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IMPACT OF VOLATILITY AND PERFORMANCE OF MAJOR STOCK MARKETS ON SARAJEVO STOCK EXCHANGE IN 2008 – 2012 PERIOD

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ABSTRACT

Previous research indicates that performance and volatility of small and regional stock markets can be influenced by the performance of major world exchanges such as New York, Frankfurt or Tokyo stock exchange. This research analyses weekly composite index data for SASE (Sarajevo Stock Exchange), NYSE, NIKKEI, and DAX indices, for the period from 2008 until the end of 2012. This time period contains significant events in the US and the rest of the world, including the housing bubble, and a great recession which followed after. Significant volatility of SASE was noted in 2007 while later periods suggest lesser volatility after a significant drop in index value in mid 2007. The data was analyzed in a side by side comparison, by the method of regression in order to establish a correlation of NYSE, NIKKEI and DAX indexes with Sarajevo Stock Exchange index. Furthermore the performance was visually represented, segmented into several dynamic and steady periods, whose regressions were separately calculated, in order to see the difference in steady and dynamic periods. Previous research suggests strong correlation between regional and major stock market indices at times of crisis, a so called spillover effect, while low correlation at times of low volatility. With these results, we will be able to understand the impact of major world indices on volatility and performance movements of Sarajevo Stock Exchange in the long and short run, as well as at times of low and high volatility. The results of research suggest that when there is less dynamics in major world indices, the SASE market becomes less affected by their results and by the global market trends, thus its performance is then dictated to a higher degree by regional or country specific financial, economic and to some degree political factors. On the other hand we can also deduce that when there are significant events developing in these major world indices, SASE's composite index performance are highly correlated to the dynamics and trends of major world indices. One such case this paper analyzed is evident in the 'dynamic period' of some 18 months, ranging from 01.01.2009-16.06.2010, where the impact of global recession on major world indexes spilled over to smaller regional exchanges; correlation between SASE and NYSE in that period is 0,92.

Keywords: stock price volatility, fundamental analysis, Sarajevo Stock Exchange, regression analysis, correlation analysis

JEL Classification: G12, G14

INTRODUCTION

Objective of this research was to explore and understand the performance on financial markets in Bosnia and Herzegovina over time, and the assumed external influence exerted by mayor world indices such as New York, Tokyo or Frankfurt stock exchanges; and thus to develop a better understanding of the possible impacts those markets convey to a small country economy as a whole. The results of the research may be used to produce a more accurate forecasting model with practical applications for investors in securities traded on exchanges such as the Sarajevo Stock Exchange. Data from Sarajevo stock exchange (SASE) was used in this research, as it is representative of the Bosnian stock exchanges, and we may assume the results obtained for this exchange can be extrapolated to any other and all stock exchanges within the country.

The hypothesis is that Sarajevo stock exchange performance and volatility moved independently in times of relative 'stability' of the performance and volatility parameters in the mayor world indices, therefore SASE composite price index and volatility dynamics were the result of local factors determining supply and demand. In turn, during 'dynamic' periods, when major world indices have above average volatility, the performance and volatility of Sarajevo stock exchange is influenced by performances and volatilities of mayor world indices, and the composite price index and volatility could be explained by movements in these markets, implying that SASE shows less autonomy, and more dependence during these 'dynamic' periods.

Previous research supports this hypothesis. Chesnay i Jondeau (2001) established an increase of correlation between exchanges at times of crisis, or declining value of indices. Longin and Solnik (2001) in a paper entitled « Extreme correlations of international equity markets during extremely volatile periods » conducted a multivariate analysis of final values of G-5 countries in 1959 to 1996 period and established a correlation of index declines to an extent much greater than anticipated. Silvennoinen and Terasvirta (2005) analyzed a 4 stock portfolio whose correlation coefficient increases with the increase in volatility. We should also note a study by King i Wadhvani (1990) entitled « Transmission of volatility between stock markets» which indicates low volatility of London Stock Exchange in trading days during which New York Stock Exchange is closed for trading during 1968. Ang i Beakert (2002) point out to high correlation coefficients during high volatility periods on US, UK and German stock exchanges, while Beakert and Harvey (2005) reach similar conclusions for European, Asian and South American markets.

Methodology

The data for this research consists of composite index price data for four exchanges; Sarajevo Stock Exchange (SASE) as well as New York (NYSE), Tokyo (NIKKEI) and Frankfurt (DAX) stock exchanges. The time period in question is January 2008 to December 2012. These 1296 data points were analyzed using single (each major market index and SASE) and finally multiple regressions (only multiple regression results are represented in this paper). Two time slots were isolated, marked "static" and "dynamic" in this paper, and multiple regressions run on these as well, in order to test the crisis spillover effect. As the hypothesis states, correlation during "dynamic" period marked with increased volatility in large exchanges is larger than during static period or the overall period, since we can assume that at times of instability (increased volatility) the impact of trading patterns in major stock markets is larger than at other times.

Results

The following three tables summarize results of the analysis for the overall time period for the long term (2008-2012), and two short term periods characterized by high volatility and low volatility on major stock markets.

Fig 1. Multiple regression analysis of SASE and NYSE, NIKKEI and DAX indices 2008-2012

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.876952692							
R Square	0.769046024							
Adjusted R Square	0.768509753							
Standard Error	300.4616868							
Observations	1296							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	3	388389611	129463203.7	1434.063	0			
Residual	1292	116638175	90277.22526					
Total	1295	505027786						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	-1311.401167	67.79680002	-19.34311305	2.07E-73	-1444.40505	-1178.39728	-1444.40505	-1178.39728
NYSE Close	0.268136604	0.02840187	9.440808144	1.66E-20	0.212417764	0.32385544	0.212417764	0.32385544
NIKKEI Close	0.306071646	0.008383183	36.51019491	4.1E-201	0.289625502	0.32251779	0.289625502	0.32251779
DAX Close	-0.414306449	0.028815682	-14.37781148	1.36E-43	-0.47083711	-0.35777579	-0.47083711	-0.35777579

Fig 2. Multiple regression analysis of SASE and NYSE, NIKKEI and DAX indices 01/2008 - 06/2009 ("dynamic")

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.936014183							
R Square	0.876122551							
Adjusted R Square	0.875131532							
Standard Error	284.4433792							
Observations	379							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	3	2.15E+08	71527703	884.0618	1.2512E-169			
Residual	375	30340513	80908.04					
Total	378	2.45E+08						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	-1950.08918	106.7861	-18.2616	9.34E-54	-2160.063722	-1740.11	-2160.06	-1740.11
NYSE Close	0.169490815	0.064766	2.616988	0.00923	0.042141542	0.29684	0.042142	0.29684
NIKKEI Close	-0.23835981	0.037165	-6.41349	4.29E-10	-0.311438506	-0.16528	-0.31144	-0.16528
DAX Close	0.920833867	0.084839	10.85384	4.74E-24	0.754013214	1.087655	0.754013	1.087655

Fig 3. Multiple regression analysis of SASE and NYSE, NIKKEI and DAX indices 06/2009 - 07/2010 ("static")

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.719569325							
R Square	0.517780013							
Adjusted R Square	0.515091054							
Standard Error	55.27588222							
Observations	542							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	3	1765037	588345.5	192.5578	8.29309E-85			
Residual	538	1643818	3055.423					
Total	541	3408854						
	<i>Coefficients</i>	<i>Standard Err</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	605.1769152	49.93672	12.11888	4.68E-30	507.0820666	703.2718	507.0821	703.2718
NYSE Close	0.247310641	0.011772	21.00873	5.3E-72	0.224186313	0.270435	0.224186	0.270435
NIKKEI Close	0.003299296	0.005027	0.656296	0.511914	-0.006575949	0.013175	-0.00658	0.013175
DAX Close	-0.232527916	0.011361	-20.4668	2.78E-69	-0.25484572	-0.21021	-0.25485	-0.21021

Discussion

When examining Figure 1, we can note several points. Multiple R value of 0.87 indicates significant correlation of indices investigated in this paper. The value suggests a strong causal effect of major world indices on the performance of Sarajevo Stock Exchange. The coefficient of determination-R squared, has a value of 0.77, which suggests 77% of SASE composite index performance is explained by the performance of these three indices. One issue to note is that it is typical for the R square value to increase with each new addition of independent variables. It is not the case with the adjusted R square, which does not increase unless there is a stronger relationship between each new independent and the dependent variable. In the case of this multiple regression, adjusted R square has just a slightly lower value than the R square, but on the other hand, it has a higher value than the value of the adjusted R square in any of the individual three regressions. F significance of the regression is zero so we are confident results could not be obtained randomly. The same conclusion can be reached if we examine p intercept value, since it is very close to zero as well. Therefore we can be confident that in the long term, there is significant impact of trading patterns of major world indices examined in the analysis and the patterns on Sarajevo Stock Exchange.

If we compare the results of Figure 1 and 2 it is easy to note that impact of major world indices increases significantly when those indices are more volatile. Correlation indexes are 0.87 and 0.94 respectively, The R square factors are also different, which tell us that a greater percent of SASE index performance is explained in the time period examined in Figure 2, the "dynamic" time period. Significance F being low gives us assurance that regression results aren't random, and also the adjusted R square value has very small difference compared to the R square, underlying the goodness of fit.

As it was suggested in the introduction, low volatility periods in major world exchanges suggest higher autonomy of small regional exchanges, or SASE in this case. Figure 3 clearly indicates this trend. During low volatility period, the multiple regression analysis yielded weaker correlation numbers than both the

dynamic and complete period regression analysis. The multiple R is 0.72 for this steady period in figure 3, which is less the 0.88 in figure 1, and 0.94 in figure 2. The significance F for the regression is near zero, minimizing possibility for this result to occur randomly. The R square, factor follows a similar trend. What we can understand from this are several important things: with the increase of independent variables, the more accurate the regression becomes regardless of the individual correlations which are present.

CONCLUSION

As previous research indicates, major world indices performance is highly correlated with the performance of small exchanges of local importance, such as the Sarajevo Stock Exchange. This correlation increases at times when volatility is greater at major indices, confirming the spillover effect. We can thus conclude that the performance of major world indices is a key determinant of the performance of small exchanges, and this research can help us build more effective forecasting models with practical applications for investors.

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