 Research questions regarding the diversification risk of the Visegrad Stock Exchanges

O3Q3: What is the risk level of the individual stock markets, such as: PSE, SAX, BUX and WIG20?

O3Q4: How would change, risk level of the PSE when it joins stock markets of the hypothetical Visegrad countries?

2. THEORITICAL BACKGROUND

2.1 Stock market equilibrium

Stock prices are driven by fundamental capitalist forces such as supply and demand. Stock price movements gained the attention of numerous researchers and wide-ranging conclusions are achieved. The demand for stocks is influenced mostly by firm specific factors and macroeconomic context of the country. Stock prices stand in the past and future cash flow of the company. Political environment, elections, wars, oil prices tends to influence stock prices. The study by Jones and Kaul (1996) for the UK, Japan, Canada and US stock markets found a positive association within stock prices and oil shocks. The study by Edmans (2011) shows that satisfied workers generate long run returns for the company.

Firm specific factors stand within internal company performance, such as: corporate governance, talent management, financial management, dividend policy, etc. The profound work of Gordon (1959) considers that stock prices are directly influenced from dividend per share (DPS), growth rate and discount rate. However, Modigliani and Miller (1961) confirms that dividends per share is totally offset from other financial indicators and it loses the significance within the model. Modigliani and Miller theory stands under the assumption of perfect market conditions. Moreover, the study by Wippern (1966) on 60 companies within four years' time period concludes that growth rate, payout ratio and size have a significant effect on the share prices. However, Uddin (2009) found a significant relationship within stock prices and assets, earnings per share and dividend per share. Uwuigbe et al. (2012) on the study for 30 listed companies detected that leverage indicators and company profitability have a significant effect on the stock prices.

Development of the stock markets is also affected from the political parties in power. Conventional parties tend to give more attention to the development of the stock market. They consider that developed stock market, accumulate and distribute income among diverse layouts of the society. However, Piketty (2015) in his book "Capital in the 21st century" confirms with the real historical data that stock markets are one of the components that generates income and wealth inequality. Moreover, the book confirms that stock markets create income that remain solely on the wealthiest people of the society. Blinder and Watson (2016) found that stock markets were performing better in the US when the Democratic Party was leading the country. Moreover, Santa-Clara and Valkanov (2003) have proven that equity markets were generating better performance in the US during the democratic premiership. Naes et al. (2011) confirms higher liquidity in the stock markets during the democrat's period. However, equity markets remain a controversial topic among economist and scholars that attracts a lot of research.

2.2 Factors of stock market equilibrium

Stock markets are an important element of the financial system. Moreover, risk linked with the volatility of the stock markets has always been a major concern for the financial investors. A small number of publicly listed companies tend to increase correlation coefficient and the overall risk level within the stock markets

(Demiguel et al. 2013). Current stock prices reflect expectation for the future cash flows that companies tend to generate. In addition, stock prices are unpredictable since depend on the upcoming choice that has not occurred from: investors, governments, international environment, nature, etc. The manufacturing sector is the most important sector, while the financial sector is the fastest growing sector in the Czech Republic and other Visegrad countries (Pražak and Stavarek, 2017). PSE contains limited number of the listed companies and low turnover (PSE, 2017). It is considered that stock markets reflect overall information on the economy when they are strong efficient form. Fama (1968) considers that investors cannot beat the stock markets for a long time since markets have the ability to adjust their own excesses. However, stock price equilibrium is an ideal concept since stock prices reflect expectation for the future cash flow. In contrast, the future is unknown since depends on the decisions that are not made from people, government, companies, environment, etc.

The study conducted by Boulton et al. (2000) within the period 1978-1998 of 10000 US public companies confirmed that the market value of the shares represents 95% of the book value. However, the study conducted by King and Langli (1998) for the Germany, UK and Norway found that the difference between market value and book value is quite low compared to US companies. Moreover, the study completed for Poland from Gornik et al. (2001) showed that the ratio book value to market Price is lower compared to other European countries. The study realized by Hellström (2006) for the period 1994-2001 on the Czech and Swedish companies confirmed that results are diverse within two stock markets. In addition, Hellström (2006) detached his word in two periods (1994-1997 and 1998-2001), the results confirmed that market to book value ratio declined for the Prague Stock Exchange from 0.74 to 0.57 while in Stockholm Stock Market increased from 2.35 to 2.67. The work by Korányi (2008) claimed that companies listed on the Budapest Stock Market were undervalued for 150%. In addition, Juhász (2004) confirmed that public companies within BUX (Budapest Stock Market) were undervalued in the period within 1999 and 2002 (book value to market value was in the range of 1.0). Examples mentioned in the text show that there are differences among countries concerning the deviation within market value and book value. However, in USA difference within book value and market value of the listed companies is quite large. Mezisi (2008) confirms that shares of the A-class companies are bought below their book value which reflects the pessimistic environment within financial investors.

Irfan and Nishat (2002) in the case of Pakistan revealed that dividend yield, payout ratio, leverage and size of the company are important elements that affect stock prices. However, Omar and Mutair (2008) in a case of Kuwait found that significant factors that affect stock market prices are book value and earnings per share. Somoye et al. (2009) shows that the Stock Market of Nigeria is influenced from earnings per share, foreign exchange rate, GDP, interest rate.

3. METHODOLOGY AND DATA

3.1 Methodology

The research work contains diverse methodological process since it is based on different objectives. Each process contains its own methodological approach. The first objective of the work tends to cover the intrinsic value of the companies listed on the Prague Stock Exchange. The methodology used in the first objective will stand on the discounted cash flow method. Monte Carlo simulation is conducted to generate possible estimated intrinsic values of the companies listed in PSE.

The second objective was completed via existing literature on the issue of the factors influencing stock prices in the PSE. The third objective measure the diversification risk of the individual stock exchanges within Visegrad countries. Portfolio diversification techniques are used to obtain results of the third objective. Each stock exchange has been considered as an independent portfolio within the work. The following programs have been used to generate the results of the third objective, such as: Python 3.6.3 (version: 0.21.0), Numpy (version: 1.13.3), Jupiter Notebook (version: 5.2.0). The results of the third objective will deliver clear signals what will happen with the risk-reward tradeoff when PSE join other stock markets of Visegrad countries.

3.2 Monte Carlo Simulation

Simulation of the Discount Cash Flow is calculated by using Monte-Carlo technique. Growth rate is the only parameter that is simulated to generate random growth rate values. Moreover, to generate a random growth rate is used a Monte Carlo simulation method, known as the Percentage Point Function (PPF). PPF is a type of cumulative distribution function. Percentage Point Function (PPF) is used to generate the growth rates, based on that the calculation of the growth rates are reached by inputting three parameters:

- X - randomly generated number where x such as: $0<x<1$ (probability)

- Growth rate mean (based on the Damodaran database estimations)
- Standard deviation of growth rate

Number of randomly generated growth rates are equal with the number of years we want to simulate. Standard deviation of 1% is used for each company. Moreover, each year we generate randomly x values used for the PPF calculations. Each sample has its own randomly generated growth rate values. Based on the sample size, the experiment is repeated under the same conditions and independently from each other. What we want to find with PPF is the x value in the formula of Cumulative Distribution Function, such as:

$$P(X >= x) = p, \text{ where p is the randomly generated number} \quad (8)$$

So we want to find x area by given the probability p. So in this case we have inverse DCF that we call PPF, where we are going to find the x value. Parameters below define the experiment conducted with Monte Carlo Simulation, such as:

- Cash Flow for the first year (known as 'CF_1')
- Growth Rate in decimal format (known as 'g')
- Standard deviation
- Discount Rate in decimal format (known as 'r')
- Number of years to simulate
- Number of samples or simulations

The process starts with randomly generating growth rates for the number of years specified. In addition, the second step starts with calculating cumulative DCF. Cumulative DCF interrupts adding new values if the difference of the two consecutive DCF is less than 6%. Cumulative DCF output can be less than the number of years that are specified in the parameter. Moreover, we are interested to identify the list of Cumulative DCFs when they are reaching the max value before the specified year in the parameter. Moreover, each company has been simulated with three different sample sizes, such as: 500, 1000 and 10000. For each company are provided three normal distributions based on their corresponding number of samples. Plots represent Normal Distribution of their own Cumulative DCF results.

Tools used for the simulation process:

- Programming Language: Python 3.5.3
- Development Environment: Jupyter Notebook

- Random Number Generator: used “np.random.rand” method from Pandas library, ver: 0.24.1
- Generating Random Growth Rate (as ‘g’) we used: “norm.ppf” function from “scipy.stats” library, ver: 1.2.1
- Calculation of Standard Deviation, Mean, Maximum, Minimum values: used DataFrame methods “std”, “mean”, “max”, “min”, from Panda Libscipyrary, ver: 0.24.1
- Representing “Cumulative DCF” and Normal Distribution plots we used: pyplot functions from Matplotlib Library, ver: 3.0.2 and for PDF we used: stats functions from scipyLibrar, ver: 1.2.1
  (The program concerning the implementation of the formula is available on request).

3.3 Diversification model

Markowitz (1952) proposed a three dimensional model where risk is measured from the variance of returns, correlation coefficient within asset classes and their weights within the portfolio. Moreover, the model developed by Sharpe (1964) and Lintner (1965) enhance the concept of risk through involving systematic risk as a component indicator

The Markowitz (1952) formula is used to measure the risk level of the individual stock markets and Visegrad Stock Market.

$$\sigma_k^2 = \sum_i^{n_k} w_{ik}^2 \sigma_{ik}^2 + 2 \sum_i^{n_k} \sum_{j \neq i}^{n_k} w_{ik} w_{jk} \sigma_{ik} \sigma_{jk} \rho_{ijk} \qquad (8)$$

Formula explanation: σ_k^2 of the portfolio in the year k is computed on the sample of n_k companies. Index i indicates a company, j is an auxiliary index assuring that covariance is computed on distinct companies, ω-represents weight of each listed company within the portfolio based on their total assets, ω^2 represents weight in square, σ^2- variance of returns, σstands for the standard deviation of returns while $\varphi(i,j)$ shows correlation coefficient within returns of the companies in the portfolio.

Mathematical formula has been implemented from the following computer programs: Python 3.6.3 (version: 0.21.0), Numpy (version: 1.13.3), Jupiter Notebook (version: 5.2.0). Generating the inputs of the risk level (σ^2) starts with splitting the tables that contain prices and trade volume. Following matrix has been used to generate the results *(the program concerning the implementation of the formula is available on request)*.

3.4 Data

3.4.1 Model 1 data (DCF model)

The study uses secondary data of the companies listed on the Prague Stock Exchange (PSE, 2018). Data were collected from the annual statements of listed companies in PSE. The following accounting items were used to generate results for the intrinsic value of the listed companies, such as: interest expenses, property-plant & equipment, depreciation & amortization, cash flow from operations, total equity and total liabilities (PSE, 2018). The growth rate has been obtained from the Damodaran database (Damodaran, 2018). Growth rate within the Damodaran Database is classified based on the industry characteristics. However, risk free rate measured through interest rate is collected from 10 years' Czech government bonds (CNB, 2018). Moreover, 10 blue chip companies in 2017 from the Prague Stock Exchange were selected for generating the estimated intrinsic values. The selected companies were, such as: O2, Phillip Morris CR, Moneta Bank, Komercni Banka (KB), Vienna Insurance Group (VIG), Kofola Ceskoslovensko, CEZ, Erste Group Bank and Stock Spirit PLC (PSE, 2018). In contrast, companies such as: Central European Media Enterprises Ltd and Pegas Nonwovens were not selected since they were generating negative FCFF from 2013 till 2017.

3.4.2 Model 2 data (Diversification Model)

Model 2 uses two types of inputs (stock prices and trade volume) to generate diversification risk of the individual stock markets (portfolios). Data concerning stock prices and trade volume on the individual stock markets of the Visegrad countries are collected from the Thomson Reuters Eikon database (Eikon, 2018). Stock prices and trade volume are collected from 2009 till 2017, on the weekly basis. Moreover, prices and volume of trading are collected in a euro currency that enables pooling of the Visegrad Stock Exchanges. Moreover, 12 companies are selected from the PSE, 16 companies from BUX, 20 companies from WIG20 and 6 companies from SAX. However, companies are changing among years since some companies are leaving the stock exchange while the others are entering it.

4. RESULTS

4.1 Verification of the first research question (Q1: O1)

What is the estimated intrinsic value of the companies listed on the Prague Stock Exchange?

Table 1 and Table 2 indicate Czech and international companies that are listed on the PSE. Deviation of market prices in 2017 from their estimated intrinsic value with 10000 samples was in the range of 179.82%. However, the average deviation of the market prices from estimated intrinsic value in the absolute numbers was 1766.6 CZK. The companies overvalued in 2017 were, such as: Kofola Ceskoslovensko, Unipetrol Orlen Group, Moneta Bank, Stock Spirit, Phillip Morris and Vienna Insurance Group. In contrast, 4 companies were undervalued in 2017, such as: CEZ, Komercni Banka, Unipetrol Orlen Group and O2.

Table 1 shows Czech companies listed on the Prague Stock Exchange. The average deviation of the Czech companies in the PSE from the average market price in 2017 was 58.17% or in absolute numbers 350 CZK. The company that has the lowest deviation within estimated intrinsic value and market price was Moneta Bank (5 CZK), followed by CEZ (19 CZK), Unipetrol Orlen Group (46 CZK) and Komercni Banka (1651 CZK).

Table 1 Indicates if the companies listed in the PSE are undervalued or overvalued in 2017

Czech listed companies	**DCF mean 10000 samples/ number of shares (in CZK)**	**Average Market Price in 2017 (in CZK)**	**Deviation in %**	**Deviation in absolute numbers (in CZK)**	**Market Position in 2017**
CEZ a.s.	454.3	435.6	4.07	19	Undervalued
KofolaCeskoslovenskoa.s.	381	409	7.3	29	Overvalued
UnipetrolOrlen Group	239.9	285.8	16	46	Overvalued
Komercni Banka (KB)	2591.2	939.8	257	1651	Undervalued
Moneta Bank	75.2	79.9	6.5	5	Overvalued

Source: Authors own elaborations based on the audited financial statements of the Czech companies listed in the PSE (PSE, 2018).

Table 2 shows the level of deviation within average market prices in 2017 and the estimated intrinsic value for the international companies listed on the PSE. The average deviation of the international company's stock prices from their estimated intrinsic value was 301% or in the absolute number 3183 CZK. Average stock prices of the international companies were deviating 5.2 times more than a deviation occurred by Czech listed companies. However, the company with the lowest deviation was Stock Spirit Group (22 CZK), followed by Vienna Insurance Group (224 CZK), O2 (819 CZK), Erste Group Bank (2,297 CZK) and Phillip Moris CR (12,554 CZK).

Table 2 Indicates if the international companies within the PSE are undervalued or overvalued in 2017

International listed companies	**DCF mean 10000 samples/ number of shares (in CZK)**	**Average Market Price in 2017 (in CZK)**	**Deviation in %**	**Deviation in absolute numbers (in CZK)**	**Market Position in 2017**
Stock Spirit Group PLC	39.2	61.4	43.3	22	Overvalued
Erste Group Bank	3,178.9	1,084	360	2,297	Undervalued
O2	1,088.1	270	400	819	Undervalued
Vienna Insurance Group (VIG)	416.6	641.2	54	224	Overvalued
Phillip Morris CR	2,276	14,830	650	12,554	Overvalued

Source: Authors own elaborations based on the audited financial statements of the international companies listed in the PSE (PSE, 2018).

According to the results obtained from the valuation, average stock prices in 2017 of the Czech listed companies are closer to the estimated intrinsic value than international listed companies. The deviation of the average market price in 2017

from their estimated intrinsic value of the Czech listed companies was 58% or 350 CZK while for international listed companies was 301% or 3183 CZK. Overall deviation of 10 selected companies within the PSE was in the range of 179.82%. The company that was close to the equilibrium from the Czech listed companies in 2017 was Moneta Bank with deviation of 6.5% or 5CZK. However, from the international listed companies only Stock Spirit PLC was closer to the equilibrium with 43.3% deviation or 22 CZK.

4.2 Verification of the third research question (Q3: O3)

What is the risk level of the individual stock markets, such as: PSE, SAX, BUX and WIG20?

Table 1 represents the risk level of the Visegrad Stock Exchanges from 2009 till 2017.The lowest average risk level and the highest diversification benefits from 2009 till 2017 has BUX ($\sigma = 1.07$), followed by PSE ($\sigma = 1.28$), WIG20 (2.08) and SAX ($\sigma = 3.11$). Basically the lowest diversification benefits and the highest average risk level from 2009 till 2017 contains SAX.

Table 1 Risk level of the Visegrad Stock Exchanges from 2009 till 2017.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	Avg. Risk 2009-2017
Portfolio A (SAX)	19.6	0.38	5.98	0.84	0.26	0.04	0.16	0.63	0.05	3.1
Portfolio B (WIG20)	4.48	2.21	2.76	1.95	1.27	0.76	2.41	1.11	1.82	2.09
Portfolio C (BUX)	2.87	1.22	2.32	0.54	0.29	0.37	0.82	0.72	0.52	1.07
Portfolio D (PSE)	3.37	0.83	3.35	1.03	1.05	0.52	0.83	0.28	0.27	1.28

Source: Authors own elaborations based on the Thomson Reuters Eikon database (Eikon, 2018).

4.3 Verification of the fourth research question (Q4:O3)

How would change, risk level of the PSE when it joins stock markets of the hypothetical Visegrad countries?

Standing on the received results, risk level of the PSE declines from $\boldsymbol{\sigma}$=1.28 to the $\boldsymbol{\sigma}$=1.09 when it operates under hypothetical common Visegrad Stock Exchange. Moreover, the average risk level from 2009 till 2017 would have been reduced for 17.5%, if PSE would operate under the hypothetical Visegrad Stock Exchange.

5. DISCUSSION

The study by Gilmore and MC Manus (2003) used weekly data from July 1995 till September 1997 to test efficiency level of the Czech, Polish and Hungarian stock markets. The results of their work confirm that the three stock markets stand as weak efficient markets. The study by Dragotă and Tilica (2014) claims that

abnormal returns can be realized in the stock markets of the Eastern Europe if the appropriate financial instruments are used.Pošta (2008) confirms weak efficient form of the Prague Stock Exchange with the data from January 1995 till June 2007.Moreover, other scholars have also confirmed the weak efficient form of the Prague Stock Exchange in the different intervals (Smith, 2012; Todea and Lazar, 2012; Stoica and Diaconasu, 2011; Dritsaki, 2011).Weak efficiency within the PSE confirm that stock prices didn't experience random walk which create space for arbitrage (abnormal returns in the long run).

In contrast, the results of my work tend to find the estimated intrinsic value (equilibrium level) of the listed companies in PSE based on my estimations. However, based on the estimated results concerning the intrinsic value of the companies listed in the PSE, Czech listed companies were closer to their intrinsic value than international companies. Czech listed companies based on my estimated results show that average market prices deviate from intrinsic value 58.17% while international companies for 301%.

6. CONCLUSION

According to the estimated results, average market price of Czech listed companies was closer to the estimated intrinsic value than of the international listed companies. The average deviation of the Czech listed companies between average market price and estimated intrinsic value was in the range of 58 % or 350 CZK. International companies in 2017 had a deviation in the level of 301 % or 3183 CZK. However, from the 10 selected companies within the PSE in 2017, the average deviation was 179 %. From the Czech listed companies the company that had the lowest deviation within average market prices and estimated intrinsic value was Moneta Bank, with 6.5 % or 5 CZK. However, from international listed companies Stock Spirit PLC had the deviation of 43 % or 22 CZK.

Results from 2009 till 2017 show that SAX on average is the riskiest portfolio and offer the lowest diversification benefits. In contrast, the least risky portfolio that offers the highest diversification benefits on average is BUX. The results confirm that the risk level of the Prague Stock Exchange (PSE) would decline for 17.5% if it would have operated under the hypothetical Visegrad Stock Exchange.

6.1 Limitations of the work

DCF Model used for the first objectives, consider certain assumptions that make the model to certain level unrealistic. Moreover, the assumptions linked with the DCF model stand on the future growth rate, future cash flow and future discount rate. The results of my work identify the intrinsic value of the listed companies in the PSE based on my estimations. Moreover, other scholars or evaluators might identify other estimated values of the companies listed on the PSE. The work cannot identify if the selected companies are in the equilibrium, since there is no threshold that shows to what extent of deviation within intrinsic value and market prices the equilibrium exists. Additional limitation of the method is that it does not take into consideration lifespan of the companies and the possibility of the bankruptcy. Lack of financial and legal due diligence provides a biased outlook on the legal and financial issues which are not revealed in the annual reports.

Since the work propose hypothetical Visegrad Stock Exchange, it does not consider that each country has a diverse tax structure imposed on corporations. Monetary policy is unique within each country which complicates the issue of joining stock markets even more. Slovakia is operating under a Eurozone monetary system while the Czech Republic, Hungary and Poland operate under

their own currency regime. Unique currency regime among selected countries cause extra limitation for joining the stock exchanges.

7. CONTRIBUTION

7.1 Contribution to the theory

Incorrect valuation lies within the theoretical concept of the markets with asymmetric information. My contribution to the theory lies within the concept of Fama (1968) that markets adjust very fast toward equilibrium (estimated intrinsic value). However, the results of my work suggest that stock prices might be prone to disequilibrium, even we don't know the exact reasons for this disequilibrium.

7.2 Practical applications

The results of the work show new insights into the way valuation has been taught in the university. Moreover, it provides ecidence that valuation techniques can be used to determine estimated equilibrium price of the listed companies. Outcomes from the third objective, deliver signals to the governments of Visegrad countries on the risk-reward benefits of having a common stock market. Index funds will get an overview on the risk reward trade-off linked with stock markets of Visegrad countries.

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