The Indonesian Capital Market Review

Volume 4
Number 2 *July*

Article 3

7-30-2012

The Impact of 2008 Global Financial Crisis on the Performance of Selected Indonesian Stocks: A Preliminary Study

Edwin Suparman
Portek International Limited, edwin.suparman@portek.com

Recommended Citation

Suparman, Edwin (2012) "The Impact of 2008 Global Financial Crisis on the Performance of Selected Indonesian Stocks: A Preliminary Study," *The Indonesian Capital Market Review*: Vol. 4 : No. 2 , Article 3.
DOI: 10.21002/icmr.v4i2.3617
Available at: https://scholarhub.ui.ac.id/icmr/vol4/iss2/3

INDONESIAN
CAPITAL MARKET REVIEW

The Impact of 2008 Global Financial Crisis on the Performance of Selected Indonesian Stocks: A Preliminary Study

Edwin Suparman*
Portek International Limited

This research is a preliminary study that analyzes the impact of the US financial markets on Indonesian financial markets during the 2008 global financial crisis. It specifically investigates the occurrence of contagion effect in the Indonesian IHSG index and selected LQ45 stocks with the US S&P500 index by the measurement of correlation using simple correlation, EWMA, OGARCH, and DCC GARCH. It also attempts to discuss on the decoupling of Indonesian market and provide recommendations on dealing with future similar events.

Keywords: *Contagion, correlation analysis, 2008 crisis, decoupling, LQ45 stocks performance, Indonesian stocks*

Introduction

The global financial crisis of 2008 was triggered by the closures and bail-outs of unprecedented number of financial institutions, such as Bear Sterns, Citigroup, Lehman Brothers, US Merrill Lynch, Dexia, Fortis, etc. Brunnermeier (2009) gave complete blow-by-blow chronological events during the period and argued that the current crisis was a "classical banking crisis" which was magnified via several "amplification mechanisms".

What started off in the United States of America triggered a plethora of banks and financial institutions failures across the Europe, and eventually Asia. With the increased inability of customers to fulfill their mortgage obligations, banks suffer liquidity crisis which affects their performance.

In Indonesia, a dip in Jakarta Stock Index during September 2008 until April 2009 is clearly observed. Such contagion effect in stock market had been studied extensively. Untoro and Widodo (2008) stated the same on Indonesian stock market relative to regional stock movements, such as Singapore and Hongkong. More recently, Wuryandani (2011) proved the movement of Jakarta Stock Index is significantly affected by the regional stock movement, despite the different macroeconomic conditions of every country. The significance of these studies is two-folds. *First*, it becomes crucial to react when there is any 'first sign of trouble' even if that comes from outside the country (regional or even international). *Second*, any kind of crisis can be affected by the contagious effect of other stock markets. Hence, the need to consider the external movement trends for any kind of macroeconomic policies.

With the Foreign Direct Investment (FDI) in Indonesia jumped 54% to USD 13.95 billion for the first ten months of 2008, it may not come as a surprise as investors were concerned about the capital outflows from Indonesia during the 2008 crisis. And this is proven true as a clear dip in FDI from the third quarter of 2008

*Jl. Griya Utama, Sunter Agung, Puri Mutiara Blok N117, Jakarta Utara 14350, Indonesia, E-mail: edwin.suparman@portek.com

Table 1. Selected LQ45 2008 and 2010 stocks shareholders composition

No	Company name	Stock code	2008 Shareholders composition		2010 Shareholders composition	
			Indonesian Government	Foreign (at least)	Indonesian Government	Foreign (at least)
1	PT. Bank Mandiri Tbk (MANDIRI)	BMRI	66.97%	21.87%	66.68%	26.68%
2	PT. Bank Negara Indonesia Tbk (BNI)	BBNI	76.36%	14.93%	60.00%	22.99%
3	PT. Bank Rakyat Indonesia Tbk (BRI)	BBRI	56.83%	36.98%	56.75%	36.81%
4	PT. Bank Central Asia Tbk (BCA)	BBCA	-	47.15%	-	47.15%
5	PT. Jasa Marga Tbk (JASAMARGA)	JSMR	70.00%	N/A*	70.00%	N/A*
6	PT. Bakrieland Development Tbk (BAKRIELAND)	ELTY	-	30.77%	-	12.17%
7	PT. Lippo Karawaci Tbk (LIPPO)	LPKR	-	19.66%	-	18.71%
8	PT. Perusahaan Gas Negara Tbk (PGN)	PGAS	54.58%	33.28%	56.97%	36.18%
9	PT. Bumi Resources Tbk (BUMI)	BUMI	-	8.14%	-	20.17%

*Data not available
Source: 2008 and 2010 Company Annual Reports

to the first quarter of 2009 on all economies (advanced, emerging, and low income). Although outflow in low income economies is slower compared to other more advanced economies (http://www.tradingeconomics.com/indonesia/FDI), Indonesia is classified under emerging economies with a clearly impact in FDI as Indonesia's FDI dropped by USD 790 million in 2009 as compared to 2008 (Indexmundi). However, the effect on contagion cannot be concluded from FDI flow alone.

Table 1 shows selected LQ45 stocks along with the shareholders composition of each stock, separated into government and foreign shareholders, in 2008 and 2010. LQ45 is a stock market index for the Indonesia Stock Exchange (IDX). The LQ45 index consists of 45 companies that fulfill certain criteria in terms of high market capitalization and transaction value in the last 12 months, listed company for at least three months in IDX, good financial conditions, prospect of growth, and high transaction value and frequency (as per IDX criteria). The foreign shareholders percentages show that it is the minimum as available in the public information and company's websites. The remaining percentage goes to major shares by domestic institutions and public (each with less than 5% shares). The selected stocks consist of financial institutions, infrastructure, and commodity.

Titiheruw et al. (2009) pointed out that no financial institutions had any direct exposure to the subprime mortgage problem. Indonesian bank's indicator of Capital Asset Ratio (CAR), Return on Assets (ROA), etc. showed resilience in the early stage of the crisis. In macro level, the financial crisis "clouded" the outlook of Indonesian economy. However, stock performance is not solely dependent on a company's performance. Shiller (2000) said that irrational exuberance (as coined by Alan Greenspan) causes stock prices to be overvalued or undervalued most of the time. Shiller describes irrational exuberance as "*a heightened state of speculative fervor*".

Thus, the contagion effect is an interest for policy makers, portfolio managers, economists, and the general community. Any evidence of contagion will serve as a future notice for investors, policy makers, and general community on how to react if there is any global event which potentially affect the economy.

In this literature, the day 15th September 2008 was considered as the defining date in which Lehman Brothers filed for bankruptcy and the US government decided not to support Lehman Brothers. Of course, arguably, the crisis could be defined starting March 2008 when Bear Sterns was sold to JPMorgan Chase with the help of Federal Reserve, or even as early as spring 2007 in which the credit rating of Private Mortgage Backed Securities was downgraded. However, 15th September 2008 date is chosen as the start of the crisis in this paper is the clarity of the event i.e. the announcement of the first major failure (bankruptcy) during the crisis period. This date is supported as the end of the subprime phase and the start of the global crisis

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

as well by Sahalia et al. (2010) when examining the macroeconomic policy changes during the crisis.

This paper shall attempt to analyze whether there was any observable impact on the very initial stage of, arguably, the start of 2008 financial crisis on the stock performance of selected Indonesian LQ45 stocks as a preliminary study. This will be done by comparing the stock's correlation with S&P index before, the first 60 days, and after the 60 days. The 60 days period is arbitrarily chosen as the market response period to the announcement.

Using the evidence of the average correlation between those three periods, it shall be analyzed for any evidence of contagion. The contagion shall be observable via the increase of correlations before, directly after, and after the crisis period. The observed contagion will show how interconnected the Indonesian market with the US market. Thus, this will spark the decoupling debate on whether Indonesian market is relatively unaffected by the US market.

The underlying question which is explored in this paper is how the Indonesian investors react with the knowledge of the 2008 global financial crisis. Hence, the following questions are the focus on this paper: 1) How correlated are the performance of selected Indonesian stocks before, directly after, and after the crisis?; 2) Was there any contagion effect in the selected Indonesian stocks?; 3) What was the impact in the different industry and the different shareholders' composition from the selected stocks?; and 4) Is there any evidence of decoupling in the Indonesian economy?

The paper will analyze the trend of selected LQ45 stock performance during the initial timeline of what, arguably, is the start of 2008 financial panic in the United States. The choice of the LQ45 stocks considers the nature of the 2008 financial crisis. This includes the financial industry (noting that the crisis is triggered by the collapse of the US financial industry), infrastructure/real estate (as the crisis arguably started by the prime mortgage failures i.e. the real estate industry), and commodity (naturally the crisis will follow the drop of the demand for commodities). In this paper, the selected stocks for each of the described industry consist of the government related stocks and the private stocks for comparison.

Although the analysis of such stocks will give the proposal of the impact of the selected industries due to the crisis, further study will be needed to explore all the related stocks to understand the general trend in a more expansive manner.

Also, noting that even though the 2008 global financial crisis may trigger the movement of stocks, other factors may not be accounted in explaining the phenomenon. However, given the magnitude of the event, the study gives some views of the market movement by comparison of the three time periods.

Literature Review

Thailand currency crisis in 1997 has sparked not only the shock in the financial market; it also gave the new meaning of the term contagion. Claessens and Forbes (2001) found that the term contagion is only referred as a medical term prior to 1997. A Lexis-Nexis search in July 1997 onwards, shows the widespread use of the word 'contagion' in referring to spreading of financial turmoil cross countries i.e. contagion of 'contagion'.

Definition of contagion

Defining the term contagion is not an easy task. Controversial at best, defining contagion is actually an interest for policy makers, portfolio managers, economists, and the general community. If really contagion does occur, it will devalue the concept of diversification. Thus, defining contagion should refer also the cause and reason of its occurrence.

The World Bank gives its version of definition not only one, but three types of definition (broad, restrictive, and very restrictive). In summary, World Bank defined contagion broadly by cross-country transmission of shocks or spillover events. This is similar to the definition as suggested by Pritsker (2000) that contagion happens "*when a shock to one or a group of*

markets, countries, or institutions, spread to other markets, or countries, or institutions". The restrictive definition tags along that those linkages are "beyond fundamentals". The term fundamentals here is referring to normal and expected interdependencies amongst countries such as in politics, trade, investment, and finances. Such excess co-movements in the definition is supported by Baig and Goldfjan (2000) in identifying the contagion effect in Brazil due to Russian default. The cause of these excess co-movements can be explained by the herding behavior due to information asymmetry. Being rational, public follows others in packs in the absence of complete information i.e. public exuberance. Arguably, Alan Greenspan, Chairman of US Federal Reserve (1987–2006) coined this reaction as an "irrational exuberance". The third very-restrictive definition referred to the increase in cross-country correlations during "crisis times" as compared to "tranquil times".

Kaminsky et al. (2003) proposed that the reaction of contagion should be considered, that is if the effect is immediate or "fast and furious effect", evolving in matter of days or hours. This would mean that the effect of contagion differs with the effect of common news which has gradual and relatively slower spillovers. This definition of "excess co-movement" is consistent with the restrictive view from the World Bank.

This paper will concentrate on the World Bank's restrictive view of defining contagion in terms of correlation of between periods and Kaminsky et al. (2003) view on the immediate effect of contagion. Forbes and Rigobon (2000) propose the term "shift-contagion". This is to explain that contagion is a shift in cross-country linkages (in terms of correlation) without the need to explain the cause and methods of contagion. Claessens et al. (2001) similarly define this by the cross-market linkages through various causes and categories. In this definition, contagion is basically a measure of (stock) prices in the propagation of shocks. Some may argue that prices may not show any before and after distinction during crisis, as other variables such as quantity will (Royen, 2002). This paper, however, is in the view that price and quantity correlate as well. Any changes in stocks quantity in the market will be efficiently reflected in terms of prices. Thus, the study of prices should capture any movements in traded quantity in the market.

Contagion channels

The contagion mechanism can occur via several channels. This paper would like to follow the categorization as suggested by Pritsker (2000). The two broad categorizations mainly touch on the fact that there is a fundamental cause and the non-fundamental cause. "Fundamentals-based contagion" is suggested by Calvo and Reinhart (1996) and refers to the normal propagation methods via real and financial linkages. This interdependence occurs not only during the crisis. Hence, the term normal interdependence as suggested by some economists. In this paper, we consider the excess of such co-movements as contagion as per the definition of contagion used in this paper.

It is important to explain these fundamentals, however, for the purpose of identifying the normal. *First*, Claessens et al. (2001) listed common shocks. This refers to the common global shocks which potentially generate any form of market correction internationally. Such correction can be in the form of capital outflows generated by, for example, change in interest rates and/or commodity prices. *Second*, trade links which refers to the connectivity between trading partners. The real linkage here is basically stems from the open economy model of the world macroeconomy. A slump of economy of a trading partner will understandably reduce the demand of goods from another country. *Third* is the financial linkage. As the world becomes highly integrated, a crisis in the country can affect others in terms of reduction of foreign direct investment, reduction of trade credits, and other capital flows. The last two (trade and financial linkages) is widely documented. Blanchart et al. (2010) conducted a study of the impact to the 2008 crisis in emerging countries and conclude that the shocks include the sharp decrease in exports, especially for commodity producers, and a sharp increase in capital

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

outflows. Naude (2009), similarly, found that the crisis effect in developing countries are reduction in export earnings, reduction of capital flows to the developing countries, and bank failures and reduction of domestic lending.

The non-fundamentals channels include herding behavior, financial panic, irrational exuberance, and so on. The main idea here is informational asymmetry. Countries with high levels of asymmetric information experience great fluctuations in asset prices, whereas countries with low levels of asymmetric information do not. When high levels of asymmetric information are present, uninformed investors perceive changes in asset prices in other countries as possibly reelecting information held by informed investors, thus inducing them to alter their expectations about the fundamental value of assets, causing asset prices to change (Kodres and Pritsker, 2001). The categorization of non-fundamentals is suggested by others by the name of investor behavior (Claessens et al., 2001), market imperfections (Willett et al., 2011), and shifts in markets sentiment unexplained by macroeconomic fundamentals which were considered as "pure contagion" (Bazedresch and Werner, 2000). However, the idea is basically similar, all the channels beyond the normal interdependence which includes psychological and crowd-pressure to act in a similar fashion rationally or irrationally.

Addressing the differences between crisis and non-crisis factors, Forbes and Rigobon (2000) divided the channels into crisis channels and non-crisis channels, where the crisis channels included multiple equilibria, endogeneous liquidity, and political economy considerations and the non-crisis channels included trade, policy coordination, country reevaluation and learning, and common shocks.

Measurement of contagion

Various literatures have proposed methodologies of testing contagion. The common methods include analyses of correlations, volatility spillovers GARCH models, VAR models, probability models, and others. As per our definition, this paper would concentrate on using the analysis of correlations of cross-market linkages, which basically a measure of interdependencies between two variables (Kaminsky et al., 2003).

Simple correlation

The use of correlations of asset returns has been used extensively in analyzing the presence of contagion in financial asset returns (King and Wadhani, 1990; Baig and Goldfjan, 2000; and references cited in Forbes and Rigobon, 1999). Angkinand et al. (2010) investigated co-movements of national stock markets using ordinary least squares (OLS) and Generalized Method of Moments (GMM) in the US and some advanced economies from 1973 to 2009. They found an increase in interdependence between national stock market returns over time and the spillover effects from the United States to other industrial countries were greatest after the emergence of the subprime meltdown in summer 2007, and especially after the collapse of Lehman Brothers in 2008. In the case of Indonesia, Sufian and Habibullah (2010) used a similar correlation analysis using OLS method to measure the impact of the 2008 financial crisis in Indonesian banking sector with multivariate variables. The advantage of the simple linear model is the speed of calculation. The measurement of relationship between two variables (returns of market, for example) will churn out a single number which shows how one variable moves in relative to the other. The higher the number, the more correlated they are.

Forbes and Rigobon (2001; 2002) warned against the bias in correlation coefficient using the simple regression method. They claimed that using such method is "biased and inaccurate" due to the potential presence of heteroscedasticity in market returns. When stock market volatility increases, unadjusted estimates of cross market correlations will be an overestimate, thus potentially leading to false conclusions about the existence of contagion. The proposed using the adjustments to the volatility during the crisis period extending the proof from Ronn (1998) for the case of general distribution function for error terms. However, they

also warned that the adjustments can be less accurate in certain circumstances and "*should be used cautiously*". Such adjustments for variance, for the purpose of this paper, are not exercised in our calculation of correlation using the simple correlation method. The reasons for the non-adjustments are the following. *First*, the result for the simple correlation serves as a control in this paper, that is as a comparison between the other methods applied. *Second*, Baig and Goldfein (2001) argued that volatility is an integral part of the crisis. Hence, increased variances might form the contagion and adjustments will underestimate the test. This paper is of this view.

Exponentially weighted moving averages (EWMA)

Equal weighting of historical data was the first widely accepted statistical method for forecasting volatility and correlation of financial asset returns. For many years, it was the market standard to forecast average volatility over the next *h* days by taking an equally weighted average of squared returns over the previous *h* days. This method was called the historical volatility forecast. However the disadvantage of the equal weights is when there is a case of extreme market condition. It is suitable for a calculation over a long period of time. For a short period of time, however, it is unable to account for the sudden large rare jumps. The weakness of it is clear the attempt to estimate of a constant volatility into a forecast of a time-varying volatility.

Thus, the exponentially weighted moving average (EWMA) was introduced to address the pitfalls. The concept of EWMA is basically putting higher weights in the more recent observations. Thus, any large extreme jumps will be of less importance as it moves to the past observations. A EWMA volatility estimate will react immediately following an unusually large return then the effect of this return on the EWMA volatility estimate gradually diminishes over time. This is achieved by defining a smoothing constant λ. The larger the value of λ, the more weight is placed on observations in the past and so the smoother the series becomes. Obviously, there lies the disadvantage as well. *First*, the critical decision which has to be made of the value of λ. *Second*, the forecast of volatility/correlation over all future horizons is simply taken to be the current estimate of volatility, because the underlying assumption in the model is that returns are independent and identically distributed.

Aguirre (2011) did a study in the use of EWMA as a currency trading strategy and found that a backward looking estimate of volatility measure, such as EWMA, is inferior as compared to other trading tactics using forward looking measure of volatility. Nevertheless, EWMA correlation is presented here as a comparison between methods and to give a view whether such methodology applies to the Indonesian market.

Orthogonal GARCH

The univariate generalized autoregressive conditional heteroscedasticity (GARCH) which was introduced by Engle (1982) and Bollerslev (1986) has been widely used due to its usage of heteroscedasticity as a variance to be modeled. GARCH is considered to be more preferable as compared to EWMA, due to the convergence of GARCH volatility and correlation forecast to their long term average levels. EWMA, on the other hand, has constant term structure of forecasts (Alexander, 2000).

However, multivariate GARCH has always been computationally challenging especially as the dimension increases. The orthogonal generalized autoregressive conditional heteroscedasticity (OGARCH) is a generalization of a factor in GARCH model introduced by Engle et al. (1990) to a multi-factor model with orthogonal factors. OGARCH was introduced by Alexander and Chibumba (1996) and Alexander (2000) and later extended by Van der Weide (2002) in the form of generalized orthogonal GARCH (GO-GARCH).

The motive behind OGARCH is to simplify the process of producing large covariance matrices in a regular basis. Alexander and Chibumba (1995) propose the Orthogonal GARCH model, based on a principal component GARCH meth-

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

odology. The idea of OGARCH is simple; capturing the variability of the market due to some defined variable and treat the rest as "noise". The use of orthogonal factors allows OGARCH to run on univariate time series which reduces computational complexity.

However, OGARCH does have its limitations. Yhap (2003) conducted an extensive Monte Carlo study of the properties of the orthogonal GARCH model and one of his findings is that the model performs well for samples of less than 500 observations but that its ability to accurately track conditional covariance deteriorates substantially as the sample increases beyond this number of observation.

DCC GARCH

To counter the problem of heteroscedasticity, Engle (2002) proposed the method of dynamic conditional correlation (DCC) which is using a multistep of univariate GARCH, thus "*have the flexibility of univariate GARCH but not the complexity of conventional multivariate GARCH*". The idea is similar to OGARCH that is simplifying the computation by fitting univariate GARCH time series.

The usage of DCC GARCH in analysis has becoming accepted recently (Wang and Thi, 2006; Hesse et al., 2008; and Burdekin and Siklos, 2010). Even the 2008 Global Financial Stability IMF Reports (IMF, 2008) used DCC-GARCH in analyzing the correlations of US stock markets and some global emerging market regions.

The robustness of DCC GARCH makes it advantageous as it takes care of the changing volatilities and the relatively easy calculation as compared to the conventional multivariate GARCH which difficult to optimize due to the large number of parameters. Thus, DCC GARCH is one of the methods which is adopted in this literature.

The decoupling debate

Following Zhang (2011), the writer would like to also mention very briefly on the decoupling debate which might be applicable to the result of the paper in chapter 4. It seems to be oxymoronic to speak about decoupling when we strongly believe on the spread of globalization. However, Cigdem and Ayhan (2007) found that it is possible to have both decoupling and globalization at the same time. A study of 106 countries from 1960 – 2005 are divided into three groups: developed, emerging, and low-income developing countries. This is then measured in terms of the correlation between economies has changed over time as cross-border flows have expanded. They find that growth has indeed become more synchronized among developed economies and also among emerging economies. But, surprisingly, economic activity in emerging economies has decoupled from that of developed economies over the past two decades. The impact of rich economies on emerging economies' growth has fallen sharply.

Rossi (2008) suggested that decoupling is growth in one area becoming less dependent on growth in another area. As decoupling implies a break in a relationship that was previously closely linked, this definition lends itself naturally to discussions of changes in patterns of correlations or influences, especially in discussions of equity markets.

It is not difficult to find the examples of this. During the unfortunate 11th September 2001 terrorist attack on US, India and China continued to grow. Even during the 2008 subprime mortgage crisis, Indonesia continued registering single digit growth. Although the fact that by mid-October 2008, BRIC (Brazil, Russia, India, and China) Index was down by 57%, sparked a further debate of the emergence of recoupling after decoupling.

Titiheruw et al. (2009) noted that Indonesia was in good position even until September 2008, with growth rate of 6.1% (year-on-year). Thus, does this mean that Indonesia has decoupled?

Research Method

This chapter will explain the calculations of the correlations between Standard & Poor 500 (S&P500) Index, Jakarta Stock Index (IHSG), and selected Indonesian LQ45 stocks. There are

four methods applied in obtaining the correlations: simple correlation method, EWMA, OGARCH, and DCC GARCH. As per the World Bank definition, the correlation is calculated during "crisis period" and "tranquil period". The crisis period here is defined as the initial 60 days after the announcement of the collapse of Lehman Brothers (day X). The writer would like to propose one step further by defining a post crisis period which is the period 60 days after day X.

Data

Nine random stocks are chosen out of the LQ45 list (February 2012–July 2012) to be considered in this paper, namely: PT Bank Mandiri Tbk. (BMRI), PT Bank Central Asia Tbk. (BBCA), PT Bank Negara Indonesia Tbk. (BBNI), PT Bank Rakyat Indonesia Tbk. (BBRI), PT Lippo Karawaci Tbk. (LPKR), PT Bakrieland Development Tbk. (ELTY), PT Jasa Marga Tbk. (JSMR), PT Perusahaan Gas Negara Tbk. (PGAS), and PT Bumi Resources Tbk. (BUMI). The reason for the choice is to observe the co-movements of three categories: financial institutions (BMRI, BBCA, BBNI, BBRI), infrastructure/real estate (LPKR, ELTY, JSMR), and energy/commodity (PGAS, BUMI). Also, for each of the categories, it is purposeful as well to select fully private and government-linked institutions for comparison purposes. As a point of reference of how the Indonesian market moves against the US market index, this paper shall be comparing IHSG index and S&P500 index (which is a free float capitalization-weighted index of 500 large-cap actively traded stocks).

Method

To detect any contagion in selected Indonesia equity market, the calculations of correlation between S&P500 and IHSG and the selected Indonesian LQ45 stocks are conducted for three periods i.e. pre-crisis period (1st January 2005–12th September 2008), crisis period (15th September 2008–14th November 2008 or 60 days after day X), and post-crisis period (15th November 2008–9th April 2012) using simple correlation, EWMA, OGARCH and DCC GARCH.

Simple correlation

The simple correlation or Pearson's correlation measures the dependence between two variables and it is a measure of strength of dependency of the two variables. This is calculated by dividing the covariance of the two variables by the product of their standard deviations. Though the simple correlation might produce a biased result in the analysis of contagion as it tends to rise when the volatility is high as suggested by Forbes and Rigobon (2002) and hence lack of robustness as compared to other methods. However, it provides a simple intuitive overview on how the series move together and it will act as a control to compare with a more complicated methods.

EWMA

A weighted average concept arises by giving weightage in form of factor multiplication dependent on the data position in the sample. An exponentially weighted moving average (EWMA) applies weighting factors which decrease exponentially i.e. the weightage decreases exponentially as the data is older but it will never reach zero.

$$EWMA(x_{t-1},....,x_1) = (1-\lambda)\sum_{i=1}^{\infty}\lambda^{i-1}x_{t-1}$$

$$\sigma_{x,t}^2 = (1-\lambda)\sum_{i=1}^{\infty}\lambda^{i-1}x_{t-1}^2 = (1-\lambda)x_{t-1}^2 + \lambda\sigma_{x,t-1}^2 \quad (1)$$

The value of λ for EWMA is important to be determined. A high λ gives little reaction to actual market events but great persistence in volatility and a low λ gives highly reactive volatilities that quickly die away. An unfortunate restriction of EWMA models is that the reaction and persistence parameters are not independent: the strength of reaction to market events is determined by $1 - \lambda$, whilst the persistence of shocks is determined by λ.

The calculation of EWMA in this paper will follow the recommendation of RiskMetrics™

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

(developed by JP Morgan Chase and Co.) of using $\lambda = 0.94$ for calculation of daily returns. It is not dissimilar to an equally weighted average with $n = 25$, except that it does not suffer from the ghost features caused by very extreme market events. The volatilities and correlations constructed from this matrix represent forecasts of average volatility (or correlation) over the next day (RiskMetrics™ technical document, 1996)

OGARCH

Orthogonal GARCH model is developed using the basic factor model of GARCH. The OGARCH model allows the *k* x *k* GARCH covariance matrices to be generated only from *m* univariate GARCH models, where it is possible where *m* (number of principal components) is less than *k* (the number of variables) (Alexander, 2002). The idea is to fit a univariate GARCH model to each of the principal components of the covariance matrix, forecast those, and then reassemble the forecasted covariance matrix from the eigenvector / eigenvalue decomposition. Thus, it would not require a bivariate GARCH processes.

In this literature, it will adopt Bollerslev's (1986) GARCH (1,1) which defines the conditional variance to be as follows:

$$\sigma^2_{x,t} = \omega + \alpha x^2_{t-1} + \beta \sigma^2_{x,t-1}$$
$$\text{where } \omega > 0, \alpha, \beta \geq 0, \alpha + \beta < 1 \qquad (2)$$

This is done for each principle component X and Y (methods to get principle components can be referred to Alexander, 2002), giving a time varying diagonal matrix of $\boldsymbol{D}_t$:

$$D = diag(\sigma^2(P_x), \sigma^2(P_y)) \qquad (3)$$

Thus, the time varying matrix $\boldsymbol{V}_t$ is approximated by:

$$\boldsymbol{V_t = AD_tA'} \qquad (4)$$

where $\boldsymbol{A}$ is the matrix of rescaled factor weights. Alexander (2000b) noted that the accuracy of this is dependent on the number of principle components are sufficiently enough in representing the market variation.

DCC GARCH

The idea of the models in this class is that the covariance matrix can be decomposed into conditional standard deviations, and a correlation matrix where both conditional standard deviations and correlation matrix are time-varying. Thus, DCC GARCH superiority lies on the fact that it takes care of heteroscedasticity, volatility, and time-varying correlation.

Similar to OGARCH, DCC GARCH – developed by Engel and Sheppard (2001) – is estimated using univariate GARCH. Again as with OGARCH, GARCH (1,1) in this literature for the first step of the process is fitted for each variable. The second step involves using transformed residuals results from the univariate GARCH model; the dynamic conditional correlation estimators are estimated (Engel, 2002).

Using the summary of Orskaug (2009) and Zhang (2011), the DCC GARCH is also defined as follows:

$$r_t = \mu_t + a_t$$
$$a_t = \sqrt{H_t} z_t \qquad (5)$$

where r_t is the *n* x *1* matrix of log returns of *n* assets, a_t is the mean-corrected returns of the assets, μ_t is the expected value of r_t, H_t is the matrix of conditional variances of a_t, D_t is the diagonal matrix of conditional standard deviations of a_t, R_t is the conditional correlation matrix, and z_t is the errors where $E[z_t]=0$.

Furthermore,

$$r_t \, \varsigma_{t-1} \sim N(0, D_t R_t D_t)$$
$$D_t^2 = diag\{\omega_i\} + diag\{\kappa_i\} \circ a_{t-1} a_{t-1}^{'} + diag\{\lambda_i\} \circ D_{t-1}^2$$
$$\varepsilon_t = D_t^{-1} a_t$$
$$Q_t = S \circ (\mu^{'} - A - B) + A \circ \varepsilon_{t-1} \varepsilon_{t-1}^{'} + B \circ Q_{t-1}$$
$$R_t = diag\{Q_t\}^{-1} Q_t diag\{Q_t\}^{-1}$$
$$Q = E\left[\varepsilon_t \varepsilon_t^{'}\right] \approx \frac{1}{T} \sum_{t=1}^{T} \varepsilon_t \varepsilon_t^{T} \qquad (6)$$

Table 2. Comparison of daily returns performance for S&P 500, IHSG, and selected LQ45 stocks for the three different periods

	1 Jan 2005 - 14 Sep 2008				15 Sep 2008 - 14 Nov 2008				15 Nov 2008 - 9 Apr 2012			
	Mean	Std dev	Max	Min	Mean	Std dev	Max	Min	Mean	Std dev	Max	Min
S&P 500	0.009%	0.009	4.241%	-3.473%	-0.692%	0.046	11.580%	-9.035%*	0.066%	0.015	7.076%	-8.930%
IHSG	0.075%	0.014	7.921%	-7.698%	-0.801%	0.041	7.641%	-10.375%*	0.154%	0.015	7.626%	-8.880%
BMRI	0.081%	0.027	13.333%	-12.941%	-0.622%	0.074	20.000%	-9.756%	0.211%	0.028	18.356%	-14.516%*
BBCA	0.116%	0.023	12.500%	-10.077%*	0.317%	0.056	12.500%	-9.836%	0.154%	0.023	13.513%	-8.387%
BBNI	0.011%	0.026	16.201%	-11.764%	-1.938%	0.076	19.608%	-23.711%*	0.297%	0.029	20.000%	-14.839%
BBRI	0.127%	0.025	13.084%	-8.824%	0.127%	0.025	13.084%	-8.824%	0.216%	0.028	16.326%	-13.115%*
LPKR	0.149%	0.014	5.941%	-6.544%	-0.483%	0.022	7.017%	-6.557%	0.067%	0.025	18.920%	-17.647%*
ELTY	0.067%	0.041	33.331%	-20.456%	-2.554%	0.107	19.472%	-36.170%*	0.134%	0.044	31.132%	-18.873%
JSMR	-0.317%	0.023	7.143%	-11.189%	-0.419%	0.068	19.737%	-14.608%*	0.248%	0.020	11.570%	-9.494%
PGAS	0.265%	0.032	21.078%	-23.317%*	-0.012%	0.081	20.126%	-19.494%	0.122%	0.025	16.250%	-12.871%
BUMI	0.212%	0.030	15.842%	-13.855%	-5.299%	0.098	22.481%	-32.031%*	0.180%	0.044	24.369%	-16.235%

Source: Calculated from Yahoo! Finance (finance.yahoo.com)

R_t is the time dependent correlation matrix and is a function of Q_t, which is the covariance matrix, κ_i is the parameter associated with the squared lagged asset returns and λ_i is a weight parameter with the contributions of D^2_{t-1} declining over time. S is the unconditional correlation matrix of the residuals ε_t of the asset returns a_t. In the matrix Q_t denotes a vector of ones, A and B are square, symmetric and ○ is the product (Orskaug, 2009).

Result and Discussion

The results of the calculations as described in the previous chapter are presented here for the purpose of the analysis.

Daily returns of indices

Stock volatility during the crisis is one of the most visible impacts of the crisis. Schwert (2011) observed that the spike in stock volatility occurred in many countries during the 2008 crisis. Furthermore, it was observed that volatility was highest among stocks in the financial sector, but it was also high market-wide. Table 2 on the daily stock return performance is presented. The first thing noticeable about the two indices is that the average daily return is remarkably higher in Indonesia as compared to the US during the pre-crisis and post-crisis period respectively but not during the crisis period. During the pre-crisis period, Indonesian stock market was visibly more volatile although the volatility comes with a prize (and price), the maximum daily return is higher and the minimum is lower than US. Although the reaction was more muted in the post-crisis period, the pattern was almost similar. During the crisis period, unsurprisingly, US stock market took a less of a hit. One can guess that this might be due to all the money that was frantically flowing out of Indonesia and back to US.

For the banks, BRI as the best performer in the pre-crisis period performed fairly well during the crisis period and decently in the post-crisis period. One thing to note is how well BCA performs during the crisis period in terms of volatility; the banks were expectedly more volatile during the crisis period and return to the pre-crisis period after that.

Out of the three infrastructure/real estate stocks, one thing which can be pointed out is how Jasamarga performed before 15th November 2008. During the comparatively short pre-crisis period (Jasamarga initial public offering is on 1 November 2007), it performs badly before it regained in the post-crisis period with a 0.248% mean daily return. Bakrieland (ELTY) appeared to be the most volatile with 0.107 standard deviation and the biggest loss of -36.2% during the crisis period.

The commodity industry proved to be the most volatile during the crisis period with standard deviation of 0.081 and 0.098 for PGN and Bumi Resources respectively. Out of the two selected commodity stocks, the bigger loser was Bumi Resources with a mean daily return of -5.3% during the crisis. However, this is reversed in the post-crisis period where the mean daily return of Bumi Resources is higher at 0.180% as compared to PGN (0.122%).

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

Table 3. Mean value of DCC GARCH correlation results between IHSG and selected stocks returns compared to S&P 500

		Pre-crisis 1 January 2005 - 12 September 2008	*Crisis* 15 September 2008 - 14 November 2008	*Post-crisis* 15 November 2008 - 9 April 2012
IHSG	Simple	0.0891	0.1757	0.2032
	EWMA	0.0541	0.2013	0.2037
	DCC	0.0715	0.1764	0.2196
	OGARCH	0.0931	0.2345	0.3057
MANDIRI	Simple	0.0717	0.1207	0.1524
	EWMA	0.0535	0.1216	0.1476
	DCC	0.0712	0.1296	0.1647
	OGARCH	0.0814	0.6024	0.1741
BNI	Simple	0.1298	0.1481	0.1589
	EWMA	0.1328	0.1683	0.1657
	DCC	0.1370	0.1495	0.1751
	OGARCH	0.1448	0.6642	0.1739
BRI	Simple	0.0162	0.0284	0.1482
	EWMA	0.0220	0.0634	0.1356
	DCC	0.0253	0.0443	0.1341
	OGARCH	0.0266	0.2324	0.1329
BCA	Simple	0.0471	0.0812	0.1041
	EWMA	0.0037	0.1319	0.1081
	DCC	0.0290	0.1044	0.1094
	OGARCH	0.0512	0.2705	0.1408
JASAMARGA#	Simple	-0.0378	0.3292	0.1261
	EWMA	-0.0377	0.3430	0.1203
	DCC	-0.0155	0.3461	0.1361
	OGARCH	-0.0203	0.3392	0.1218
BAKRIELAND	Simple	0.0754	0.2188	0.1280
	EWMA	0.0595	0.2395	0.1178
	DCC	0.0671	0.2195	0.1567
	OGARCH	0.0704	0.2176	0.1344
LIPPO@	Simple	-0.0113	-0.0311	0.1057
	EWMA	-0.0250	0.0367	0.1014
	DCC	-0.0364	-0.0224	0.1016
	OGARCH	-0.0123	-0.0338	0.1411
PGN	Simple	-0.0226	0.1839	0.1200
	EWMA	-0.0008	0.2081	0.1267
	DCC	-0.0086	0.1884	0.1395
	OGARCH	-0.0285	0.5637	0.1233
BUMI	Simple	0.0603	0.2500	0.1490
	EWMA	-0.0034	0.2853	0.1806
	DCC	0.0126	0.2560	0.1955
	OGARCH	0.0611	0.2438	0.1425

Note: # for JASAMARGA pre-crisis period starts from November 2007 where it started the listing, @ for LIPPO pre-crisis period starts from July 2006.

A few observations can be made in this stage about the daily returns of the indices and selected stocks. *First*, as discussed above, the increased volatility of the indices during the crisis period is observed as well for all the selected stocks. Financial sector, real estate, and commodity stocks are generally more volatile during crisis period. The standard deviations dropped to almost pre-crisis level after which. *Second*, the biggest loss for most stocks occurred during the crisis period (biggest losses are shaded in the table). Similarly, this is true for S&P 500 as well. An evidence of fast and furious contagion effect? The correlation result will further reinforce these findings and will be presented in the next section of this literature. And *third*, the relative volatility of financial sector as compared to the others in the selected LQ45 stocks is inconclusive. The increased standard deviations during the second period relative to the first period are observed without discrimination for all sectors. One exception is for BBRI, in

which the volatility remains somewhat consistent for all periods. As a preliminary discussion, it should be noted that Bank Rakyat Indonesia (BRI) is very much focused on microfinancing, which is proven to be resilient during the crisis (Seibel and Rachmadi, 2011).

Results comparison

A general observation from the Table 3 and Figure 1 is that for all the selected stocks and the IHSG index, the correlation level seems to rise during the initial period of the crisis as compared to before the crisis. This result is consistent for all methods. Looking specifically for each industry selected, the following are observed. The financial industry correlations increase quite significantly when comparing the post crisis and pre crisis period. Again this should not be surprising, noting the nature of the crisis which stems from the collapse of financial institutions. However, more interestingly, if we look at non-financial stocks, the correlations drop after crisis period. Of course, arguably, it can be said that the data for each of the three periods are not consistent in terms of the quantity. Nevertheless, the following is observed, the increased in the correlation during the crisis period for the non-financial stock is relatively more rapid as well, with the exception of LIPPO. Does this mean that the investors for non-financial stock displayed more exuberance? Hypothetically this might be true.

A consistent conclusion for all methods for the IHSG – S&P 500 index correlations is that the increased correlations from pre-crisis to post-crisis periods i.e. an evidence of contagion. This evidence of correlation is presented as well by Zhang (2011) on Indonesian case. He showed that the correlation of Indonesia to US equity market (similarly using IHSG and S&P index) increases during the after the 1997 Asian crisis and the 2008 sub prime crisis. The correlation is even higher for period September 2008 to August 2010 according to Zhang.

Although the correlation which value presented in this paper is lower as compared to Zhang's calculation (0.4708), the reason might lie on the fact that the periods chosen are different. The calculation of our pre-crisis period is consistent with Zhang's calculation (less than 1% difference). Thus, it can be hypothesized that the correlation after 2010 dropped which resulted in the low mean correlation. Again, this supported the theory that correlation tends to increase during the crisis period (hence, economically contagious) and drops afterwards, in the non-crisis period.

Generally, it is observed that EWMA gives a lower correlation as compared to the simple correlation in the pre-crisis period and higher correlation in crisis and the post-crisis period. The correlations for EWMA also seem to be the most volatile. This is not surprising as EWMA model captures the past data overreaction. The way covariance is calculated, by way of products of daily returns can drive the correlation down drastically if they are moving in different directions.

OGARCH does not seem to fare as well during crisis period as compared to the other methods i.e. over the top estimation as compared to the other methods' results, despite that the number of data used is over 30 following the central limit theorem. For data of at least 190, OGARCH result is somewhat consistent as compared to the rest. However, OGARCH seems to be less volatile as compared to EWMA. The correlation of OGARCH and DCC GARCH are relatively more stable, in comparison, with OGARCH value having the higher mean correlation.

The stocks of financial institutions in this paper can be categorized into the state banks stocks (Mandiri, BNI, and BRI) and the private bank stocks (BCA). The post-crisis average correlations of state banks are higher as compared to the private one. This should not be surprising considering the foreign ownership of the three selected stocks in 2008. The effect on these three banks was so high, so much so that they requested from the government for an injection of IDR 5 trillion each in October 2008 (Bank Indonesia, 2008). BCA, on the other hand, although it is slightly more than 50% foreign owned, showed a higher correlation in the pre-crisis period and increased only slightly in the post-crisis period.

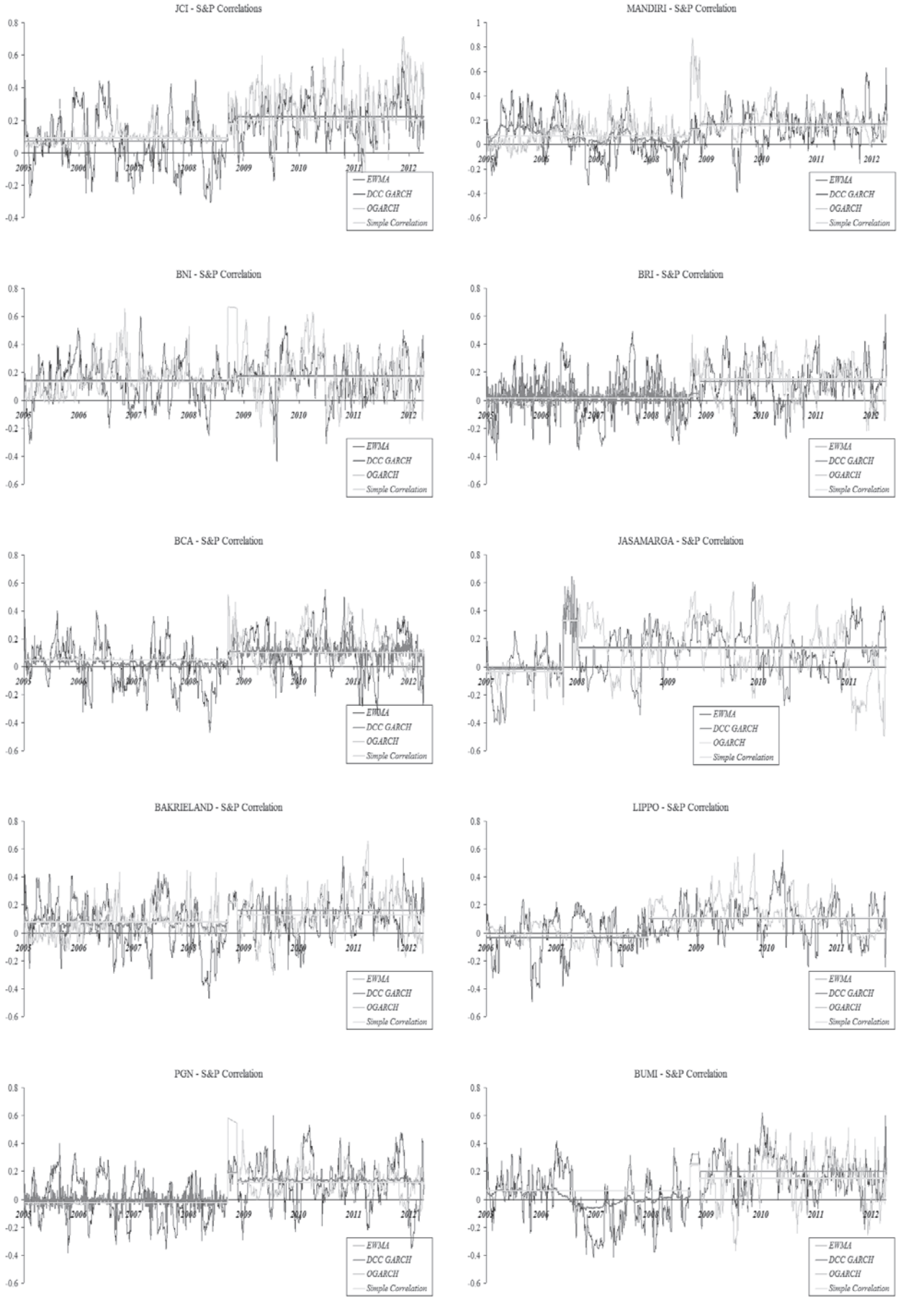

Figure 1. Correlation results between IHSG, selected LQ45 stocks and S&P 500

Ignoring some discrepancies of OGARCH correlations during the crisis period, the volatility of the correlation is lower for Mandiri, the biggest bank in Indonesia in terms of assets, out of the three state banks. However, it should be noted here that BRI has the lowest mean of correlations during the pre-crisis and the crisis period as compared to all selected banks. Seibel and Rachmadi (2011) studied how BRI focus on the microbanking units had made BRI more resilient in the face of crisis. They mentioned that "*crisis has played a crucial role in their evolution*" after going through the 1982 oil crisis and the 1997 Asian crisis. Thus, the drive of the microbanking units in BRI might be the reason of the relatively stable volatility of daily returns as discussed earlier and the relatively low interconnectedness with the US market. Although there was no visible effect of the 2008 global crisis to the overall performance of BRI, it still impacted the stock performance of BRI. This should not be surprising due to the nature of the 2008 global crisis driven by the failures of financial institutions which impacted the any financial linked stocks.

The study of commercial bank performance indicators from December 2007–January 2009 in terms of capital adequacy ratio (CAR), return on assets (ROA), loan-to-deposit ratio (LDR), net interest margin (NIM), and non-performing loans (NPL) by Titiheruw et al. (2009) shows that the performances of the commercial banks were not affected in the crisis period as defined in this paper and a few months afterwards. This further reinforces the evidence of contagion due to the excess correlation of the banks during the 2008 global crisis.

Due to the nature of the 2008 crisis involving subprime, it is interesting to analyze the stock performance of infrastructure and real estate industry in Indonesia. Again, the stocks chosen represent the government linked and the non-government linked stocks. Arguably, infrastructure stock (Jasamarga) might not be the best fit to compare with the other two stocks involving real estates, however for the purpose of the analysis it is sufficient to see the movement of the industry that is directly linked to the collapse of the US financial market in 2008.

The first thing noticeable is the negative correlation for the pre-crisis period for Jasamarga and Lippo stocks. Jasamarga is 70% owned by the Indonesian government and is a company providing the service of infrastructure in Indonesia; specifically they are operators of expressways in Indonesia. Thus, it can be said that the business is relatively resilient to global economic conditions as compared to the rest of the stocks due to the domestic focus. This is proven by the increased revenue and operating profit in the midst of the crisis. From the negative correlation in the pre-crisis period, it can be said that there seems to be inverse relationship between S&P index and Jasamarga daily returns. One hypothesis to explain the negative relationship is the increased demand of international products when the local currency is stronger. This will drive the logistics movements domestically which in turn contributed directly/indirectly to the revenue of the expressway operator. Interestingly, although the nature of the business of Jasamarga seems to be relatively detached from US market, there is still effect of contagion during the crisis. The correlation during the crisis period increased quite significantly and dropped afterwards in the post-crisis period and remains positive. From Table 2, it is observed that the greatest loss during the analyzed period is during the crisis phase.

Bakrieland and Lippo are both private companies which engage in real estate development and real estate infrastructure. Both companies deal with residential and hotels. The initial reaction, noting the nature of the business and the nature of the crisis, is that the real estate industry might have a noticeable impact. And clearly there is an evidence of contagion noting the increased correlation from the pre-crisis to post-crisis period. Interestingly, Bakrieland has a more positive correlation as compared to Lippo on all periods. The reason for this might lie on the foreign shareholder composition of Bakrieland. A major shareholder of Bakrieland is Avenue Luxembourg SARL (Avenue Capital group) which American investment firm focusing on distressed securities and private equity with regional teams focusing on opportunities in the United States, Europe and Asia. Avenue

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

capital had been steadily increasing its shares in Bakrieland from 12% stake in November 2005 to 15.31% stake in October 2008 (currently it is holding 12.16% stake). As a majority shareholder and investment firm which manages funds in real estate in the US, one can only hypothesized that the impact of the 2008 crisis will cause a noticeable capital outflow. Another possible reason for the close correlation is Bakrieland investment on the prime central business district in Jakarta which is usually the center of for big multinational companies in Indonesia.

Lippo shareholder composition, on the other hand, is majorly owned by Pacific Asia Holding Ltd (17.88% as of March 2012) which is an affiliation of Lippo Group. Besides focusing in real estate development, Lippo's portfolio also encompasses shopping centers and hospitals. The diversification explains the negative correlation in the pre-crisis period. The strong consumerism has always been the selling point in Indonesia. With the stronger Rupiahs, spending tends to increase. However, it can be observed that even with that Lippo still bear the brunt of the crisis. A stronger correlation is observed and the biggest daily return loss (-17.6%) was observed during the post-crisis period.

Interestingly, the real estate and infrastructure stocks were not impacted as greatly as the banks. Despite so, the evidence of contagion is clear. The increased correlations are observed, despite lower in comparison with the banks.

Two commodities/energy stocks chosen in this paper are government linked (PGN) and private (Bumi Resources). PGN is a company which is currently held 57% by the government and 43% by the public. Out of the 43%, 84.08% is held by foreign owners (as of December 2010). PGN deals with producing and trading of natural gas either domestically or for export. PGN proved to be fairly resilient in the face of the crisis. In fact, the biggest loss occurred in the pre-crisis period. However, it cannot be denied that the crisis is contagious even towards the commodity stocks as shown by the increased correlation.

Bumi Resources, on the other hand, deals with mostly coal business although they have some production in iron ores, oil, and natural gas. The biggest shareholder of Bumi Resources (as of February 2012) is Vallar Investments UK Limited (29.18%) followed by Citibank London (3.41%), Interventures Capital (2.71%), and Bakrie & Brothers (2.64%). The rest of 62.07% is held by public. From the correlation, besides the evidence of contagion, it can be seen that the correlation is higher as compared to PGN.

Both Bumi Resources and PGN are comparatively more affected during the crisis period towards to US market. This should not come as a surprise as the price index of the coal and natural gas market are affected greatly by New York Mercantile Exchange (NYMEX). Although China and India were increasing its coal consumption, BUMI was affected greatly by the steady drop of the coal price to more than 50% by the end of 2008.

Titiheruw et al. (2009) found that out of the 10 companies with the biggest market capitalization on the stock exchange for 2008 which are dominated by banking (Bank Mandiri, BCA), mining (Bumi Resources, Adaro Energy, and PGN), plantation (Astra Agro Lestari) and telecommunication (Telkom, Indosat) companies, only the telecommunication companies were considered as having a better outlook, owing to its domestic orientation. "*Banking, mining and plantation are predicted to be severely affected by the global crisis*". From our analysis, it is decidedly so.

Also, another consistent fact found in this analysis is that foreign majority shareholders which are closely lined to the US market is more correlated as compared to the stocks with majority of Indonesian government. It seems that stocks which are held majorly by the Indonesian government seem to do much better in the face of the 2008 crisis.

Decoupling or lagged response?

As discussed earlier, the debate on the possibility of decoupled Asia (or Indonesia) was heavily discussed in the past. Until September 2008, Indonesia was relatively healthy economically with the growth rate was still recorded at 6.1% (year-on-year). The weakened

export growth had weakened was balanced by the increasing import of capital goods. Thus, it is suggesting that some investment activities were still taking place (Titiheruw et al., 2009). However, together with the rest of the world, prospects for Asia and the Pacific changed significantly with the collapse of Lehman Brothers in September 2008 (Filardo et al., 2009).

The low correlations of selected stocks support this evidence of the decoupled era in which very little relation between the stock performance with the US market. The abrupt change in the correlation, however, showed that the stock market is not decoupled after all. With the increased foreign capital flow which reached the peak in second quarter of 2008, Indonesia was hit contagiously by the 2008 crisis.

It can be observed the lagged response in the Indonesian market. Some of the biggest daily loss occurred in the post-crisis era. The lagged response might signify the slow recoupling to the rest of the world.

Conclusion

After discussion of the 2008 global financial crisis, contagion, and the investigation of comovements of the daily stock returns between the Indonesian stock index and selected LQ45 stocks and the US S&P500 index through various methods of correlation analyses, this chapter will attempt to summarize the major findings of our study. At the same time, it will attempt to provide some recommendations of actions which can be taken for similar occurrences in the future.

Thus, attempting to answer the problems as identified in the first chapter, this paper suggests several issues. In general, the result shows that there is an increased interdependence between Indonesia and US between the pre-crisis, 60 days from event of Lehman Brothers collapse, and the post-crisis period. Also, looking at the selected stocks from different industries, the same result applies as well. This result is consistent for all the methods applied (simple correlation, EWMA, OGARCH, and DCC GARCH). Such results infer that there is contagion effect from the US stock market to Indonesian stock market. This result is consistent with the study done by Wikanti (2011) using a different method of Vector Autoregression and Vector Error Correction Model when the comparison is between IHSG and Dow Jones Composite Index. Wikanti (2011) added that at least within a day, IHSG would follow any slump observed in the Dow Jones index. "*This contagion is a direct one where the regional markets do not serve as transmitter of the crisis*".

It is found that the crisis affected the financial and commodity stocks greatly as observed in the selected stocks. Interestingly, the infrastructure and real estate stocks were not as affected as much in comparison although the crisis rooted from such industry. This confirms the previous study by Titiheruw et al. (2009).

It is also observed that for the selected stocks, those which the Indonesian government is a major shareholder were less volatile as compared to those which shareholders' compositions do not contain such. Looking at how the global crisis increased the outflow of foreign direct investments, it should not be a surprise that stocks with majority of foreign shareholders were affected more greatly in general.

The fact that Indonesia seems to do relatively well before the crisis – with double digit growth – gives the perception of decoupling. However, it is found that both emerging and developed economies growth rate declined at a similar magnitude when compared to the pre-crisis period (Didier et al., 2011). Thus, although the Indonesian economy appeared to be more resilient in the face of the crisis, there is no evidence of decoupling during the crisis.

The lesson learned from the 1997 financial crisis has equipped Indonesia with the necessary experience to act on the 2008 crisis. And from the latest experience, it is clear that specifying the crucial signals are important to identify and plan for a better response. The signals can be in the form of changes of economic indices of advanced economies. A few lessons can be learned here in for the policy makers. Domestic indices such as the Indonesian Stock Exchanges Index or certain stocks financial performances may prove to be useless if it is used primarily due to the low correlation in the face

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617

of non-crisis i.e. a more decoupled economy. Hence, trigger points such as outflow of foreign direct investment, currency depreciation, and lower export balance might prove to be too late to be used as signals to act. Conversely, trigger points should include international signals such as the volatility of selected area/ country indices, overseas local events – which potentially global-inflicting and even regional political climate. However, the idea is not to overreact but to plan ahead the transmission of the crisis.

The Indonesian government has taken some steps in dealing with the the liquidity problem in the domestic financial market. Some of the steps taken include reducing the reserve requirement ratio, relaxing accounting rules in marked-to-market asset valuation in October 2008. After which, Bank Indonesia reduced the interest rate to induce the cut in lending rate (Titiheruw et al., 2009).

One of the choice is to strengthen the domestic fundamentals to hedge the slow down of international economy. Capital inflows experienced during the 1997 crisis has proven to be fatal. This experience should be considered in promoting a stable domestic trade growth and policy adjustments in the area of interest rate, exchange rate, inflation, capital flows, reserves, and political environment.

Fiscal stimulus in Indonesian case should be properly assessed in size and implementation steps. The speed of government spending is proven at times not fast and efficient enough. Titiheruw et al. (2009) noted that for the year 2008, the government only managed to spend 50.7% of the budget in the first nine months. Thus, the government should be cautious in the implementation of fiscal policy without proper elaboration.

It is undeniable that the interdependency of the global economy is increasing as the global trade and the 'flattening' of the world. Thus, the role of international and regional organization (such as IMF, WTO, ASEAN, etc.) is growing in importance to ensure a global and regional cooperation in the face of crisis to limit the impact via mutual financial cooperation.

Lastly, further research can be done for more stocks of the selected/ different industries to further evaluate whether the contagion impact is indeed a national wide. This paper only focuses the correlation between the Indonesian and US equity market; future study can be conducted to investigate the correlation with other regional economy. The study of comovement between Indonesia and Europe might be of relevance due to the condition of Europe at the point when this paper is being written.

Reference

Aguirre, E. (2011), Essays on Exchange Rates and Emerging Markets, *Doctoral Thesis*, Columbia University.

Aït-Sahalia, Y., Andritzky, J., Jobst, A., Nowak, S., and Tamirisa, N. (2010), Market Response to Policy Initiatives during the Global Financial Crisis, *NBER Working Paper*, 15809.

Alexander, C. (2002), Orthogonal GARCH, in *Mastering Risk Volume 2*, Financial Times, Prentice Hall, London, 21-38.

Anaraki, N.K. (2009), *The European Stock Market Impulse to the US Financial Crisis*, Science and Research branch Islamic Azad University, Tehran.

Angkinand, A.P., Barth, J.R., and Kim, H. (2010), Spillover Effects from the U.S. Financial Crisis: Some Time-Series Evidence from National Stock Returns, in Benton, E. (Ed.), *The Financial and Economic Crises: An International Perspective*, 24-52. Cheltenham: Edward Elgar Publishing.

Baig, T. and Glodfjan, I. (2000), The Russian Default and the Contagion to Brazil, *IMF Working Paper*.

Bank Central Asia Tbk. (2008), *Annual Reports*.

Bank Central Asia Tbk. (2010), *Annual Reports*.

Bank Indonesia (2010), Krisis Global dan Penyelamatan Sistem Perbankan Indonesia, *Bank Indonesia Publication*.
Bank Mandiri Tbk. (2008), *Annual Reports*.
Bank Mandiri Tbk. (2010), *Annual Reports*.
Bank Negara Indonesia Tbk. (2008), *Annual Reports*.
Bank Negara Indonesia Tbk. (2010), *Annual Reports*.
Bank Rakyat Indonesia Tbk. (2008), *Annual Reports*.
Bank Rakyat Indonesia Tbk. (2010), *Annual Reports*.
Bakrieland Development Tbk. (2008), *Annual Reports*.
Bakrieland Development Tbk. (2010), *Annual Reports*.
Bazdresch, S. and Werner, A. (2001), Contagion of International Financial Crisis: The Case of Mexico, in Claessens, S. and Forbes, K.J. (Eds.), *International Financial Contagion*, 301-328, New York: Springer.
Beltratti, A. and Stulz, R.M. (2011), The Credit Crisis around the Globe: Why Did Some Banks Perform Better?, *Fisher College of Business Working Paper Series*, Ohio State University.
Blanchart, O.J., Faruqee, H., and Das, M. (2010), The Initial Impact of the Crisis on Emerging Market Countries, *Brookings Papers on Economic Activity*, Spring, 263-323.
Bollerslev, T. (1986), Generalized Autoregressive Conditional Heteroskedasticity, *Journal of Econometrics*, 31, 307-327.
Brunnermeier, M.K. (2009), Deciphering the Liquidity and Credit Crunch 2007–2008, *Journal of Economic Perspectives*, 23, 77-100.
Bumi Resources Tbk. (2008), *Annual Reports*.
Bumi Resources Tbk. (2010), *Annual Reports*.
Calvo, S. and Reinhart, C. (1996), Capital Flows to Latin America: Is There Evidence of Contagion Effect, in Calvo, G.A., Goldstein, M., and Hochreiter, E. (Eds.), *Private Capital Flows to Emerging Markets After the Mexican Crisis*, Institute for International Economics, Washington, D.C.
Çigdem, A. and Ayhan, K.M. (2007), Changing Nature of North-South Linkages: Stylized Facts and Explanations, *IMF Working Paper*, 07(280).
Claessens, S. and Forbes, K. (2001), *International Financial Contagion: How It Spreads and How It Can Be Stopped*, New York: Springer.
Damodaran, A. (2002), *Investment Valuation: Tools and Techniques for Determining the Value of Any Assets*, New York: John Wiley & Sons, Inc.
Daníelsson, J. (2011), *Financial Risk Forecasting*, John Wiley & Sons.
Didier, T., Hevia, C., and Schmukler, S.L. (2011), How Resilient were Emerging Economies to the Global Crisis?, *The World Bank Policy Research Working Paper*, 5637, The World Bank Office of Economics.
Dornbursch, R., Park, Y.C., and Claessens, S. (2000), *Contagion: How It Spreads and How It Can Be Stopped*, Forthcoming World Bank Research Observer.
Engle, R.F. (2002), Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models, *Journal of Business and Economic Statistics*, 20, 339-350.
Engle, R.F., Ng, V., and Rothschild, M. (1990), Asset Pricing with a Factor ARCH Covariance Structure: Empirical Estimates for Treasury Bills, *Journal of Econometrics*, 45, 213-238.
Engle, R.F. and Sheppard, K. (2001), Theoretical and Empirical Properties of Dynamic Conditional Correlation Multivariate GARCH, *Working Paper*, 8554, National Bureau of Economic Research.
Filardo, A., George, J., Loretan, M., Ma, G., Munro, A., Shim, I., Wooldridge, P., Yetman, J., and Zhu, H. (2009), The International Financial Crisis: Timeline, Impact and Policy Responses in Asia and the Pacific, in *The International Financial Crisis and Policy Challenges in Asia and the Pacific*, 21-82, Basel: Bank for International Settlements.

Forbes, K. and Rigobon, R. (2002), No Contagion, Only Interdependence: Measuring Stock Market Comovements, National Bureau of Economic Research Working Paper, 7267, *The Journal of Finance*, 57(5), 2223-2261.

Forbes, K. and Rigobon, R. (2001), Measuring Contagion: Conceptual and Empirical Issues, in Claessens, S. and Forbes, K.J. (Eds.), *International Financial Contagion*, 43-66. Norwell: Kluwer Academic Publishers.

Jasamarga Tbk. (2008), *Annual Reports*.

Jasamarga Tbk. (2010), *Annual Reports*.

Kaminsky, G.L., Reinhart, C.M., Vegh, C.A. (2003), The Unholy Trinity of Financial Contagion, *The Journal of Economic Perspectives*, 17(4), 51-74.

Kodres, L.E. and Pritsker, M. (2001), A Rational Expectations Model of Financial Contagion, The Journal of Finance, 57(2), 769 – 799.

Lippo Karawaci Tbk. (2008), *Annual Reports*.

Lippo Karawaci Tbk. (2010), *Annual Reports*.

Manda, K. (2010), Stock Market Volatility during the 2008 Financial Crisis, *Thesis for The Leonard N. Stern School of Business*, Glucksman Institute for Research in Securities Markets.

Naude, W. (2009), The Financial Crisis of 2008 and the Developing Countries, *United Nations University Discussion Paper*, 2009(01).

Onyeaso, G. and Rogers, M. (2004), An Econometric Investigation of the Volatility and Market Efficiency of the U.S. Small Cap 600 Stock Index, *Quarterly Journal of Finance and Accounting*, 43(3/4), 139-155.

Perusahaan Gas Negara Tbk. (2008), *Annual Reports*.

Perusahaan Gas Negara Tbk. (2010), *Annual Reports*.

Pritsker, M. (2000), The Channels for Financial Contagion, *The Contagion Conference*.

Roberts, S.W. (1959), Control Chart Tests Based on Geometric Moving Averages, *Technometrics*, 1, 239-250.

Ronn, E. (1998), The Impact of Large Changes in Asset Prices on Intra-market Correlations in the Stock and Bond Markets, *Mimeo*.

Royen, A.S.V. (2002). Financial Contagion and International Portfolio Flows, *Financial Analysts Journal*, 58(1), 35-49.

Seibel, H.D. and Rachmadi, A. (2011). Growth and Resilience of Savings-based Commercial Microfinance Institutions: The Case of the Microbanking Units of Bank Rakyat Indonesia, *Second European Research Conference on Microfinance*.

Schwert, G.W. (2011), Stock Volatility during the Recent Financial Crisis, *NBER Working Paper Series*, 16976.

Thomas, R. and Shapiro, R. (2008), Managed Volatility: A New Approach to Equities, *Pensions & Investments*, 36(21), 42-43.

Titiheruw, I.S., Soesastro, H., and Atje, R. (2009), Global Financial Crisis Discussion Series Paper 6: Indonesia, *Overseas Development Institute*.

Untoro and Widodo, P.R. (2008), Mengkaji Perubahan Nilai Tukar Rupiah dan Pasar Saham, *Buletin Ekonomi Moneter dan Perbankan Bank Indonesia*, 10(4).

Wikanti, A.S. (2011), Contagion Effects of US Financial Crisis on Indonesia, *Economic Journal of Emerging Markets*, 3(2), 125–137.

Willett, T.D., Liang, P., and Zhang, N. (2011), Global Contagion and the Decoupling Debate, in Cheung, Y.W., Kakkar, V., and Ma, G. (Eds), *The Evolving Role of Asia in Global Finance* (Frontiers of Economics and Globalization, Volume 9), 215-34. Bingley: Emerald Group Publishing.

Wuryandani, G. (2011), The Behavior and Determinants of Stock Market Index in Indonesia, *Centre for Central Banking Studies*, Bank Indonesia.

Yhap, B. (2003), The Analysis of Principal Component GARCH Models in Value-at-Risk Calculations, *PhD Thesis*, London Univesity.
Zangari, P. (1996), *RiskMetrics Technical Document*, RiskMetrics.
Zhang, N. (2011), Contagion and the Spread of the Recent Global Crisis to Asia: The Effect of the Transmission on Equity Markets, *Dissertation*, Claremont Graduate University.

https://scholarhub.ui.ac.id/icmr/vol4/iss2/3
DOI: 10.21002/icmr.v4i2.3617