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BSc International Economics and Business Economics

Stock Returns, Risk, and Firm Characteristics of an Emerging Market: Evidence from the Macedonian Stock Exchange

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Abstract

This paper examines the firm characteristics that affect stock returns and models the index volatility of an emerging stock market, the Macedonian Stock Exchange. Moreover, the index returns and firm characteristics are compared with the developed country Slovenia, to see if emerging markets are significantly different from developed ones. The analysis of this paper is divided into three parts and is based on data from 2017-2021. In the first part, a linear regression examines which firm characteristics impact stock returns in an emerging market. The model found that annualized volatility, beta, marginal expected shortfall (MES), and market capitalization have a positive and significant relationship with stock returns. In the second part, the Macedonian MBI10 index returns are used to create a GARCH volatility model, in order to delve into the volatility characteristics and to forecast volatility. The results indicated that the ARCH and GARCH terms equaled 0.295 and 0.597, respectively. Thus, data stationarity, volatility persistence, and mean-reverting property of volatility have been observed. Finally, the third part compares the markets of Macedonia and Slovenia using t-tests. The index returns and annualized volatility were on average higher in Macedonia, but they were not statistically different from Slovenia. Also, Macedonia had significantly higher betas and absolute MES and lower dividend yields.

Chapter 1: Introduction

Emerging markets are becoming an attractive and popular venue for investors due to their diversification benefits, high-growth potential, and risk-reward ratios. Emerging markets describe the economies that are positioned between the levels of developing and developed markets. In fact, the International Monetary Fund (IMF) classifies emerging markets based on several characteristics. These include income level, systemic presence, population, and market access. For instance, market access measures the country's external debt and the systemic presence takes into account the size of the economy (nominal GDP) and share of exports (Duttagupta & Pazarbasioglu, 2021). Based on pre-established benchmarks, the IMF successfully divides the world markets into groups. Often, investors are keen to discover opportunities that allow for rapid growth in countries where there is no political or social instability and market manipulation. One country that qualifies as an emerging market under the IMF criteria is the Republic of Macedonia. Located on the Balkan peninsula, Macedonia is a small country with a population of 1.8 million and a nominal GDP of $13.9 billion (World Bank, 2022b). Meanwhile, the country is on the path toward the developed stage, due to its human development index of 0.774, a stable currency pegged to the euro, its increasing FDIs, low inflation, and large import and export volumes (World Data, 2022a).

The Macedonian Stock Exchange (MSE) was established in September 1995 and it officially began trading in March 1996. It was founded by 13 banks, 3 insurance companies, and 3 saving houses which later became the first members with a right to trade the securities. Currently, 368 companies are listed on the exchange and some of the exchange's key indicators are presented in Table 1.1. In 2005, the MBI10 index was introduced by the MSE, which is a free-float market capitalization price index. It consists of 10 common stocks, previously selected by the Stock Exchange Index Commission based on specific criteria (MSE, 2022). The current constituents of the MBI10 index are the companies: Komercijalna Banka, Stopanska Banka Skopje, TTK Banka, NLB, Stopanska Banka Bitola, Alkaloid AD, Granit, Makpetrol, Makedonski Telekom, MakedonijaTurist. Thus, the index is composed of 5 banks and companies specializing in pharmaceuticals, construction, petrol, telecommunications, and hospitality, respectively. The composition of the index is presented in Figure 1.1.

Table 1.1 Key Indicators of the Macedonian Stock Exchange in 2021

Indicator	
Number of listed companies	368
Market Capitalization (USD)	3,814,041,083
Market Capitalization / GDP ratio	27.40%
Volume of trade [a]	20.647
Turnover (USD) [b]	218,966,249
Index [c]	**MBI10**
Mean Daily Return [d]	0.131%
Maximum	2.040%
Minimum	-2.456%
Standard Deviation	0.617%
Sharpe Ratio [e]	0.212

Note. [a] The volume of trade indicates the total number of shares exchanged during the year. [b] Turnover is the measure of stock liquidity as reported by the exchanges. [c] The index measures are computed using the replicated index returns mentioned in the methodology of this paper. [d] The mean daily return can be annualized to 38.7% assuming 250 trading days. [e] Sharpe ratio is the mean daily return divided by the standard deviation. It indicates the additional return the investor is receiving for the additional volatility of holding the asset.
Adapted Source: Kovačić, 2007

The objective of this paper is to provide insight into the Macedonian stock market, the characteristics of some of its listed firms and index, and to examine whether they behave differently from a developed economy. To determine how emerging markets perform relative to developed ones, Slovenia is chosen for comparison, since it is classified as a developed economy, based on the high human development index of 0.917 and economic prosperity. Slovenia has a population of 2.1 million and a GDP of $61.5 billion (World Bank, 2022a). Also, the country has maintained low inflation levels, high export volume, and a high degree of political stability and rule of law (World Data, 2022b). Slovenia was chosen as an appropriate benchmark for Macedonia, primarily due to its similar population size. Additionally, both countries were part of the former Socialist Federal Republic of Yugoslavia until its disintegration in 1992. Since their declaration of independence, the countries have maintained close political and economic relations. Thus, their mutual historical and cultural background allows for a viable comparison and understanding of how the two countries progressed after Yugoslavia's disintegration.

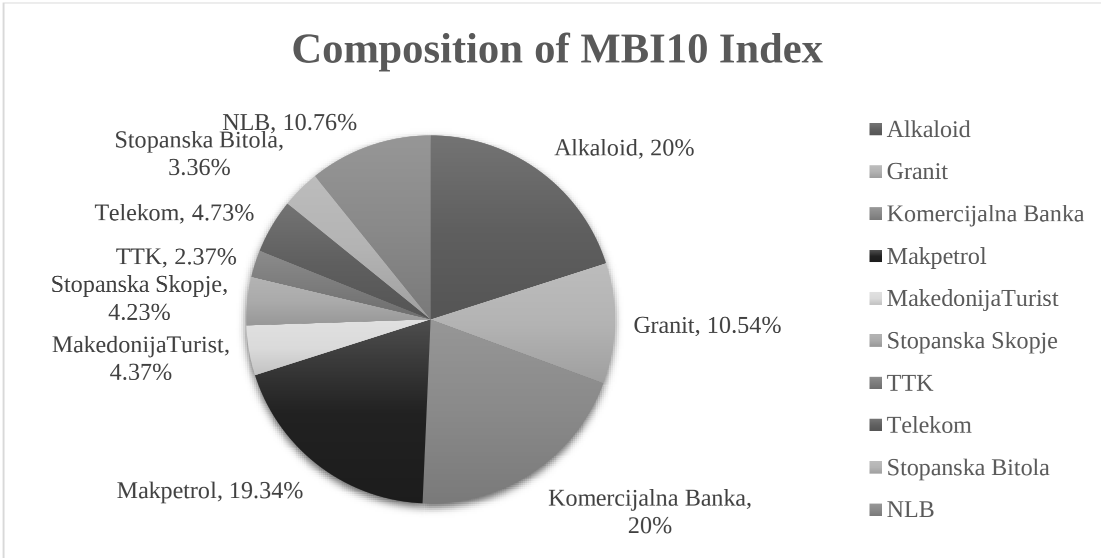


Figure 1.1 Composition of the MBI10 index in 2021

Adapted Source: MSE, 2022.

The Ljubljana Stock Exchange (LJSE) was established in 1989, six years prior to the establishment of the MSE. The LJSE started calculating indices in 2000, beginning with the SBI20 index. In 2006, this index was replaced by the SBITOP, which is a price index and serves as the Slovenian market benchmark. Appendix A contains the key indicators of the LJSE and the composition chart of the SBITOP index. Contrary to the MBI10, the SBITOP only includes the most liquid and highly capitalized stocks and it can contain between 5 and 15 shares. In the past 5 years, the index included 10 shares which coincides with the number of shares on the MBI10 and allows for a more reliable comparison. Moreover, the index is also valued using the free-float market capitalization method. The constituents of the SBITOP index are: Cinkarna Celije, Krka, Luka Koper, NLB, Petrol, Salus, Telekom Slovenije, Unior, Pozavarovalnica Sava, and Zavarovalnica Triglav. Thus, the index includes companies specializing in metallurgy, pharmaceuticals, logistics, banking, energy, medical equipment, telecommunications, tools, and two insurance companies, respectively (LJSE, 2022). In this way, this index is diversified across more industries compared to the Macedonian one, which is predominantly composed of banks.

This topic is academically relevant since there is no sufficient information regarding the opportunities or risks that can arise from investing in an emerging market like Macedonia. Thus, this paper is intended to serve as a guide for global investors, covering the Macedonian Stock Exchange (MSE) extensively and the Ljubljana Stock Exchange (LJSE) briefly. In fact, this paper addresses the research question of what are the characteristics of firms and systemic risk of the emerging market Macedonia and do they differ significantly from those of the developed market of Slovenia?

The analysis to answer the research question has been separated in three parts. First, a linear regression model was used to examine the characteristics of the index component firms and their impact on stock returns. This model found that the firm characteristics that predict stock returns with statistical significance in the Macedonian market are annualized volatility, stock beta, marginal expected shortfall (MES), and market capitalization. Moreover, these variables exhibit a positive relationship with the stock returns and have high magnitude coefficients. Apart from these variables, the dividend yield, profitability, inflation, and GDP per capita were also investigated. The results showed that only inflation had a negative relationship with the stock returns, however the coefficients of these variables were insignificant. In the second part of the analysis, the volatility of the MBI10 index was modeled with the GARCH method using 5-year daily observations of the index returns. The aim of this part was to explore the volatility characteristics in detail and to create a volatility model that can be used for forecasting. The results showed that the ARCH and GARCH terms equaled 0.295 and 0.597, respectively. Since the sum of the terms is less than one, the data is stationary and exhibits the mean-reversion property. Also, since the GARCH term is larger, the volatility is persistent and clustering over time. In the third part, the MBI10 returns and the firm-specific characteristics are compared with the SBITOP index and its constituents through a t-test. Thus, it has been found that the MBI10 index returns and annualized volatility are on average higher, but not significantly different. Whereas for the firm characteristics, the Slovenian firms have significantly higher dividend yields, while the Macedonian firms have higher betas and absolute MES.

The remainder of this paper is organized as follows. Chapter 2 depicts the current literature on the characteristics of emerging markets, motivates the use of variables whose impact on the stock returns will be examined, and summarizes the academic papers on the MSE and LJSE. Then, Chapter 3 covers the data obtained and the methodology used in the paper. Chapter 4 presents the empirical results of the analysis. Chapter 5 focuses on the discussion and explains the implications, limitations, relevance, and future areas of the research. Chapter 6 concludes the paper.

Chapter 2: Literature Review

In recent years, there has been an increase in research on the emerging markets' properties and their performance relative to the developed markets. For instance, Abor and Bokpin (2010) investigated the investment opportunities, corporate finance, and dividend payout policy in emerging countries. They examined 34 emerging markets and substantiated the existing literature on what factors influence dividend payout. In those 34 emerging markets, the only countries from the Balkan region were Greece, Slovenia, and Turkey. Their findings implied that firms with high investment potential would pursue a low dividend payout policy. Similarly, Shin (2005) examined the relationship between emerging market stock returns and volatility, using data from Greece and Turkey as representatives of emerging European markets. This paper found that a positive relationship between expected stock returns and conditional volatility prevails for the majority of emerging markets. This finding contrasts with the study by Li et al. (2003) which observed developed markets and found a negative and often significant relationship between stock returns and volatility. In that manner, the current knowledge has little information on the stock returns, volatility, dividends, and the overall behavior of the other Balkan regions, especially the stock market of Macedonia.

Ivanovski et al. (2016) investigated the relationship between the 10 most liquid stocks and concluded that Macedonian companies have highly correlated returns. While Bucevska (2013) investigated which GARCH models are best suited for Value-at-Risk Estimation in the Macedonian Stock Exchange. These papers provide some insight into the potential diversification opportunities and risk management in Macedonia, respectively. Hence, this paper attempts to fill the knowledge gaps on the relationship between stock returns and risk, dividend yield, and other accounting measures in the emerging market of Macedonia. In addition, a volatility model approximated by the GARCH method is constructed using the most recent MSE data. Finally, some characteristics of the stocks included in the index are compared with those of Slovenia.

2.1 *Regression analysis*

Scholars and investors have long sought to identify which company-specific variables can successfully predict stock returns. This part uses linear regression to analyze which variables affect stock returns in an emerging market. The first variable constructed is the dividend yield, which is calculated by dividing the dividend paid by the stock price on the last day of the corresponding year. The use of this variable dates back to Fama and French (1988) and Nelson and Kim (1993), who found that dividend yield can predict stock returns to some extent. Moreover, Aras and Yilmaz (2008) have also found that in emerging markets, investors can partially predict stock returns from the dividend yield ratio. Therefore, we expect that firms with higher dividend yields will have higher stock returns:

Hypothesis 1: Firms with higher dividend yield in emerging markets are more likely to have higher stock returns than low dividend yield firms.

Then, the variables used to quantify the firms' risk are annualized volatility, stock beta, and marginal expected shortfall (MES). The most commonly used measure of stock returns' volatility is the standard deviation, as it summarizes the probability of observing extreme changes in returns (Schwert, 1990). In this case, the standard deviation is annualized to facilitate interpretation and to capture the probability of extreme changes for the entire year. The second risk variable, stocks' beta, measures the stock's volatility relative to the overall market volatility. Hence, if the stock is more volatile than the market, the beta will be larger than 1, and if it is less volatile, the beta will be less than 1. The use of this variable was motivated by Downs and Ingram (2000) and Al-Rjoub et al. (2010) who have concluded that average returns are positively related to beta, the latter study focusing on emerging markets. The third risk variable, marginal expected shortfall (MES), rather than capturing the extreme changes, can be defined as the expected equity loss when the market itself is in the left tail (Idier et al., 2014). The effect of MES on stock returns has not been investigated; however, Acharya et al. (2015) concluded that MES is a relevant and predictable measure of the firms' contribution to systemic risk. Thus, based on this research and the theoretical aspect of risk-return tradeoff, we expect a positive relationship between the risk variables and the stock returns:

Hypothesis 2: The risk variables annualized volatility, stock beta, and marginal expected shortfall are positively related to the stock returns in emerging markets.

Then, to capture the accounting characteristics of the firms and their impact on stock returns, the variables profitability and market capitalization are included in the regression. Profitability, measured by the returns on assets ratio, is positively related to stock returns (Nadyayani and Suarjaya, 2021). Whereas the market size measured by market capitalization has been often used as a determinant of stock returns. Berk (1997) and Leledakis et al. (2004) concluded that market capitalization has an inverse relationship with stock returns for U.S. and U.K. stocks, respectively. While Amel-Zadeh (2010) investigated that small companies in the German stock market perform worse than large companies in bear markets, but better in bull markets. Thus, a relationship between firm size and stock returns exists, but the evidence for emerging markets in the Balkans is limited. Correspondingly, the firm characteristic profitability is expected to have a positive relation to stock returns, while the market capitalization is expected to have a negative relation:

Hypothesis 3: Firms with higher profitability, measured by return on assets, are expected to have higher stock returns in emerging markets.

Hypothesis 4: Higher market capitalization is expected to lead to lower stock returns in emerging countries.

Finally, two macroeconomic variables, inflation and GDP per capita, are used as control variables. It has been explored that these variables may also have an impact on stock returns. Namely, inflation erodes the purchasing power and corresponds to lower equity returns, due to its effect over the company's earnings. Therefore, in this study, we isolate the effect of these variables, as we are concerned with the firm-specific variables that can impact the stock returns.

2.2 *Volatility Modeling*

Volatility forecasting is an area that has attracted considerable attention in academia due to its application in asset and risk management. Time series financial data has been long explored and several stylized facts have been established due to occurrence of empirical regularities. Some of the stylized facts regarding volatility are: volatility tends to cluster, it is mean reverting, return distributions are leptokurtic (have heavy tails with narrower and higher peaks), and there is an asymmetric reaction between good and bad news. The first stylized fact of volatility clustering indicates that large price changes tend to cluster together, resulting in the persistence in price change amplitudes (Cont, 2007). This infers that volatility can be used as a predictor of future volatility. The mean-reverting property points out that there exists a normal level of volatility, and that volatility eventually returns to that level. Regarding the return distributions, the heavy tails are a sign of extreme returns occurring more frequently than a normal distribution would suggest. Finally, the asymmetric reaction means that volatility reacts differently upon the arrival of “good” and “bad” news in the market. It has been researched that bad news tend to generate higher volatility in the future than good news of the same magnitude (Black, 1976). This is referred to as the leverage effect (Kovačić, 2007).

The process of volatility modeling in financial assets is usually carried out using models of the GARCH family (Poon and Granger, 2003). Originally, the model proposed by Engle (1982), ARCH, was used to model volatility as a time-varying function of past squared observations (q). Successively, Bollerslev (1986) developed the generalized ARCH (GARCH) model, which models variance as a function of past variances (p) and past squared observations (q). Hence, the GARCH model was introduced as an adaptive learning mechanism of the ARCH model. Today, the GARCH (1,1) model is the most robust and most commonly used in application. The (1,1) notation indicates that one autoregressive lag (ARCH term) and one moving average (GARCH term) are included in the equation. Also, other extensions of the GARCH model have been developed, which account for some features that are observed in the volatility estimation process. For instance, the Threshold GARCH (TGARCH), the Asymmetric GARCH (AGARCH), and the Exponential GARCH (EGARCH) were developed to capture the previously mentioned leverage effect (Wallenkamp, 2008).

Kovačić (2007) studied volatility forecasting using the GARCH models and evidence from the Macedonian Stock Exchange. Using the variance, he implemented and tested one symmetric GARCH model and four asymmetric models, specifically the models EGARCH, GJR, TARCH, and PGARCH. The study focused on the returns of the MBI10 Index in the period from 4/1/2005 to 21/9/2007, totaling 632 observations. The results showed that in all GARCH models, the sum of the ARCH and GARCH coefficients was close to one, meaning that stationary data and mean-reverting property was present in the index volatility. Additionally, volatility clustering was also observed. On the other hand, the asymmetry test (Engle and Ng, 1993) provided weak evidence of the asymmetric behavior of variance. Thus, the presence of the leverage effect was not detected in the Macedonian returns. As for the fit of the GARCH models, the results showed that the asymmetric model such as TGARCH had better forecasting performance compared to the symmetric GARCH models, but without significant advantage. Therefore, for simplicity and based on Kovačić's (2007) findings, the 'bare' GARCH (1,1) model is used in this study.

2.3 *Developing versus developed economies*

Emerging markets are particularly interesting for investors, due to the high potential for firm growth and diversification. Divecha et al. (1992) found that emerging markets are more volatile than developed ones and they also have low correlation with developed markets. It was also established that emerging markets tend to be homogenous, meaning that they are highly responsive to overall market movements. Hence, investments in emerging markets resulted in lower portfolio risk and a wide array of diversification benefits.

There is little academic evidence on the characteristics of the Slovenian stock market, the Ljubljana Stock Exchange. Some insight regarding volatility was provided by Moore and Wang (2007), who investigated the then-new European Union member states, including Slovenia. Their results showed that there was a tendency of the stock markets to transit from high volatility to low volatility regime as they moved into the European Union. Furthermore, Egert and Koubaa (2004) discovered that the sum of GARCH parameters for Slovenia is over 1, suggesting that the stationary GARCH methods probably do not fit the data well. Dedi and Skorjanec (2017) have explored the co-movements of equity returns, volatility persistence and spillovers among the six countries that were part of former Yugoslavia, including Slovenia and Macedonia. They found that the Slovenian and Macedonian stock markets volatility reacts strongly to the market movements. In that manner, the current literature provides limited information on the firms' characteristics of both Macedonia and Slovenia, hence the returns, the risk measures, and the dividend yields will be presented and compared across the two countries. It is expected that the returns of the MBI10 will surpass the returns of the SBITOP10 index significantly as Macedonia is classified as an emerging market:

Hypothesis 5: On average, the MBI10 returns in the emerging market of Macedonia are significantly higher than the SBITOP returns in the developed market of Slovenia.

Chapter 3: Data and Methodology

Primary data for this research are obtained from the websites of the Macedonian Stock Exchange (MSE) and Ljubljana Stock Exchange (LJSE), the System for Electronic Information (SEI, 2022) of listed companies, and the annual reports of the companies included in the indices. The data consists of the index components, daily closing stock prices of the companies, dividend payments, and accounting numbers such as total assets and net income. Moreover, the data regarding the macroeconomic variables, inflation, and GDP per capita, are obtained through the National Bank of the Republic of Macedonia (NBRM, 2022) and the World Bank (2022b) database, respectively. The data is collected beginning of January 2017 for the Macedonian market and January 2018 for the Slovenian market until December 2021. Hence, for the Macedonian market, 5 years is sufficient data in order investigate the effects of firm characteristics on stock returns and to produce a volatility model. The reason why the dataset starts later for Slovenia is due to the LJSE website reporting the stock prices and market movements for the most recent 5 years. Moreover, 2021 was chosen as the final year, since 2022 is not finished and variables such as inflation or dividend payments are not reported yet.

The main dataset which is used throughout the analysis are the returns of the MBI10 index. As the prices for the Macedonian Index MBI10 are only reported for one year, this paper attempts to replicate the returns of the index by using the prices of the included stocks and the most recent weights assigned by the original index. The index's calculation methodology is the free-float market capitalization system, where the weights of the stocks in the index are determined through the market capitalization of the company adjusted for the shares that are only accessible to the general public. Namely, the returns of the companies multiplied by the respective index weights were summed up for the 10 companies in order to reproduce the index returns. The 5-year data corresponds to 1229 observations of returns. This replication resembles building an investment portfolio, where one can invest in the stocks individually and based on the weights assigned, achieve the returns as investing in the index. To avoid calculation differences, the same method is employed for the Slovenian SBITOP index. However, due to lack of data for 2017 on the LJSE website, only 1089 observations were obtained and only the 4-year time period from 2018 to 2021 is compared.

3.1 Regression analysis

3.1.1 Variable Construction

In the first part, the average daily returns per year of the 10 companies that make up the MBI10 index are used as the dependent variable for the period from 2017 to 2021. Hence, 50 observations for the stock returns were obtained. The 5-year daily data was accessible and sufficient to investigate the relationship between the stock returns and other firm characteristics. In this part, we use the company returns rather than the index returns since we are interested in their relationship with the company risk, dividend payments, and other accounting measures. Returns were calculated using the companies' reported historical share prices and dividends paid using the following formula:

$$R = \frac{(P1-P0)+D}{P0}$$

Where P_1 represents the closing price, P_0 the initial stock price, and D the dividends paid. The dividends were added to the price difference, according to the date on which they were paid. This information was available from the reports of the shareholders' general meetings.

Whereas, the index returns were calculated from the returns of the companies multiplied by their reported weights in the index. In this part of the research, the index returns were used as a market benchmark to compute some of the independent variables, such as the stocks' beta.

Then, for the independent variables, three variables were used to capture the risk component, one to examine dividend payments, and two to capture the firms' accounting variables. The risk variables included annualized volatility, stock beta, and marginal expected shortfall (MES). These variables were used to quantify the risk of the investments and to examine the risk-return relationship of the components of the index. The individual characteristics of the Macedonian firms across the 5-year period are presented in Appendix B.

The first variable, annualized volatility, was calculated by computing the standard deviation of returns for each period and then multiplying it by the square root of the number of observations. The formula used is shown below:

$$\text{Annualized Volatility} = \text{SD (daily returns)} * \sqrt{n}$$

This variable describes the fluctuations in the value of an asset over the course of a year. The number of observations includes the trading days on the MSE, which are on average 247.

The second variable, beta, measures the stock volatility of the companies relative to the volatility of the overall market. The index returns were used as the market benchmark, and the following formula was used to calculate beta:

$$\text{Beta} = \frac{Cov\ (Ri,Rm)}{Variance\ (Rm)}$$

where Ri is the return of the individual stock and Rm is the return of the market.

The final measure of risk associated with investing in the companies of the MBI10 Index is the Marginal Expected Shortfall. This variable measures the expected stock loss when a firm is exposed to aggregate tail shocks in the market. It is calculated by averaging the firm’s returns during the 5% worst days for the market. Since there are 247 trading days in Macedonia on average, the 13 worst days of market returns are filtered out to calculate the average returns of the firms on these days.

Then, to capture the effect of dividend payments, the dividend yield variable is constructed. The dividend yield is the ratio of the dividend amount and the final stock price. Dividends can be defined as the cash amount paid to shareholders from the company's profits. The dividend yield is used because it is an indicator of the financial well-being of companies and is also an important characteristic of investors’ decision-making.

Furthermore, profitability and market capitalization were used as the two independent variables capturing the accounting measures of the company. Profitability was measured as returns on assets (ROA), dividing net income by total assets. An increase in ROA over time indicates that the company increases its profits with each investment. Therefore, an increase in ROA should have a positive impact on a company's stock return. In addition, market capitalization was collected from the companies' financial statements to account for the size of the companies and it was adjusted with a logarithm to improve the fit of the model. Indeed, market size is important for stock returns, as investments in companies with larger market capitalizations are usually associated with lower risk and thus lower possibility of exceptional growth.

The macroeconomic variables used as control were the inflation rate as reported by the National Bank of Macedonia and the log GDP per capita from the World Bank database (2022b). These macroeconomic variables are controlled for as they could impact the returns of the companies. For example, a high inflation rate is usually associated with lower stock returns as it affects company earnings.

3.1.2 Model Specification

The regression model estimation from the previously constructed variables looks as follows:

$$Y_{it} = \beta_0 + \beta_1 DividendYield_{it} + \beta_2 AnnualizedVolatility_{it} + \beta_3 Beta_{it} + \beta_4 MES_{it} + \beta_5 Profitability_{it} + \beta_6 MarketCap_{it} + \beta_7 Inflation_{it} + \beta_8 GDPperCapita_{it} + \mu_{it}$$

Where Y_{it} is the dependent variable or daily stock return, and its subscripts i and t represent the firm and time, respectively. Then, the βs capture the relationship and its magnitude between the dependent variable and the independent variables, which are the dividend, risk, and accounting variables. Finally, the μ_{it} term is the error term. By implementing this model, it is possible to investigate the effects of company-specific factors on stock returns, controlling for the effect of the macroeconomic variables.

3.2 Volatility Modeling

The second part of this research focuses on modeling the volatility of the MBI10 Index by using the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model. This model can successfully describe the tendency for volatility clustering in financial time series data, such as the index returns in this case. Volatility clustering refers to the behavior of financial data when volatility changes over time and exhibits persistence. In other words, large changes in volatility tend to be followed by large changes, regardless of sign, and small changes tend to be followed by small changes (Mandelbrot, 1963).

First, to ensure whether a GARCH process will be suitable for the data, autocorrelation and partial autocorrelation functions of the observations were plotted and then the statistical test Ljung-Box was performed. The Ljung-Box tests whether the autocorrelation in time series data is different from zero. Proceeding with the model construction, the replicated daily index returns data consisting of 1229 observations are used as the ex-post volatility proxy. Since trading days do not include weekends and holidays, these dates are omitted and returns are assumed to be consecutive. Then, the model specifies a lag of the ARCH term (ε_t^2), a lag of the GARCH term (σ_t^2), and the constant. The ARCH term measures how returns adjust to past shocks, while the GARCH term captures the persistence of volatility. The GARCH equation is be defined as follows:

$$\sigma_t^2 = \omega + \sum_{i=1}^{p} \alpha_i \mu_{t-1}^2 + \sum_{i=1}^{q} \beta_i \sigma_{t-i}^2$$

where μ_{t-1}^2 is the ARCH parameter, and σ_{t-i}^2 is the GARCH parameter. The coefficient ω is a constant parameter and the ARCH and the GARCH coefficients are captured by α and β, respectively. In addition, p and q represent the lags of the model. In this research, the GARCH model implemented is the GARCH (1,1), which means that one lag is used for the estimation. In practice, small lags are preferred (Walenkamp, 2008). The constraints applied to this model to ensure that there are no negative variances are that the parameters α, β, and ω must be non-negative and that $\alpha + \beta$ must be < 1 to ensure stationarity (Bollerslev, 1986).

***3.3** Developing versus developed economies*

The last part compares the index returns and some firm characteristics of Macedonia with those of the developed country, Slovenia. First, the replicated returns of the indices from 2018 until 2021 amounting to 1089 observations for each country were used to test for difference in the mean. The method used is a two-sample t-test, assuming unequal variances since the two indices have different volatilities. It is also important to note that Slovenia has more trading days compared to Macedonia, and in this paper, the returns for the Macedonian index on these days will be assumed to be zero since there is no trading. It has been verified that the added returns do not change the results. In addition, previous work has found that developed markets have a low correlation with developing markets and that investing in both markets can yield large diversification benefits for global investors. Therefore, the correlation between the two indices' returns will be examined, as well as the relationship between the returns of the 10 index constituents for each country. Furthermore, the firm characteristics such as the dividend yields and the risk measures will also be compared with a two-sample t-test. There are 40 observations for each variable, one per company for each year of the 4-year timeframe. This allows us to determine whether there are any observable differences between companies in the two markets. The individual firm characteristics of the Macedonian and Slovenian companies are presented in Appendix B and C, respectively.

Chapter 4: Empirical Results

4.1 *Regression Analysis*

4.1.1 *Descriptive Statistics*

Table 4.1 presents the descriptive statistics of the dependent, independent, and control variables used in the regression. Shown are the mean, standard deviation, minimum, and maximum values of the variables.

Table 4.1 Descriptive statistics of variables

	Mean	SD	Min	Max
Stock Returns	0.001	0.001	-0.001	0.003
Dividend Yield	0.042	0.032	0.000	0.150
Annualized Volatility	0.259	0.077	0.136	0.430
Beta	0.856	0.364	0.213	1.601
Marginal Expected Shortfall	-0.017	0.015	-0.061	0.006
Profitability	0.037	0.035	-0.014	0.173
Market Capitalization	15.656	1.221	13.545	17.312
Inflation	0.016	0.008	0.008	0.032
GDP per Capita	12.773	0.067	12.670	12.879
Observations	50			

Note. Stock returns are calculated by averaging the daily returns of each of the 10 companies per year; dividend yield is calculated by dividing the dividend paid by the stock price on the last day of the year; annualized volatility is the standard deviation of the stock return in annual terms, assuming 247 trading days on the MSE; beta is the covariance of the market and stock return divided by the variance of the market return; MES is the average company return on the 5% worst days on the market; profitability is measured as returns on assets; market capitalization is taken as reported on the companies' financial statements, adjusted with a log; inflation and GDP per capita are taken as reported by NBRM and World Bank, and GDP per capita is adjusted with a log. There are in total 50 observations of each variable, one per company per year. Inflation and GDP per capita are assumed the same for each company based on the year. The raw data is presented in Appendix B.

The dependent variable, the daily stock returns of the 10 companies part of the index, has a mean value of 0.001. This indicates that over the 5-year period of analysis, the average daily returns of the companies included are positive. In addition, there is a variation in the stock returns indicated by the standard deviation of 0.001. We also observe the minimum value of daily stock returns to be -0.001 and the maximum 0.003. Then, the dividend yield shows a mean value of 4.24% with a variation of 0.032. The average dividend yield is high and based on the analysis only one company that is included in the index did not pay annual dividends. It is also possible that companies have skipped a dividend payment in some years, such as during the Covid pandemic. However, most payments are realized on a specific date, so they are predictable and increase over time. For the risk components, we observe a mean annualized volatility of 26%, a mean beta of 0.86, and mean marginal expected shortfall of -1.72%. The profitability component, measured as return on assets, has a mean value of 0.037. It is also evident that some of the companies make losses on their investments, as indicated by the minimum value of -0.014. Finally, for the macroeconomic variables, the average inflation rate is 1.6%, while the maximum is 3.2%, which is still within the boundaries of desired inflation levels by an economy.

4.1.2 *Regression Results*

From the regression analysis presented in Table 4.2, it is evident that most variables have a positive relationship with the dependent variable daily stock return. These include dividend yield, annualized volatility, beta, MES, profitability, market capitalization, and GDP per capita. On the other hand, only inflation is negatively related to daily stock returns, which is intuitive since higher inflation erodes the value of the currency used and consequently the earnings and other aspects of the businesses. However, the variables that show a significant relationship at the 5% level with the stock returns are the annualized volatility and the market capitalization. Whereas, the beta and the MES are significant at the 1% significance level. Hence, the first hypothesis that higher dividend yield leads to higher stock returns is rejected, since the p-value of the variable is high. The second hypothesis which stated that the risk variables annualized volatility, beta, and MES are positively related to stock returns is accepted. Then, the third hypothesis which related profitability positively to stock returns is rejected. And finally, the fourth hypothesis which expected a negative relationship between market capitalization and stock returns is rejected, as we observe the opposite relationship in this emerging market.

Table 4.2 Linear regression results for impact on daily stock returns

Daily Stock Returns	Coefficient	Std. err.	t	P>$\|t\|$	[95% $conf.interval$]	
Dividend Yield	0.004	0.003	1.41	0.167	-0.002	0.009
Annualized Volatility	0.004	0.002	2.17	0.036**	0.001	0.006
Beta	0.002	0.002	7.59	0.000***	0.001	0.002
Marginal Expected Shortfall	0.042	0.007	5.18	0.000***	0.024	0.054
Profitability	0.001	0.003	0.37	0.710	-0.004	0.006
Market Capitalization	0.001	0.001	2.13	0.039**	0.001	0.003
Inflation	-0.020	0.013	-1.53	0.134	-0.049	0.006
GDP per Capita	0.002	0.002	1.22	0.229	-0.001	0.005
Constant	-0.029	0.021	-1.40	0.168	-0.006	0.001
Observations	50					
R^2	0.6264					

Note. Significance levels indicated by * *p < 0.1*, ** *p < 0.05*, *** *p <0.01.* Stock returns are calculated by averaging the daily returns of each of the 10 companies per year; dividend yield is calculated by dividing the dividend paid by the stock price on the last day of the year; annualized volatility is the standard deviation of the stock return in annual terms, assuming 247 trading days on the MSE; beta is the covariance of the market and stock return divided by the variance of the market return; MES is the average return on the 5% worst days on the market; profitability is measured as returns on assets; market capitalization is taken as reported on the companies' financial statements, adjusted with a log; inflation and GDP per capita are taken as reported by NBRM and World Bank, and GDP per capita is adjusted with a log. There are in total 50 observations of each variable, one per company per year. Inflation and GDP per capita are assumed the same for each company based on the year. The raw data is presented in Appendix B.

This model has an R^2 of 0.63, which means that the 63% of the variation in the dependent variable can be explained by the regressors. This explanatory power is quite high considering that stock returns are usually random and can be influenced by many events that cannot be always quantified.

To test the robustness of this regression, the assumptions of the classical linear regression model are checked. First, since the Ordinary Least Square estimator is applied to estimate the regression, the distance between the actual and estimated data points is minimized so it is assumed that the model has zero mean error. Then, a white test was performed to test for heteroskedasticity. Due to the high p-value, the null hypothesis of homoscedasticity is accepted, so no adjustments for the variance of residuals are required. For the zero covariance between the error terms, we are unable to add lags and test for autocorrelation with the available data. Finally, correlation between the explanatory variable and the error term (endogeneity) might exist as a potential problem in this regression due to omitted variable bias. Daily stock returns can be affected by numerous variables and events, making it very difficult to capture and quantify all of them. Therefore, we are unable to find an instrumental variable that does not explain the daily stock returns. Consequently, the exclusion restriction is not satisfied and it should be noted that the coefficients might be inconsistent due to the bias.

4.2 *Volatility Modeling*

Before constructing the volatility model, a check for autocorrelation in the index returns is performed in order to justify the use of the GARCH model and to ensure its validity. Figure 4.1 presents the plots for the autocorrelation and partial autocorrelation of the index returns. From the plots, it is evident that the first lag of the index return data is significant. Moreover, the plots show an alternating sequence of positive and negative spikes, which slowly decay. Then, by implementing a Ljung-Box statistics test for the index returns and the squared returns, it has been determined that the null hypothesis of no autocorrelation has been rejected. In that manner, the GARCH effect where the variance error is believed to be autocorrelated has been observed, which justifies the use of the GARCH (1,1) model.

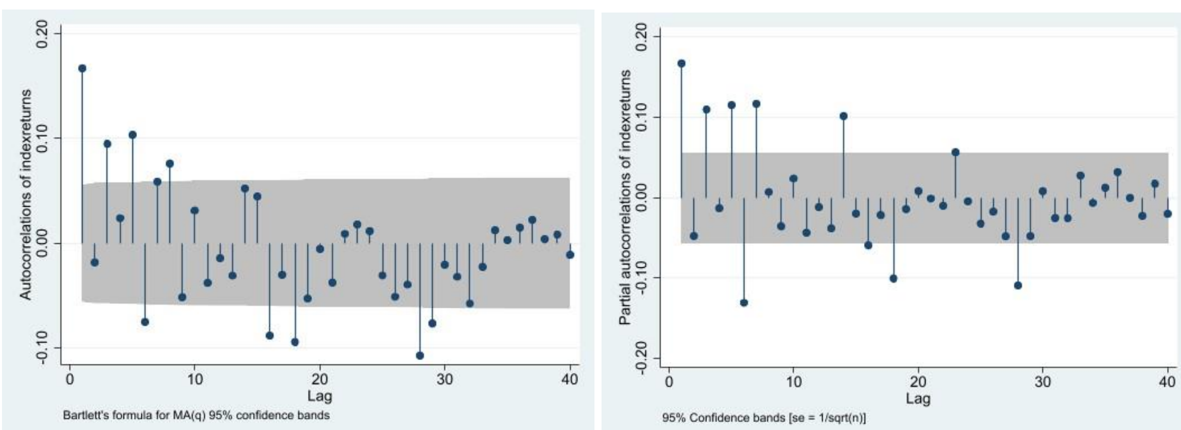


Figure 4.1 Autocorrelation (left) and partial autocorrelation (right) plot of index returns time period 2017-2021

The GARCH model used the returns of the MBI10 index from January 2017 until December 2021. This amounted to 1229 observations, assuming a Gaussian (normal) distribution. The GARCH table output is presented in Appendix D. From the results of the GARCH model, the ARCH term equals 0.295 and the GARCH term equals 0.597. Hence, the sum of the ARCH and the GARCH terms is less than 1. Therefore, our data is stationary and the volatility exhibits the mean-reverting property. Moreover, since the GARCH coefficient is higher than the ARCH coefficient value and significant, we can conclude that the volatility is persistent and clustering over time. The model of volatility obtained from the analysis is as follows:

$$\sigma_t^2 = 0.001 + 0.295\mu_{t-1}^2 + 0.597\sigma_{t-i}^2$$

Figure 4.2 (left) shows the returns of the MBI10 Index over time, using the historical returns from 2017 until 2021. It is evident that the volatility is clustering, i.e. large fluctuations are followed by large fluctuations. This is the case in 2020 when the Covid-19 crisis commenced. This event had a significant impact on the volatility of the market and the stocks. Yet, it is visible that the volatility has normalized after this period and apart from the crisis, the return changes are not very high. This confirms the stylized fact of financial time series data regarding the mean-reverting property of volatility. Whereas, Figure 4.2 (right) presents the returns distribution, which characterizes the volatility with a high and narrow peak at the center, which is also a stylized fact mentioned in Chapter 2.

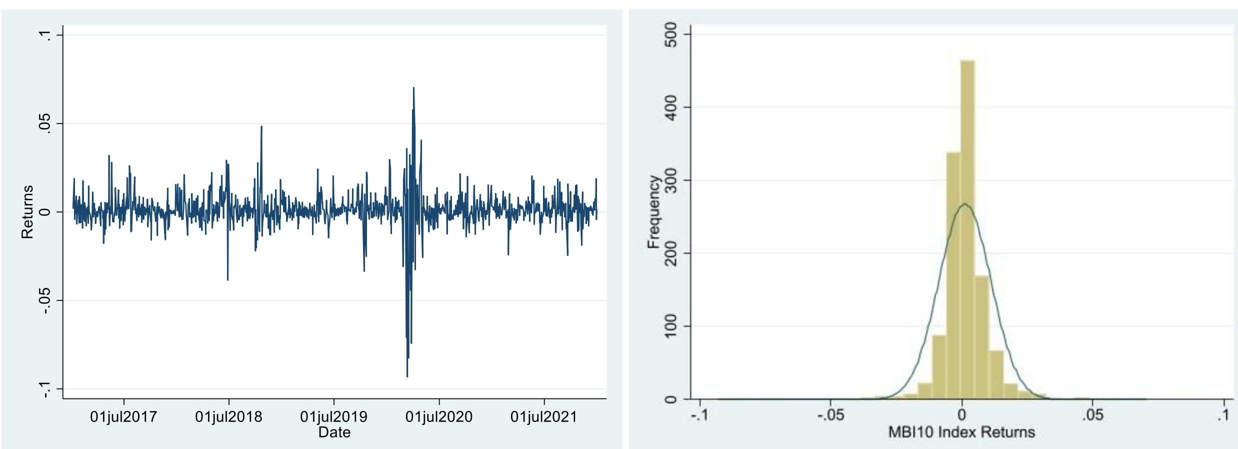


Figure 4.2 The returns of the MBI10 Index (left) and returns distribution (right) in the period 2017-2021

Finally, since the model can vary from the true variance process, several conditions were checked to ensure the validity of the GARCH model. First, the histogram of the residuals was plotted and it was observed that the residuals follow a normal distribution with a constant mean and variance. Then, the squared residuals were tested for autocorrelation, using the Ljung-Box test and it was observed that the autocorrelations were significantly reduced from those observed in the returns. Moreover, since the p-values exceeded 0.05 in the correlogram, no remaining

ARCH effects were detected in the residuals. Therefore, this volatility model captures the data successfully.

4.3 *Developing versus developed economies*

The descriptive statistics table 4.3 shows that the daily returns of the MBI10 index are on average higher than the returns of the SBITOP. Moreover, the standard deviation of Macedonia's returns is also higher, which may signal higher risk. In terms of dividend yield, the Slovenian index provides a higher dividend yield on average, compared to the Macedonian one.

Table 4.3 Descriptive statistics for characteristics of the MBI10 and SBITOP indices, 2018-2021

Variable	Observations	Mean	SD	Min	Max
MBI10 Returns	1086	0.0011	0.010	-0.093	0.070
SBITOP Returns	1086	0.0007	0.006	-0.045	0.031
MBI10 Dividend Yield	40	0.039	0.028	0.000	0.101
SBITOP Dividend Yield	40	0.059	0.051	0.000	0.286
MBI10 Volatility	40	0.264	0.082	0.136	0.430
SBITOP Volatility	40	0.248	0.080	0.073	0.481
MBI10 Beta	40	0.851	0.363	0.213	1.60
SBITOP Beta	40	0.285	0.582	-0.396	2.242
MBI10 MES	40	-0.019	0.016	-0.061	-0.001
SBITOP MES	40	-0.004	0.007	-0.029	0.006

Note. MBI10 and SBITOP refer to the Macedonian and the Slovenian index, respectively. The returns refer to the daily returns of the replicated indices from 2018 until 2021. The firm characteristics (dividend yield, volatility, beta, and MES) are calculated based on the 10 firms that are part of the index. Dividend yield is the dividend paid divided by the stock price on the last day of the year; volatility is the standard deviation of the stock return in annual terms, assuming 247 trading days on the MSE and 270 on the LJSE; beta is the covariance of the market and stock return divided by the variance of the market return; MES is the average return on the 5% worst days on the market. For the returns, there are 1086 observations since LJSE has more trading days than MSE, and returns for MBI10 on those days is assumed to be zero. For the firm characteristics, there are in total 40 observations for each variable, one per company per year. The raw data which shows the firm characteristics per company and per year are presented in Appendix B for Macedonia and Appendix C for Slovenia.

Regarding the risk measures, the Macedonian index has a higher annualized volatility, but the difference with the Slovenian index is not large. As for the beta measure, the Macedonian stocks have a much higher beta than the Slovenian stocks. This means that the Macedonian stocks are more responsive to the market movements. Finally, for the last measure of risk, the Macedonian stocks have higher absolute marginal expected shortfall compared to the Slovenian stocks. This indicates that on the 5% worst days in the Macedonian market, the index returns were worse than on the 5% worst days on the Slovenian market. This is intuitive following the implication of the stocks' beta, and how the Slovenian stocks are not highly sensitive to market movements.

To test the statistical significance of the relationship between the mentioned variables, a two-sample t-test with unequal variances was performed. The test showed that the returns of the Macedonian index were higher on average, but were not statistically significant. Thus, the fifth hypothesis is rejected and the null hypothesis that there is no significant difference between the means of the returns of the two indices is accepted. Next, the remaining variables were tested, namely, dividend yield, annualized volatility, betas, and marginal expected shortfall. The results of the t-tests are presented in Appendix E.

Table 4.4 Two-sample t-test with unequal variances to compare index returns

Group	Observations	Mean	Std. err.	Std. dev.	[95% $conf.interval$]	
MBI10	1086	0.0011	0.0003	0.0100	0.0005	0.0017
SBITOP	1086	0.0007	0.0002	0.0056	0.0004	0.0010
Combined	2172	0.0009	0.0002	0.0081	0.0005	0.0012
diff		0.0004	0.0003		-0.0003	0.0012

diff = mean(MBI10) – mean (SBITOP) t = 1.1128

H0: diff = 0 Welch's degrees of freedom = 1688.02

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr (T < t) = 0.8670	Pr ($|T|$ > $|t|$) = 0.2659	Pr ($|T|$ > $|t|$) = 0.1330

Note. The two-sample t-test is performed using the replicated index returns of the MBI10 and SBITOP indices for the time period 2018-2021. Unequal variances are assumed because the two indices have different volatilities. The null hypothesis states that there is no difference between the means of the index returns. The alternative hypothesis states that there is significant difference between the means. Due to high p-values, the null hypothesis of no significant difference is accepted. The results are rounded to the fourth decimal, in order not to minimize the difference between the two variables due to rounding.

For the dividend yield, the t-test showed a significant difference between the Slovenian and Macedonian yields. In fact, the dividend yields of the Slovenian stocks were significantly higher than the Macedonian ones. In terms of the annualized volatility, there was no significant difference between the volatility of the Macedonian and the Slovenian indices. In contrast, the beta and the absolute value MES of the Macedonian stocks were significantly higher than those of the Slovenian stocks.

Finally, the correlation between the returns of the two indices was checked and the result showed that the correlation was -0.018. This means that the returns of the Macedonian and the Slovenian indices were negatively correlated, with a low magnitude. Also, its been observed that the index constituents have low correlation among each other, both in Macedonia and Slovenia. The correlation tables which describe the relationship between the 10 firms in the index, both in Macedonia and Slovenia, are presented in Appendix F. Hence, it is evident that investing in both indices can be very beneficial for risk diversification.

Chapter 5: Discussion

The discussion of this paper is covered in 4 parts, focusing on interpretations, implications, limitations, and recommendations. The first part is based on what the results mean and how they contribute to the current literature. The second part discusses why the results matter, while the third part presents some limitations of this paper. Finally, the last part contains recommendations that can be beneficial for further research related to this topic.

As previously mentioned, this paper is intended to serve as a guide for global investors who are interested in the emerging market of Macedonia and its potential investment opportunities and drawbacks. Hence, the results matter since they indicate which firm characteristics can predict stock returns in an emerging market. Moreover, this paper contributes to the literature of the characteristics of the MSE and LJSE. Interpreting the results, the index MBI10 has realized an average daily return of 0.001 in the time period 2018-2021, which translates to 28.4% annually assuming 250 trading days. While its volatility quantified with the annualized volatility variable has an average of 26.4%. On the other hand, the benchmark developed country Slovenia has realized an annualized average return of 19.1%, while the annualized volatility averaged 24.8%. Yet, the annualized volatility is not significantly different from the MBI10 index. Thus, Macedonian stocks have provided a higher return relative to their volatility. Moreover, it was found that the returns of the MBI10 and the SBITOP indices have a correlation of -0.018 and that firms within the index have low correlation in both countries.

Going back to the existing literature on emerging markets, this paper supports the results of Shin (2005) that there exists a positive relationship between stock returns and volatility in emerging markets. And also Divecha et al. (1992) who found that emerging markets are more volatile, have a low correlation with the developed markets, and are homogenous. Additionally, this paper substantiates the results of Downs and Ingram (2000) and Al-Rjoub (2010) regarding the positive and significant relationship between stock returns and beta. In regards to the profitability as returns on assets, this paper also found a positive relationship with stock returns as Nadyayani and Suarjaya (2021), however a non-significant one. Another interesting finding is that the market capitalization in the emerging market of Macedonia is positively related to the stock returns, contrary to the findings of Berk (1997) and Leledakis (2004). Thus, firms with higher market capitalization have on average provided higher returns. In the second part, the volatility modeling research also supported the results of Kovačić (2007) and justifies the use of GARCH models for the newer and more extensive data. Then, this paper contrasts the finding of Ivanovski et al. (2016) which suggested that the 10 firms of the index are highly correlated. While, in regards to the current knowledge of the LJSE, this paper contrasts the finding of Dedi and Skorjanec (2017) that Slovenian firms are highly responsive to market movements.

The results of this research are relevant since they portray the benefits and opportunities of investing in the stock markets of the two Balkan countries Macedonia and Slovenia. Over the years, the companies in the indices SBITOP and MBI10 have shown steady growth and exceptional financial well-being. Moreover, they have expanded manufacturing or distribution to different regions in the world. The results also matter as they can be beneficial for different types of investors. For instance, it is evident that risk-averse or dividend investors should consider investing in the developed market of Slovenia. Whereas, more risk-loving investors can consider investing in Macedonian firms, due to the high growth potential and historical risk-reward ratios. Also, the two indices have low and negative correlation, therefore investing in both can yield great diversification benefits. For academic purposes, this research is relevant since it shows that the risk variables and market capitalization can be used to predict stock returns to an extent in an emerging market. And also, the results are relevant for global investors as they can facilitate the investing decision-making process and diversification knowledge.

Nevertheless, this paper also has several limitations. First, there is limited data available on the historical prices of the stocks and indices in the stock exchanges' archives. For instance, the MSE only shows the index returns for the current year, hence the index returns for the previous periods had to be manually computed. With this methodology, there is a slight discrepancy between the actual index and the replicated index returns used in this study. Yet, the same methodology was implemented for the Slovenian index, in order to minimize differences. In addition, the third part of the analysis which compared the Macedonian and Slovenian exchanges had to start in 2018 since the LJSE only presents company metrics for the last 5 years. Overall, there might be significant differences in the result of this study if the original indices are attainable and implemented. Another limitation of this research is the possibility of omitted variable bias in the regression analysis. Namely, stock returns can be influenced by numerous variables or unquantifiable events, therefore it is impossible to incorporate all and control for this bias. Currently, the model of this study has a high R^2 and thus high explanatory power, but this might be improved if new variables are added to the model. Then, another limitation of this paper is that the analysis has a strong regional focus, therefore other developing and developed countries can be included in order to perform a better cross-examination of the differences between developing and developed markets.

Finally, some recommendations for further research are to expand this study and examine the stock returns, risk, and other firm characteristics of the other Balkan countries. The focus can become predominantly on the differences between the EU vs non-EU countries since the countries are almost fairly divided. Namely, Croatia, Bulgaria, Slovenia, and Greece can be compared with the countries from the Western Balkans alliance: Macedonia, Serbia, and Albania. Another further research option is to expand this analysis and incorporate more emerging and developed countries from Europe, in order to see whether all emerging markets embody similar firm characteristics and whether they provide on average higher returns. It is also intriguing to investigate the characteristics or returns of the firms with different market capitalizations in bull and bear markets, following the methodology of Amel-Zadeh (2010). Moreover, another research area can be to expand the volatility modeling part of this study and investigate which of the GARCH model variations are best suited with high forecasting power for the MBI10 or SBITOP returns. In past research, it has been found that GARCH models are not suitable for the Slovenian market and that asymmetric models are not useful for Macedonia, yet this might have changed over the years.

Chapter 6: Conclusion

Stock returns, risk, and firm characteristics are all important factors for investors' portfolio selection and risk management. In this paper, the stock market of Macedonia and its MBI10 index were used to illustrate how these factors behave in a developing market. This topic is relevant for both academics and investors because there is limited information about the Macedonian stock market and its listed firms regarding stock returns, risk, dividend payments, and other firm characteristics. The analysis is divided into three parts, covering the returns of the index constituents and the factors affecting them, the volatility modeling of the MBI10, and the comparison of the firm characteristics with the developed country Slovenia. The cohesion of these three parts succeeds in answering the research question raised in the introduction: What are the characteristics of firms and systemic risk of the emerging market Macedonia and do they differ significantly from those in the developed country Slovenia?

In the first part, linear regression was used to quantify the impact of firm characteristics on the daily stock returns of the firms. This helps to understand how the most liquid Macedonian firms are structured and their contribution to the overall market risk. The results have shown that the three risk variables annualized volatility, beta, and marginal expected shortfall, and market capitalization have a positive and significant relationship with the stock returns. Meanwhile, the variables dividend yield, profitability, and GDP per capita have a positive relationship with the stock returns and inflation has a negative relationship. Nevertheless, these variables did not have statistically significant coefficients.

The second part delves into the volatility modeling of the MBI10 Index since the optimal decision of investors relies on the variance of returns, which changes over time. Therefore, it is important to model and forecast variance, and this paper uses an econometric model to do so. More specifically, this study employs the GARCH (1,1) model, with 1229 observations ranging from January 2017 until December 2021. After the establishment of the model, it has been concluded that volatility in the MBI10 index is persistent and clustering over time. Moreover, the stylized facts of time series data regarding mean-reversion, volatility persistence, and leptokuritc distribution of returns have been confirmed.

The third part benchmarks the results of the MBI10 Index against the SBITOP index, to conclude how the firms of the developing market compare with the developed, EU-member market of Slovenia. Regarding the last hypothesis, it was found that the MBI10 index returns are on average higher than those of the SBITOP index, using a two-sample t-test assuming unequal variances, but the difference is not statistically significant. The other firm characteristics consisting of the risk variables and the dividend yield were also computed. This paper concludes that the dividend yield is significantly higher in Slovenia, while beta and absolute value MES are significantly higher in Macedonia. Whereas, there was no significant difference in the annualized volatility variable between the two countries. And it was also found that the two indices have a low and negative correlation, hence investing in both can provide great diversification.

Finally, this study has highlighted the importance of analyzing the firm characteristics and their impact on stock returns in emerging markets as they differ from what is observed in well-developed economies. Nevertheless, further research is needed to examine the other emerging countries, especially the Balkan countries which exemplify spillovers in returns and volatility and can be highly profitable or risk-mitigating investments.

Bibliography

Abor, J. & Bokpin, G.A. (2010). Investment opportunities, corporate finance, and dividend payout policy: Evidence from emerging markets. *Studies in Economics and Finance*, *27*(3), 180-194. doi: https://doi-org.eur.idm.oclc.org/10.1108/10867371011060018

Acharya, V.V., Pedersen L.H., Philippon T., Richardson M. (2017). Measuring Systemic Risk. *The Review of Financial Studies*, *30*(1), 2–47. doi: https://doi.org/10.1093/rfs/hhw088

Al-Rjoub, S.A., Al Yousef, A., & Ananzej I.E.N. (2010). Beta Wins Again: Case of four Emerging Markets. *Journal of Economic Cooperation and Development*, *31*(1), 1-16.

Amel-Zadeh, A. (2010). The Return of the Size Anomaly: Evidence from the German Stock Market. *European Financial Management*, *17*(1), 145-182. doi: https://doi-org.eur.idm.oclc.org/10.1111/j.1468-036X.2010.00581.x

Anatolyev, S. (2006). Nonparametric retrospection and monitoring of predictability of financial returns. *Journal of Business & Economic Statistics*, *27*(2), 149-160. doi: 10.1198/jbes.2009.0010

Aras, G., Yilmaz M.K. (2008). Price-earnings ratio, dividend yield, and market-to-book ratio to predict return on stock market: evidence from the emerging markets. *Journal of Global Business and Technology*, *4*(1), 18-30.

Berk, J.B. (1997). Does Size Really Matter?, *Financial Analysts Journal*, *53*(5), 12-18. doi: 10.2469/faj.v53.n5.2112

Black, F. (1976). Studies in stock price volatility changes. Proceedings of the 1976 Business Meeting of the Business and Economics Statistics Section, *American Statistical Association*, 177-181.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroscedasticity. *Journal of Econometrics*, *31*(3), 307-327. doi: https://doi.org/10.1016/0304-4076(86)90063-1

Bucevska, V. (2013). An Empirical Evaluation of GARCH Models in Value-at-Risk Estimation: Evidence from the Macedonian Stock Exchange. *Business Systems Research: International Journal of the Society for Advancing Innovation and Research in Economy*, *4*(1), 49-64.

Cont, R. (2007). Volatility Clustering in Financial Markets: Empirical Facts and Agent-Based Models. *Long Memory in Economics*, 289–309. doi: https://doi-org.eur.idm.oclc.org/10.1007/978-3-540-34625-8_10

Dedi, L., Škorjanec, D. (2017). Volatilities and Equity Market Returns In Selected Central And Southeast European Countries. *Ekonomski pregled*, *68*(4), 384-398. Retrieved from https://hrcak.srce.hr/187555

Divecha, A. B., Drach, J., & Stefek, D. (1992). Emerging Markets: A Quantitative Perspective. *Journal of Portfolio Management*, *19*(1), 41-50.

Downs, T.W., & Ingram, R.W. (2000). Beta, Size, Risk, And Return. *Journal of Financial Research*, *23*(3), 245-260. doi: https://doi-org.eur.idm.oclc.org/10.1111/j.1475-6803.2000.tb00742.x

Duttagupta, R., Pazarbasioglu, C. (2021). MILES TO GO. International Monetary Fund. Retrieved from: https://www-imf-org.eur.idm.oclc.org/external/pubs/ft/fandd/2021/06/the-future-of-emerging-markets-duttagupta-and-pazarbasioglu.htm#:~:text=As%20the%20COVID%2D19%20pandemic,hard%2Dhit%20sectors%20and%20households.

Egert, B., Koubaa, Y. (2004). Modelling Stock Returns in the G-7 and in Selected CEE Economies: A Non-Linear GARCH Approach. doi: http://dx.doi.org.eur.idm.oclc.org/10.2139/ssrn.512862

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica*, *50*(4), 987-1007.

Engle, R. F., & Ng, V., K. (1993). Measuring and testing the impact of news on volatility. *Journal of Finance*, *48*(5), 1749-1778.

Fama, E.F., & French, K.R. (1988). Dividend yields and expected stock returns. *Journal of Financial Economics*, *22*(1), 3-25. doi: https://doi.org/10.1016/0304-405X(88)90020-7

Idier, J., Lamé, G., Mésonnier, J.S. (2014). How useful is the Marginal Expected Shortfall for the measurement of systemic exposure? A practical assessment. *Journal of Banking & Finance*, *47*, 134-146. doi: https://doi.org/10.1016/j.jbankfin.2014.06.022

Ivanovski, Z., Ivanovska, N., & Narasanov, Z. (2016). The Regression Analysis of Stock Returns at MSE. *Journal of Modern Accounting and Auditing*, *12*(4), 217-224. doi: 10.17265/1548-6583/2016.04.003

Kovačić, Z. (2007). *Forecasting volatility: Evidence from the Macedonian stock exchange*. Retrieved from https://mpra.ub.uni-muenchen.de/5319/

Leledakis, G. N., Davidson, I. R., & Smith, J.P., Does Firm Size Predict Stock Returns? Evidence from the London Stock Exchange. doi: http://dx.doi.org.eur.idm.oclc.org/10.2139/ssrn.492283

Li, Q., Yang J., & Hsiao C. (2003). The Relationship between Stock Returns and Volatility in International Stock Markets. *Journal of Empirical Finance, 12*(5), 650-665. doi: https://doi.org/10.1016/j.jempfin.2005.03.001.

LJSE. (2022). *Ljubljana Stock Exchange*. Retrieved from https://ljse.si/en

Mandelbrot, B. (1963). The variation of certain speculative prices. *Journal of Business*, 36, 394–419.

Moore, T., Wang, P. (2007). Volatility in stock returns for new EU member states: Markov regime switching model. *International Review of Financial Analysis*, *16*(3), 282-292. doi: https://doi.org/10.1016/j.irfa.2007.03.006.

MSE. (2022). *Macedonian Stock Exchange, Inc. Skopje*. Retrieved from https://www.mse.mk/en

Nadyayani, D.A.D., Suarjaya, A.A.G. (2021). The effect of profitability on stock return. *American Journal of Humanities and Social Sciences Research, 5*(1), 695-703.

NBRM. (2022). *National Bank of the Republic of Macedonia*. Retrieved from https://www.nbrm.mk/

Nelson, C. R., & Kim, M. J. (1993). Predictable Stock Returns: The Role of Small Sample Bias. *The Journal of Finance, 48*(2), 641–661. doi: https://doi.org/10.2307/2328916

Poon, S., & Granger C.W.J. (2003). Forecasting Volatility in Financial Markets: A Review. *Journal of Economic Literature, 41*(2), 478-539. doi: 10.1257/002205103765762743

Schwert, W.G. (1990). Stock Market Volatility. *Financial Analysts Journal*, *46*(3), 23-34. doi: 10.2469/faj.v46.n3.23

SEI. (2022). *System for Electronic Information from listed companies*. SEI. Retrieved from https://www.seinet.com.mk/ShowLayoutDocs.aspx?Layout=DOC_10187

Shin, J. (2005). Stock Returns and Volatility in Emerging Stock Markets. *International Journal of Business and Economics, 4*(1), 31-43.

The World Bank. (2022a). *Data: Slovenia*. Retrieved from https://data-worldbank-org.eur.idm.oclc.org/country/slovenie

The World Bank. (2022b). *The World Bank in North Macedonia*. Retrieved from https://www-worldbank-org.eur.idm.oclc.org/en/country/northmacedonia

Walenkamp, M. (2008). *Forecasting Stock Index Volatility*. Retrieved from https://www.universiteitleiden.nl/binaries/content/assets/science/mi/scripties/walenkampmaster.pdf

World Data. (2022a). *North Macedonia: Country Data and Statistics*. Retrieved from https://www.worlddata.info/europe/northmacedonia/index.php

World Data. (2022b). *Slovenia: Country Data and Statistics*. Retrieved from https://www.worlddata.info/europe/slovenia/index.php

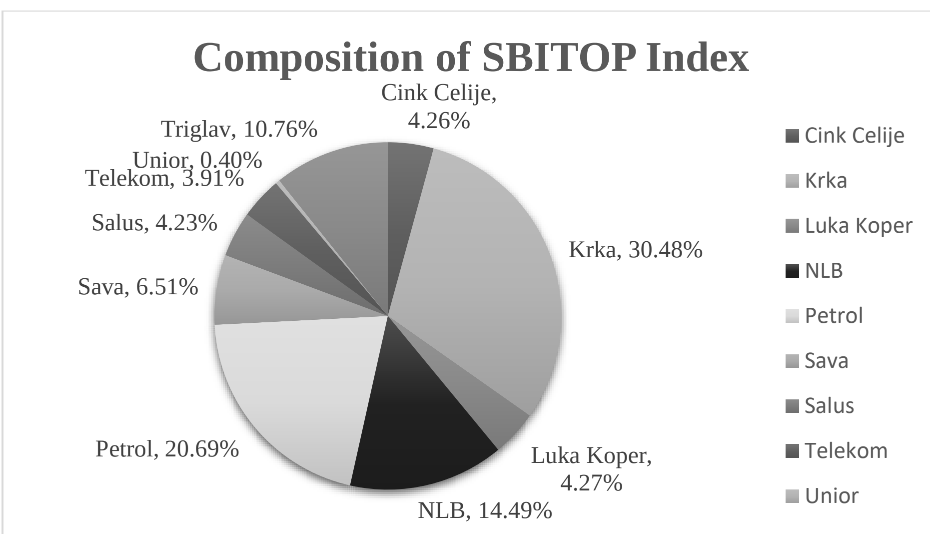
Appendix A: Key indicators of the LJSE and SBITOP index composition

Key Indicators of the Ljubljana Stock Exchange in 2021

Indicator	
Number of listed companies	30
Market Capitalization (EUR)	9,513,500,000
Market Capitalization / GDP ratio	18.9%
Volume of trade	32.731
Turnover (EUR)	379,960,000
Index	SBITOP
Mean Daily Return	0.034%
Maximum	1.854%
Minimum	-1.518%
Standard Deviation	0.506%
Sharpe Ratio	0.067

Note. [a] The volume of trade indicates the total number of shares exchanged during the year. [b] Turnover is the measure of stock liquidity as reported by the exchanges. [c] The index measures are computed using the replicated index returns mentioned in the methodology of this paper. [d] The mean daily return can be annualized to 33.6% assuming 250 trading days. [e] Sharpe ratio is the mean daily return divided by the standard deviation. It indicates the additional return the investor is receiving for the additional volatility of holding the asset.

Adapted Source: Kovačić, 2007



Composition of the SBITOP index in 2021

Adapted Source: LJSE, 2022

Appendix B: Individual firm characteristics of MBI10 constituents (2017-2021)

Year 2017											
Company	Stock Return	Annualized Return	Dividend Paid (Denars)	Dividend Yield	Annualized Volatility	Beta	MES	Profitability (ROA)	Market Capitalization (in thousand denars)	Inflation	GDP per Capita
Alkaloid	0.158%	48%	250	3.333%	15%	0.770	-1.001%	0.073	10,730,567	1.35%	318091.18
Granit	0.143%	43%	28	3.613%	24%	1.151	-1.050%	0.017	2,370,488		
Komercijalna Banka	0.021%	5%	150	5.398%	22%	1.332	-2.209%	0.008	6,286,009		
Makpetrol	0.036%	9%	1000	3.636%	21%	1.204	-1.638%	0.040	3,090,505		
Makedonija Turist	0.078%	22%	186	4.537%	28%	0.867	-0.267%	0.049	1,853,878		
Stopanska Banka Skopje	0.143%	43%	138	15.000%	26%	0.485	-0.142%	0.024	16,063,365		
TTK	0.135%	40%	82.2	9.786%	31%	0.342	0.581%	0.013	762,625		
Telekom	0.050%	13%	14.5	5.273%	18%	0.334	-0.347%	0.070	26,355,665		
Stopanska Banka Bitola	0.201%	65%	0	0.000%	30%	1.341	-1.693%	0.004	789,774		
NLB	0.216%	72%	995	7.654%	24%	0.910	-0.735%	0.029	11,102,895		

Year 2018											
Company	Stock Return	Annualized Return	Dividend Paid (Denars)	Dividend Yield	Annualized Volatility	Beta	MES	Profitability (ROA)	Market Capitalization (in thousand denars)	Inflation	GDP per Capita
Alkaloid	0.054%	15%	270	3.293%	15%	0.648	-1.423%	0.076	11,738,011	1.46%	356503.73
Granit	0.040%	11%	28	3.500%	27%	1.160	-1.639%	0.010	2,458,576		
Komercijalna Banka	0.270%	96%	180	3.565%	24%	1.180	-1.624%	0.016	11,510,200		
Makpetrol	0.248%	86%	999.35	2.104%	30%	1.602	-2.434%	0.095	5,337,617		
Makedonija Turist	0.116%	34%	208	4.160%	28%	0.578	-0.978%	0.044	2,261,235		
Stopanska Banka Skopje	0.169%	53%	117	9.750%	29%	0.996	-1.250%	0.030	20,952,216		
TTK	0.247%	85%	104	8.125%	40%	1.137	-1.889%	0.012	1,156,749		
Telekom	0.058%	15%	18.32	6.317%	23%	0.506	-0.809%	0.073	27,861,292		
Stopanska Banka Bitola	0.053%	14%	0	0.000%	39%	0.626	-1.121%	0.003	836,691		

Year 2019											
Company	Stock Return	Annualized Return	Dividend Paid (Denars)	Dividend Yield	Annualized Volatility	Beta	MES	Profitability (ROA)	Market Capitalization (in thousand denars)	Inflation	GDP per Capita
Alkaloid	0.172%	54%	320	2.689%	17%	1.125	-1.562%	0.080	17,033,287	0.77%	354268.54
Granit	0.152%	46%	30	2.727%	22%	1.259	-1.432%	0.041	3,459,261		
Komercijalna Banka	0.149%	45%	420	6.318%	18%	1.120	-1.393%	0.015	15,151,237		
Makpetrol	0.216%	72%	1300	1.670%	20%	1.337	-1.686%	0.103	8,748,960		
Makedonija Turist	-0.007%	-2%	239	4.268%	14%	0.213	-0.119%	0.040	2,546,250		
Stopanska Banka Skopje	0.033%	9%	73	6.058%	19%	0.393	-0.509%	0.024	20,980,152		
TTK	0.120%	35%	105	6.731%	22%	0.487	-0.781%	0.012	1,414,671		
Telekom	0.068%	19%	18.5	5.781%	15%	0.268	-0.438%	0.076	30,668,410		
Stopanska Banka Bitola	0.173%	54%	0	0.000%	33%	0.863	-0.713%	0.001	1,212,029		
NLB	0.132%	39%	1738	10.105%	20%	0.749	-1.058%	0.021	14,693,411		

Year 2020											
Company	Stock Return	Annualized Return	Dividend Paid (Denars)	Dividend Yield	Annualized Volatility	Beta	MES	Profitability (ROA)	Market Capitalization (in thousand denars)	Inflation	GDP per Capita
Alkaloid	0.075%	20%	400	2.727%	32%	1.016	-4.465%	0.082	18,903,850	1.20%	345333.628
Granit	0.052%	14%	16.67	2.949%	40%	1.176	-5.344%	0.008	3,436,717		
Komercijalna Banka	0.096%	27%	600	7.535%	34%	1.138	-5.199%	0.015	16,636,391		
Makpetrol	0.013%	3%	2000	2.740%	37%	1.198	-6.100%	0.042	8,274,273		
Makedonija Turist	-0.081%	-18%	0	5.405%	28%	0.418	-2.784%	-0.014	1,884,464		
Stopanska Banka Skopje	0.008%	2%	0	0.000%	38%	0.947	-4.938%	0.018	19,991,557		
TTK	0.004%	1%	90	8.118%	38%	0.941	-4.767%	0.010	1,229,053		
Telekom	0.022%	6%	16	4.901%	22%	0.311	-1.446%	0.080	30,093,377		
Stopanska Banka Bitola	0.009%	2%	0	0.000%	43%	0.697	-3.700%	0.007	1,129,924		
NLB	0.051%	14%	1787	0.000%	34%	0.880	-4.387%	0.018	15,723,263		

Year 2021											
Company	Stock Return	Annualized Return	Dividend Paid (Denars)	Dividend Yield	Annualized Volatility	Beta	MES	Profitability (ROA)	Market Capitalization (in thousand denars)	Inflation	GDP per Capita
Alkaloid	0.144%	43%	400	2.201%	15%	0.836	-0.970%	0.087	26,394,393	3.20%	391829.04
Granit	0.114%	33%	16.67	1.190%	30%	1.321	-1.350%	0.017	4,277,752		
Komercijalna Banka	0.224%	75%	600	5.172%	21%	1.515	-2.121%	0.016	26,724,180		
Makpetrol	0.043%	11%	2000	2.555%	15%	0.778	-1.134%	0.173	8,797,263		
Makedonija Turist	0.069%	19%	0	0.000%	23%	0.424	-0.200%	0.008	2,193,398		
Stopanska Banka Skopje	0.082%	23%	0	0.000%	21%	0.559	-1.122%	0.022	23,977,541		
TTK	0.058%	16%	90	6.294%	25%	0.458	-0.627%	0.005	1,298,280		
Telekom	0.067%	18%	16	4.638%	22%	0.462	-0.728%	0.080	33,064,379		
Stopanska Banka Bitola	0.050%	13%	0	0.000%	33%	0.881	-0.228%	0.029	1,212,029		

Appendix C: Individual firm characteristics of SBITOP constituents (2018-2021)

Year 2018							
Company	Stock Return	Annualized Return	Dividend Paid (euro)	Dividend Yield	Annualized Volatility	Beta	MES
Cinkarna Celije	-0.01%	-1%	26.52	12.60%	35%	0.829	-0.943%
Krka	0.04%	10%	2.9	5.00%	16%	1.186	-1.378%
Luka Koper	-0.03%	-7%	1.23	4.73%	23%	0.831	-0.469%
NLB	0.03%	10%	0	0.00%	7%	0.038	0.000%
Petrol	-0.02%	-4%	16	5.16%	17%	0.742	-0.380%
Sava	0.02%	5%	0.8	5.23%	28%	0.906	-0.949%
Salus	0.09%	27%	20	9.48%	25%	0.383	0.000%
Telekom	-0.12%	-27%	14.3	28.60%	22%	0.386	-0.227%
Unior	-0.01%	-2%	0	0.00%	33%	0.391	-0.234%
Triglav	0.05%	15%	2.5	8.25%	22%	1.122	-1.254%

Year 2019							
Company	Stock Return	Annualized Return	Dividend Paid (euro)	Dividend Yield	Annualized Volatility	Beta	MES
Cinkarna Celije	0.071%	20.92%	28.27	13.20%	28%	0.139	-0.308%
Krka	0.110%	33.92%	3.2	4.40%	18%	1.249	-1.223%
Luka Koper	-0.023%	-5.98%	1.33	5.88%	25%	-0.396	0.606%
NLB	0.047%	13.45%	7.13	11.50%	21%	-0.111	0.175%
Petrol	0.090%	27.16%	18	4.80%	13%	-0.037	0.055%
Sava	0.085%	25.22%	0.95	5.28%	18%	-0.040	0.049%
Salus	0.068%	19.76%	22	5.48%	16%	0.028	0.000%
Telekom	0.091%	27.53%	4.5	7.19%	33%	-0.231	0.558%
Unior	-0.044%	-11.05%	0	0.00%	27%	-0.098	0.347%
Triglav	0.067%	19.52%	2.5	7.51%	20%	-0.250	0.160%

Year 2020							
Company	Stock Return	Annualized Return	Dividend Paid (euro)	Dividend Yield	Annualized Volatility	Beta	MES
Cinkarna Celije	0.043%	12%	17.00	11.00%	38%	0.304	-0.983%
Krka	0.115%	36%	4.25	4.60%	28%	1.755	-2.938%
Luka Koper	-0.033%	-8%	1.07	5.82%	35%	0.226	-0.902%
NLB	-0.092%	-22%	0.00	0.00%	32%	0.173	-0.254%
Petrol	-0.016%	-4%	22.00	6.77%	25%	-0.143	-0.476%
Sava	0.029%	8%	0.00	0.00%	32%	0.076	-0.859%
Salus	0.119%	37%	25.00	9.78%	20%	-0.160	-0.043%
Telekom	-0.038%	-10%	3.50	6.48%	31%	0.102	-0.453%
Unior	-0.123%	-28%	0.00	0.00%	48%	0.065	-0.502%
Triglav	-0.023%	-6%	0.00	0.00%	29%	0.068	-0.492%

Year 2021							
Company	Stock Return	Annualized Return	Dividend Paid (euro)	Dividend Yield	Annualized Volatility	Beta	MES
Cinkarna Celije	0.178%	61%	21.00	9.00%	21%	-0.166	0.313%
Krka	0.117%	37%	5.00	4.20%	19%	2.242	-2.083%
Luka Koper	0.132%	42%	1.14	4.67%	26%	0.019	0.116%
NLB	0.230%	84%	4.61	6.05%	25%	0.094	0.610%
Petrol	0.187%	65%	22.00	4.33%	18%	-0.198	0.416%
Sava	0.170%	57%	0.85	3.05%	19%	0.357	-0.337%
Salus	0.186%	64%	30.00	5.14%	22%	-0.078	-0.633%
Telekom	0.128%	40%	4.50	8.01%	20%	-0.138	0.258%
Unior	0.103%	32%	0.00	0.00%	38%	-0.349	0.389%
Triglav	0.099%	30%	1.70	4.67%	18%	0.095	-0.087%

Appendix D: GARCH output for MBI10 index volatility

ARCH family regression

Sample: 1 through 1229 Number of obs = 1229

Log likelihood = 4331.98

	Coefficient	Std. err.	Z	P > $\|z\|$	[95% conf. interval]	
Market Returns _cons	0.0098	0.0002	4.76	0.000	0.0006	0.0014
Arch L1.	0.2946	0.0314	9.38	0.000	0.2331	0.3561
Garch L1.	0.5970	0.0306	19.54	0.000	0.5372	0.6570

Appendix E: T-tests for comparing firm characteristics between Macedonia and Slovenia

Two-sample t-test with unequal variances to compare **dividend yield**

Group	Observations	Mean	Std. err.	Std. dev.	[95% $conf.interval$]	
MKD	40	0.039	0.004	0.028	0.029	0.048
SLO	40	0.059	0.008	0.051	0.043	0.076
Combined	80	0.050	0.005	0.043	0.040	0.058
diff		-0.021	0.009		-0.039	-0.002

diff = mean(MKD) – mean (SLO) t = - 2.256

H0: diff = 0 Welch's degrees of freedom = 61.967

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr (T < t) = 0.014	Pr ($\|T\|$ > $\|t\|$) = 0.028	Pr ($\|T\|$ > $\|t\|$) = 0.99

Two-sample t-test with unequal variances to compare **annualized volatility**

Group	Observations	Mean	Std. err.	Std. dev.	[95% $conf.interval$]	
MKD	40	0.264	0.013	0.082	0.237	0.290
SLO	40	0.248	0.013	0.080	0.222	0.273
Combined	80	0.256	0.009	0.081	0.238	0.273
diff		0.016	0.018		-0.039	0.052

diff = mean(MKD) – mean (SLO) t = 0.890

H0: diff = 0 Welch's degrees of freedom = 79.943

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr (T < t) = 0.812	Pr ($\|T\|$ > $\|t\|$) = 0.376	Pr ($\|T\|$ > $\|t\|$) = 0.188

Two-sample t-test with unequal variances to compare **beta**

Group	Observations	Mean	Std. err.	Std. dev.	[95% $conf.interval$]	
MKD	40	0.851	0.057	0.363	0.735	0.967
SLO	40	0.285	0.092	0.582	0.099	0.471
Combined	80	0.568	0.063	0.560	0.444	0.693
diff		0.566	0.108		0.350	0.782

diff = mean(MKD) – mean (SLO) t = 5.220

H0: diff = 0 Welch's degrees of freedom = 66.736

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr (T < t) = 1.000	Pr ($\|T\|$ > $\|t\|$) = 0.000	Pr ($\|T\|$ > $\|t\|$) = 0.000

Two-sample t-test with unequal variances to compare **MES**

Group	Observations	Mean	Std. err.	Std. dev.	[95% $conf.interval$]	
MKD	40	-0.019	0.003	0.016	-0.025	-0.014
SLO	40	-0.004	0.001	0.007	-0.006	-0.001
Combined	80	-0.012	0.002	0.015	-0.015	-0.001
diff		-0.016	0.003		-0.022	-0.010

diff = mean(MKD) – mean (SLO) t = -5.692

H0: diff = 0 Welch's degrees of freedom = 55.284

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr (T < t) = 0.000	Pr ($\|T\|$ > $\|t\|$) = 0.000	Pr ($\|T\|$ > $\|t\|$) = 1.000

Appendix F: Correlation matrices of MBI10 and SBITOP constituents

MBI10 Correlation Matrix

	Alkaloid	Granit	Komercijal na Banka	Makpetrol	Makedonij a Turist	Stopanska Banka Skopje	TTK	Telekom	Stopanska Banka Bitola	NLB
Alkaloid	1.0000									
Granit	0.3598	1.0000								
Komercijal na Banka	0.4650	0.3681	1.0000							
Makpetrol	0.4046	0.3856	0.4066	1.0000						
Makedonij a Turist	0.1481	0.1797	0.1313	0.1927	1.0000					
Stopanska Banka Skopje	0.3281	0.2442	0.3245	0.3072	0.1246	1.0000				
TTK	0.2937	0.2523	0.2486	0.2627	0.1934	0.1998	1.0000			
Telekom	0.1374	0.1676	0.1558	0.1548	0.0994	0.1190	0.1166	1.0000		
Stopanska Banka Bitola	0.1883	0.1633	0.2006	0.2044	0.1213	0.1221	0.0882	0.0797	1.0000	
NLB	0.2674	0.2286	0.3002	0.2669	0.1183	0.2074	0.1916	0.0977	0.1404	1.0000

SBITOP Correlation Matrix

	Cink Celije	Krka	Luka Koper	NLB	Petrol	Sava	Salus	Telekom	Unior	Triglav
Cink Celije	1.0000									
Krka	0.0103	1.0000								
Luka Koper	0.0142	0.0474	1.0000							
NLB	0.0510	-0.0093	0.0812	1.0000						
Petrol	-0.0122	-0.0498	0.0430	-0.0260	1.0000					
Sava	-0.0369	0.0331	0.1333	-0.0203	0.0151	1.0000				
Salus	0.0371	-0.0503	-0.0269	-0.0026	0.0224	-0.0460	1.0000			
Telekom	-0.0011	0.0345	0.0836	0.0305	-0.0254	0.0126	-0.0357	1.0000		
Unior	-0.0038	-0.0459	0.0667	0.0669	0.0326	0.0331	0.0726	-0.0597	1.0000	
Triglav	-0.0363	0.1210	0.0426	0.0780	-0.0032	0.0681	-0.0199	0.0568	0.0669	1.0000