Yayın Geliş Tarihi: 21.08.2017
Yayına Kabul Tarihi: 12.06.2018
Online Yayın Tarihi: 17.08.2018
http://dx.doi.org/10.16953/deusosbil.335534

Dokuz Eylül Üniversitesi
Sosyal Bilimler Enstitüsü Dergisi
Cilt: 20, Sayı: 2, Yıl: 2018, Sayfa: 171-187
ISSN: 1302-3284 E-ISSN: 1308-0911

Araştırma Makalesi

SPILLOVERS OF STOCK RETURN VOLATILITY TO TURKISH EQUITY MARKETS FROM GERMANY, FRANCE, AND AMERICA[1]

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Abstract

The aim of this study is to examine the volatility spillover effects of German, French and American stock market indices on BIST 100 Turkish stock market index. Dataset consists of daily closing price observations starting from January 2, 2004, until February 6, 2017, for indices DAX 30, CAC 40, S&P 500 and BIST 100. E-GARCH(1,1) method has been used to model the conditional variance. Volatility is in a relatively narrow band under a non-crisis economic conjuncture. On the other hand, it is expected that the global risk will be higher during crisis periods. Therefore, the differentiation in the volatility spillover behavior among the markets while under different economic conditions is a rational expectation. In this regard, the Threshold VAR (TVAR) model was used in the study. In the result of the study, it has been observed that the volatility spillover effect on the BIST 100 index is relatively low in the regimes where the global risk is low, whereas the effect is relatively higher in the regime where the global risk is high. Furthermore, results of analysis also indicate that S&P is the most influential index to affect BIST 100 both in high and low-risk regimes.

Keywords: *Volatility, Spillover, E-GARCH, TVAR, BIST100, DAX30.*

Bu makale için önerilen kaynak gösterimi (APA 6. Sürüm):

Kargın, S., Kayalıdere, K., Güleç, T. C. & Erer, D. (2018). Spillovers of stock return volatility to Turkish equity markets from Germany, France, and America. *Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 20* (2), 171-187.

[1] Abstract of this article was previously presented in International Congress On Economics and Business 2017 in Serbia, Novi Sad.

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ALMANYA, FRANSA VE AMERIKA'DAN TÜRK HISSE SENEDI PIYASALARINA STOK GETIRI VOLATILITE YAYILIMLARI[2]

Öz

Bu çalışmanın amacı Almanya, Fransa ve Amerika hisse senedi piyasalarının Türkiye hisse senedi piyasası üzerindeki oynaklık yayılımı etkisini incelemektir. 02.01.2004 - 06.02.2017 dönemi için günlük frekansda DAX 30, CAC 40, S&P 500 ve BİST 100 endekslerine ilişkin kapanış verileri kullanılmıştır. Koşullu varyans değerlerini elde etmek amacıyla E-GARCH(1,1) modelinden yaralanılmıştır. Volatilitenin normal bir ekonomik konjonktürde nispeten daha dar bir bant içinde olması olağandır. Buna karşın küresel riskin yüksek olduğu kriz dönemlerinde ise daha büyük bir aralıkta seyretmesi beklenen bir durumdur. Dolayısıyla risk açısından farklılık gösteren ekonomik koşullarda, piyasalar arası oynaklık yayılımı davranışlarının da farklılaşması rasyonel bir beklentidir. Bu açıdan araştırmada söz konusu durumu dikkate alan Threshold VAR (TVAR) modellemesi kullanılmıştır. Çalışma sonucunda küresel riskin düşük olduğu rejimde BİST 100 endeksi üzerindeki yayılım etkisinin göreli olarak düşük olduğu, buna karşın küresel riskin yüksek olduğu rejimde ise söz konusu etkinin nispeten yüksek olduğu gözlemlenmiştir. Buna ek olarak BİST 100 endeksinin bu gelişmiş ülkelere ait 3 endeks içerisinden en yoğun olarak S&P endeksinden etkilendiği bulgulanmıştır.

Anahtar Kelimeler: *Volatilite Yayılımı, E-GARCH, TVAR, BIST100, DAX30.*

INTRODUCTION

Predicting the movement patterns of the global financial system is a complex procedure, focusing on the inner dynamics of just one market is insufficient to model the whole financial system. Spillover effects among the stock markets are one of the main issues affecting the predictability of financial markets. The importance of analyzing the spillover effects is derived from the fact that, markets around the world are dependent on each other. An event causing a volatility shock in a market may cause an even bigger shock in a dependent market, in an example such as this, the spillover effect between the markets is responsible from the volatility shock in the latter market even though nothing substantial has happened domestically. Therefore, studying these spillover effects is an elementary part of understanding, modeling and predicting the market volatility behavior.

When building a portfolio or enacting a legal regulation, it is of crucial importance to be able to predict markets within a certain level of confidence. While finding the right tool to realistically measure volatility is a challenge by itself, observing and forecasting the volatility in indices require evaluating numerous external and internal variables all at once. Along with ever-increasing commercial relations and technological development among countries, it has become important for policymakers to determine the links between international financial markets and

[2] Bu bildirinin özeti daha önce International Congress On Economics and Business 2017 kongresinde Sırbistan'ın, Novi Sad kentinde sunulmuştur.

investors. The dominant view in the literature is that the various transmission mechanisms throughout the international markets are the main cause of spillover effects. Expected returns and intrinsic risk variables differ substantially among international markets, however, said transmission mechanisms cause them to move between markets as a bundle. Variation in investor characteristics is another issue to consider as well. When a shock occurs in a specific market, the part of investors that are most sensitive to volatility shocks in the market is expected to move first.

In this paper, we first evaluate the existing literature on the topic of volatility spillover effects. In process of literature review, we discover that CAC40, DAX30 and S & P500 indices are commonly referred as generators of volatility spillovers. From this point, we proceed to model the volatility spillover from said markets to BIST100 index using the data between 02.01.2004 - 31.01.2017. At first, we model the volatility of each index using EGARCH, this procedure yielded conditional volatility series. In order to evaluate the spillover effects of these conditional volatility series, we applied TVAR model while providing VIX index as threshold variable. TVAR method indicated two different regimes with high and low international risk perception. In the conclusion section, we evaluate the empirical findings and discuss the possible reasons and relationships in accordance with these findings.

LITERATURE REVIEW

In order to effectively evaluate the literature of Spillover effect, we have separated the prior studies that focused on the spillover effects among the equity markets from the studies that focus on the spillover effects among different markets such as among commodity and bond markets. We have also made a distinction between studies that used GARCH methods to determine the spillover effects and studies that used VAR methods to increase the comparability of the results.

By using a multivariate GARCH model, Ng (2000) has studied the volatility spillover effects from Japan and the US to six Pacific– Basin equity markets using a dataset with daily frequency starting from 1975 until the end of 1995. Results of the study indicate that the unexpected returns caused by idiosyncratic shocks in observed markets cause a spillover effect in relevant markets in a consistent manner.

By using a multivariate GARCH-M model Theodossiou & Lee (1993), tests the mean and volatility spillover effects among Canada, Germany, The U.S., The U.K., and Japan by using a dataset consisting of weekly frequent observations of national stock markets between the years 1980 and 1991. Study finds conflicting results, a relationship of weak statistical significance in terms of spillover effect was found from the U.S. markets to the U.K. markets while no significant relationship among any other Country markets was found. This supports the view that the substantial part of volatility in world markets are imported from the volatility shocks in major financial markets such as the U.S. and the U.K.

By using a bivariate GARCH and Regime-switching GARCH models together, Baele (2005) has investigated the level of equity market independence in 13 local European markets. The dataset used is in weekly frequency and in years between 1980 and 2001 with a total of 1130 observations. Study finds an ever-increasing spillover intensity between the U.S. and the European markets, study relates this to increasing integration between economies with increasing trade relations and capital movements in researched years.

By using a volatility spillover model to determine the effects of US equity market shocks in Japan and Asia markets, Miyakoshi (2003) has used the US shocks as an exogenous variable on a daily dataset with approximately 500 observations for each country. Results found by using a bivariate EGARCH model for Japan and Asian markets indicate that The U.S. market has a spillover effect on the returns of Asia market while Japan has no significant spillover effect on returns of Asia market. However, when it comes to volatility spillover it is the Japanese market that has a significant spillover effect on Asia market in form of adverse influence.

Christiansen (2007) has studied the volatility spillover effects from the U.S. and aggregate European bond markets into individual European bond markets. The study uses a dataset consisting of 777 observations between the years 1988 and 2002. Using a GARCH model, the study has found strongly significant spillover from the U.S. markets and Aggregate European bond markets to individual bonds within Europe. Additionally, study finds relatively less significant spillover effects from U.S. market compared to European Aggregate markets for EMU member countries. This is thought as an indicator that European bond markets are more interdependent than they depend on the U.S. market and that the monetary unification has successfully integrated financial aspects of European markets.

In their study, Skintzi and Refenes (2006) have examined the spillover effect from U.S. bond markets to aggregate European bond markets of twelve countries using EGARCH Model. The dataset includes the years between 1991 and 2002 in weekly frequency. Research results indicate that Introduction of EURO currency has increased the spillover effects throughout the European bond markets. Additionally, a strong significant relationship is found between the US and European bond markets individually.

A Weekly dataset consisting of the years between 1992 and 2009 has been used by Yilmaz (2010) for 10 East Asian country indexes with the purpose of examining the extent of contagion and interdependence across the East Asian equity markets. Using VAR decomposition methods, the study concludes that there is an increasing level of interdependence and intensifying level of spillover among East Asian countries. Additionally, the intensity of these spillover effects is positively correlated with increasing global risk factors.

Billio and Pelizzon (2003) have researched the effects of significant economic global events such as convergence of European economies, the introduction of Euro and financial crises, in terms of volatility spillovers from World indexes to European stock markets. Dataset used in the study includes the years between 1988 and 2001 and covers 687 observations. Using multivariate regime-switching model results of the study indicate that for the period between 1996 and 2001, there has been an ever-increasing risk factor in world markets and German markets. These increases are also thought to be also a possible cause of increased spillover from world market to the European market in the said period.

By using a daily dataset with 1441 closing and 1369 opening prices for years between 2000 and 2008, Singh et.al. (2010) has examined the price and volatility spillovers for a total of 15 Asian, European and North American stock market indices. The study has used VAR model for regression and calculated spillover volatility by using AR-GARCH model in order to incorporate the same day effect. According to the findings of the study, a market index is most likely to be affected by a market that opens and closes just before it does.

In an attempt to model the spillover effects between the developed country stock markets and emerging country stock markets, Li & Giles (2015) has made a study which they used E-GARCH method to model the volatility. Dataset consisted of 5217 daily observations of The U.S., Japan and 6 Asian Country stock markets over the years of 1993 to 2012. According to the finding of the study, there is a unidirectional volatility spillover from The U.S. stock market to Asian markets during non-crisis times, and in crisis times these shocks are bidirectional. It is also added that the linkages between Japan and Asia market are getting stronger in last 5 years of the study.

Using GARCH, BEKK, CCC and DCC models, Majdoub & Mansour (2014), has examined the spillover effects between the emerging country stock markets and the U.S. stock market indices in Islamic equity market. Dataset is made of 1306 daily observations from the U.S. and 5 emerging country Islamic equity markets. According to the findings of the analysis, there is an only weak correlation between the U.S. market and the Islamic equities and the significance of spillover effect is largely insignificant.

A recent study of Santamaria et.al (2017), aiming to extend the framework of Diebold & Yilmaz (2012) uses DCC GARCH framework to model the volatility spillover among Australia, Canada, China, Germany, Japan, the United Kingdom, and the United States for the period January 2001 to August 2016. Using a dataset from 2001 to 2016 with a daily frequency and an unspecified number of observations, a study has managed to find results in line with the literature, stating that Developed market indices are mainly sender of volatility spillover rather than receivers and that this spillover effect is higher in extraordinary situations such as global crises.

Spillover literature also contains a substantial amount of studies that neighbor to our topic and are still largely relevant. Hong (2001), So (2001), Yang &

Doong (2004), Black & McMillan (2004), Mishra et.al. (2007) and Inagaki (2007), has made studies under volatility spillover of the exchange rate and currency based indices. General consensus revealed in the literature demonstrates that volatility spillover in the exchange rate is actually very similar to the spillover of stock market indices in the way that of its direction from developed countries to emerging. However, volatility boost in spillover during extraordinary times such as crises demonstrate conflicting results.

Reviewing the volatility spillover literature also reveals a significant amount of studies that focus on international commodity markets. Study of Nazlioglu et. al. (2013) states that there is spillover effect among oil and agriculture markets in the pre-crisis period however that there is a relationship within the post-crisis period. Arouri et.al. (2012) has used a VAR-GARCH model to investigate the spillover effects between oil and stock markets and found that oil markets have significant spillover effects over certain sectors under stock markets.

DATASET AND METHODOLOGY

The aim of this study is to examine the volatility spillover effect between the stock market of Turkey and the stock market of Germany, France, and the USA for the period of 02.01.2004 - 31.01.2017. For this purpose, BIST100, CAC40, DAX30 and S & P500 indices are used. The data used in the study were obtained from the Yahoo Finance database.

Figure 1: Time path graphs for BIST 100, CAC40, DAX30 and S & P 500 indices

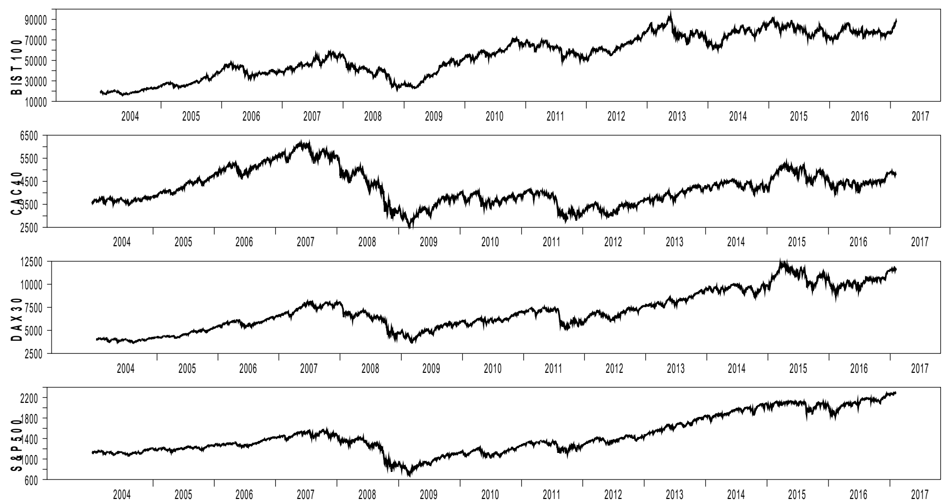


Figure 1.Figures of BIST100, CAC40, DAX30 and S&P500

First, we obtain the return series of stock markets. The formulation used to create return series are as follows:

$$return = \frac{\log(x_t)}{\log(x_{t-1})}$$

Here, x_t shows closing prices of stock markets in t term. Descriptive statistics of return series are demonstrated in Table 1.

Table 1: Descriptive Statistics

	GBIST100	GCAC	GDAX	GSNP
Mean	0.000452	8.16E-05	0.000308	0.000209
Median	0.000420	0.000234	0.000701	0.000351
Maximum	0.121272	0.105946	0.107975	0.109572
Minimum	-0.110638	-0.094715	-0.074335	-0.094695
Std. Dev.	0.016784	0.013915	0.013540	0.011811
Skewness	-0.272005	-0.004807	0.001044	-0.334538
Kurtosis	6.539248	9.806744	9.441583	15.10014
Jarque-Bera	1805.262	6523.139	5842.009	20676.81
Probability	0.000000	0.000000	0.000000	0.000000

In Table 2, the results of ADF, Phillps-Perron and ERS unit root tests regarding GBIST100, GCAC, GDAX, and GSNP are shown. All series are shown to be stationary at levels.

Table 2: The Results of Unit Root Tests

		Constant	Constant and Trend
GBIST100	ADF	-56.62198(0)***	-56.6230(0)***
	PP	-56.60485(16)***	-56.60523(16)***
	KPSS	0.095857(15)	0.041249(15)
GCAC	ADF	-28.56678(4)***	-28.56254(4)***
	PP	-61.42527(10)***	-61.41535(10)***
	KPSS	0.079130(11)	0.078889(11)
GDAX	ADF	-27.55238(4)***	-27.54831(4)***
	PP	-58.41418(13)***	-58.40499(13)***
	KPSS	0.049111(13)	0.048835(13)
GSNP	ADF	-14.17890(17)***	-14.20319(17)***
	PP	-64.99423(13)***	-65.00831(13)***
	KPSS	0.144996	0.603050

Note: *,**,*** represent respectively significance levels at %1, %5 and %10. Values in the parenthesis show lag length according to Akaike information criteria for ADF unit root tests. Values in the parenthesis show lag length according to Newey-West bandwidth for Phillip-Perron and KPSS unit root tests.

In order to obtain volatility series, EGARCH (1,1) model with GED distributed errors was estimated for each stock exchange. Later, conditional variance values were found from estimated models. To ensure control of established models, the Box-Pierce test was applied to the 5th and 10th lags testing the autocorrelation between residuals from the EGARCH (1,1) models estimated for the respective country stock market indices. The ARCH-LM test was then applied for the 2nd and 5th lags which test for the different variances of the residuals. The results are shown in Table 3. When Table 3 is examined, it is seen that residuals for 5% significance level do not have autocorrelation and ARCH effect problems. Therefore, it can be said that the established models are valid.

Table 3: Diagnostic Test Results for Residuals Related to EGARCH (1,1) Models Created for Stock Exchanges

	BP(5)	**BP(10)**	**ARCH(2)**	**ARCH(5)**
BIST100	19.071	53.875	0.1999	0.3831
CAC	144.344	227.661	17.232	16.178
DAX	125.179	193.521	19.167	16.053
S&P	67.189	125.617	0.9404	14.556

Table 4 shows the Spearman correlation matrix showing the relation between the conditional variance values obtained from the EGARCH (1,1) models established for the stock exchanges in the country.

Table 4: Spearman Correlation Matrix

	BIST100	CAC	DAX	S&P
BIST100	1.000			
CAC	0.4282***	1.000		
DAX	0.4164***	0.9165***	1.000	
S&P	0.2597***	0.5345***	0.5282***	1.000

Note: *** represents significance for 1% level of significance.

When the Spearman correlation matrix results are examined, it is seen that BIST100 has a moderate relationship with CAC and DAX and a low level with S & P.

In this study, the effect of global risk levels on international volatility spillovers is addressed by the Threshold Vector Autoregressive Regression (TVAR) method (Tsay, 1998). The reason for using the TVAR method in the study is to determine how financial markets have changed between multiple regimes.

The linear VAR model used in the study can be written as:

$$Y_t = \sum_{i=1}^{p} A_i Y_{t-i} + \sum_{i=1}^{q} B_i X_{t-i} + \varepsilon_t$$

Where Y_t is a vector containing the intrinsic variables of t.

$$Y_t = [\sigma_{RBIST100}, \sigma_{RCAC}, \sigma_{RDAX}, \sigma_{RS\&P}]$$

Where σ denotes the conditional variance of the index return. X_t is a vector containing extrinsic variables at time t. ε_t, is the vector of structural shocks at time t, and A and B are coefficient matrices. The effect of the volatility spillover is obtained by the Impulse Response functions which define the response of the internal variables to the shocks in ε_t.

The TVAR model (Atasanova, 2003, Balke, 2000) expresses the expanded state of the VAR model for different regimes of the economy, depending on the value of the threshold variable.

$$Y_t = I[c_{t-d} \geq \gamma]\left(\sum_{i=1}^{p} A_i^1 Y_{t-i} + \sum_{i=1}^{q} B_i^1 X_{t-i}\right) + I[c_{t-d} < \gamma]\left(\sum_{i=1}^{p} A_i^2 Y_{t-i} + \sum_{i=1}^{q} B_i^2 X_{t-i}\right) + u_t$$

c_{t-d} Threshold value, $I[c_{t-d} \geq \gamma]$ $c_{t-d} \geq \gamma$ the indicator function, which takes the value 0 if it is zero otherwise, refers to the γ threshold value.

EMPIRICAL EVIDENCE

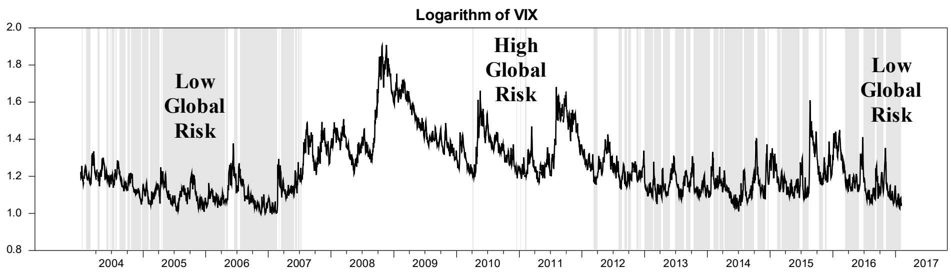
Before moving on to the forecasting phase of the TVAR model, the existence of multiple regimes was explored by C (d) statistics suggested by Tsay (1998). In the model, VIX index values are used as the threshold variable. The C (d) nonlinearity test results based on the repetitive regression estimated using delay parameters d and m0 = 50 and m0 = 100 alternative starting points are given in Table 5. When examining Table 5, the null hypothesis stating that all models are linear for all delays is rejected for the 1% significance level The maximum delay parameter for the threshold variable VIX index was chosen to be d = 5, which had the value of χ2 test statistic (2425.6 to 2423.1). According to the results obtained, Regime 1,$\log(VIX) < 1.22333$ represents the period when the global risk is low; and Regime 2 shows the period when global risk is high when $\log(VIX) \geq 1.22333$

Table 5: Threshold Non-Linearity Test Results

D	m_0	C(d)	D	m_0	C(d)
1	25	4153.2***	4	25	4211.5***
1	50	4150.5***	4	50	4209.4***
2	25	3987.2***	5	25	4245.6***
2	50	3984.0***	5	50	4243.1***
3	25	4106.4***	6	25	4187.2***
3	50	4104.2***	6	50	4184.8***
γ= 1.22333					

Figure 2 shows the graph of the regime classification for the VIX index. According to Figure 2, the period from mid-2007 to 2012 is the period when the VIX index, which indicates the global risk level, is high (regime 2).

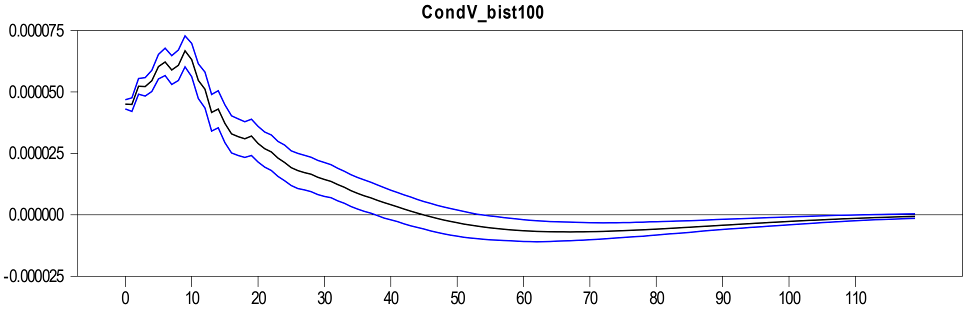
Figure 2: Regime Classification Regarding VIX Index



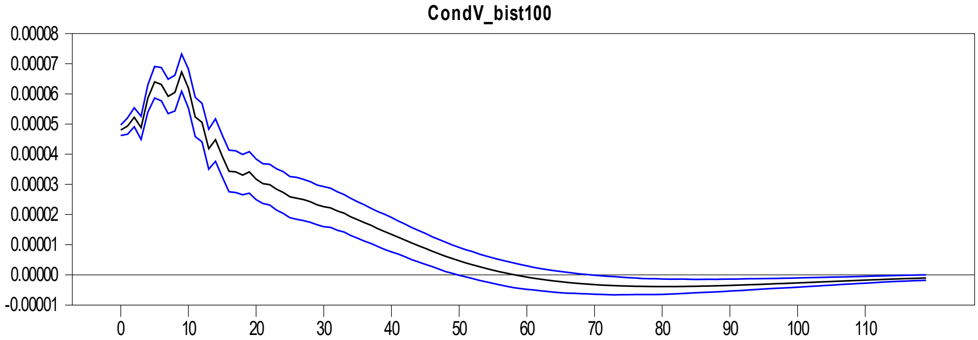
The response of the BIST100 index volatility in response to one standard deviation shock in the fluctuations of the CAC40, DAX30, and S & P indexes is explained by examining the impulse-response functions for the periods when the VIX index is low and high. 2008 global crisis seems to be the starting point of "High Global Risk" period. This high-risk trend starts to diminish at the beginning in 2012.

Figure 3 shows the responses of BIST100 index volatility to the CAC40, DAX30, and S & P500 index volatility for the period when the global risk level is high (regime 2). When Figure 3 is examined, it is observed that BIST 100 index volatility rises gradually in the first 10 days against a standard deviation shock of DAX 30 index volatility. After these 10 days, the BIST 100 index volatility increases and this effect decreases day by day and in about 40 days the effect is completely gone. Looking at the impact of BIST 100 index volatility against a standard deviation shock in the CAC 40 index volatility, it appears that the BIST 100 fluctuation gradually increased over the first 10 days and then decreased gradually and after about 50 days the effect had completely disappeared. In response to a standard deviation shock in the S & P 500 index volatility, the BIST 100 index volatility increases more during the first 10 days than in the other two stocks and fades in 50 days.

Figure 3: Impulse-Response Functions for the High Global Risk Period (Panel A: Response of BIST 100 Volatility to DAX 30 Volatility)



Panel B: Response of BIST 100 Volatility to CAC 40 Volatility



Panel C: Response of BIST 100 Volatility to S&P 500 Volatility

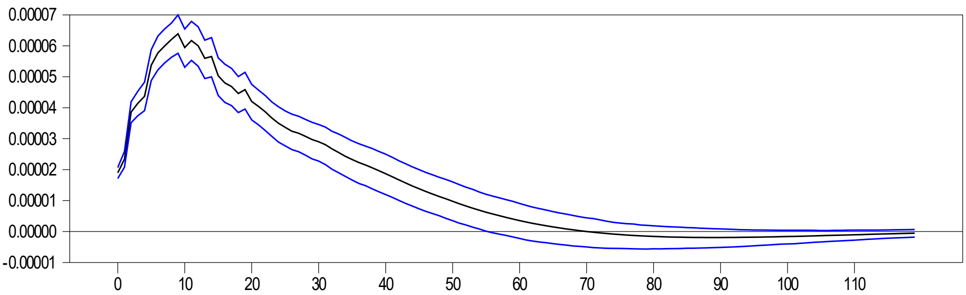
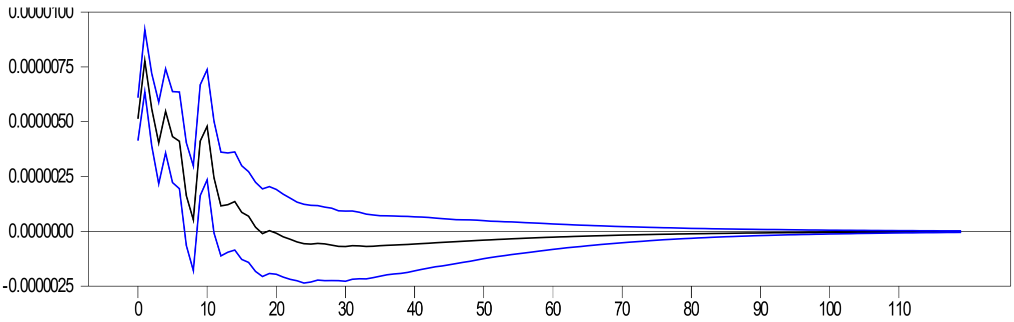
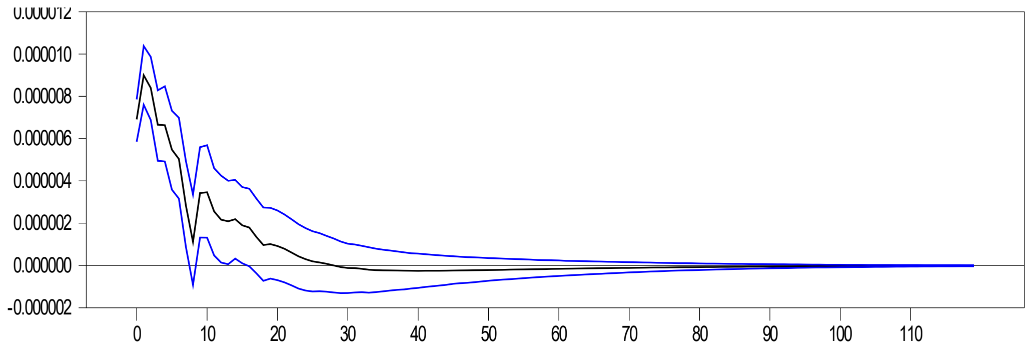


Figure 4 shows the responses of the BIST 100 index volatility to the CAC 40, DAX 30 and S&P 500 index volatility for the period when the global risk level is low (regime 1). When we look at Figure 4, BIST 100 index volatility increases for the first 2 days against a standard deviation shock that occurs in the DAX 30 and CAC 40 index volatilities, and then it decreases rapidly and then drops off in less than 10 days. It appears that the impact on the volatility of the BIST 100 index, which is a standard deviation shock in the S & P 500 index volatility, lasts longer.

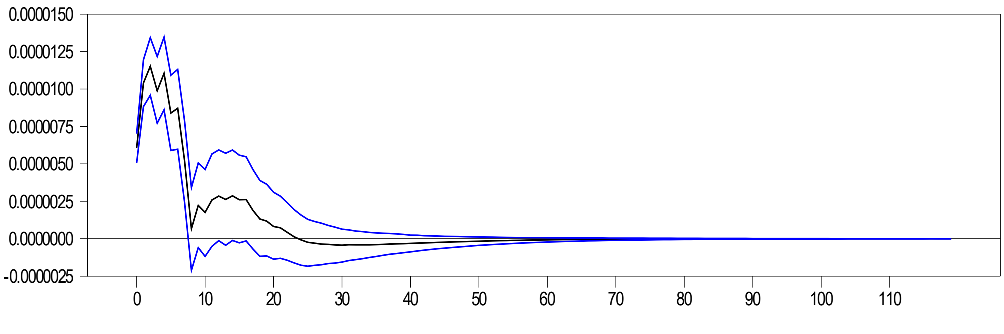
Figure 4: Impulse-Response Functions for the Low Global Risk Period
Panel A: Response of BIST 100 Volatility to DAX 30 Volatility.



Panel B: Response of BIST 100 Volatility to CAC 40 Volatility.



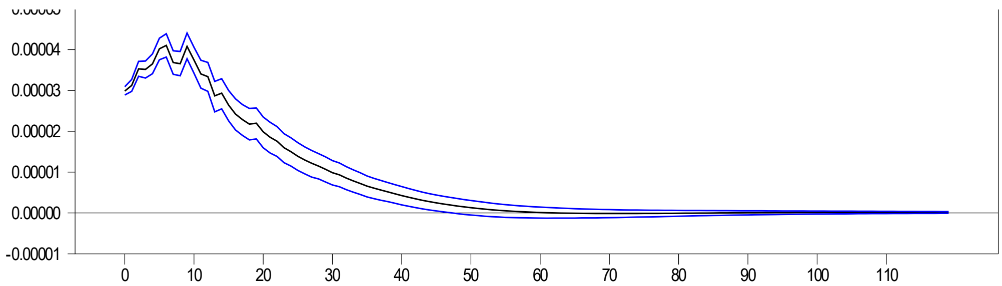
Panel C: Response of BIST 100 Volatility to S&P 500 Volatility



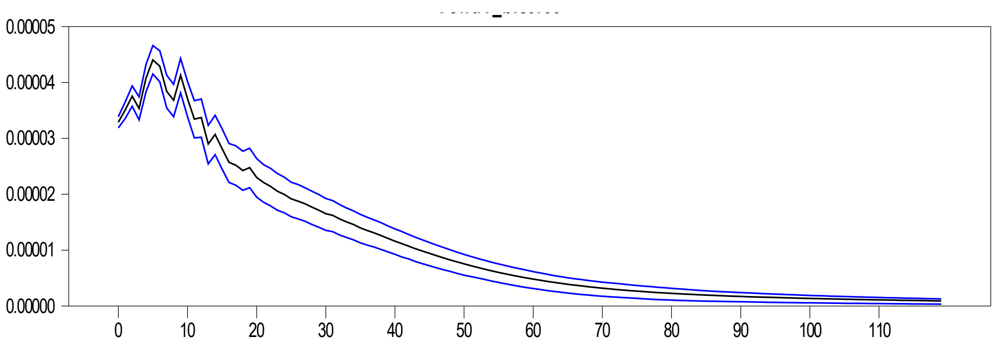
Finally, Figure 5 shows the Impulse - Response functions of the linear VAR model. Looking at Figure 5, it can be seen that BIST 100 index volatility increased during the first 10 days versus a standard deviation shock in the DAX 30, CAC 40 and S & P 500 index volatilities, and then this effect gradually decreased. However, the impact of the S & P 500 index is greater. The effect of the DAX 30 index is about 40 days, the CAC effect is about 80 days, and the S & P 500 index is about 100 days.

Figure 5: Impulse Response Functions for Linear VAR

Panel A: Response of BIST 100 Volatility to DAX 30 Volatility



Panel B: Response of BIST 100 Volatility to CAC 40 Volatility



Panel C: Response of BIST 100 Volatility to S&P 500 Volatility

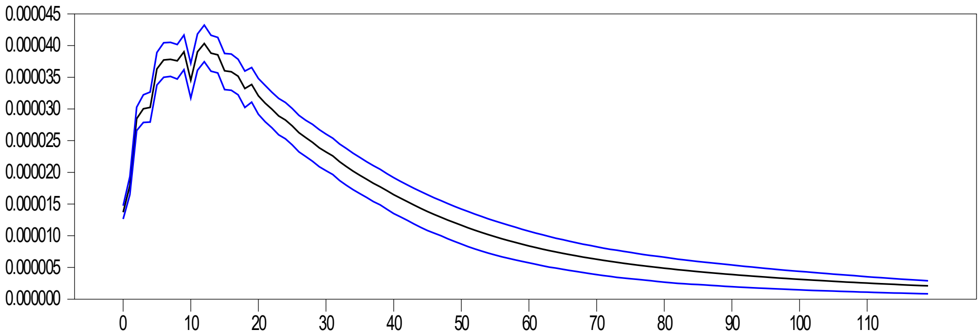


Table 6 shows the variance decomposition results for linear VAR, Regime 1 and Regime 2.

Table 6: Variance Decomposition Results for International Volatility Spillover

BIST100														
	Linear VAR					Regime 1					Regime 2			
	σ_{RBIST1}	σ_{RCAC}	σ_{RDAX}	$\sigma_{RS\&P}$		σ_{RBIST1}	σ_{RCAC}	σ_{RDAX}	$\sigma_{RS\&P}$		σ_{RBIST1}	σ_{RCAC}	σ_{RDAX}	$\sigma_{RS\&P}$
	8.000	.076	.131	.794		9.536	.023	.050	.391		7.154	.086	.426	.335
5	9.687	.241	.537	.535	5	9.386	.143	.145	.327	5	4.062	.067	.953	0.917
0	1.732	.311	.838	4.119	0	9.320	.160	.197	.323	0	8.638	.816	.189	6.356
0	4.719	.708	.928	7.684	0	9.269	.179	.222	.330	0	3.185	.527	.785	8.504
0	3.462	.676	.602	8.260	0	9.267	.179	.223	.330	0	2.306	.867	.541	8.466
20	3.254	.672	.678	8.396	20	9.267	.179	.223	.330	20	2.282	.715	.544	8.458

When Table 6 is examined, it is seen that the BIST 100 index fluctuation is affected by at least the CAC index and the S & P 500 index at the most. In the period when the global risk level is high, BIST 100 stems from 84.062% of the changes in the first 15 days of the index fluctuation, 4.067% from the CAC index, 0.953% from the DAX index and 10.917% from the S & P index. In periods where global risk level is low, BIST 100 stems from 99.386% of the index fluctuations in the first 15 days, 0.143% from the CAC index, 0.145% from the DAX index and 0.327% from the S & P index.

CONCLUSION

As a stock market under an emerging economy, BIST100 is susceptible to volatility shocks from stock markets around the world. Volatility spillover effects portray the transmission mechanism of volatility among stock markets around the world. This mechanism is not always directly related to volatility on a market to market basis. Domestic stock market behavior is a triggering mechanism for several domestic macroeconomic variables and in order to determine which of those variables construct the international transmission mechanisms of volatility spillover, further analysis including multiple macroeconomic variables is required. While all stock markets demonstrate a relationship to some degree, S&P has especially been influential in volatility spillover to Borsa Istanbul. The effects of volatility spillovers become more prominent when investigated in datasets that include global crisis periods. The regime classification period using VIX index yielded rationally expected results, as observed in Figure 2 the high global risk period starts with 2008 and gradually extinguishes until 2012. 2008 is the starting date of one of the biggest financial crises in recent years and this crisis affected stock markets around the world directly.

One of the main reasons why S&P has the highest influence on BIST may be the currency of U.S. Dollar itself. USD is the global reserve currency and interest rates around the world are directly affected by the FED's monetary policy decisions. American stock markets are one of the most influential indicators of economic conjecture in the United States and monetary policy decisions of FED are based upon indicators such as these. Especially during the recovery attempt from 2008 crisis, FED has significantly increased the supply of USD to the whole world as a part of quantitative easing program. Any movement in American Stock markets such as S&P indicates a possible policy change on part of FED, therefore American stock markets have been especially influential during the crisis period. Additionally, results of analysis also indicate that S&P is the most influential index to affect BIST 100 not only during high-risk regimes but also during low-risk regimes. American market keeping its dominance under low-risk regime over BIST may possibly be due to capital inflow expectations and denomination of the majority of the foreign debt in US Dollars.

Results of the study are in line with the efficient market hypothesis as it has been observed that the volatility spillover effect on the BIST 100 index is relatively low in the regimes where the global risk is low whereas the effect is relatively higher in the regime where the global risk is high. This points out a risk to portfolio managers who diversify their portfolios across developed and emerging country stock markets. In an enduring crisis, the negative correlation among invested markets may turn positive due to spillovers, which may decrease the effectiveness of hedge and increase the unsystematic risk in portfolios.

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