ESTIMATING THE VOLATILITE OF STOCK MARKETS IN CASE OF FINANCIAL CRISIS

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Abstract - In this paper, effects and responses of stock were analyzed. This analysis was done periodically. Thedimensions of the financial crisis impact on the stock market was investigated by GARCH model. In this context, S&P 500 stock market are modeled with DAX, NIKKEI and BIST100. In this way, The effects of the changing in S&P 500 stock market were examined on European and Asian stock markets. Conditional variance coefficient will be calculated through garch model. The scope of the crisis period, the conditional covariance coefficient will be analyzed comparatively.

Keywords - Conditional Variance Coefficient, Financial Crisis,Garch Model,Stock Market

I. INTRODUCTION

Between 2005 and 2014, the S&P 500, DAX and NIKKEI 100 BIST by taking the logarithm of the closing stock index returns are calculated.These data were uused in the model. GARCH (1,1) model was estimated in the EViews program.As dependent variables, DAX and NIKKEI BIST 100 were taken. As independent variables, lag(1) of S&P 500 and lag(1) of each stock market were taken. In addition to model, unit root test and correlogram analysis were performed for each variables. In this way, the validity of the model will be tested. According to the Garch(1,1) model we will measure the effect size of financial crises (2008-2009) on stock markets.

The following table shows the evolution of the stock markets.

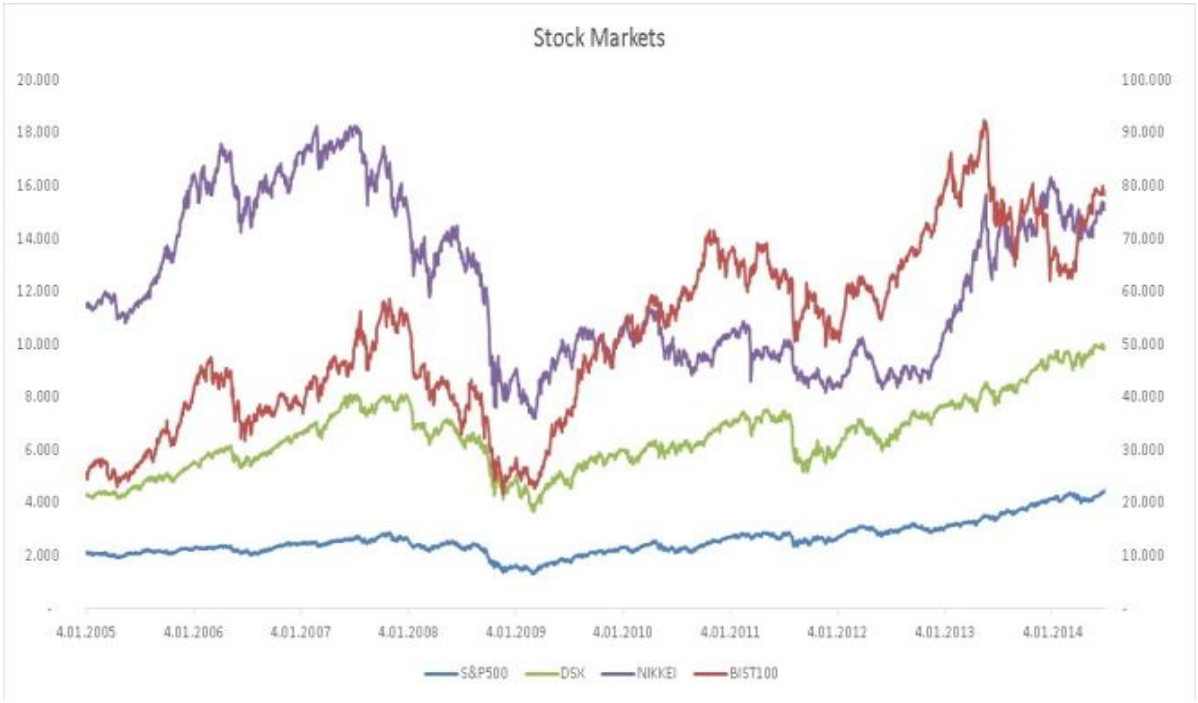


Fig. 1 Stock markets evolution

II. METHOD

First of all, logarithm is taken of all the variables. The yield was calculated based on the data log was taken. Unit root tests were performed for all variables. In case of not being root volume, the model will be established.Established for each model, longer terms correlogram analysis will be carried out. In case of not being autocorrelation in all models, established models will be reviewed.

III. RESULTS

Variables	ADF					PP		
	Test Stat.	Prob.	Lag	Max. Lag	n	Test Stat.	Prob.	n
DAX	28,85	0.0000	0	24	1801	28,88	0.0001	1801
S&P500	32,74	0.0000	1	24	1800	33,37	0.0001	1801
NIKKEI	30,83	0.0001	0	24	1801	30,47	0.0001	1801
BIST100	30,79	0.0000	0	24	1801	30,78	0.0000	1801

TABLE I
UNIT ROOT TESTS

ADF and PP test were perferomed all variables. For each tests, the prob value is less than 0,05. Due to the ADF and PP unit root tests, DAX, S&P500, NIKKEI and BIST100 has not unit root. In this instance, returns of variables will be used in garch model.

GARCH (1,1) Models

This table includes the result of garch model.

$DAX = 0{,}047 - 0{,}1789*DAX_{(t-1)} + 0{,}344*S\&P500_{(t-1)}] + 0{,}0082 + 0{,}0989*ARCH(1) + 0{,}8818*GARCH(1)$
$NIKKEI = 0{,}0212 - 0{,}1105*NIKKEI_{(t-1)}] + 0{,}555*S\&P500_{(t-1)} + 0{,}0128] + 0{,}113*ARCH(1) + 0{,}862*GARCH(1)$
$BIST100 = 0{,}0428 - 0{,}076*BIST100_{(t-1)}] + 0{,}599*S\&P500_{(t-1)} + 0{,}0224] + 0{,}0679*ARCH(1) + 0{,}903*GARCH(1)$

	05/01/2005-01/07/2014					
	Return Model			Variance Model		
Variables	μ	γ_1	γ_2	ω	α_1	β_1
DAX	0,047*	-0,1789*	0,344*	0,0082*	0,0989*	0,8818*
NIKKEI	0,0212***	-0,1105*	0,555*	0,0128*	0,113*	0,862*
BIST100	0,0428**	-0,0763*	0,599*	0,0224*	0,0679*	0,9031*

*, **, *** shows %1, %5 ve %10 significance level.

μ: return model constant; γ_1: each variables lag return; γ_2: S&P500 lag return; ω: variance model constant; α_1: arch coefficient; β_1: garch coefficient.

TABLE II
GARCH MODEL EQUATION

The coefficients for each model were statistically significant.Comparing to the garch coefficients; for DAX model garch coefficient is 0,8818; for NIKKEI model garch coefficient is 0,862; for BIST100 model garch coefficient is 0,9031. For all periods; the biggest garch + arch coefficient is 0,980. Due to the this output; S&P500 has the biggest impact on DAX comparing to the NIKKEI and BIST100 stock markets.

Second higher garch + arch coefficient is 0,975. Due to the NIKKEI model; S&P500 has the second biggest impact on NIKKEI stock markets comparing to the BIST 100.

Lastly, for BIST 100 model; garch + arch coefficient is 0,971. Due to the BIST 100 model; S&P500 has the strong impact on BIST 100 stock market.

For all model arch+garch coefficients are less than 1. However, S&P500 stock market has strong impact on European and Asian stock markets. In case of any financial crisis, all stock markets are affected almost equally.

This graph shows the conditional variance of the garch model. Until the crisis period; NIKKEI stock market has most response to the S&P500. Secondly,until the crisis priod; BIST 100 stock market has most response to the S&P 500. Lastly, until the crisis period, DAX has small response to the S&P500.

In crisis period (2008 and 009); comparing to the DAX and BIST100; NIKKEI sock has biggest response to the S&P500. It is around 6. Nikkei stock market seems to be more precise. Comparing to the DAX and BIST 100 stock markets; NIKKEI has more sensitive on risk against S&P500.

BIST 100 has second biggest response to the S&P 500 in crisis period. It is around 5.

Lastly, DAX stock market has response to the S&P 500 in crisis period. It is around 4. Due to the garch model and conditional graph; S&P 500 stock market has impact all stock markets. After crisis period After the crisis period the effects were continuing. In this case; NIKKEI has more sensivity risk against S&P500.

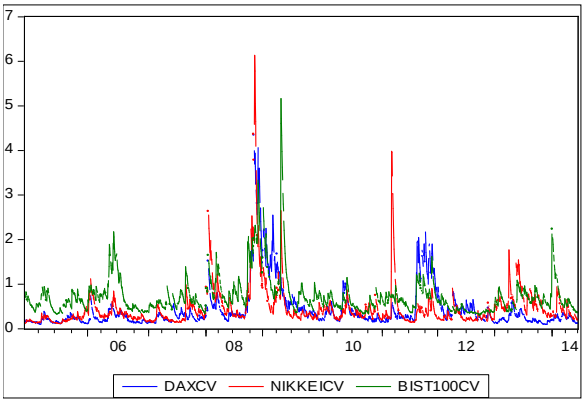


Fig. 2 Conditional Variance Evolution

Correlogram Analysis

This table shows correlogram analysis for DAX, NIKKEI and BIST 100 models. For all lag periods and models, prob values are grather than 0,05. In this case all models have not autocorrelation in their residual. Finally all models are statistically significant.

	DAX		NIKKEI		BIST100	
LAG PERIOD	Q Stat.	Prob.	Q Stat.	Prob.	Q Stat.	Prob.
1	0.1146	0.735	29160	0.088	0.1197	0.729
5	22.218	0.818	35.480	0.616	24.464	0.785
10	53.816	0.864	82.316	0.606	41.341	0.941
15	86.041	0.897	97.545	0.835	49.691	0.992

TABLE III
CORRELOGRAM TABLE

CONCLUSION AND DISCUSSION

The results of this study financial crises impact were analyzed in the stock market. As a result, the volatilite on stock markets increased at crisis period. Before crisis period, volatilite is stable. However due to the S&P500 changes, volatilite is increased seriously at crisis period. Taking risk will bring big losses in that time.

According to the crisis, it creates gateway for investors. In similar cases away from trust will not be easy. As shown, both European and Asian stock markets are deeply affected. This has happened all over the world. For further reasearch, other financial instruments will be included in variance model therefore effects of other financial instruments can test in garch model.

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