

A COMPARISON OF THE STOCK EXCHANGES OF THE CENTRAL AND EASTERN EUROPE STOCK EXCHANGE GROUP

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***Abstract:** This article deals with an evaluation of the stock exchanges of the Central and Eastern Europe Stock Exchange Group (CEESEG), which comprises four stock exchanges. The individual stock exchanges of the CEESEG are characterized using the main stock indicators and we also compare their development and achievements. The stock exchanges are evaluated in terms of their market capitalization, liquidity and volatility. Correlation coefficients are used to express the dependence of the indices of the monitored stock exchanges with the Dow Jones Euro Stoxx 50, which is an important indicator of the European capital market. The obtained results complement the knowledge of this interesting segment of the European capital market and can be used by both retail and institutional investors.*

***Keywords:** Securities, Share, Stock exchange, CEESEG, Market capitalization, Yield, Risk.*

***JEL Classification:** G12.*

Introduction

Stock markets have an important place in the market economy of each country. A well-functioning stock market positively affects the economy and enables investors to capitalize on their financial resources. Today's modern times exhibit a high degree of globalization, providing investors with easy access to almost all of the world's stock markets. Highly advanced information technology has led to countless securities becoming available for trading on stock exchanges. Common European legislation and the different levels of economic development of the Member States of the European Union facilitate the analysis of investment indicators of stock markets focusing on Central and Eastern Europe, in order to make investment decisions. Stock markets in this region are still considered to be emerging and in many cases their development deviates from advanced markets. This provides investors with attractive investment opportunities. In terms of interest from investors, the Polish market dominates in the region and the other markets are often overlooked. However, an important association of Central and Eastern European stock exchanges is the Central and Eastern Europe Stock Exchange Group (CEESEG), which comprises four stock exchanges.

The aim of this article is to characterize the individual stock exchanges of the CEESEG and to compare their development and achievements using the main stock market indicators. The reason for addressing this issue is the possible applicability of the knowledge gained for the entire investor spectrum from retail to institutional investors. It should also supplement the knowledge of this interesting segment of the Eastern European stock market.

1 Formulation of the issue

The main aim of each investor is to gain the maximum yield from their invested resources. One of the offered opportunities of gaining a relatively high yield is investment in the stock market. The stock market represents one of the most important parts of any economic market system. One of its fundamental tasks has always been to transform household savings in investment firms. Its main benefit lies in its ability to provide finances to companies entering the market and evaluate their performance through market-formed prices.

Movements in stock prices are an important profit factor for investors. The desire to understand stock prices movements is probably as old as the stock market itself.

Investors in equity markets require a tool to help them perform the most accurate predictions of the future developments of share prices. For this, three independent and completely different analytical methods have been developed during the history of economic theory i.e. fundamental, technical, psychological analysis and a combined approach. [7]

Fundamental analysis is the most comprehensive investment method for analyzing securities. It involves analytical activity, which, based on economic, political, statistical and other indicators, estimates the value of the given investment instruments and where its price will go in the future. If the market price is higher than the intrinsic value, the security is overvalued and the investor does not buy it. Conversely, if the market price is lower than the intrinsic value, the investor opens space for the purchase [4].

With the increase in technological advancement, technical analysis has become a popular approach to predicting the future price movements of stocks. Technical analysis does not take into account the fundamental value because it assumes that all of the investors' expectations regarding the future development of these fundamentals are already reflected in the market price. Technical analysis assumes various different trends in price developments. The subjects of this analysis are time series of market prices or the volume of trade of the shares. The following authors [5, 8] deal with technical analysis.

Psychological analysis primarily examines man and the factors that affect his investment decision-making process. According to this theory, market prices of securities are shaped by the behavior of the crowd performing investment activities on the stock exchange. Whereby, the driving force of all activities is the human psyche. [3, 10] .

In addition to fundamental, technical and psychological analysis, another way of looking at the functioning of capital markets has gradually begun to appear, and that is through efficient market hypothesis.

Efficient market hypothesis investigates the deviations of investment instruments prices from their fundamental values. According to this theory, rational investors immediately translate all of the available information to the price of the stocks. For the efficiency of financial markets the prerequisites of a competitive market, the profit motive of investors, free and continuous flow of information, quality of the market infrastructure, liquidity and quality of regulatory legislation must be met. [11]

Investors evaluate their investments according to certain criteria. Return, risk and liquidity are traditionally considered the most important aspects of each investment and form a well known investment triangle. Return is the sum of all income the investor receives from the given investment instrument. Risk is the risk that the real rate of return

deviates from the expected rate of return. Liquidity is the ability to convert an investment instrument into cash with the lowest possible transaction costs. A rational investor would try to achieve a maximum return and liquidity with the lowest possible risk. In practice, however, these investment factors are mutually contradictory and therefore it is not always possible to achieve the maximum conditions for all of the criteria at the same time. On the capital market, the return and the associated risk of the investment instrument are the most important for the investor. Each investor has a different degree of risk aversion, according to which they diversify their investment portfolio. This term represents a risk management system, which blends various different investment instruments within a single portfolio, so that the resulting portfolio composed of various kinds of securities has, on average, a higher return and a lower risk than any asset within the portfolio.

The factors an investor takes into account when deciding where to invest on the market are affected by the quantitative and qualitative characteristics of the individual markets. In this article, quantitative indicators, including the development of indices and their volatility, market capitalization and liquidity, are of particular relevance.

Each stock exchange has indices, which act as stock market indicators. They concentrate price movements into a single number and provide information on the development of the stock market. Indices provide the investing public with very valuable information on the overall market atmosphere and performance. [11]

Market capitalization in absolute values reflects the size of the market in relation to GDP, as well as the relative importance of the capital market for the economy. Larger markets are more attractive to an investor or issuer because they can expect higher liquidity.

Another factor that significantly determines the allocation function of the stock market is sufficient liquidity. Liquidity is one of the three key aspects of investment along with return and risk. The higher the volume of trade, the easier the transfer of ownership of shares to new owners. In addition, liquidity is an indicator of the activities of investors and also, in terms of individual issues, a sign of prestige.

2 Method of calculation and data

From the perspective of the investor an appropriate method for spreading the risk is to build a portfolio of both domestic and foreign titles. In order to diversify, the generated assets should not positively correlate too strongly. From this perspective, information on the interaction of various stock exchange indices is very important for investors. The following equation was used to calculate the correlation coefficients of the individual stock exchange indices:

$$R_{x,y} = \frac{\frac{1}{n} \sum_{i=1}^n (X_i - \bar{X}) \cdot (Y_i - \bar{Y})}{\sqrt{\frac{1}{n} \sum_{i=1}^n (X_i - \bar{X})^2} \cdot \sqrt{\frac{1}{n} \sum_{i=1}^n (Y_i - \bar{Y})^2}}$$

where:

$R_{x,y}$ = correlation coefficient showing the degree of dependence between x and y,

X_i = measured value of x in the order 1,2,3...n; \bar{X} is the mean value,

Y_i = measured value of y in the order 1,2,3...n; \bar{Y} is the mean value.

The basis for calculation of the correlation coefficient is the profitability of the individual indices in quarterly intervals.

Market capitalization the stock exchange is obtained by multiplying the number of shares quoted on the stock exchange by their current rate. This is an important indicator, which shows the size of the stock market. Share prices expressed in domestic currency were converted to Euros based on the exchange rates of the national banks on the last trading day of the given year. Volatility of the stock exchange indices was measured as the percentage difference between the maximum and minimum values reached by the main stock exchange indices. Liquidity of the individual markets is expressed by the “turnover ratio”, which is an indicator of market activity as the share of the trading volume in market capitalization.

The calculation of the individual indicators is based on an analysis of the annual statistical yearbooks of the stock exchanges in the years 2004-2014. For a comparison of the individual indices, the individual indicators were recalculated into Euro based on the exchange rate on the last day of the given year.

3 Characteristics of the individual stock exchanges of the CEESEG

The Central and Eastern Europe Stock Exchange Group (CEESEG) represents a stock exchange alliance, which has a major ownership stake in the stock exchanges of Prague, Budapest, Ljubljana and Vienna. The origins of this group date back to 2004, when the Vienna Stock Exchange partially entered the Budapest Stock Exchange. Its influence strengthened in 2008, when the Vienna Stock Exchange acquired a majority share of the Hungarian Stock Exchange. In 2008, the Vienna Stock Exchange continued in its business activities by acquiring a majority share of the Prague and Ljubljana stock exchanges.

A holding company called CEESEG AG, which is responsible for the strategic and financial management of the entire group, was founded in 2009. These stock exchanges affect not only the economic development of these countries but also economic development e.g. in the EU, because all of the countries in the group are EU Member States. Efforts to harmonize the stock exchanges resulted in the adoption of a single trading platform, Xetra. This group of stock exchanges is among the strongest in Eastern and Central Europe in the 21st century.

3.1 The Prague Stock Exchange (PSE)

The PSE is the oldest stock exchange in the Czech Republic, being established back in 1871. The activities of the stock exchange have been interrupted several times. The main events that affected the functioning of the stock exchange were World War II and the introduction of the principles of a centrally planned economy in the 1950s. A positive change for trading on the stock exchange came after 1989, when the Czech Republic was transformed into a market economy, which provided a positive impulse for the beginning of a new stock exchange era in the Czech Republic. [9]

Trading takes place through licensed securities dealers who can perform transactions and are members of the stock exchange. The PSE uses three indices. The main official index is PX, which was established in 2006 based on the PX 50 and PX-D indices. Shares forming the base of the PX index, traded daily in the selected segment of issue, are referred to as blue chips. As of the 8th of July 2015 there were fifteen issues in the base. Another index is the PX-TR, which has the same base and includes the payment of dividends in the value calculation. The PX-GLOB Index is calculated using the rate of all the traded issues. These indices have an initial value of 1000 points. [1]

3.2 The Vienna Stock Exchange (Wiener Börse)

The Wiener Börse was founded in 1771 and ranks among the oldest stock exchanges in the world. Stock titles have been traded since 1818, before then government bonds, currencies and bills of exchange were traded. The importance of this stock exchange was previously supported by the economic and political influence of the monarchy of Austria-Hungary, and it has also seen several interruptions. A new era began at the end of the 20th century, when new laws were adopted dealing with the privatization of state enterprises. This helped to shape the current form of the Wiener Börse, which was further supported in 1997 when it merged with the Austrian Stock Exchange, which traded in futures contracts. The main official index is the ATX index (Austrian Traded Index), which has been calculated with an initial value of 1000 points since 1991. As of the 8th of July 2015 the index contained twenty of the largest and most liquid stocks traded on the regulated market. The Wiener Börse also has indices for the needs of investors, for example the ATX TR, ATX five, and WBI. [12]

3.3 The Budapest Stock Exchange (BSE)

The main stock exchange in Hungary was founded in 1864 and focused mainly on the commodity of grain. The volume of trading in this commodity led to the BSE becoming the leading cereals market. In the same century, the BSE expanded to other investment instruments and shares. The activities of the BSE were interrupted by the global economic crisis between 1931 and 1932. In the aftermath of the consequences of the crisis it resumed its activities in 1934, and even traded during World War II, when many stock exchanges were closed. The year 1948 was a significant year for the BSE, as the change in political system with a transition to the socialist system meant the activities of stock exchange were completely interrupted until 1990. The BSE became part of the CEESEG in 2010 and three years later it began using the Xetra trading system. The main index on the BSE is the BUX, which is calculated since 1991, which as of the 8th of July 2015 had a base of fourteen titles. Other indices used on the BSE are the BUMIX and CETOP20. [2]

3.4 The Ljubljana Stock Exchange (LJSE)

The main stock exchange in Slovenia dates back to 1924. At the beginning trade focused on commodities, mainly corn and wood, but securities were added over time. The LJSE expanded its activities in 1927 when it started trading with foreign currencies, which contributed to a total turnover of 95%. As with other stock exchanges the LJSE suffered the consequences of World War II. In 1942, activities were completely suspended up until 1989 when trading began again. The LJSE is currently part of the CEESEG and is one of the smallest stock exchanges trading on the same Xetra platform. The official index is the SBITOP, which as of the 8th of July 2015 had a base of only seven stock titles. [6]

4 Comparison of selected data from the stock exchanges in the period between 2004 and 2014

Indicators that influence decision-making in the investment plans of individual investors represent important information for the investment community. Investors will base their investment decisions on their own experience, estimates, intuition and the available public information on the individual stock exchanges. Each stock exchange has its own rules on the disclosure of data and information to the general public. The most important

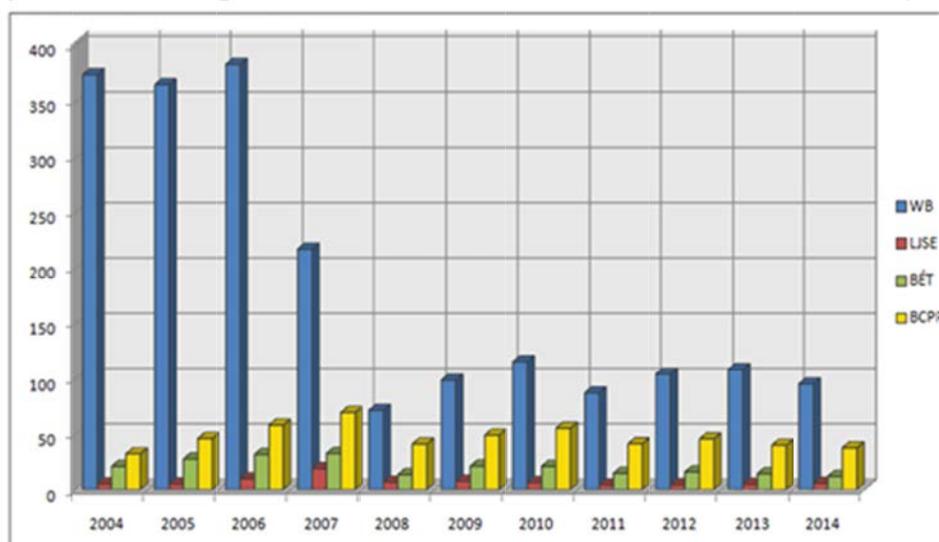
indicators are considered to be e.g. market capitalization, total volume of executed trades, and volatility of securities prices.

4.1 Market capitalization

The market capitalization of stock exchanges is one of the most significant parameters expressing the importance of the stock market. It states the sum of the market values of all of the shares admitted to trading on regulated markets. A comparison of the market capitalization values of the individual stock exchanges therefore involves domestic and foreign shares, common and preferred shares and shares without voting rights.

The market capitalization values in Fig. 1 are in billions of Euros. Some stock exchanges report data in a currency other than Euros, so they were recalculated using the exchange rates valid on the last day of the given year set by the national banks of the monitored countries.

Fig. 1: Market capitalization between 2004 and 2014 in billions of EUR



Source: own work

For the year 2014, the largest stock market in the CEESEG was the Wiener Börse, which recorded a market capitalization of 95.1 billion Euros. The PSE ranks second with 37.5 billion EUR. Conversely, the two other members of the group, the BSE and LJSE, had only very low levels of market capitalization in the same period, with 12 billion EUR and only 5.8 billion EUR, respectively.

4.2 Liquidity using the turnover ratio

Liquidity can also be expressed using the turnover ratio. This indicator assesses market activity and expresses the share of trading volume and market capitalization. The indicator shows how the stock exchange is able to exploit its stock market potential.

The BSE held the lead position for this indicator in 2014, with a 50% share. The PSE and Wiener Börse had a value of around 20% and the LJSE only fulfilled 10% of its business potential. Given that for advanced stock exchanges this indicator stands at around 200%, all of the individual stock exchanges of the CEESEG have very low values.

4.3 Volatility

Volatility of main stock indices was observed on the evaluated stock markets. Volatility means fluctuations in the value of assets and is used to assess risk when investing on financial markets. For the selected time period from 2004 to 2014, the volatility is measured as the percentage difference between the maximum and minimum values of the main stock indices. The data are presented in Table 1.

Tab. 1: Volatility of the main indices between 2004 and 2014 in %

Year	ATX	SBITOP	BUX	PX
2004	35.47	20.52	36.6	35.84
2005	34.14	16.17	39.05	28.93
2006	25.53	31.52	27.36	28.26
2007	16.26	46.48	25.5	19.15
2008	66.55	69.76	59.62	61.2
2009	48.7	26.44	57	47.44
2010	24.64	20.99	21.78	16.87
2011	44.92	33.24	40.39	33.95
2012	23.59	21.56	20.25	17.49
2013	18.56	16.69	11	20
2014	25.54	21.58	19.49	13.84
Average	33.08	29.54	32.54	29.36

Source: own work

Table 1 shows the different volatility values for the individual stock market indices during the monitored period. The variation in values results from the diverse composition of the base indices and the different weights used when listing securities. The highest volatility was in 2008 when the financial crisis broke out in full. For the year 2014, we can conclude that the least risky stock exchange was the PSE with 29.36% and behind that the LJSE with 29.54%. The BSE and Wiener Börse both had values above 30%. The BSE reached 32.54% but the most risky was the Wiener Börse, which reached a value of 33.08%.

4.4 Correlation of the CEESEG indices with the Dow Jones Euro Stoxx 50 index

For professional as well as armature investors, information about the relationship of indices on stock exchanges is very important. It is one of the factors that help investors make their final decisions on their investment plans. The equation given on page 4 was used to calculate the correlation coefficients of the stated examples.

Given that the DJES50 index is considered the main indicator for the development of the European economy, the values of the correlation coefficients were calculated in relation to the main indices of CEESEG. For the comparison were used quarterly values from 2004 to March 2015.

Tab. 2: Correlation of CEESEG indices with the DJES50 index for the period 2004-2015

	ATX	SBITOP	BUX	PX
DJES50	0.858	0.645	0.660	0.802

Source: own work

From the results of Table 2 we can confirm the positive correlation of the indices of the stock exchanges of the CEESEG with the DJES50 index. The greatest dependence is

shown by the Wiener Börse, followed by the PSE. The BSE shows a slightly smaller dependence and the smallest is shown by the LJSE.

Furthermore, correlations were calculated for the shortest period from 2014 to March 2015. This is the most recent period for investors deciding on their future investments. The results are shown in Table 3.

Tab. 3: Correlation of CEESEG indices with the DJES50 index for the period 2014-2015

	ATX	SBITOP	BUX	PX
DJES50	0.229	0.313	0.796	0.554

Source: own work

For a shorter time period there is a change in the order of dependence on the results of the DJES50 index. The lowest statistical dependence is shown by the Wiener Börse index and the largest by the BSE index.

Finally, the dependence of the indices between the individual members of the CEESEG was calculated for the most recent period, i.e. from 2014 to March 2015. The results are shown in Table 4.

Tab. 4: Mutual correlation of CEESEG indices for the period 2014-2015

	ATX	SBITOP	BUX	PX
DJES50	x	-0.374	0.660	0.852
SBITOP	-0.374	x	0.307	-0.010
BUX	0.660	0.307	x	0.903
PX	0.852	-0.010	0.903	x

Source: own work

The LJSE showed the least dependence of all the members for the selected duration; in contrast the other stock exchanges had a positive mutual correlation, the largest being between the PSE and BSE.

4.5 Summary evaluation of the stock exchanges of the CEESEG

Table 5 was compiled from the point of view of the basic investment indicators i.e. return, liquidity and risk. The evaluation was carried out for 2014 only. The value in the return column represents the percentage change of the index from the beginning to the end of the monitored year. Market liquidity is expressed by the evaluative indicator “turnover ratio” and risk is determined as the percentage difference between the maximum and minimum values of the main stock exchange index in the monitored period. The risk is derived from volatility because market volatility increases the risk of not achieving the expected return.

Tab. 5: Evaluation of the basic investment criteria in %

Stock exchange	1/2014 – 12/2014		
	Return	Liquidity	Risk
WB	-15.18	25.08	25.54
LJSE	19.12	9.16	21.58
BET	-10.34	49.58	19.49
BCPP	-4.76	14.86	13.84

Source: own work

In terms of return, it is possible to state that three of the stock exchanges generated a loss, with the highest loss being experienced by the Wiener Börse, followed by the BSE and the PSE. The only member of the group to have a positive return was the LJSE, with 19.12%.

The second criterion to be assessed was liquidity. The BSE had the highest value of 49.58% and the Wiener Börse also reached a high level of 25.08%. The PSE has a lower liquidity of 14.86% and the lowest liquidity was measured at the LJSE, with only 9.16%.

The last to be assessed was risk, using the volatility of the main stock exchange index. The PSE had the lowest value of 13.84%, the second lowest was the BSE with 19.49%, followed by the LJSE with 21.58%. The Wiener Börse had the highest investment risk of 25.54%.

In addition to the above evaluation of investment criteria there are other important aspects characterizing the attractiveness of the individual exchanges. One such aspect is the number of registered trading issues, which expresses the number of investment opportunities for the investor. The largest number of issues is registered on the Wiener Börse, which had 73 issues in 2014 and over the last ten years the number of issues has fallen by 18%. The BSE has the second highest number of issues with 52 in 2014 with a ten year decline of 13.5%. Both the PSE and LJSE had 22 issues in 2014 and decreased over the last ten years by 18.5% and 12%, respectively.

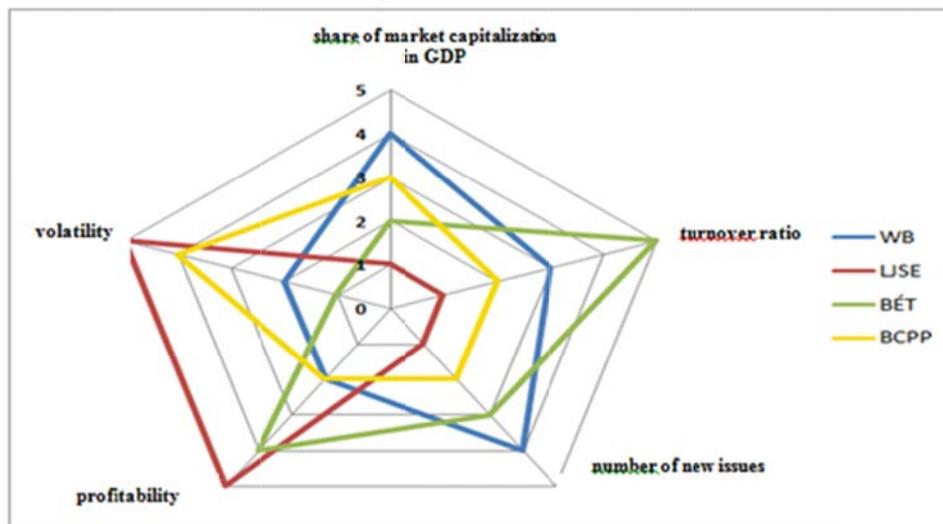
Another important aspect is the number of completed initial public offerings (IPO), which represents the attractiveness of the stock market for the issuers. The most IPOs in 2014 were carried out on the Wiener Börse where there were 3 issues and 33 over the last decade. Next is the BSE, where in 2014 there were 2 issues and a total of 24 over the last ten years. Third is the PSE with 1 issue in 2014 and 15 over the last ten years. Last is the LJSE, which recorded no primary issues in 2014 and only 7 over the last ten years, with the last completed IPO being in 2009.

5 Discussion

The CEESEG holds an important position on the stock markets of Eastern Europe. It consists of four stock exchanges each with a different history, maturity, and achieved results. Heterogeneity of the group of stock exchanges arises from their differing sizes and traditions. Three of the stock exchanges have been affected by long-term interruptions during the period of a central economy as well as the different methods of transformation of their economies to market conditions.

The stock exchanges of the CEESEG with the most suitable conditions for investors and issuers can be determined by evaluating the development of the individual stock exchanges and comparing their current results. The evaluation is based on the data analyzed in the previous chapter. The evaluation includes data on the “number of new issues” between 2004 and 2014, the “turnover ratio” for 2014 and the “share of market capitalization in GDP” for the last possible reference year of 2013. The individual results are evaluated in a range of 0-5 points, with five being the highest and zero the lowest. The resulting points are taken from the spider graph shown in Fig. 2.

Fig. 2: Evaluation of conditions for investing in the particular stock exchanges of the CEESEG



Source: own work

The Wiener Börse achieves the highest rating with 15 points. It is the largest stock exchange in the CEESEG measured by the share of market capitalization in the GDP, the most active in adopting new share issues on regulated markets and the spread of investment opportunities. It is also not lagging in the other monitored investment indicators. Therefore, the Wiener Börse offers the greatest opportunities to investors and issuers. In 2014, however, it showed the highest decline in returns, measured by the values of the official index.

The same rating of 15 points was reached by the BSE. The BSE greatly exceeded the other stock exchanges in terms of the “turnover ratio”. Thanks to its robust activity in the acceptance of new share issues on the market and the relatively good profitability of the main stock exchange index (which, however, showed significant volatility) the BSE is ranked as one of the leading stock exchanges. Therefore, entry onto this stock exchange could be interesting for investors and issuers. The BSE did not escape a decline in returns last year either, recording the second largest decrease of the whole group.

The PSE has a rating of 13 points in the monitored period, and scored the best in terms of the low volatility of its main stock exchange index. This is associated with the lowest reported decline in revenue. Other market value indicators reflect average to below-average results. It is less attractive to investors and issuers due to its low number of traded issues and IPOs.

The LJSE also has 13 points and leads the rankings in profitability and, surprisingly, its stock exchange index has the lowest volatility. It showed the worst results for the remaining monitored stock exchange indicators. The small number of traded emissions

and no long-term IPO, indicating the vanishing interest of investors, could threaten the existence of the LJSE in the future.

The stock exchanges from the CEESEG with the best conditions for investment are the Wiener Börse and BSE. The Wiener Börse is recommended for investors looking for a stable and prestigious traditional market with lower volatility. The BSE is recommended for investors looking for growth opportunities on a market potentially capable of achieving positive results in the future.

This recommendation needs to be considered in the context of two factors. Firstly, it is based on past data and, therefore, cannot guarantee similar developments in the future. Secondly, for the sake of comparability the comparison of the indicators was conducted in Euros, and some of the stock exchanges trade in their national currencies, therefore in addition to capital gains investors must also consider currency risk.

Conclusion

The evaluation of the stock exchanges of the CEESEG shows how individual stock exchanges with the same owner and a unified trading platform can have different results. Central and Eastern Europe is characterized by smaller investor prestige compared to the stock exchanges in Western Europe. Unlike their western competitors, the stock exchanges of the CEESEG have failed to build on positive developments or even reach the levels of the period prior to the crisis in 2008. However, some of them are interesting markets with a unified market system. The markets of the CEESEG can be an interesting option for aggressive, high-risk investors seeking investment opportunities. The BSE occupies a leading position. This stock exchange has successfully expanded its portfolio of issues traded on a regulated market with a high degree of liquidity. The Wiener Börse is a suitable choice for conservative investors seeking security in the form of market size and the quality of investment instruments on offer. The PSE and LJSE are lagging behind the lead stock exchanges and investors and issuers show little interest in them. One solution to this situation may be to specialize in certain investment instruments. The results of the evaluation of the stock exchanges will provide common and professional investors with information on the development of the individual stock exchanges, and provide a recommendation of the most suitable conditions for investment in the stock exchanges of the CEESEG.

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