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Opportunities for International Portfolio Diversification across the South Eastern European Region

Jasmina Okičić[1]
University of Tuzla, Faculty of Economics,Bosnia and Herzegovina

Abstract. The main goal of this paper is to scientifically examine the opportunities for international portfolio diversification across the selected stock markets in the South Eastern European (SEE) region. Apart from examining potential portfolio risk reduction we will also investigate possibilities for realization of excess return on these markets. Therefore, this approach is two-dimensional and consists of (1) weak-form efficiency testing, by using autoregressive (AR) model, and (2) by using Johansen's cointegration and Granger causality tests examining long and short-run relationships among selected stock markets in the SEE region. We use publicly available data and information available from stock traded indices in the SEE region and benchmark these against the index of European developed economy. The real implications of this research can be seen in the shaping of investment strategies of potential investors looking to diversify their portfolios.

Keywords: portfolio diversification; cointegration; causality; weak-form efficiency.

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1. Introduction

Investing in stock market is a risky business. In order to reduce risk, both practitioners and theoreticians recommend holding a well diversified portfolio. Diversifying a portfolio between several different securities allows the total portfolio risk to be reduced, and therefore allows the portfolio performance in general to be improved. Out of the total portfolio risk, only unsystematic (company-specific) risk can be reduced by diversification. This risk is caused by such things as lawsuits, strikes, successful and unsuccessful marketing programs, and other events that are unique to a particular company. Since these events are random, their effects on a portfolio can be eliminated by diversification. This is mainly because of the correlations between returns on selected securities: the weaker the correlations between these securities, the greater the reduction in total portfolio risk is. The part of the total portfolio risk which is irreducible despite

1. University Of Tuzla, Faculty Of Economics, Univerzitetska 8, 75.000 Tuzla, Bosnia and Herzegovina, Telephone number: +387603444419, E-mail: jasmina.okicic@untz.ba

constructing a well diversified portfolio is called systematic or market risk. This risk stems from factors which systematically affect most companies, such as war, inflation, recession and high interest rates. Since most securities will tend to be negatively affected by these factors, systematic risk cannot be simply eliminated by classical *domestic* diversification. Systematic risk can only be reduced by *international* diversification, i.e. focusing on securities from foreign markets rather than domestic ones. However, the usefulness of international diversification is a very controversial subject.

In principle, the values of assets in each country are influenced by national economic factors (interest rates, domestic politics, etc.). All of these constitute the specific risk of each country. International diversification allows investors to spread their risk between the specific levels of risk in each country and thereby eliminate part of the risk. For the same level of return, the global risk of the portfolio is diminished. Portfolio performance can therefore be improved, without increasing the risk. However, this is only true to the extent that the financial markets in the different countries are not perfectly correlated (Amenc and Le Sourd, 2003, p. 20-21).

The main goal of this paper is to scientifically examine the opportunities for international portfolio diversification across the selected stock markets in the South Eastern European (SEE) region.

Apart from examining potential total portfolio risk reduction we will also investigate possibilities for realization of excess return on these markets. Therefore, this approach is two-dimensional and consists of weak-form efficiency testing and examining long and short-run relationships among selected stock markets in the SEE region.

The research should result in responses to the following questions: Is there a significant correlation between stock markets from the SEE region? Is there a possibility for realization of excess return when investing in these markets? Are stock markets in the SEE region integrated or not?

Having in mind the above said, the central research hypothesis shall be as follows: *Investing at the stock markets of SEE region results in small effects of international portfolio diversification with possibilities for realization of excess return.*

The real implications of this research can be seen in the shaping of investment strategies of potential investors looking to diversify their portfolios.

The paper is organized as follows. In the next section, in part one we bring a short overview of some recent literature that is relevant to the main objective of the paper. In part two we present a theoretical background relevant to the research. Part three provides a description of our research methodology. Part four is the centre of the paper and contains analysis and discussion of the original empirical results. The last part contains some final remarks and conclusions.

2. Literature Review

Numerous studies proved that the opportunities for international portfolio diversication have become a subject of interest to a number of theoreticians and researchers over the last few years. However, most of the empirical research on the opportunities for international portfolio diversication comes from the developed stock markets. Therefore, in this section we will only present some recent results that include underdeveloped stock markets. Wong, Agarwal and Du (2005) empirically investigated the long-run equilibrium relationship and short-run dynamic linkage between the Indian stock market and the stock markets in major developed countries (United States, United Kingdom and Japan) after 1990. They concluded that Indian stock market is integrated with mature markets and sensitive to the dynamics in these markets in a long run. Maneschiöld (2006) investigated financial integration between Baltic countries (Estonia, Latvia and Lithuania) and international capital markets. The results suggest that international investors can obtain diversification benefits given a long-term investment horizon because of the low degree of integration between the Baltic and international capital markets. Vizek and Dadić (2006) examined bilateral and multilateral integration of equity markets of selected CEE countries including Croatia, and German equity market. Application of the Johansen cointegration procedure indicated existence of multilateral integration between equity markets of analyzed CEE economies, as well as between the group of CEE equity markets and German equity market. Furthermore, Middelton, Fifield and Power (2008) investigated the potential benefits from diversifying into eight stock markets of CEE quantified the importance of country, industry and time factors in CEE equity returns. The findings suggest that substantial benefits exist from investing in CEE stock markets and that they accrue more from the geographical spread than from the industrial mix of the equities included in the portfolio. Subha and Nambi (2010) confirmed the absence of cointegration between Indian and American stock market. Caporale and Spagnolo (2010) estimated a trivariate VAR-GARCH(1,1)-in-mean model to examine linkages between the stock markets of three Central and Eastern European countries (CEECs), specifically the Czech Republic, Hungary, and Poland, and both the UK and Russia. The empirical findings suggest that there is significant interdependence of these CEEC markets with both the Russian and the UK ones. According to Marashdeh and Shrestha (2010), the results of the empirical tests suggest that the Gulf Cooperation Council (GCC) stock markets are not fully integrated and there still exist arbitrage opportunities between some of the markets in the region. On the other hand, the results show no evidence of cointegration between the GCC stock markets and developed markets, which implies that international investors can diversify their portfolio and obtain long-run gains by investing in the GCC markets. Svilokos (2012) revealed a growing trend of integration level between new and old capital markets of the European Union. Kenourgios and Samitas

(2011) examined dynamics in the relationship between five major Balkan emerging stock markets (Turkey, Romania, Bulgaria, Croatia and Serbia), European developed stock markets (UK, Germany and Greece) and the United States. Results indicated that both domestic and external factors affect the Balkan stock markets, shaping their long-run equilibrium. Most of these studies have reported different levels of opportunities for international portfolio diversification across various national stock markets. In this paper we will, on the basis of these results, create new approach to test the opportunities for international portfolio diversification across the selected stock markets in the SEE region.

2. Theoretical Framework

In order to examine potential opportunities for international portfolio diversification across the SEE region we will use a two-dimensional approach which consists of weak-form efficiency testing and examining long and short-run relationships among selected stock markets. The reason for developing such approach is based on the following well known theoretical concepts:

- *International portfolio diversification is less expective across the cointegrated and correlated markets.* For the purpose of our study the most useful definition of stock market integration is the one that claims that in integrated markets indices of national markets move together over the long run with possibility of short-run divergence (Vizek and Dadić, 2006, p. 632). The fundamental principle underlying stock market integration is the law of one price which indicates that when transaction costs and taxes are not taken into account, identical securities should carry the same price across all stock markets where such securities are traded. This means that, if two or more stock markets are integrated, then assets with identical cash flows should command the same return within both markets. Moreover, in the absence of barriers generating country risk and exchange rate premium, financial assets of similar risk and liquidity are expected to achieve similar yields, irrespective of nationality or location (Marashdeh and Shrestha, 2010, p. 105).

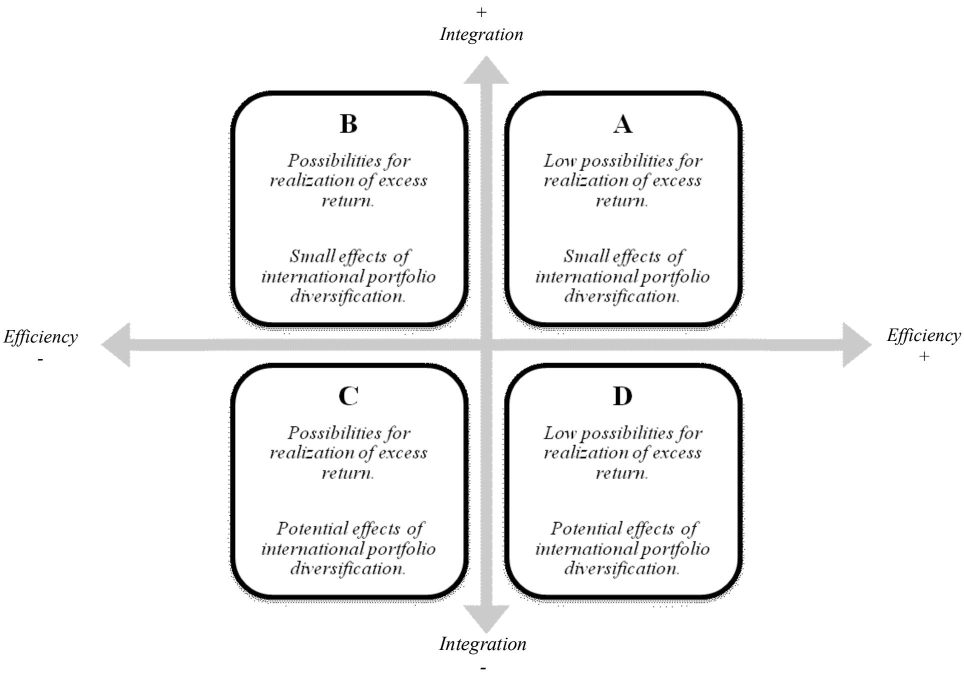
- *Stock market efficiency determines possibilities for realization of excess return.* The idea, based on the fact that stocks are continually priced at their fair value is known as the efficient market hypothesis (EMH). So far, EMH, has been tested in many studies[2], such as: Black and Scholes (1972), Lo and MacKinlay (1988), Balvers, Cosimano and

2. See Fama (1991, 1970) and Sewell (2011) for a review of theory and empirical work surrounding EMH.

McDonald (1990), Deelan (2000), Malkiel (2003), Gupta and Basu (2007) and many others. Fama (1965) defined an efficient market for the first time, in his landmark empirical analysis of stock market prices where he concluded that they follow a random walk. According to Fama (1970), a market in which prices always *fully reflect* available information is called *efficient.* Depending on the information set involved there are three forms of the EMH: (1) weak-form efficiency, (2) semi strong-form efficiency and (3) strong-form efficiency. *Weak-form efficiency* assumes that all historical information is incorporated into the market stock price. *Semi strong-form efficiency* assumes that, beside all historical information, stock market price also reflects expectations about a company. *Strong-form efficiency* is based on assumption that market stock prices reflect, not only historical and expected, but also insider information. What it means is that in an efficient market excess return equals zero even with insider information.

Figure 1 illustrates our two-dimensional concept.

Figure 1: Theoretical concept



The degree of integration determines the possibility of portfolio diversification in various stock markets. So, as stock markets integration increases, the effect of portfolio diversification decreases. Furthermore, depending on efficiency and integration of the selected stock markets investor should be able to set his portfolio in one out of four (A, B, C and D) potential positions presented in Figure 1. In the following section we will explain data and methodology used for the purpose of testing the above explained theoretical concept.

3. Data and Research Methodology

Previously explained two-dimensional approach consists of (1) weak-form efficiency testing, by using autoregressive (AR) model, and (2) by using Johansen's cointegration and Granger causality tests examining long and short-run relationships among selected stock markets in the SEE region. For the purpose of modeling, instead of original index values data, certain transformations will have to be made. So, if we denote successive index value observations made at time t and $t+1$ as P_t and P_{t+1}, respectively, then continuous compounding transforms an index value series $\{P_t\}$ into an index return series $\{r_t\}$ as:

$$r_t = ln\frac{P_t}{P_{t-1}} \quad . \tag{3.1}$$

As previously mentioned, in this paper, weak-form efficiency of stock markets shall be tested by using autoregressive (AR) model where the rate of return, r_t, is regressed on its past values r_{t-k}:

$$AR(p): \quad r_t = \varphi_1 r_{t-1} + \varphi_2 r_{t-2} + ... + \varphi_p r_{t-p} + \varepsilon_t \tag{3.2}$$

If a market is weak-form efficient then the estimated coefficient in AR(p) model should not be statistically significant.

Stock markets are completely integrated if assets of equal risk have identical expected returns, irrespective of the location of the stock market. The degree of financial integration of stock markets can be determined by analyzing the movement of market indices (Svilokos, 2006, p. 313). Since non-stationarity is a precondition for cointegration, the first step is to test each index series for the presence of unit roots. In this paper the augmented Dickey-Fuller (ADF) test, an extension of the Dickey and Fuller method, is used. Thus the hypotheses of interest are (Brooks, 2008, p. 327): H_0: series contains a unit root and H_1: series does not contain a unit root. The null hypothesis of a unit root is rejected in favour of the stationary alternative in each case if the test statistics more negative than the critical value. Phillips and Perron (1988) propose an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root (PP test). The hypothesis of interest are the same as those used in the case of ADF test. The next step is the well-known methodology of cointegration analysis to test the presence of long-run equilibrium relationships. In our analysis we use the Johansen testing procedure for testing the presence of cointegration among the selected stock indices. The first test involves a null hypothesis of no cointegrating vectors (r). If this null is not rejected, it would be concluded that there are no cointegrating vectors and the testing would be completed.

However, if H_0: $r = 0$ is rejected, the null that there is one cointegrating vector (i.e. H_0: $r = 1$) would be tested and so on. Thus the value of r is continually increased until the null is no longer rejected (Brooks, 2008, p. 352). Cointegration tests allow us to determine whether stock prices or indices of different national markets move together over the long run, while providing for the possibility of short-run divergence (Vizek and Dadić, 2006, p. 636). Furthermore, in order to examine the existence of short-term causal relationships we use the Granger causality test. The main purpose of the Granger causality test (H_0: *x* does not Granger Cause *y*) is to see how much of the current *y* can be explained by past values of *y* and then to see whether adding lagged values of *x* can improve the explanation.

3.1. Data

According to the SEE 2020 strategy the working regional definition of 'South East Europe' is taken to include Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, Serbia and The Former Yugoslav Republic of Macedonia.

Over the past two decades, the SEE countries in general have made great strides in their economic and political transformation, reintegration into the global economy and rapprochement with Europe. The resurgence of economic growth in the SEE region during the 2000s contributed to rising living standards and improving social welfare. During that decade, average annual GDP growth in the SEE region was 3.4%, which resulted in a 40% increase in regional aggregate GDP over the past decade (The Regional Cooperation Council, 2013, p. 7).

In this paper we will focus on the following countries, i.e. their stock markets, from the SEE region: Bosnia and Herzegovina, Croatia, Montenegro, Serbia and FYR Macedonia.

Stock markets from these countries are mostly classified as frontier markets. For example, according to the MSCI Inc. (2013), stock markets of Croatia and Serbia, are classified as *frontier* markets but stock market of Bosnia and Herzegovina is classified as *standalone* market. Stock markets from FYR Macedonia and Montenegro are not classified by this source. Furthermore, FTSE Int. (2014) also classifies stock markets of Croatia and Serbia as frontier markets. Stock markets from Bosnia and Herzegovina, FYR Macedonia and Montenegro are not classified by the FTSE Int.

3.1.1. Sample, Variables and Indicators

Given the fact that the main goal of this paper is to scientifically examine the opportunities for international portfolio diversification across the selected stock markets in the SEE region, we will use publicly available data and information available from stock exchanges (i.e. their websites) from the SEE countries, i.e.: SASX-10 and BIRS (Bosnia and Herzegovina), CROBEX (Croatia), MONEX20 (Montenegro), BELEX15 (Serbia) and MBI10 (FYR Macedonia) and benchmark these against the index of developed European economy, i.e. DAX (Germany).

Dependent variable in this research is presented by the effects of potential international portfolio diversification. As an *independent* variable, we used stock market efficiency and integration. Estimated AR(p) models will be used as an *indicator* of stock market efficiency. The results of Johansen's cointegration and Granger causality tests will be used as an indicator of stock market integration. Our observation period is 01 October 2005 – 31 December 2013[3].

3.1.2. Research Design

After examining some basic parameters of descriptive statistics, the research was conducted in four stages. In the first stage, each daily return series was tested for the presence of unit roots, in order to determine whether the time series was stationary or not.

Next, the presence of long-run equilibrium relationships, by using the Johansen procedure is tested as well as the existence of short-term causal relationships, by using Granger causality test. In the third stage, weak-form stock market efficiency is tested, by using autoregressive (AR) model.

Finally, these results are combined and analysed according to the previously defined two-dimensional theoretical concept.

4. Results and Discussion

In order to create a better insight into a specificity of observed financial time series we first analysed some basic parameters of descriptive statistics (Table 1).

3. *In order to keep* the *data consistency w*e used October 2005 as a starting point while the base date for BELEX15 was 01 October 2005.

Table 1: Descriptive statistics

PARAMETER	SEE REGION						BENCHMARK
	BELEX15	BIRS	CROBEX	MBI10	MONEX20	SASX10	DAX
Mean	-0,0004	-0,0004	-0,0001	-0,0003	0,0002	-0,0006	0,0004
Median	0,0001	-0,0002	0,0000	-0,0008	-0,0004	-0,0005	0,0011
Maximum	0,1696	0,0796	0,1478	0,1600	0,1584	0,1738	0,1080
Minimum	-0,1259	-0,1184	-0,2023	-0,1564	-0,1193	-0,1332	-0,0987
Std. Dev.	0,0193	0,0120	0,0175	0,0184	0,0204	0,0178	0,0170
Skewness	0,7230	-0,0245	-0,8390	0,2907	0,7628	0,2864	-0,1970
Kurtosis	20,2049	15,8715	26,4662	20,1781	12,7172	17,9542	9,3689
Jarque-Bera	18668,4840	10375,5658	34661,5571	18500,8932	6059,1193	14025,1818	2549,9714
Probability	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Based on the Jarque-Bera test we rejected the null hypothesis (H_0: *the data are from a normal distribution*) at the 5% significance level for all selected variables. From a financial perspective, skewness is crucial since it may itself be considered as a measure of risk. The skewness of a symmetric distribution, such as the normal distribution, is zero. Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. In other words, negative skewness means there is a substantial probability of a big negative return. Positive skewness means that there is a greater-than-normal probability of a big positive return.

Negative skewness was evident in the case of three variables, i.e. BIRS and CROBEX. This indicates that there was a substantial probability of a big negative return.

DAX, as a benchmark, also had negative skewness. On the other hand, kurtosis measures the degree to which extreme outcomes in the "tails" of a distribution are likely. The normal distribution has a kurtosis of 3 (mesokurtic). Kurtosis points out leptokurtosis for all selected variables.

Leptokurtosis indicates that small changes are less frequent than in a normal distribution, but extreme events such as large price moves are more likely to happen and are potentially much larger than in a normal distribution. Furthermore, excess kurtosis (K)[4] is a measure of the fatness of the tails of kurtosis where there is higher likelihood of large gains or large losses on an investment. Excess kurtosis is particularly noticed in case of all selected variables, meaning that investors may face higher likelihood of large gains or large losses when in investing in these stocks. Knowing the correlations between the returns is important for the process of allocating investments among them.

4. Excess kurtosis is simply kurtosis less 3.

That is why the next step will be to examine correlation between selected securities.

Table 2: Correlation analysis

Correlations								
		SASX-10	BIRS	CROBEX	MONEX20	BELEX15	MBI10	DAX
SASX-10	Pearson Correlation	1	0.285**	0.214**	0.198**	0.148**	0.214**	0.092**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000
BIRS	Pearson Correlation		1	0.146**	0.130**	0.094**	0.092**	0.065*
	Sig. (2-tailed)			0.000	0.000	0.000	0.000	0.012
CROBEX	Pearson Correlation			1	0.276**	0.167**	0.367**	0.508**
	Sig. (2-tailed)				0.000	0.000	0.000	0.000
MONEX20	Pearson Correlation				1	0.267**	0.179**	0.118**
	Sig. (2-tailed)					0.000	0.000	0.000
BELEX15	Pearson Correlation					1	0.165**	0.013
	Sig. (2-tailed)						0.000	0.611
MBI10	Pearson Correlation						1	0.213**
	Sig. (2-tailed)							0.000
DAX	Pearson Correlation							1
	Sig. (2-tailed)							
**. Correlation is significant at the 0,01 level (2-tailed); *. Correlation is significant at the 0,05 level (2-tailed).								

Based on the analysis of the correlation matrix it can be concluded that there is statistically significant correlation in terms of movement of all stock exchange indices (except DAX and BELEX15).

4.1. Unit Roots Tests

In order to determine whether the daily returns are stationary in levels, first differences or even in higher differences we used Augmented Dickey – Fuller (ADF) test and the Philips-Perron (PP) tests. Results are presented in Table 3, from which, it is evident that all daily return time series are stationary at 1% confidence level.

Table 3: Results of augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests

Variables		ADF		PP	
		t-value (trend included)	t-value (no trend)	t-value (trend included)	t-value (no trend)
SEE region	BELEX15	-30.417 0.000	-30.423 0.000	-30.763 0.000	-30.776 0.000
	BIRS	-31.426 0.000	-22.652 0.000	-35.005 0.000	-35.052 0.000
	CROBEX	-36.408 0.000	-36.411 0.000	-36.599 0.000	-36.608 0.000
	MONEX20	-29.612 0.000	-29.554 0.000	-30.709 0.000	-30.736 0.000
	MBI10	-25.570 0.000	-25.524 0.000	-29.609 0.000	-29.725 0.000
	SASX10	-29.157 0.000	-29.146 0.000	-29.428 0.000	-29.453 0.000
Benchmark	DAX	-40.335 0.000	-40.332 0.000	-40.470 0.000	-40.457 0.000

Also it is worth noting that this result applies to both, daily return of indices with or without trend variable included in test specification.

4.2. Cointegration Tests

Johansen (1991) defines two different test statistics for cointegration under his method: the trace test and the maximum eigenvalue test. Results[5] are presented in the following section.

Table 4: Unrestricted Cointegration Rank Test (Trace)

Hypothesized number of cointegration equations	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.144041	1080.780	125.6154	0.0001
At most 1 *	0.125617	848.4143	95.75366	0.0001
At most 2 *	0.118428	647.8643	69.81889	0.0001
At most 3 *	0.098066	459.5474	47.85613	0.0001
At most 4 *	0.091223	305.3455	29.79707	0.0001
At most 5 *	0.067469	162.4362	15.49471	0.0001
At most 6 *	0.038127	58.07555	3.841466	0.0000
Trace test indicates 7 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values				

5. The optimal lag structure is determined by minimization of the Akaike Information Criterion (AIC).

Table 5: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized number of cointegration equations	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.144041	232.3654	46.23142	0.0000
At most 1 *	0.125617	200.5501	40.07757	0.0001
At most 2 *	0.118428	188.3169	33.87687	0.0001
At most 3 *	0.098066	154.2018	27.58434	0.0001
At most 4 *	0.091223	142.9093	21.13162	0.0001
At most 5 *	0.067469	104.3607	14.26460	0.0001
At most 6 *	0.038127	58.07555	3.841466	0.0000
Max-eigenvalue test indicates 7 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values				

The trace test is a joint test that tests the null hypothesis of no cointegration (H_0: r = 0) against the alternative hypothesis of cointegration (H_1: r > 0). The maximum eigenvalue test conducts tests on each eigenvalue separately. Contrary to the findings of previous research of Marashdeh and Shrestha (2010) and Subha and Nambi (2010), our results indicate that selected indices of different national markets move together over the long run, while providing for the possibility of short-run divergence. This is consistent with the findings of Kenourgios and Samitas (2011), Erdinc and Milla (2009) and Wong, Agarwal and Du (2005).

As mentioned before, for testing the existence of short-term causal relationships we will use the Granger causality test (Table 6).

Table 6: Granger Causality test

No.	Null Hypothesis	Prob.	No.	Null Hypothesis	Prob.
	BIRS does not Granger Cause BELEX15	6.E-05		BIRS does not Granger Cause SASX10	1.E-05
	BELEX15 does not Granger Cause BIRS	0.0419		DAX does not Granger Cause CROBEX	0.0154
	CROBEX does not Granger Cause BELEX15	1.E-35		CROBEX does not Granger Cause DAX	0.1010
	BELEX15 does not Granger Cause CROBEX	9.E-05		MBI10 does not Granger Cause CROBEX	0.0059
	DAX does not Granger Cause BELEX15	5.E-18		CROBEX does not Granger Cause MBI10	9.E-10
	BELEX15 does not Granger Cause DAX	0.0086		MONEX20 does not Granger Cause CROBEX	0.0054
	MBI10 does not Granger Cause BELEX15	2.E-11		CROBEX does not Granger Cause MONEX20	3.E-10
	BELEX15 does not Granger Cause MBI10	0.0001		SASX10 does not Granger Cause CROBEX	0.0212
	MONEX20 does not Granger Cause BELEX15	5.E-13		CROBEX does not Granger Cause SASX10	5.E-09
	BELEX15 does not Granger Cause MONEX20	0.0011		MBI10 does not Granger Cause DAX	0.3068
	SASX10 does not Granger Cause BELEX15	7.E-13		DAX does not Granger Cause MBI10	0.0085
	BELEX15 does not Granger Cause SASX10	0.0005		MONEX20 does not Granger Cause DAX	0.3757
	CROBEX does not Granger Cause BIRS	0.0101		DAX does not Granger Cause MONEX20	0.0093
	BIRS does not Granger Cause CROBEX	0.1762		SASX10 does not Granger Cause DAX	0.8484
	DAX does not Granger Cause BIRS	0.0222		DAX does not Granger Cause SASX10	0.0003
	BIRS does not Granger Cause DAX	0.6229		MONEX20 does not Granger Cause MBI10	6.E-11
	MBI10 does not Granger Cause BIRS	0.0021		MBI10 does not Granger Cause MONEX20	0.0107
	BIRS does not Granger Cause MBI10	0.0308		SASX10 does not Granger Cause MBI10	0.0047
	MONEX20 does not Granger Cause BIRS	0.0024		MBI10 does not Granger Cause SASX10	0.0606
	BIRS does not Granger Cause MONEX20	0.0003		SASX10 does not Granger Cause MONEX20	0.0836
	SASX10 does not Granger Cause BIRS	0.0056		MONEX20 does not Granger Cause SASX10	0.0052

Results indicate short-term causal relationships particular between stock markets from the SEE region. This is consistent with the previous findings of Svilokos (2012) and Vizek and Dadić (2006). When it comes to the selected benchmark, short-term causal relationship is evident between DAX – BELEX15, DAX – MBI10, DAX – MONEX20 and DAX – SASX10.

4.3. Weak-Form Efficiency Testing

In this paper, weak-form efficiency of stock markets was tested by using[6] an autoregressive model.

The estimated coefficient of the autoregressive AR(p) models for observed variables and appropriate *p*-values are shown in Table 7.

6. According to Reilly and Brown (1997) two basic groups of tests for examining weak-form efficiency on stock markets are statistical tests of independence and tests of trading rules.

Table 7: Estimated AR(p) models

Models		Indices													
		SEE REGION												BENCHMARK	
		BELEX-15		BIRS		CROBEX		MONEX20		MBI-10		SASX-10		DAX	
		Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value
AR(1)	r_{t-1}	0,2372	0,0000	0,2081	0,0000	0,0636	0,0136	0,2643	0,0000	0,2633	0,0000	0,2772	0,0000	-0,0402	0,1198
	Adj. R^2	0,0559		0,0422		0,0040		0,0698		0,0691		0,0760		0,0010	
AR(2)	r_{t-1}	0,2443	0,0000	0,1931	0,0000	0,0635	0,0140	0,2695	0,0000	0,2850	0,0000	0,2955	0,0000	-0,0418	0,1052
	r_{t-2}	-0,0298	0,2485	0,0723	0,0051	0,0017	0,9496	-0,0196	0,4469	-0,0827	0,0013	-0,0659	0,0107	-0,0417	0,1065
	Adj. R^2	0,0567		0,0466		0,0032		0,0695		0,0749		0,0793		0,0020	
AR(3)	r_{t-1}	0,2455	0,0000	0,1893	0,0000	0,0635	0,0140	0,2688	0,0000	0,2861	0,0000	0,2916	0,0000	-0,0436	0,0913
	r_{t-2}	-0,0399	0,1335	0,0624	0,0175	-0,0018	0,9443	-0,0102	0,7035	-0,0862	0,0013	-0,0483	0,0722	-0,0435	0,0924
	r_{t-3}	0,0413	0,1101	0,0515	0,0464	0,0547	0,0342	-0,0352	0,1735	0,0126	0,6262	-0,0596	0,0210	-0,0424	0,1007
	Adj. R^2	0,0582		0,0485		0,0056		0,0699		0,0743		0,0820		0,0032	
AR(4)	r_{t-1}	0,2421	0,0000	0,1867	0,0000	0,0637	0,0138	0,2715	0,0000	0,2851	0,0000	0,2912	0,0000	-0,0441	0,0879
	r_{t-2}	-0,0366	0,1676	0,0591	0,0245	-0,0018	0,9433	-0,0094	0,7249	-0,0796	0,0030	-0,0485	0,0711	-0,0440	0,0889
	r_{t-3}	0,0210	0,4285	0,0417	0,1128	0,0550	0,0335	-0,0558	0,0364	-0,0095	0,7222	-0,0580	0,0310	-0,0429	0,0969
	r_{t-4}	0,0826	0,0014	0,0518	0,0450	-0,0049	0,8494	0,0770	0,0029	0,0773	0,0027	-0,0052	0,8390	-0,0120	0,6439
	Adj. R^2	0,0627		0,0504		0,0050		0,0748		0,0788		0,0814		0,0026	
AR(5)	r_{t-1}	0,2467	0,0000	0,1837	0,0000	0,0640	0,0132	0,2702	0,0000	0,2866	0,0000	0,2916	0,0000	-0,0442	0,0876
	r_{t-2}	-0,0354	0,1811	0,0567	0,0307	-0,0052	0,8397	-0,0084	0,7528	-0,0798	0,0030	-0,0450	0,0945	-0,0442	0,0876
	r_{t-3}	0,0189	0,4745	0,0382	0,1456	0,0551	0,0329	-0,0557	0,0370	-0,0111	0,6810	-0,0550	0,0407	-0,0432	0,0955
	r_{t-4}	0,0961	0,0003	0,0411	0,1176	-0,0089	0,7319	0,0722	0,0069	0,0828	0,0020	-0,0232	0,3877	-0,0122	0,6375
	r_{t-5}	-0,0558	0,0307	0,0575	0,0261	0,0621	0,0162	0,0175	0,4983	-0,0193	0,4554	0,0617	0,0170	-0,0053	0,8372
	Adj. R^2	0,0649		0,0530		0,0082		0,0744		0,0789		0,0844		0,0020	

Grey colored *p*-values indicate significant estimation at level 0.05. If the market was efficient we should not be able to explain any variance. Instead, in the observed period of time we were able to explain up to 8.4% (SASX10) of variability of the current (daily) return[7].

By a comparative analysis of variability of daily returns on stock exchange indices of stock markets of the SEE region, it can be concluded that, in the observed period of time (Table 7), CROBEX, with 0.4%, 0.32%, 0.56%, 0.50% and 0.82% (for models AR(1), AR(2), AR(3), AR(4) and AR (5) respectively) variability of daily returns, explained by historical returns and in the context of testing the weak efficiency, is the closest in its value to the previously selected benchmark, DAX index, with only 0.1%, 0.2%, 0.3%, 0.26% and 0.2% (for models AR(1), AR(2), AR(3), AR(4) and AR (5) respectively) of daily return.

On the other side, other stock markets are characterized by much larger impact which historical returns have on variability of daily returns, in comparison to the selected benchmark.

At the end, this research has confirmed that stock markets from the SEE region are integrated, correlated and not weak-efficient.

According to our theoretical concept, presented in Figure 1, it means that when investing on these stock markets, investors should be able to set their portfolio in the position "B", meaning that they could face possibiblities for

7. The rest of the variability is caused by other factors.

realization of excess return with small effects of international portfolio diversification.

5. Conclusion

In this paper we investigated the opportunities for international portfolio diversification across the selected stock markets in the SEE region. We used a two-dimensional theoretical concept by which we examined not only potential portfolio risk reduction but also possibilities for realization of excess return on these markets. Based on theoretical inferences and empirical evidence, presented in this paper, we found that taking into account that the stock markets from the SEE region are cointegrated and not week-efficient, when investing on these markets investors could face small effects of international portfolio diversification with possibilities for realization of excess return. Although further work is required to gain a more complete understanding of the opportunities for international portfolio diversification across the selected stock markets in the SEE region, the main practical consequence of these results is that investors should be careful when trying to diversify their portfolios on these markets.

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