



UNIVERSITY OF INDONESIA

**THE IMPACT OF 2008 GLOBAL FINANCIAL CRISIS ON
THE PERFORMANCE OF SELECTED INDONESIAN
STOCKS: A PRELIMINARY STUDY**

THESIS

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**FACULTY OF ECONOMICS
MAGISTER OF MANAGEMENT
MM-MBA
JAKARTA
AUGUST 2012**



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THESIS

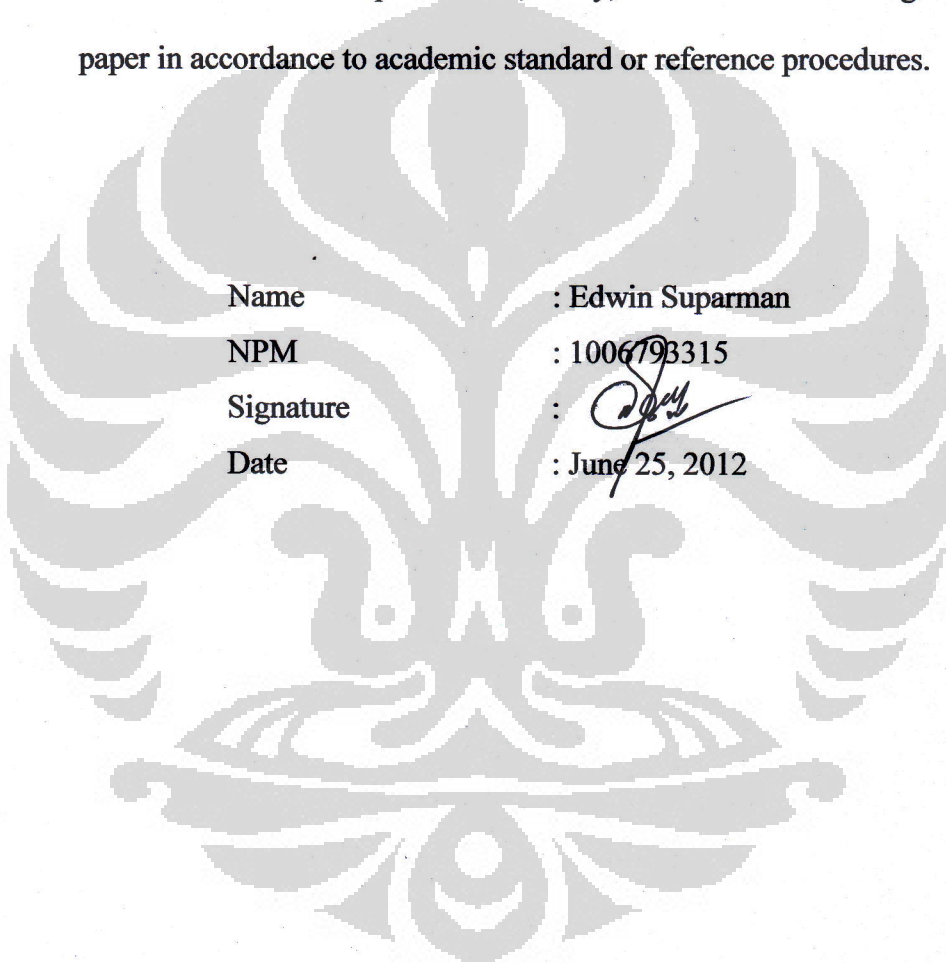
**Submitted to fulfill one of the requirements to obtain degree of
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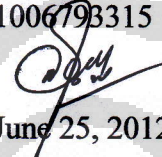
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JUNE 2012**

STATEMENT OF ORIGINALITY

This final paper represents my own effort,
any idea or excerpt from other writers in this final paper, either in form of
publication or in other form of publication, if any, have been acknowledged in this
paper in accordance to academic standard or reference procedures.



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PRELIMINARY STUDY**

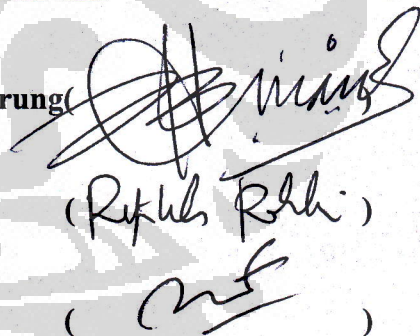
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Place : Jakarta

Date : June 25, 2012

PREFACE

I can do all things through Christ which strengthened me.

(Philippians 4:13)

Thank you Lord for all the blessings which are given to me to complete this thesis, without Him, I am nothing.

I started this research with Indonesian stock market in mind. I am always intrigued by how Indonesia is always able to attract foreign investors despite the political climate in this country. I do hope, in some ways, this research is able to shed light at least on the reaction of Indonesian investors towards a major event.

At such, completing this research and my study is part of the major event in my life and I will never be able to sail through life so smoothly. And for this I would firstly like to thank my family for their constant support, prayer, and for just being there. I love you all.

Of course, I would like to thank my thesis advisor, Prof. Dr. Adler H. Manurung, for his invaluable advice and time. Thank you for the time that you answered by bbm even in the most inconvenient hour.

Most important of all, I would like to thank my amazing MBI10 classmates who provide the colour in my life. I will always cherish all the time and laughter which we share together: Amelia for showing me what is important in life, Teh Elly for bond which glues Trio kwek-kwek together, Arseno and Ario for all the mischiefs we did, Made who is the most patient IT person (and thesis editor) I ever known, Adeline and Fanfan and Novi for the prayers and friendship, Uci who embraces Koreanism in her life, Alice for the short-lived petrol voucher, Bima who got married in the midst of thesis, Aan for being Aan, Ludwi who speaks American the way it should be, Anton who never fails to say something funny every class (if he is there), Pak Erry who is the most patient ketua kelas, Tante Ira and Frida who work hard and play harder, Pak Hans who needs to speak louder in the class, Yodi who taught me everything about hitting a ball with a stick (golf), Erwin who went

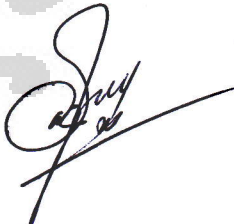
missing (where are you?), Fanny who believed I dated Amel's cousin once, Pak John about the tissue, the inseparables Muchammad and Febri, the always-sit-together Desta and Rangga, and the always-smiling Mbak Tiwi. I wish you all the very best for your future endeavours, you will always be in my prayer.

A special note is given to Junimem for always buying the lemper for me, Bajuri who always ride the bike so well – you will always be my number one ojek, Poniem – I wish you well with your new life with mang Bajuri, and mbah Surip who always tell me the wrong score during the Euro Cup. Lia, as well, who asked me specially to thank her in this preface.

Lastly, I hope this study can provide scientific contribution to anyone who reads and needs it. Suggestion and constructive criticism as an input for enhancements and improvements for the next writing are welcome.

Laus Deo.

Jakarta, June 25, 2012



Edwin Suparman

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ABSTRACT

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Study Program : Magister of Management – Master of Business
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Title : The Impact of 2008 Global Financial Crisis On The
Performance Of Selected Indonesian Stocks:
A Preliminary Study

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.

Key Words:

Contagion, Correlation Analysis, 2008 Crisis, Decoupling, LQ45 Stocks Performance, Indonesian Stocks

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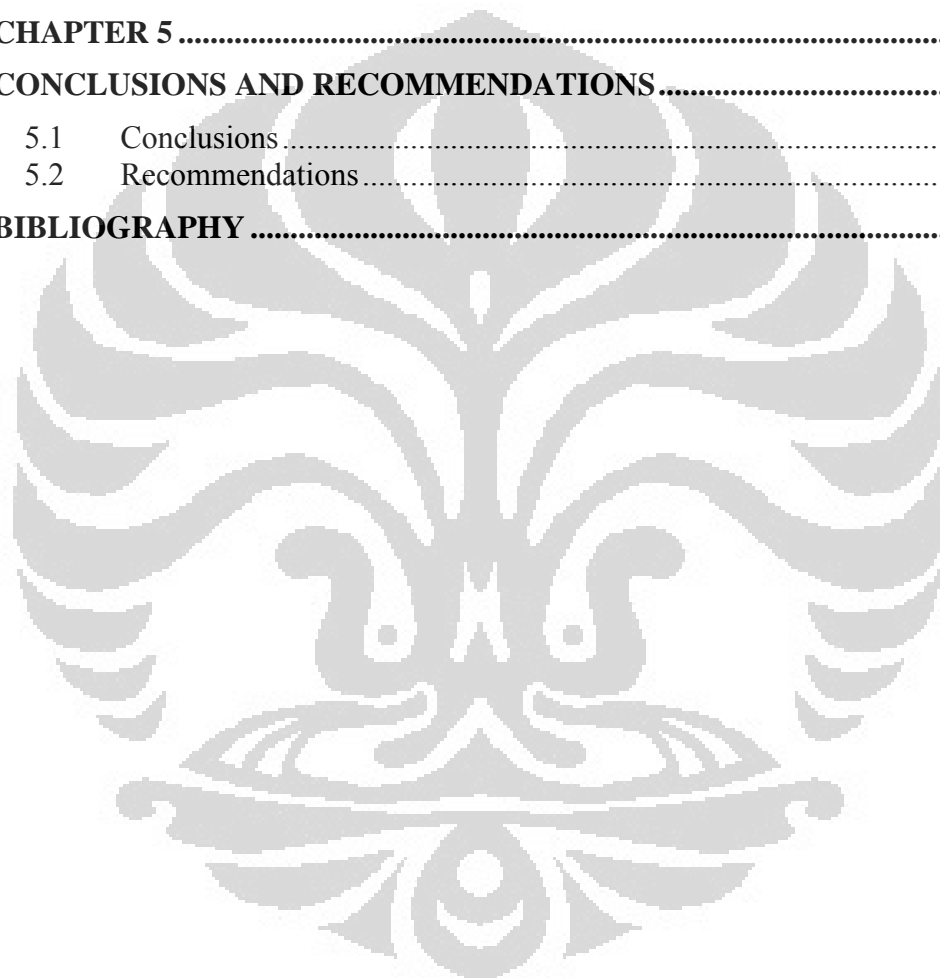


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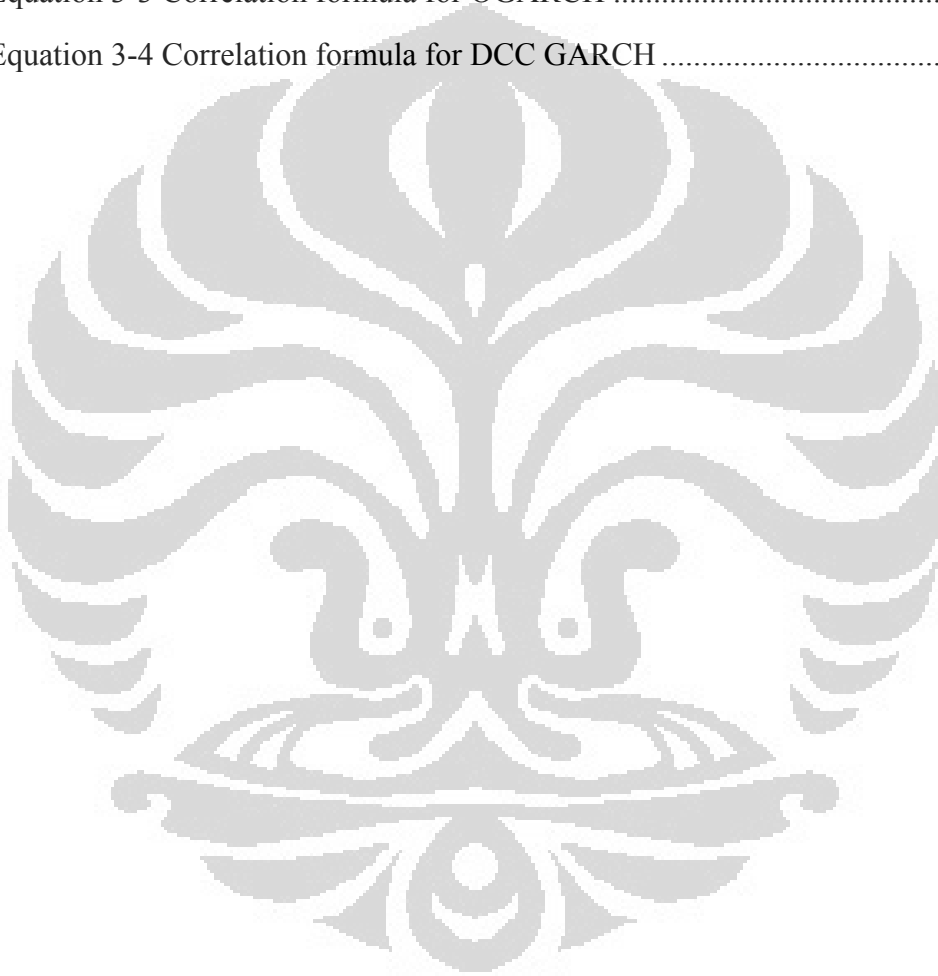
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CHAPTER 1

INTRODUCTION

1.1 Background

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, U.S. Merrill Lynch, Dexia, Fortis, etc. Brunnermeier (2009) gave complete blow-by-blow chronological events during the period. He 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 suffers liquidity crisis which affects their performance.

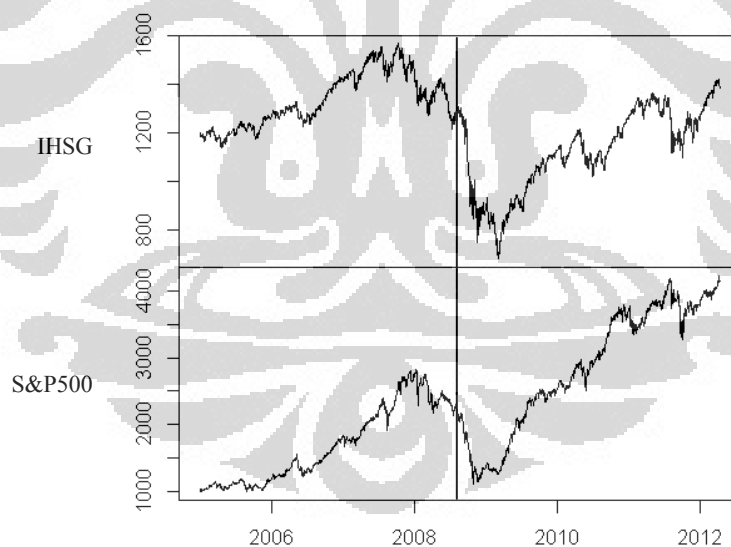


Figure 1-1 Jakarta Stock Index and S&P500 Index for the period January 2005 – April 2012

Source: Bloomberg

Figure 1.1 shows a comparative graph of Jakarta Stock Exchange Composite Index (IHSG) and Standard & Poor’s 500 (S&P) Index for the period

of January 2005 until April 2012. The vertical line shows the date 15 September 2008, one day after the information that Lehman Brothers would file for bankruptcy as it was denied support by the Federal Reserve, and the announcement of Merrill Lynch purchase by Bank of America.

The graph essentially shows the market reaction on that period. A dip in Jakarta Stock Index during September 2008 until April 2009 is 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, ex Singapore and Hongkong. More recently, Wuryadani (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 percent to US\$13.95 billion for the first 10 months of 2008, according to BKPM (<http://www.bkpm.go.id/contents/p16/PUBLICATIONS++STATISTICS/17>), it may not come as a surprise as investors were concerned about the capital outflows from Indonesia during the 2008 crisis.

The table 1.1 shows selected LQ45 stocks along with the shareholders composition of each stock, separated into government and foreign shareholders, in 2008 and 2010. 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.

Table 1-1 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

Tittheruw, Soesatro, and Atje (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". Event such as 2008 global financial crisis might be "contagious" i.e. transmitting shocks. The contagion effect is an interest for policy makers, portfolio managers, economists, and the general community. Any evidence of

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contagion will serve as a future notice for investors, policy makers, and general community on how to react if there are any global events which potentially affect the economy.

1.2 Problem Identification

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.

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?
4. Is there any evidence of decoupling in the Indonesian economy?

1.3 Objectives

1. To observe the market reaction in selected Indonesian LQ45 stocks in selected industries, to the initial event leading to the 2008 crisis,

namely the collapse of Lehman Brothers by analyzing the correlation with US S&P500 index before, directly after, and after crisis.

2. To observe whether there is any evidence of financial contagion in the Indonesian market by observing the average correlation before, directly after, and after the research using simple correlation, EWMA, DCC GARCH, and OGARCH.
3. To find out the different impacts of the 2008 global financial crisis in the selected industries in Indonesia.
4. To examine whether there is any evidence of decoupling of Indonesian economy to the rest of the world.

1.4 Research Methodology

1. Jakarta Stock Index (IHSG) will be compared with S&P 500 Index performance during the same period.
2. The following LQ45 stocks are selected: Bank Mandiri, Bank Central Asia (BCA), Bank Negara Indonesia (BNI), Bank Rakyat Indonesia (BRI), Lippo Karawaci, Bakrieland, Jasamarga, Perusahaan Gas Negara (PGN), and Bumi Resources. The selected stocks comprise of banking/finance industry, real estate and infrastructure, and commodities. These stocks will be, similarly, compared to the performance of S&P Index.
3. The daily data will be collected from various sources such as Jakarta Stock Exchange, Yahoo Finance, and Bloomberg on the stock performance of listed banks from 1 January 2005 until 9 April 2012.
4. These data will be divided into 3 different periods i.e. Period 1 (1 January 2005 – 14 September 2008), Period 2 (15 September 2008 – 14 November 2008), and Period 3 (15 November 2008 – 9 April 2012). The data will be adjusted for the calculation to ensure that the collected days are consistent with each other.
5. To calculate the correlation of the 3 Periods for the selected stocks using 4 different methods: simple correlation, EWMA, DCC GARCH, and OGARCH.

6. To analyze the result for any evidence of correlation and the different tendencies of different industries in the selected stocks.

1.5 Scope and Limitation of Research

The thesis 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 view of the market movement by comparison of the 3 time periods.

1.6 Writing Systematic

Chapter 1: Introduction

This chapter describes the background, problems, objectives of the thesis, a brief description on research methodology, and the systematic of writing. It gives a short summary on the flow of the paper in analyzing the problem.

Chapter 2: Literature Review

This chapter describes the different facts and theories on the contagion effect. It describes the definition of contagion used in this paper, how it spreads,

and the measurement of contagion using various methods as used in this paper for the purpose of analysis. It also gives a brief explanation on the decoupling debate. Overall, it gives an academic perspective on the subject.

Chapter 3: Research Methodology

This chapter provides the data from Indonesian Stock Exchange and various sources. It describes the various methods of correlations used in identifying the occurrence of contagion in Indonesia.

Chapter 4: Analysis and Findings

This chapter will analyze the result of the calculation data and attempts to come up with some conclusions on the movement of the stocks for each selected industries. It will observe for any evidence of contagion in Indonesia from the results.

Chapter 5: Conclusions and Recommendation

Finally, the last chapter will sum up the conclusion of the paper and recommend relevant actions based on the give results.

CHAPTER 2

THEORETICAL FRAMEWORK

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 (<http://www.lexisnexis.com>) 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’.

2.1 Definition of Contagion

Lawrence Summers, U.S Secretary of Treasury (1999 – 2001) explained contagion very simply in a debate on contagion during a segment called Commanding Heights with PBS: “....When bad things happen in one place, it affects other places for any number of reasons.” This is as shown in PBS website (http://www.pbs.org/wgbh/commandingheights/shared/minitextlo/ufd_contagion_full.html). In fact, 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) (<http://econ.worldbank.org>). 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 U.S. Federal Reserve (1987 – 2006) coined this reaction as an “irrational exuberance” (<http://www.federalreserve.gov/boarddocs/speeches/1996/19961205.htm>). The third very-restrictive definition referred to the increase in cross-country correlations during “crisis times” as compared to “tranquil times”.

Kaminsky, Reinhart, Vegh (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 this the Worlds 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, Dornbusch, and Park (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.

2.2 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, Dornbusch, and Park (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, Hamid, and Das (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 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 reflecting 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, Dornbusch, and Park, 2001), market imperfections (Willett, Liang, and Zhang, 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, endogenous liquidity, and political economy considerations and the non-crisis channels included trade, policy coordination, country reevaluation and learning, and common shocks.

2.3 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).

2.3.1 Simple Correlation

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.

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, Barth, and Kim (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 it 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 heteroskedasticity 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.

2.3.2 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.

2.3.3 Orthogonal GARCH

The univariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) which was introduced by Engle (1982) and Bollerslev (1986) has been widely used due to its usage of heteroskedasticity 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 Heteroskedasticity (OGARCH) is a generalization of a factor in GARCH model introduced by Engle, Ng, and Rothschild (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 methodology. The methods follow two steps. First, unconditionally uncorrelated factors are constructed, which are linear combinations of the original returns. Second, they fit univariate GARCH models to the principal components. Under the assumption that the conditional variance-covariance matrix of the principal component series is diagonal (i.e. conditional correlations are set to zero), it is possible to recover the original assets' variance-covariance matrix, through a fixed

mapping matrix. A sufficiently long sample is needed not to encounter significant variability of this matrix, which might also be sensible to different calibration procedures. Thus, 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.

2.3.4 DCC GARCH

To counter the problem of heteroskedasticity, 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) used it to examine the impact of the 1997-98 Asian financial crises on the Chinese Economic Area (CEA) and found positive correlation coefficients of stock returns. Hesse, Frank, and González-Hermosillo (2008) adopted this method and examined the linkages between market and funding liquidity pressure during the recent subprime crisis and found that the interaction between market and funding illiquidity increased sharply during the recent financial turbulence up to the beginning of 2008. Burdekin and Siklos (2010) calculated dynamic conditional correlations for the stock returns of some Asian economies and the US and found consistent and strengthening ties between Shanghai and other Asian markets but weaker ties with the S&P500 during the

recent financial crisis. The IMF in its 2008 Global Financial Stability Reports (IMF, 2008) used DCC-GARCH to analyze the co-movements in stock markets between the US and some global emerging market regions as a whole and found varied but overall increasing correlation levels during the past several years.

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.

2.4 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.

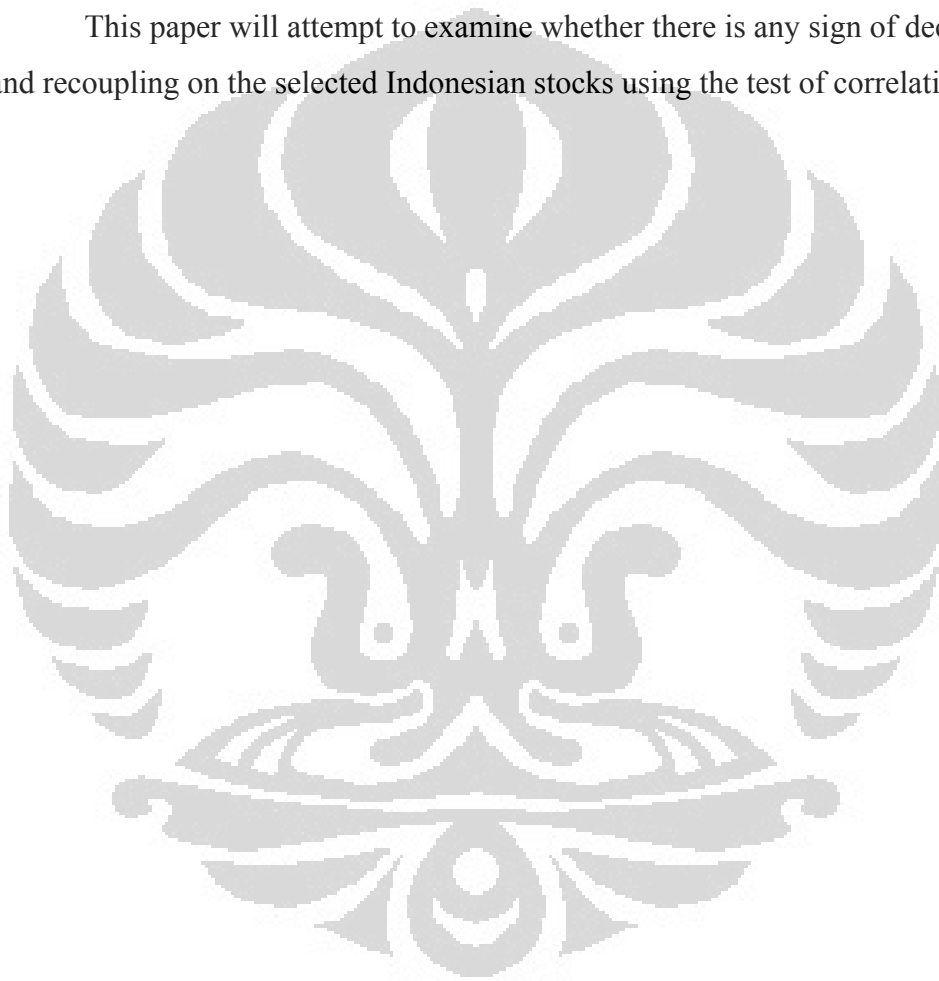
Rossi (2008) suggested that decoupling is growth in one area becoming less dependent on growth in another area. As decoupling implies a break in a relationship that was previously closely linked, this definition lends itself naturally to discussions of changes in patterns of correlations or influences,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

It is not difficult to find the examples of this. During the unfortunate 11 September 2001 terrorist attack on U.S, 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.

Titihew, Soesastro, and Atje (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?

This paper will attempt to examine whether there is any sign of decoupling and recoupling on the selected Indonesian stocks using the test of correlation.



CHAPTER 3

METHODOLOGY

In this chapter, it will calculate the correlations between Standard & Poor 500 (S&P500) Index, Jakarta Stock Index (IHSG), and selected Indonesian LQ45 stocks. This paper shall be applying 4 methods 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 after day X+60.

3.1 Data

For the purpose of the analysis, the data of Standard & Poor 500 (S&P500) Index, Jakarta Stock Index (IHSG), and selected Indonesian LQ45 stocks are obtained using Yahoo! Finance. 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). LQ45 is calculated semiannually by IDX. The list of LQ45 companies as per February 2012 – July 2012 is shown in the table below.

Table 3-1 List of LQ45 stocks for February – July 2012

No.	Stocks	Classification	Code
1	PT Delta Dunia Makmur Tbk	Apparel	DOID
2	PT Astra International Tbk	Auto Manufacturers	ASII
3	PT Aneka Tambang Tbk	Materials	ANTM
4	PT Krakatau Steel Tbk	Materials	KRAS
5	PT AKR Corporindo Tbk	Materials	AKRA
6	PT Indocement Tunggak Perkasa Tbk	Materials	INTP
7	PT International Nickel Indonesia Tbk	Materials	INCO

List of LQ45 stocks for February – July 2012 (Continued)

No.	Stocks	Classification	Code
8	PT Semen Gresik Tbk	Materials	SMGR
9	PT Timah Tbk	Materials	TINS
10	PT Adaro Energy Tbk	Energy	ADRO
11	PT Borneo Lumbing Energy & Metal	Energy	BORN
12	PT Bumi Resources Tbk	Energy	BUMI
13	PT Harum Energy Tbk	Energy	HRUM
14	PT Energi Mega Persada Tbk	Energy	ENRG
15	PT Indo Tambangraya Megah Tbk	Energy	ITMG
16	PT Indika Energy Tbk	Energy	INDY
17	PT Tambang Batubara Bukit Asam Tbk	Energy	PTBA
18	PT Perusahaan Gas Negara Tbk	Energy	PGAS
19	PT Bank Central Asia Tbk	Finance	BBCA
20	PT Bank Negara Indonesia Tbk	Finance	BBNI
21	PT Bank Rakyat Indonesia Tbk	Finance	BBRI
22	PT Bank Tabungan Negara Tbk	Finance	BBTN
23	PT Bank Danamon Indonesia Tbk	Finance	BDMN
24	PT Bank Mandiri Tbk	Finance	BMRI
25	PT BPD Jawa Barat Tbk	Finance	BJBR
26	PT Gajah Tunggal Tbk	Industry	GJTL
27	PT United Tractors Tbk	Industry	UNTR
28	PT Trada Maritime Tbk	Industry	TRAM
29	PT Jasa Marga Tbk	Infrastructure	JSMR
30	PT Alam Sutera Realty Tbk	Infrastructure	ASRI
31	PT Lippo Karawaci Tbk	Infrastructure	LPKR
32	PT Bakrieland Development Tbk	Infrastructure	ELTY
33	PT Kawasan Industri Jababeka Tbk	Infrastructure	KIJA
34	PT Astra Agro Lestari Tbk	FMCG	AALI
35	PT Bakrie Sumatra Plantations Tbk	FMCG	UNSP
36	PT Gudang Garam Tbk	FMCG	GGRM
37	PT Indofood Sukses Makmur Tbk	FMCG	INDF
38	PT PP London Sumatra Indonesia Tbk	FMCG	LSIP
39	PT Unilever Indonesia	FMCG	UNVR
40	PT Indofood CBP Sukses Makmur Tbk	FMCG	ICBP
41	PT Charoen Pokphand Indonesia Tbk	FMCG	CPIN
42	PT Salim Ivomas Pratama Tbk	FMCG	SIMP
43	PT Kalbe Farma Tbk	Pharmaceutical	KLBF
44	PT XL Axiata Tbk	Telecommunication	EXCL
45	PT Telekomunikasi Indonesia	Telecommunication	TLKM

Source: Indonesia Stock Exchange

(<http://www.idx.co.id/Portals/0/StaticData/MarketInformation/ListOfSecurities/IndexConstituent/LQ45>)

Out of the 45 stocks listed above, nine random stocks are chosen to be considered in this paper, namely: PT Bank Mandiri Tbk (BMRI), PT Bank Central

University of Indonesia

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 U.S market index, this paper shall be comparing IHSB index and S&P500 index (which is a free float capitalization-weighted index of 500 large-cap actively traded stocks).

The statistical summary of the daily stock return is shown in the table below.

Table 3-2 Summary of stock return from 1 January 2005 – 9 April 2011 as compared to S&P500

	Mean	Std Dev	Max	Min	Skewness	Kurtosis
S&P 500	0.018%	0.014	11.580%	-9.035%	-0.052	9.521
IHSB	0.092%	0.016	7.921%	-10.375%	-0.506	6.017
BMRI	0.126%	0.029	20.000%	-14.516%	0.525	5.030
BBCA	0.134%	0.023	13.513%	-10.077%	0.160	2.966
BBNI	0.102%	0.029	20.000%	-23.711%	0.498	9.397
BBRI	0.147%	0.028	18.966%	-13.115%	0.485	3.891
LPKR	0.084%	0.021	18.920%	-17.647%	0.417	12.274
ELTY	0.050%	0.044	33.331%	-36.170%	0.616	8.375
JSMR	0.119%	0.024	19.737%	-14.608%	0.675	10.461
PGAS	0.192%	0.031	21.078%	-23.317%	0.622	8.991
BUMI	0.139%	0.039	24.369%	-32.031%	0.436	7.451

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

From the summary above, the following observations can be made. First, the performance of IHSB is relatively muted as compared to the individual daily stock returns i.e. the mean, maximum, and minimum amount are not as unstable

as the individual stock performances. This is expected and supports the argument of the needs of portfolio diversification. Second, the negative skew also shows that the overall performance of the market is mostly positive with few negative values. This is valid for both indices (S&P 500 and IHSG). Again this supports the idea of *don't put all your eggs in the same basket* i.e. comparatively a calculated mix of stocks will perform much better as compared to some individual stock performance. Third, indices are less volatile as shown in the relatively low value of standard deviation. The study of this is not new (Ric and Robert, 2008; Godwin and Michael, 2004).

3.2 Methodologies

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. The methods of calculation are as discussed in chapter 2: simple correlation, EWMA, OGARCH and DCC GARCH.

3.2.1 Simple Correlation

The simple correlation which is also know as Pearson's correlation is a measure 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. The correlation coefficients show the degree of positive or negative dependency (-1 to 1) between two variables in a straight forward way. 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.

The simple correlation starts by assuming that two mean corrected variables (variables X and Y will be used to illustrate for all the methods in this

chapter) are stochastic variables which represent stock returns of different markets which are normally distributed where:

$$E(x_t) = 0, E(y_t) = 0$$

$$y_t = \alpha + \beta x_t + \varepsilon_t$$

where

$$E(\varepsilon_t) = 0$$

Thus, it can be generalized for bivariate,

$$\begin{aligned} \text{Cov}\left(\begin{bmatrix} x_t \\ y_t \end{bmatrix}, \begin{bmatrix} x_t & y_t \end{bmatrix}\right) &= \begin{pmatrix} \sigma_x^2 & \sigma_{xy} \\ \sigma_{xy} & \sigma_y^2 \end{pmatrix} \\ \text{Correlation, } \rho_{x_t, y_t} &= \frac{\sigma_{xy,t}}{\sigma_{x,t} \sigma_{y,t}} = \beta \end{aligned} \quad (3.1)$$

This is calculated for the three defined periods i.e. tranquil period (1 January 2005 – 14 September 2005), crisis period (15 September 2005 – 14 November 2005), and post-crisis period (15 November 2005 – 9 April 2012). The result on this calculation is presented in Chapter 4.

3.2.2 EWMA

A weighted average concept arises by giving weightage in form of factor multiplication dependent on the data position in the sample. In financial analysis, a weighted moving average is applied by specific weights that decrease in arithmetical progression. Hence, in an n -day WMA the latest day has weight n , the second latest $n - 1$, etc., down to one.

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.

Mathematically, the formula is presented as:

$$EWMA(x_{t-1}, \dots, x_1) = \frac{x_{t-1} + \lambda x_{t-2} + \lambda^2 x_{t-3} + \dots + \lambda^{t-2} x_1}{1 + \lambda + \lambda^2 + \dots + \lambda^{t-2}}, 0 < \lambda < 1$$

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

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

Thus, the relationship between two daily returns is

$$\begin{aligned} COV_{\lambda}(x_t, y_t) &= (1 - \lambda) \sum_{i=1}^{\infty} \lambda^{i-1} x_{t-i} y_{t-i} \\ Correlation, \rho_{x_t, y_t} &= \frac{COV_{\lambda}(x_t, y_t)}{\sigma_{x,t} \sigma_{y,t}} \end{aligned} \quad (3.2)$$

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 RiskMetricsTM (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 (RiskMetricsTM technical document, 1996)

3.2.3 OGARCH

Orthogonal GARCH model is a developed using the basic factor model of GARCH. The OGARCH model allows the kxk 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:

$$\sigma_{x,t}^2 = \omega + \alpha x_{t-1}^2 + \beta \sigma_{x,t-1}^2 \text{ where } \omega > 0, \alpha, \beta \geq 0, \alpha + \beta < 1$$

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 \mathbf{D}_t .

$$D = \text{diag}(\sigma^2(P_x), \sigma^2(P_y))$$

Thus, the time varying matrix \mathbf{V}_t is approximated by

$$\mathbf{V}_t = \mathbf{A} \mathbf{D}_t \mathbf{A}' \quad (3.3)$$

where \mathbf{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.

3.2.4 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 heteroskedasticity, 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).

DCC GARCH started of using the Constant Conditional Correlation estimator developed by Bollerslev (1990) which is

$$H_t = D_t R_t D_t \text{ where } D_t = \text{diag} \left\{ \sqrt{h_{i,t}} \right\}$$

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

$$\begin{aligned} r_t &= \mu_t + a_t \\ a_t &= \sqrt{H_t} z_t \end{aligned}$$

where r_t is the $n \times 1$ 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,

$$\begin{aligned}
 r_t | \mathcal{I}_{t-1} &\sim N(0, D_t R_t D_t) \\
 D_t^2 &= \text{diag}\{\omega_i\} + \text{diag}\{\kappa_i\} \circ a_{t-1} a_{t-1}' + \text{diag}\{\lambda_i\} \circ D_{t-1}^2 \\
 \varepsilon_t &= D_t^{-1} a_t \\
 Q_t &= S \circ (\mu' - A - B) + A \circ \varepsilon_{t-1} \varepsilon_{t-1}' + B \circ Q_{t-1} \\
 R_t &= \text{diag}\{Q_t\}^{-1} Q_t \text{diag}\{Q_t\}^{-1} \\
 \bar{Q} &= E[\varepsilon_t \varepsilon_t'] \approx \frac{1}{T} \sum_{t=1}^T \varepsilon_t \varepsilon_t'
 \end{aligned} \tag{3.4}$$

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_{t-1}^2 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 \circ is the product (Orskaug, 2009).

In this paper, it will be using R as the statistical programming tools to calculate the correlations adapted and modified from the Danielson (2011). This will be used for all the four methods and the result of these correlations are presented in Chapter 4.

CHAPTER 4

RESULT AND ANALYSIS

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

4.1 Economic Crisis of 2008

In summer of 2007, US faced increasing defaults on mortgages and growing numbers of foreclosures which signaled that the subprime market was in crisis. House prices and financial stock prices started to plummet. The question lies whether these events will impact at all on the rest of the world. We will first explore this by looking at the key events during the crisis. The timeline below shows an overview of what happened during the crisis presented by Filardo et al. (2009) in which he presented the impact of the crisis on Asia-Pacific and the world on Pre-crisis era and four phases of the crisis.

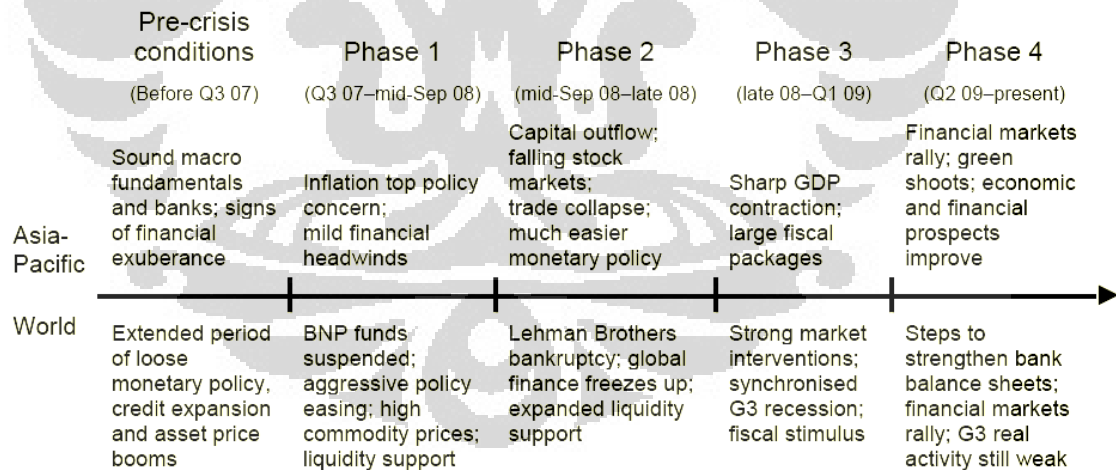


Figure 4-1 2008 Financial Crisis Timeline

Source: Filardo et. al (2009) p. 22

As mentioned earlier, the writer would like to point out that on 15 September 2008 was the defining date in which Lehman Brothers filed for bankruptcy and the U.S. 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, the reason that 15 September 2008 date is chosen as the start of the crisis 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* as well by Sahalia et al. (2010) when examining the macroeconomic policy changes during the crisis. The 60 days period is arbitrarily chosen as the market response period to the announcement.

Due to the nature of the crisis, the impact of capital outflow in Indonesia is one of object of interest. The graph below shows the Foreign Direct Investment (FDI) as a percentage of GDP. The first thing which can be observed is that there was a clear dip in FDI from the third quarter of 2008 to the first quarter of 2009 on all economies (advanced, emerging, and low income). However, interestingly the outflow in low income economies is slower as compared to other more advanced economies. This is one of the subjects of the study in this paper as Indonesia is classified under emerging economies. Clearly there was impact in FDI as Indonesia's FDI dropped by US\$790 million in 2009 as compared to 2008 (Indexmundi), however the effect on contagion cannot be concluded from FDI flow alone.

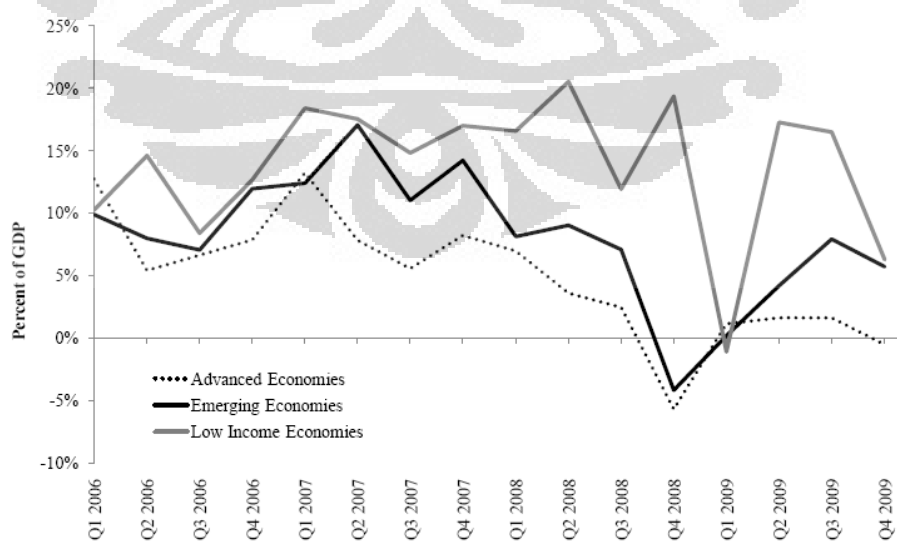


Figure 4-2 Foreign Direct Investment in Indonesia 2006 – 2009

Source: Trading Economics (<http://www.tradingeconomics.com/indonesia/FDI>)

4.2 Daily Returns of Indices

The graph below presents the log of daily returns between two market indices, namely S&P 500 and IHSG. It is interesting to note a few things. First, the returns of the two indices prior to mid 2008, seems to be less correlated as compared to after the mid 2008 period. The returns seem to move more in-sync in the current years, at least relatively. Second, IHSG is relatively more volatile relative to S&P 500 index, as it can be observed from the magnitude of gains and returns (with the exception of the 2008 crisis period). Generally, volatility refers to standard deviation, which is a dispersion measure. Greater dispersion implies greater risk, which implies higher odds of price erosion or portfolio loss. This is confirmed earlier in chapter 3, as well, as the variance of IHSG is higher than other. Third, volatility of indices increases during the 2008 crisis, in particular second half of 2008 until the first half of 2009. This should not be surprising, particularly for S&P 500 index, noting that the root of the crisis originates from the country itself.

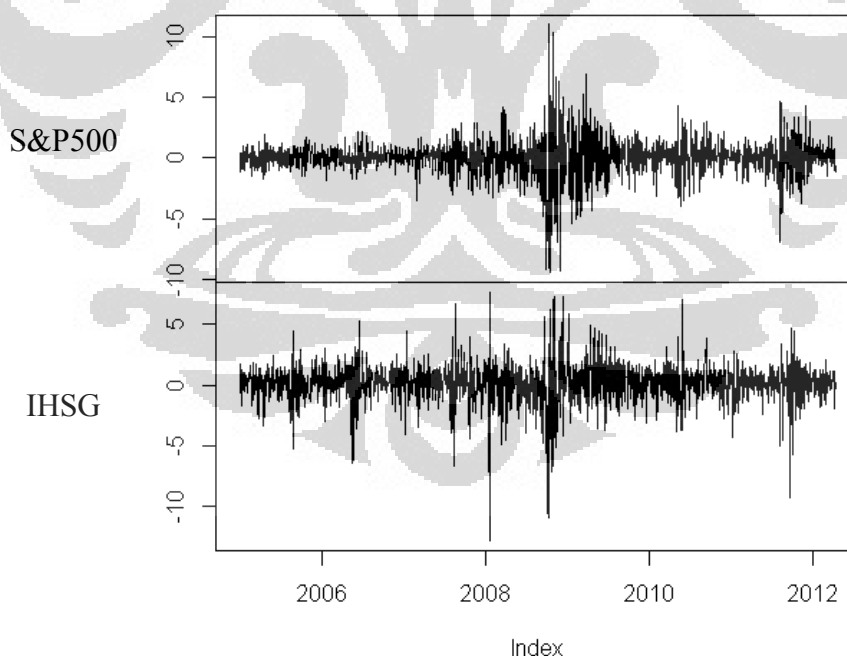


Figure -3 Comparison of percentage of daily returns between S&P 500 and IHSG for the period 1 January 2005 – 9 April 2012

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

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. For the selected LQ45 stocks, as presented in table 3-2 in the previous chapter, seems to defy this argument. However, it must be noted that the table only presents the average figure for the whole period of 2005 – 2012.

The similar table on the daily stock return performance differentiated in three different periods is presented in table 4-1. The table shows the mean, standard deviation, the maximum, and minimum daily returns in all the three defined periods for S&P 500 Index, IHSG, and the nine selected LQ45 stocks. The first thing noticeable about the 2 indices is that the average daily return is remarkably higher in Indonesia (0.075% and 0.154%) as compared to the US (0.009% and 0.066%) during the pre-crisis and post-crisis period respectively. However, during the X+60 period, the mean return is lower in Indonesia or the lack thereof. During the pre-crisis period, Indonesian stock market was visibly more volatile (with 0.014 standard deviation). 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 X+60 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. Thus, during that period, although the mean is lower for IHSG (-0.801%), it is less volatile (with 0.041 standard deviation) as compared to S&P 500.

For the banks, BRI as the best performer in the pre-crisis period with the highest mean of daily returns of 0.127% performed fairly well during the X+60 period and decently in the post-crisis period (0.216%). One thing to note is how well BCA performs during the X+60 period with the mean daily return of 0.317%. In terms of volatility, the banks were expectedly more volatile during the X+60 period and return to the pre-crisis period after that.

Table 4-1 Comparison of daily returns performance for S&P 500, IHSG, and selected LQ45 stocks for the 3 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)

Out of the three infrastructure/ real estate stocks, one thing which can be pointed out is how Jasamarga performed before 15 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 X+60 period.

The commodity industry proved to be the most volatile during the X+60 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%).

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 period X+60 days. The standard deviations dropped to almost pre-crisis level after which.

Second, the biggest loss for most stocks occurred during the X+60 days 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). This will be discussed in detail in the next section.

4.3 Simple Correlation Result

The simple correlation result for the three periods on the indices and the selected LQ45 stocks is presented in the table 4-2 and graph 4-3 below as calculated using SPSS.

Table 4-2 Simple correlation results between IHSG and selected stocks returns compared to S&P 500

	Pre-crisis	X+60	Post crisis
IHSG	0.0891*	0.1757	0.2032*
MANDIRI	0.0717	0.1207	0.1524*
BNI	0.1298*	0.1481	0.1589*
BRI	0.0162	0.0284	0.1482*
BCA	0.0471	0.0812	0.1041*
JASAMARGA	-0.0378 [#]	0.3292*	0.1261*
BAKRIELAND	0.0754*	0.2188	0.1280*
LIPPO	-0.0113 [@]	-0.0311	0.1057*
PGN	-0.0226	0.1839	0.1200*
BUMI	0.0603	0.2500	0.1490*

Note: * denotes statistical significance of 5% or less, [#] for JASAMARGA pre-crisis period starts from November 2007 where it started the listing, [@] for LIPPO pre-crisis period starts from July 2006.

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

A general observation from the above table 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 observable fact of higher simple correlations during the crisis confirms the theory that the simple correlation tends to rise in the crisis periods as the volatility increases. Thus, this is the evidence of contagion by the earlier definition. The correlation is also stronger after the crisis as compared to the pre periods.

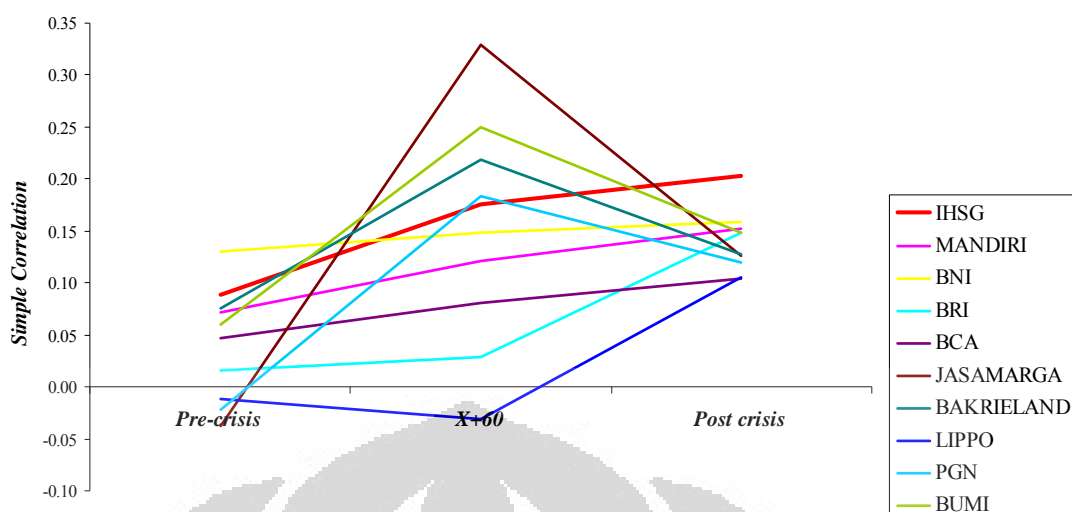


Figure 4-4 Simple correlation results between IHSX and selected stocks returns compared to S&P 500

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

If we look specifically for each industry which we selected, we can observe the following. 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 drops after X+60 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 data for each period is at least 30 to satisfy the Central Limit Theorem i.e. the data is “large enough”. The increased in the correlation during the X+60 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. This paper shall discuss about this in greater detail after we compare the consistency of correlation value across different methods in the next section.

Another point to note is that some of the non-financial stocks which are selected were negatively correlated with the US stock market. This correlation immediately change on the X+60 and post-crisis period. Also, it is observed that

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the negative correlations apply to government-linked non-financial stocks (JASAMARGA and PGN). Also, another observation for all the non-financial stocks is that the correlation for the post-crisis period are markedly different compared to X+60 period i.e. a drop in value (although still higher than the pre-crisis period).

4.4 EWMA Result

The bivariate volatility model using EWMA, OGARCH, and DCC GARCH in this paper is modeled based on the modification of the programming model as proposed by Jón Daníelsson (2010) using a statistical R program. R is an open source programming language and software environment for statistical computing and graphics. The R language is widely used among statisticians for developing statistical software and data analysis.

The results of the EWMA computation (mean value) of all the three periods are presented in the table 4-3 below.

Table 4-3 Mean value of EWMA correlation results between IHSG and selected stocks returns compared to S&P 500

	Pre-crisis	X+60	Post crisis
IHSG	0.0541	0.2013	0.2037
MANDIRI	0.0535	0.1216	0.1476
BNI	0.1328	0.1683	0.1657
BRI	0.0220	0.0634	0.1356
BCA	0.0037	0.1319	0.1081
JASAMARGA	-0.0377	0.3430	0.1203
BAKRIELAND	0.0595	0.2395	0.1178
LIPPO	-0.0250	0.0367	0.1014
PGN	-0.0008	0.2081	0.1267
BUMI	-0.0034	0.2853	0.1806

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

The very first thing which we can observe from the table above is that the result is somewhat consistent with the simple correlation results which are presented earlier i.e. the mean correlations are higher during X+60 and post-crisis

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periods as compared to the pre-crisis period. Also, we can see that the mean EWMA correlation of non-financial institutions dropped relatively more significant if comparing the X+60 and the post-crisis periods. This is in contrast with the results of financial institutions in which the post-crisis mean EWMA correlation mostly increases as compared to X+60 period.

Comparing with the previous simple correlation result, some discrepancies can be pointed out from the result. First, BCA mean EWMA correlation in the post-crisis period drops as compared to the X+60 period. This is a disparity as compared to the other financial institution result. Second, the result of LIPPO in X+60 period is positive as compared to the negative result of simple correlation method. Third, BUMI mean EWMA correlation in the pre-crisis period is negatively correlated in contrast with the simple correlation result. The disparities can be explained by the approach used by EWMA. EWMA approach of exponentially decreasing the weightage as the data is older will have the effect and the choice of using λ to be 0.94 allows the resilience to the volatility and the little reaction to the past data. Hence, any past movements has relatively little effect to the as compared to the current condition. This is evidenced for all the inconsistency observed. For example, LIPPO daily stock returns in period X+60 is positive as it takes little effect on the past returns of inversely related returns.

Below Figure 4-5 to 4-14 show the graphical representation of the correlations for IHSB and the selected stocks against S&P 500.

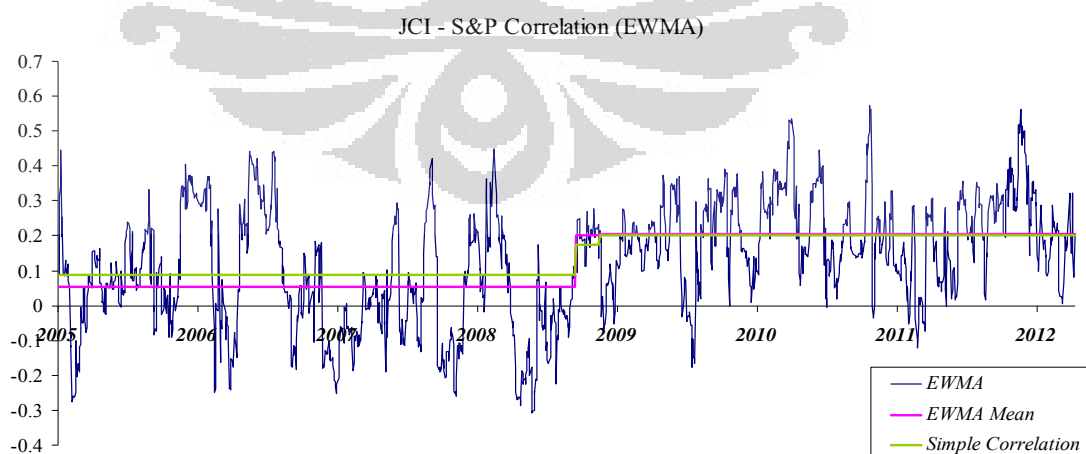


Figure 4-5 EWMA and Simple Correlation result between IHSB and S&P 500

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

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The graph 4-5 shows that the correlation between IHSG and S&P 500 during the pre-crisis period was noticeably gone into the negative region i.e. there were periods in which the Indonesian stock market moved in opposite manner as compared to the US market. However, this changed drastically during the X+60 and the post-crisis period. The correlations were mostly positive i.e. the Indonesian market moved closer following the US market during and after the crisis.

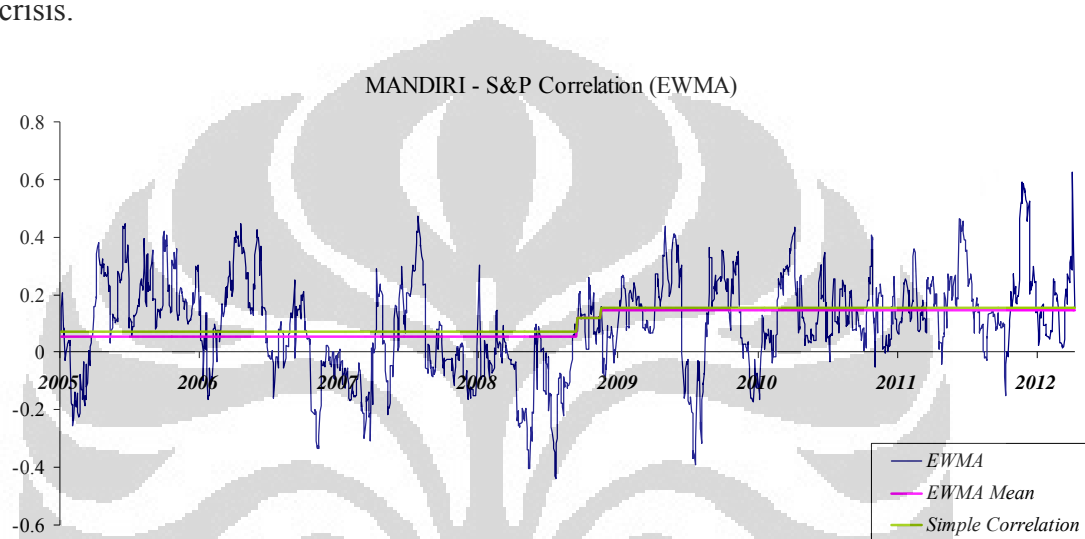


Figure 4-6 EWMA and Simple Correlation result between Bank Mandiri and S&P 500

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

The Figure 4-6 shows that the correlation between Bank Mandiri and S&P 500 follows almost the same pattern as IHSG as shown in Figure 4-5. While some negative correlation can be observed during the pre-crisis period, the period of X+60 and post-crisis display a more positive correlation.

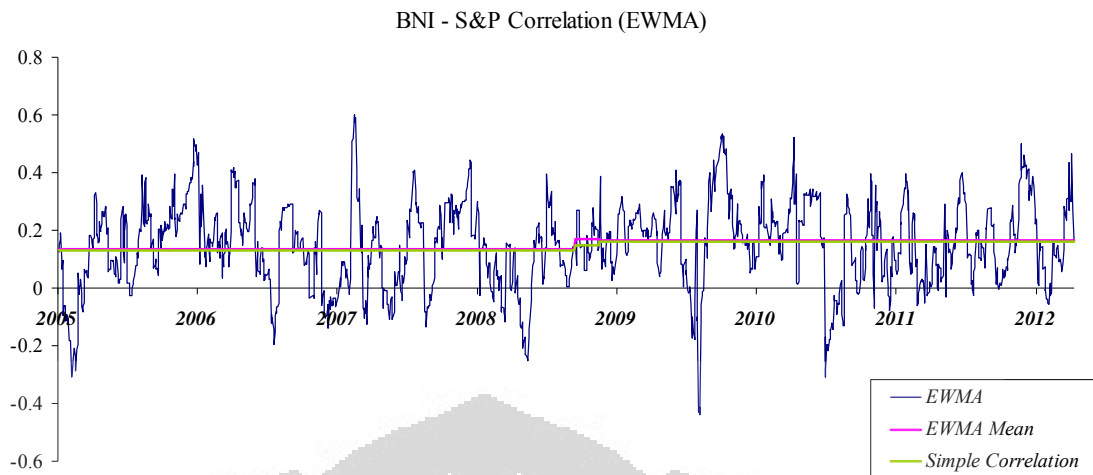


Figure 4-7 EWMA and Simple Correlation result between BNI and S&P 500

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

Figure 4-7 for BNI – S&P 500 correlation, however, shows a more consistent correlation. However, the correlation is more volatile in the post-crisis period.

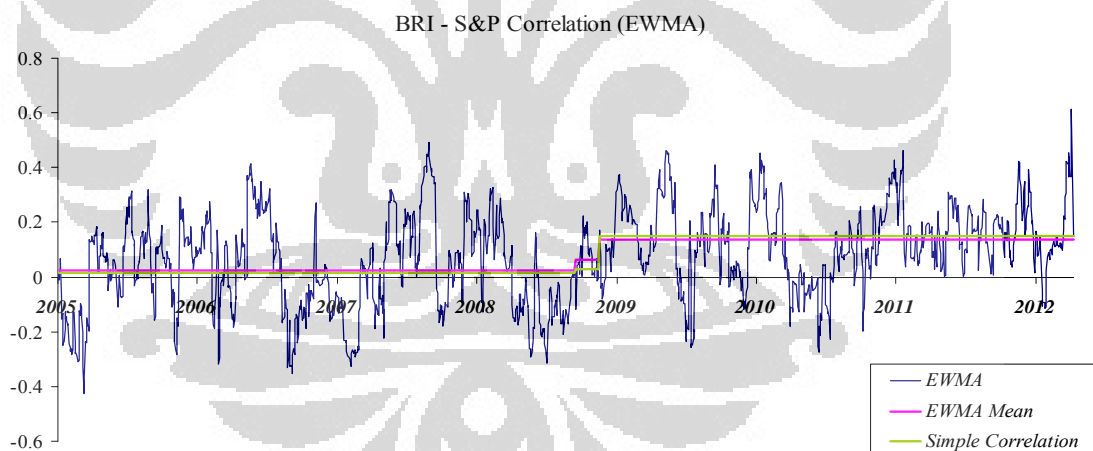


Figure 4-8 EWMA and Simple Correlation result between BRI and S&P 500

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

BRI and S&P 500 correlation in Figure 4-8 shows another typical pattern, similar to Bank Mandiri. One thing to note is that it appears to be more correlated from mid 2010 onwards.

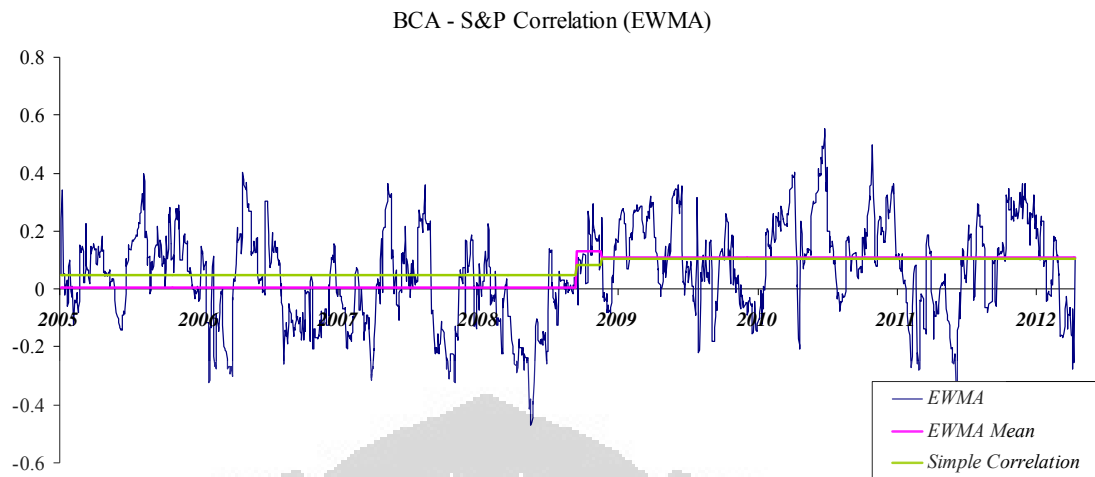


Figure 4-9 EWMA and Simple Correlation result between BCA and S&P 500

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

BCA, as shown in Figure 4-9, shows a more volatile correlation as compared to the other selected bank stocks. However, it still has the noticeable pattern of more negative in the pre-crisis and the reverse for during and post-crisis.

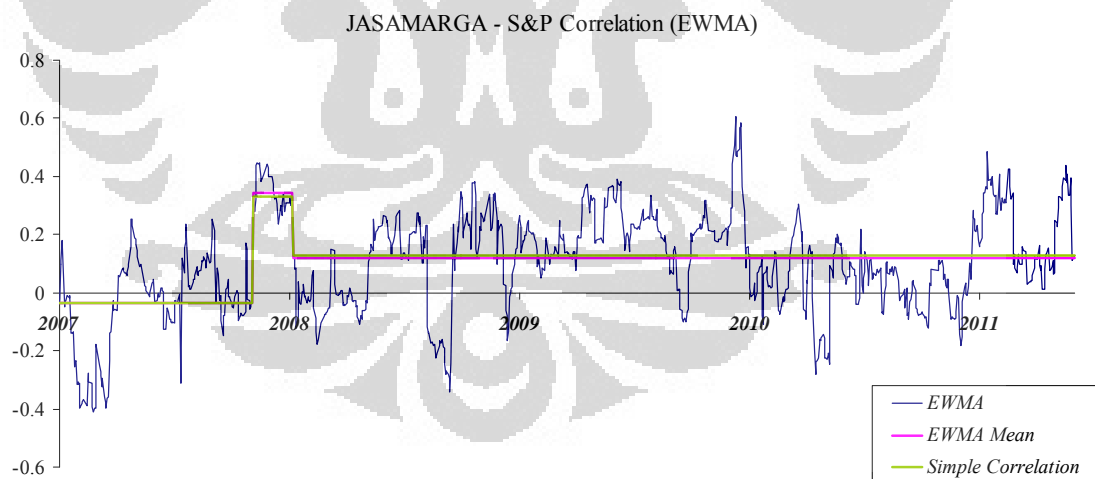


Figure 4-10 EWMA and Simple Correlation result between Jasamarga and S&P 500

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

In comparison, Jasamarga correlation in Figure 4-10 is markedly less volatile as compared to the others. Knowing the nature of Jasamarga business which is relatively unrelated to US market, it is of no surprise that the correlation is negative in the pre-crisis period. However, the crisis still impactful for

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Jasamarga, this is shown in the highly correlated return in X+60 period and the more positive post-period.

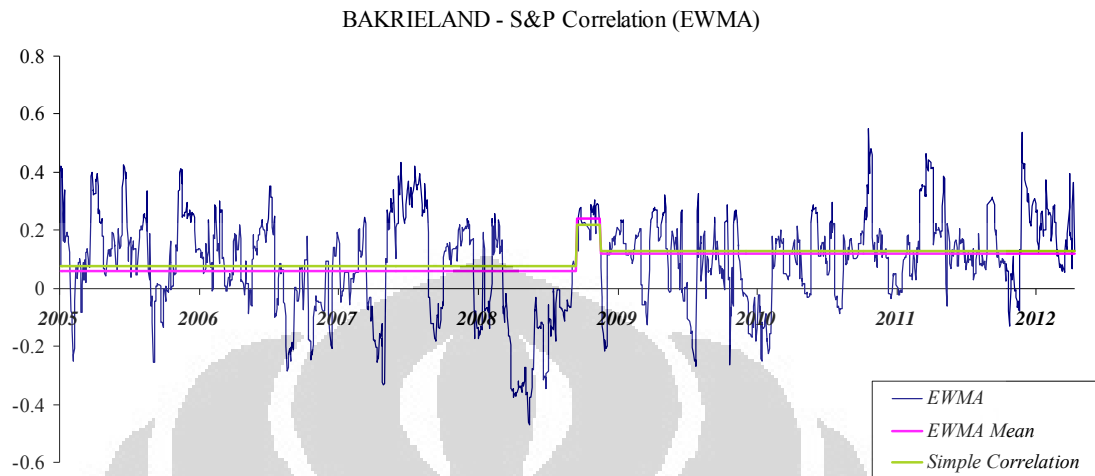


Figure 4-11 EWMA and Simple Correlation result between Bakrieland and S&P 500

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

Bakrieland and S&P correlation in Figure 4-11, shows a mostly positive correlation during the pre-crisis period which is in contrast to the other infrastructure stocks. It only goes to the highly negative zone nearing the X+60 period (about the second quarter of 2008).

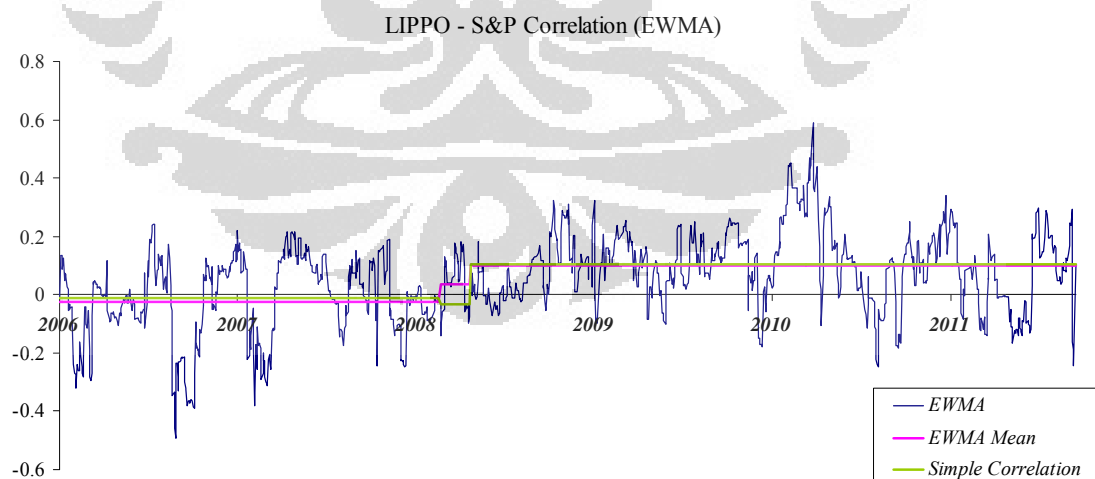


Figure 4-12 EWMA and Simple Correlation result between Lippo Karawaci and S&P 500

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

Lippo Karawaci daily return correlation in Figure 4-12 shows the typical reaction of less correlated during the pre-crisis which increased during and after the crisis. One thing to note here is that, contrary to the other stocks which experienced a drop just before day X of the crisis, Lippo Karawaci correlation seems to increase steadily nearing the crisis up to post-crisis period.

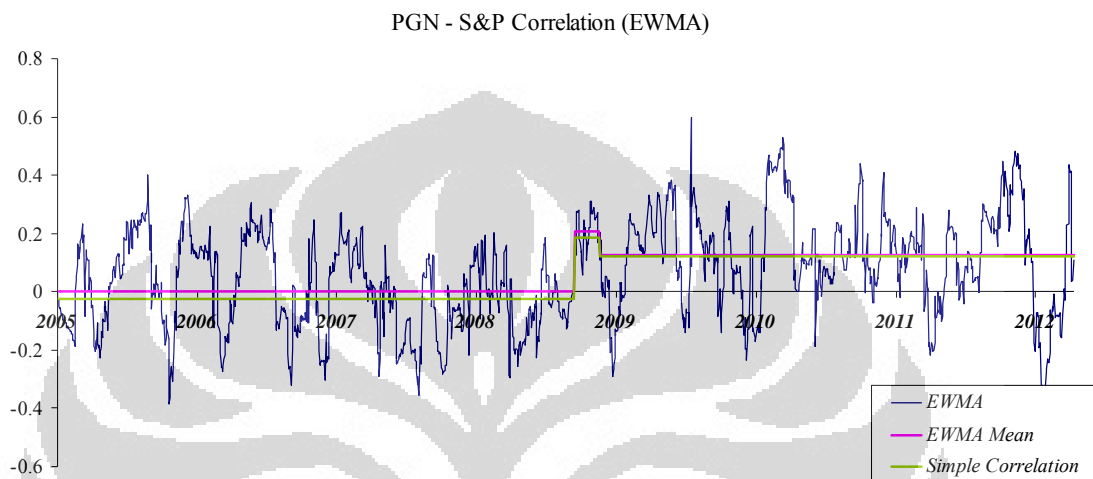


Figure 4-13 EWMA and Simple Correlation result between PGN and S&P 500

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

PGN, as commodity stock shown in Figure 4-13, similarly shows less negative correlations during the post-crisis period.

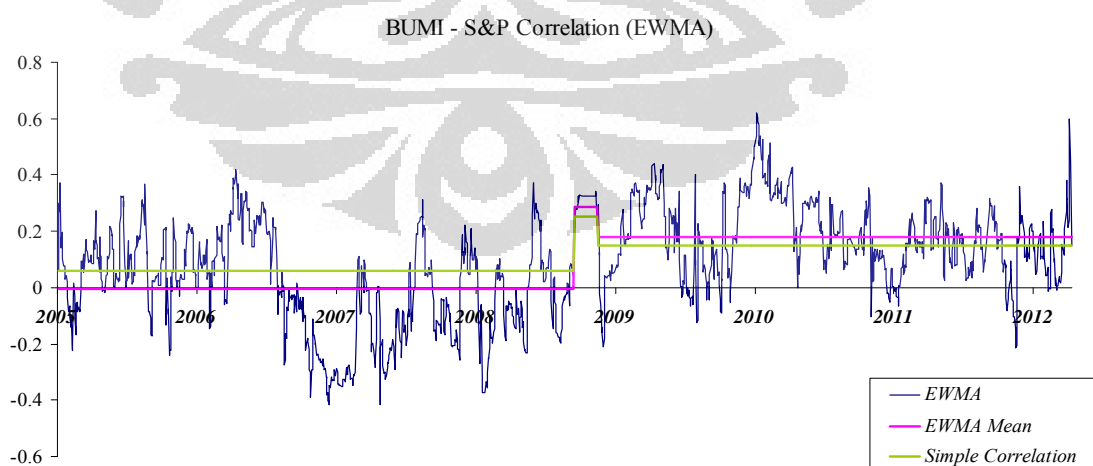


Figure 4-14 EWMA and Simple Correlation result between Bumi Resources and S&P 500

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

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Bumi Resources' correlation as shown in Figure 4-14, shows visible drop just before the crisis. This is similar to PGN earlier. Being commodity stocks, one can guess that this might be due to the increasing commodity prices during that period. In the post-crisis period, the typical mostly positive correlation is observed.

Generally, EWMA gives a lower correlation as compared to the simple correlation in the pre-crisis period and higher correlation in X+60 and the post-crisis period. Noting the nature of EWMA modeling, this signifies that the current events (at time t) are less correlated before the crisis as compared to after day X of the crisis i.e. taking note the past values (albeit a weighted one), the current position of the daily return (time t) is less or more correlated in the pre-crisis and after day X respectively.

4.5 OGARCH Result

The result of OGARCH is presented in the table 4-4. A general examination of the result shows that OGARCH result is consistent with simple correlation result at least in terms of signs and relatively close in magnitude. However, OGARCH results tend to be higher than the simple correlation result. OGARCH does not seem to fare as well during period X+60 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.

The graphs of OGARCH mean of OGARCH correlation, and simple correlation results are presented in the following Figure 4-15 to 4-24, it can be observed that the volatility of the correlation in the pre-crisis period seems to be less as compared to the post-crisis period. This is generally observed for all stocks, including the Jakarta stock index. More volatility in the post-crisis period is consistent with the study by Manda (2010). The study found that the stock market volatility, as measured by the volatility of S&P 500 Index, increased from 13.4% during the pre-crisis period to 43.6% during the Crisis (325% of pre-crisis

level). Also, even after the S&P 500 Index rebounded from its March 2009 lows, the market volatility reverted only to 20.9%, which is 156% of the pre-crisis level.

Table 4-4 Mean value of OGARCH correlation results between IHSG and selected stocks returns compared to S&P 500

	Pre-crisis	X+60	Post crisis
IHSG	0.0931	0.2345	0.3057
MANDIRI	0.0814	0.6024	0.1741
BNI	0.1448	0.6642	0.1739
BRI	0.0266	0.2324	0.1329
BCA	0.0512	0.2705	0.1408
JASAMARGA	-0.0203	0.3392	0.1218
BAKRIELAND	0.0704	0.2176	0.1344
LIPPO	-0.0123	-0.0338	0.1411
PGN	-0.0285	0.5637	0.1233
BUMI	0.0611	0.2438	0.1425

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

Also, comparing EWMA and OGARCH, it can be simply examined that the correlation results are less volatile with OGARCH as compared to EWMA.

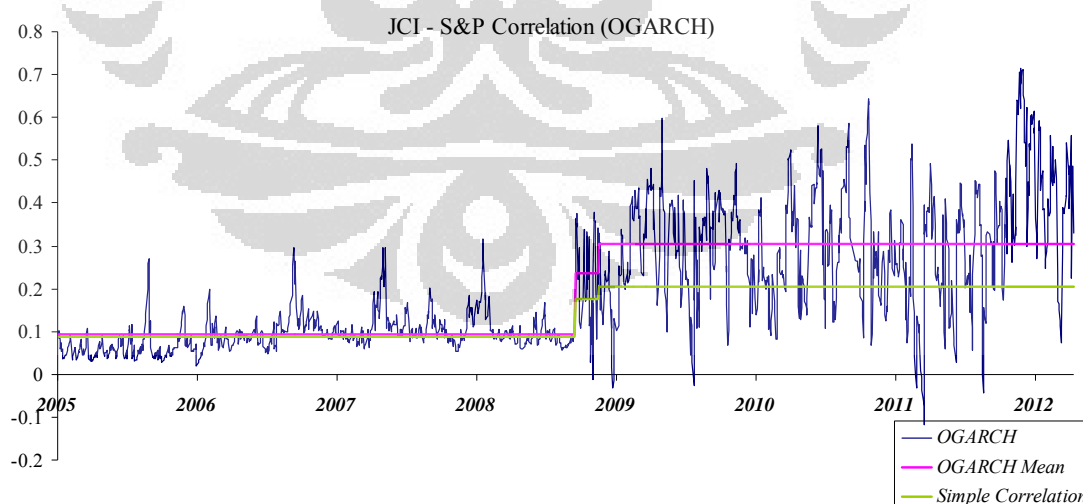


Figure 4-15 OGARCH and Simple Correlation result between IHSG and S&P 500

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

For the OGARCH correlation result for IHSB and S&P 500 as shown in Figure 4-15, it can be noted in terms of the volatility. The correlation is more volatile in the pre-crisis period as compared to the X+60 and post-crisis period. Despite that, the correlation still evidently increasing as it moves from 2005 to 2012.

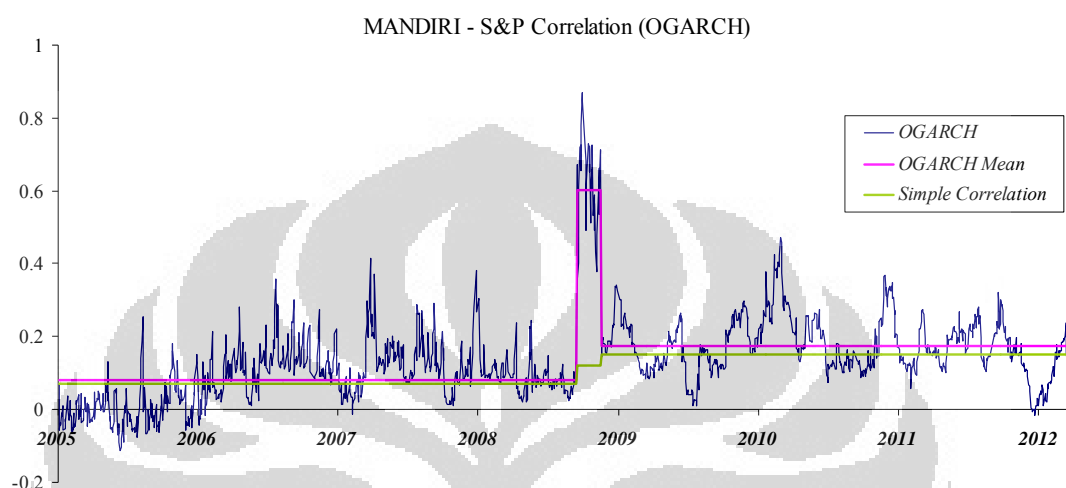


Figure 4-16 OGARCH and Simple Correlation result between Bank Mandiri and S&P 500

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

Figure 4-16 shows that the correlation of Bank Mandiri and S&P 500 increased drastically during the X+60 period. This might be due to the limitation of OGARCH as mentioned earlier. Nevertheless, the results of pre-crisis and post-crisis periods are consistent with the simple correlation result.

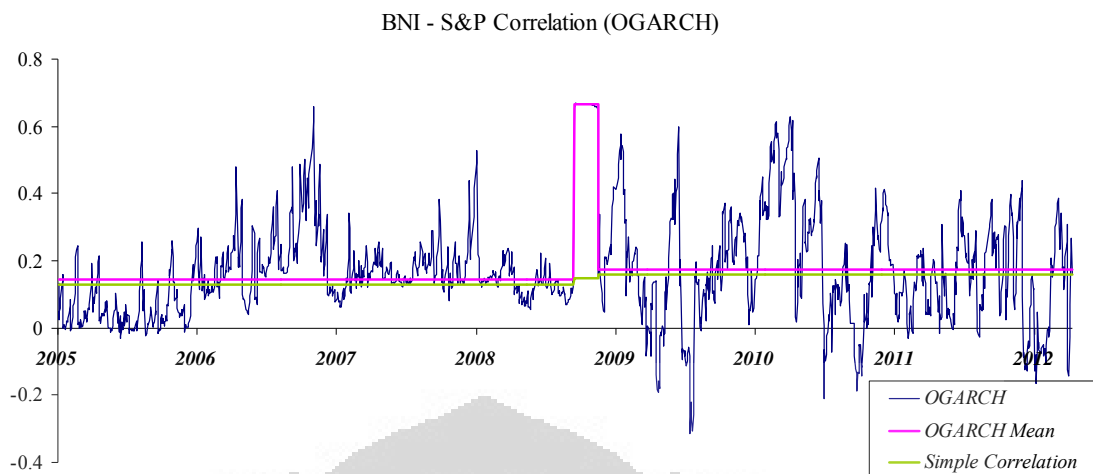


Figure 4-17 OGARCH and Simple Correlation result between BNI and S&P 500

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

Similar to IHSG, Figure 4-17 shows the increased not only mean and volatility during the post-crisis period as compared to the pre-crisis period. The X+60 period correlation shows a big overestimation as compared to the simple correlation which reinforces the earlier argument.

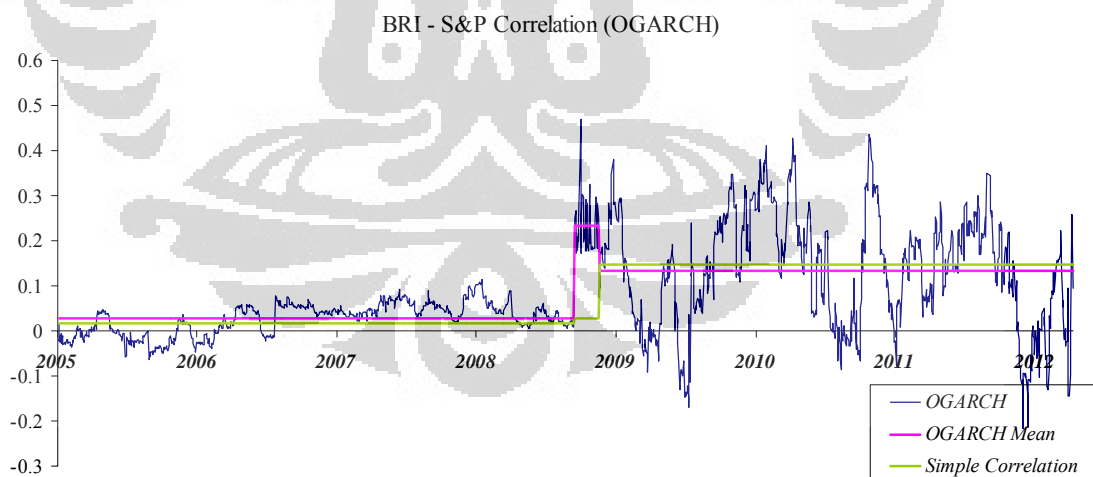


Figure 4-18 OGARCH and Simple Correlation result between BRI and S&P 500

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

Figure 4-18 again shows the higher volatility in the post-crisis period. Interestingly, the correlation is smaller as compared to the previous two

government-related banks especially in the pre-crisis period. Also, it can be observed that the correlation drops significantly at the end of 2011 to early 2012.

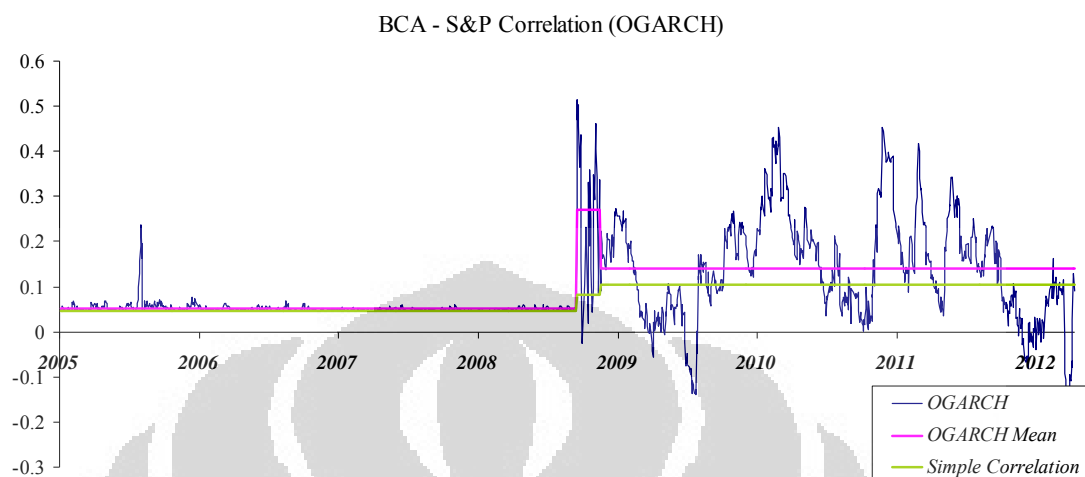


Figure 4-19 OGARCH and Simple Correlation result between BCA and S&P 500

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

Figure 4-19 shows that BCA and S&P 500 correlation which shows some similarities with the other three selected bank stocks. First, there was a drop in correlation between 2009 and 2010. Second, a similar drop is observed towards the end of 2011 and early 2012. This might possibly show the success of the fiscal and monetary policies in 2008 and another attempt in 2011.

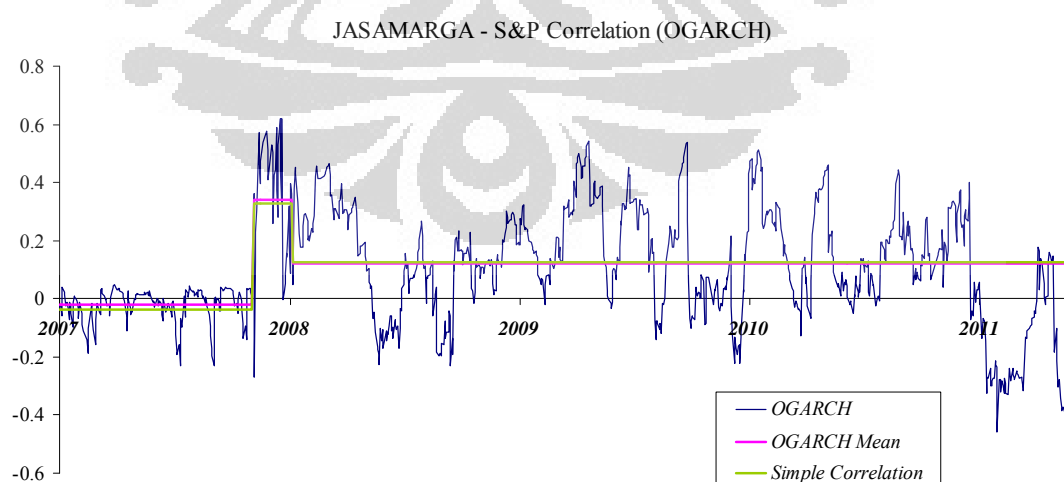


Figure 4-20 OGARCH and Simple Correlation result between Jasamarga and S&P 500

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

Figure 4-20 which shows the OGARCH correlation is consistent with the previous graph of EWMA (Figure 4-10) in the sense that Jasamarga's correlation is relatively less volatile as compared to the other stocks. This should be the case noting that the business is mainly focused on domestic.

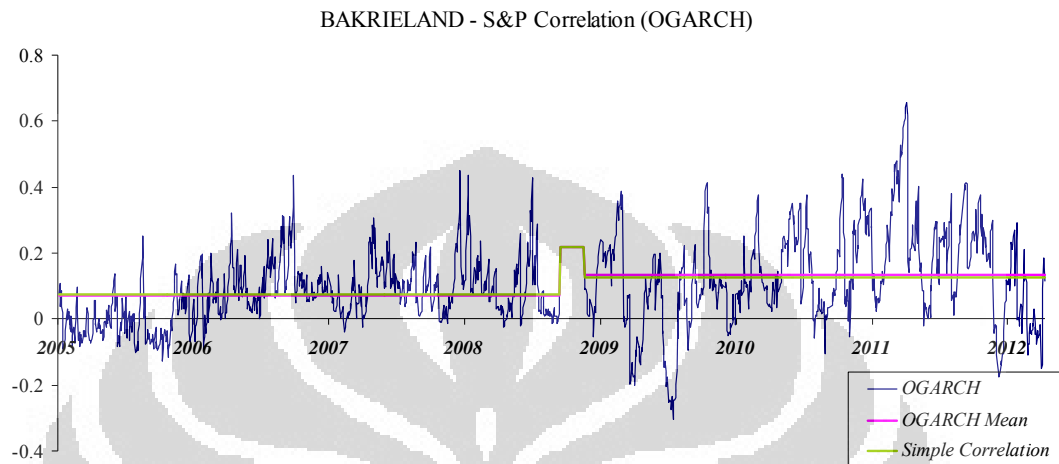


Figure 4-21 OGARCH and Simple Correlation result between Bakrieland and S&P 500

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

Bakrieland's OGARCH correlation in Figure 4-21 similarly shows how the volatility is higher during the post-crisis period. A point to note is that the maximum and minimum correlations occur during the post-crisis period, with the similar dip in the 2009 and end of 2011.

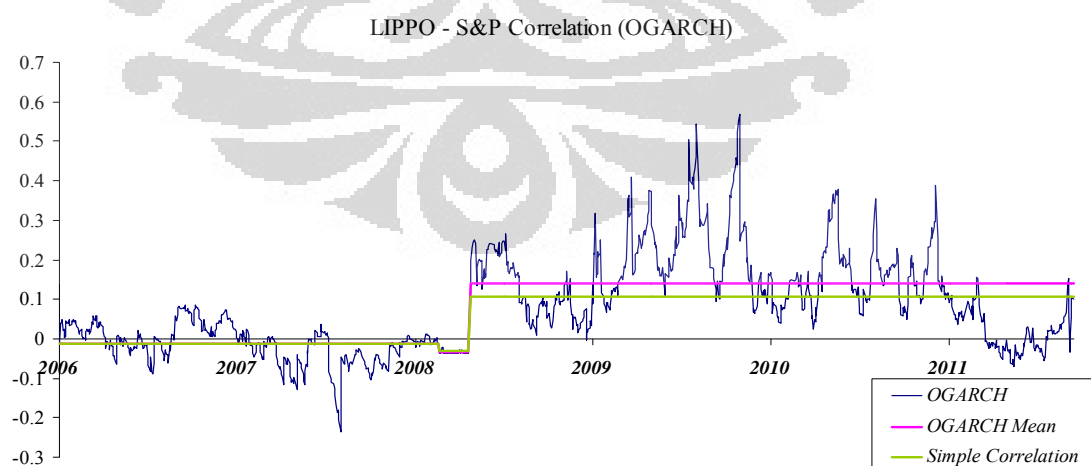


Figure 4-22 OGARCH and Simple Correlation result between Lippo Karawaci and S&P 500

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

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Comparing Lippo Karawaci and Bakrieland, Figure 4-22 shows a more muted response. The foreign shareholders' composition might explain this phenomenon, as shown in Table 1-1 earlier. However, it can be seen that some 'peaks' are observed during the post-crisis period which means that it did not escape the influence of crisis.

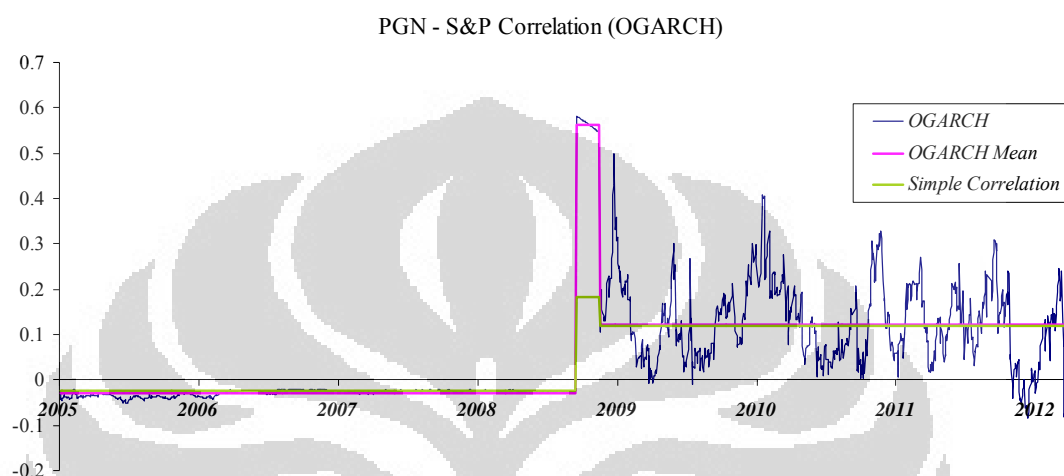


Figure 4-23 OGARCH and Simple Correlation result between PGN and S&P 500

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

Figure 4-23 shows a very steady negative correlation of PGN and S&P 500 during the pre-crisis period. This changes dramatically in the post-crisis period which the correlation increases in volatility but still positive except for the end of 2011 period.

Figure 4-24 shown below is another commodity stock – Bumi Resources, which is similar to PGN, has a very low volatility during the pre-crisis period for OGARCH correlation. This is apparent for both commodity stocks. In contrast with PGN, however, is how some 'dips' are observed in the post-crisis period.

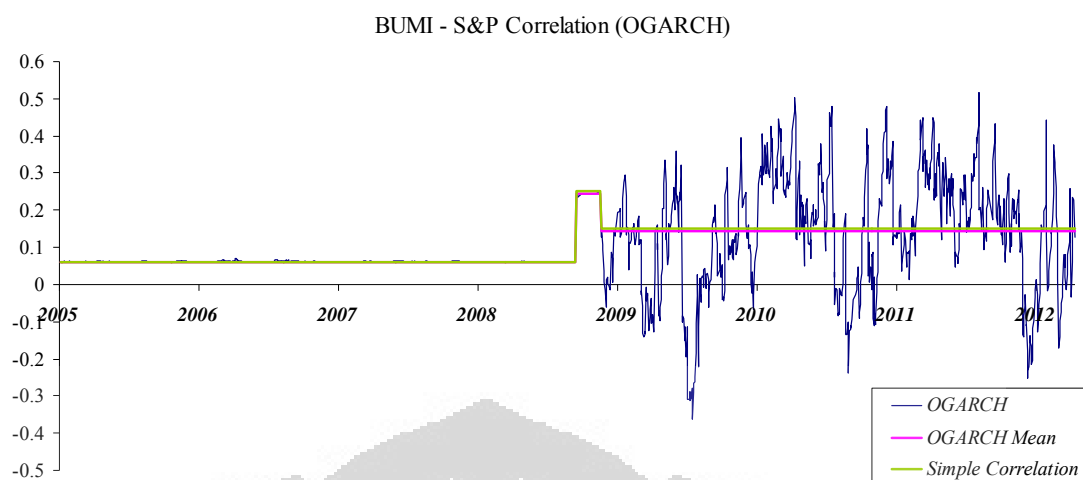


Figure 4-24 OGARCH and Simple Correlation result between Bumi Resources and S&P 500

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

4.6 DCC GARCH Result

The result of the mean of DCC GARCH correlations between the various selected stocks and IHSB is presented in the table 4-5.

The result using DCC GARCH method is relatively less volatile as compared to the other methods. In fact, some of the result of the correlations for each stocks and index for each periods only differs by the fifth decimal place. Thus, the graph below shows the mean of DCC GARCH correlation of IHSB and the selected stocks for each period.

Also, comparing Figure 4-4 and 4-25, it can be viewed that both results of simple correlation and DCC GARCH are consistent with each other. For most correlations, the DCC GARCH correlation is higher than the simple ones. An interesting observation is that the volatilities of the DCC GARCH correlations are observed mostly in the private/ non-governmental companies. This will be discussed in greater detail in the next section.

Table 4-5 Mean value of DCC GARCH correlation results between IHSG and selected stocks returns compared to S&P 500

	Pre-crisis	X+60	Post crisis
IHSG	0.0715	0.1764	0.2196
MANDIRI	0.0712	0.1296	0.1647
BNI	0.1370	0.1495	0.1751
BRI	0.0253	0.0443	0.1341
BCA	0.0290	0.1044	0.1094
JASAMARGA	-0.0155	0.3461	0.1361
BAKRIELAND	0.0671	0.2195	0.1567
LIPPO	-0.0364	-0.0224	0.1016
PGN	-0.0086	0.1884	0.1395
BUMI	0.0126	0.2560	0.1955

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

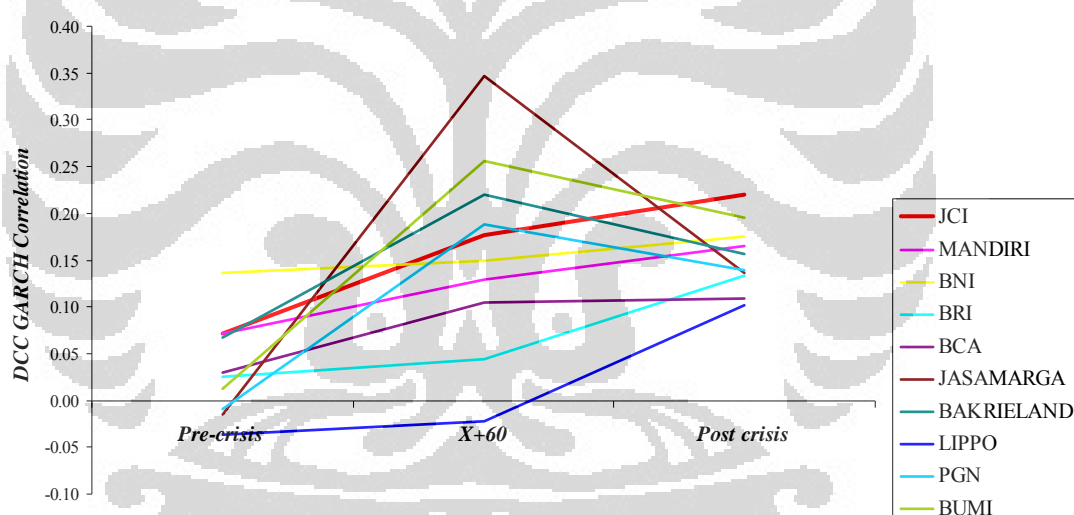


Figure 4-25 DCC GARCH correlation results between IHSG and selected stocks returns

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

4.7 Results Comparison

In this section, comparative analyses of results of the different methods are presented. In addition, this paper shall attempt to explain the variations and idiosyncrasies observed.

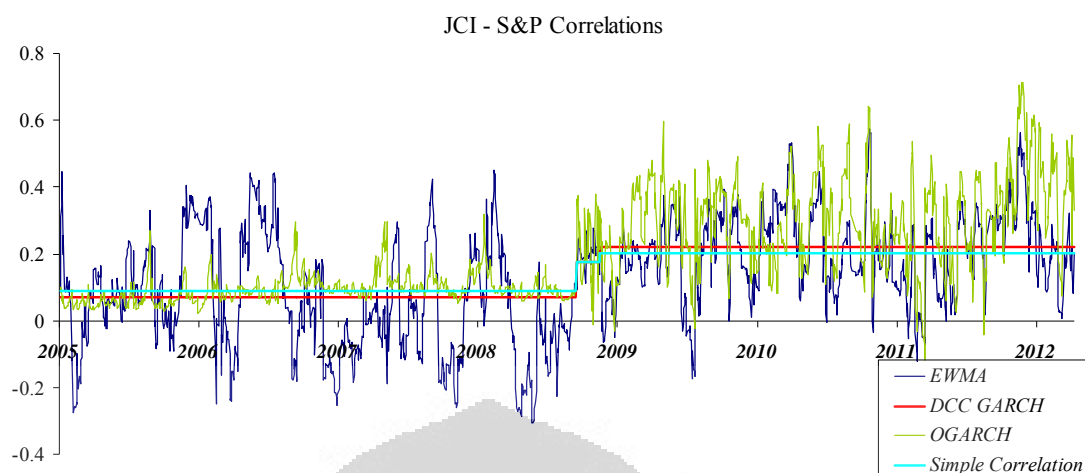


Figure 4-26 Correlation results between IHSG and S&P 500

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

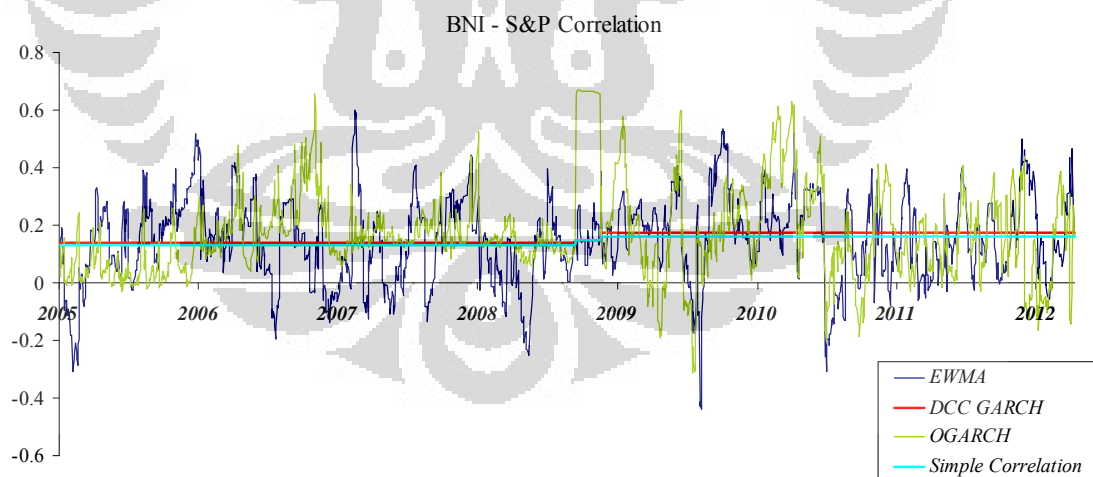
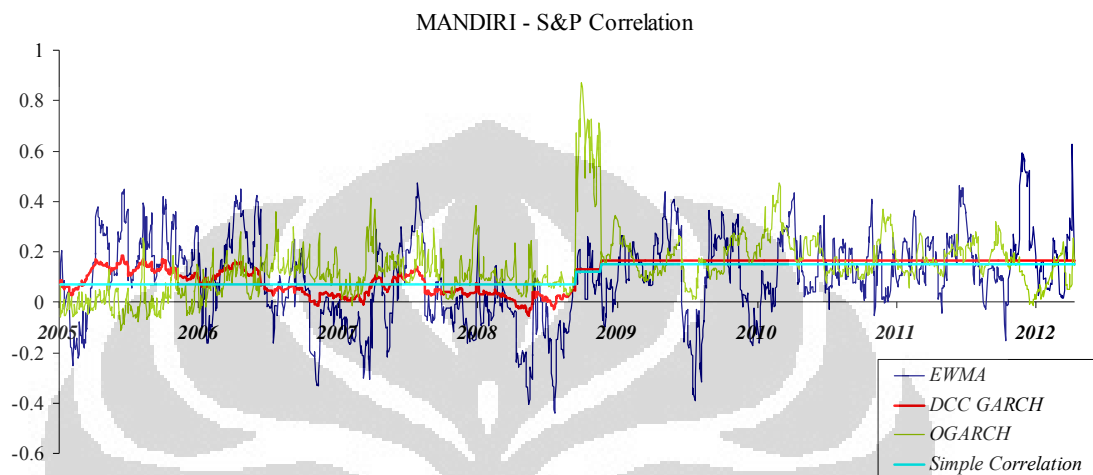
From the Figure 4 -26 above, the correlations for EWMA seem to be the most volatile. This is not surprising, as EWMA model captures the past data overreaction. The way covariance is calculated, as mentioned in chapter 3, by way of products of daily returns can drive the correlation down drastically if they are moving in different directions. The correlation of OGARCH and DCC GARCH are relatively more stable, in comparison, with OGARCH value having the higher mean correlation.

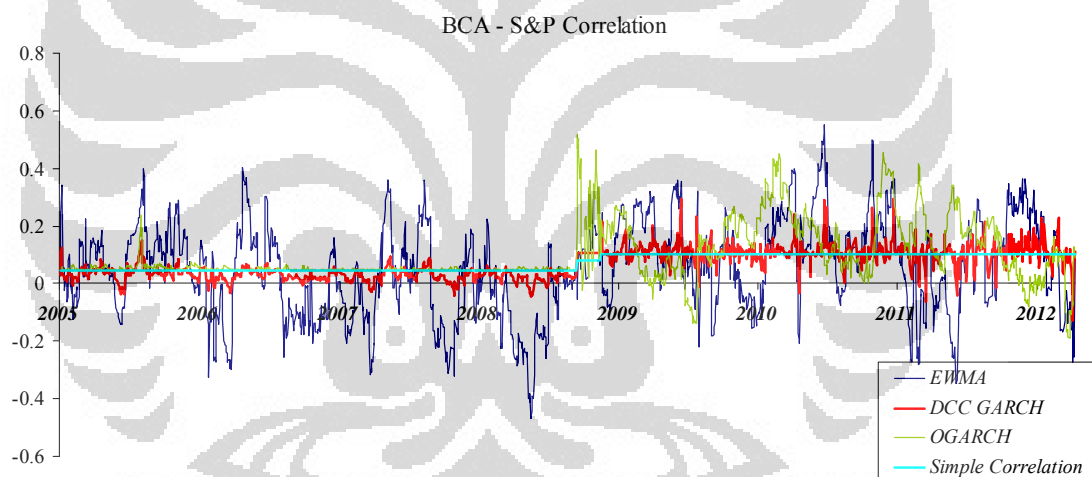
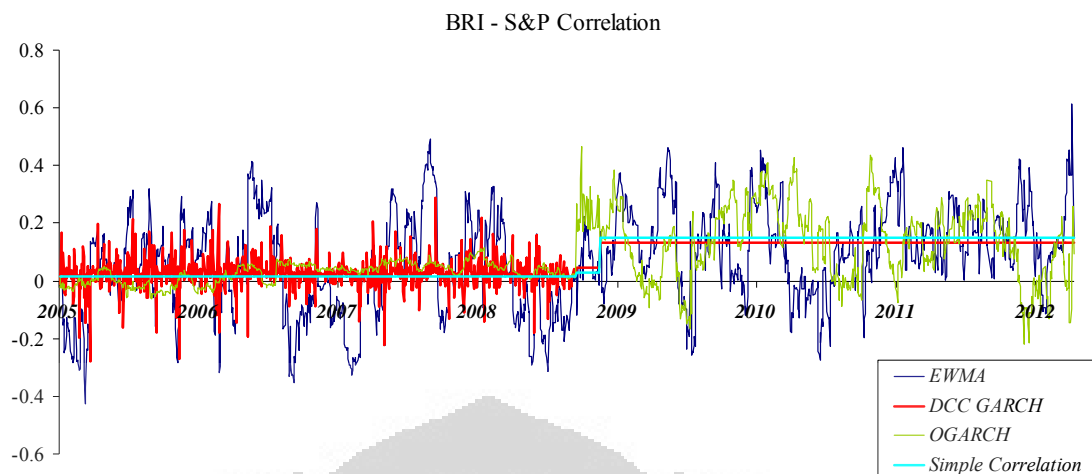
A consistent conclusion for all methods for the IHSG – S&P 500 index correlations is that the increased correlations from pre-crisis to post-crisis periods i.e. an evidence of contagion. The above graph shows that the correlations for all methods increased steadily. This evidence of correlation is presented 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.

From the financial industry, the Figure 4-27 to 4-30 below show the performance of each selected stock of financial institutions.





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 Rp 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.

Ignoring the some discrepancies of OGARCH correlations during the X+60 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 X+60 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 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 table below shows the 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) in a study by Titiheruw, Soesastro, and Atje (2009).

Table 4-6 Indonesia commercial banking performance

	Dec 07	Jan 08	Feb 08	Mar 08	Apr 08	May 08	Jun 08	Jul 08	Aug 08	Sep 08	Oct 08	Nov 08	Dec 08	Jan 09
CAR	19.30	21.60	21.00	20.52	19.39	18.26	17.58	17.44	17.10	17.26	16.70	16.77	16.76	17.82
ROA	2.78	3.16	2.93	2.72	2.56	2.62	2.53	2.68	2.71	2.64	2.68	2.60	2.33	2.69
LDR	66.32	67.06	67.89	70.66	71.65	72.80	73.89	76.00	79.02	77.72	77.48	77.60	74.58	73.76
NIM	5.70	5.70	5.56	5.64	5.60	5.60	5.65	5.69	5.73	5.73	5.69	5.65	5.66	5.56
NPL	4.07	4.24	4.21	3.75	3.82	3.76	3.54	3.50	3.42	3.32	3.34	3.49	3.20	3.59

Source: Bank Indonesia, various in Titiheruw, Soesastro, and Atje (2009) p. 12.

Hence, the performances of the commercial banks were not affected in the X+60 period as defined in this paper and a few months afterwards as well. This

further reinforces the evidence of contagion due to the excess correlation of the banks during the 2008 global crisis.

Besides the financial stocks, the selected LQ45 stocks included the stocks of infrastructure and real estates. 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 represents 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.

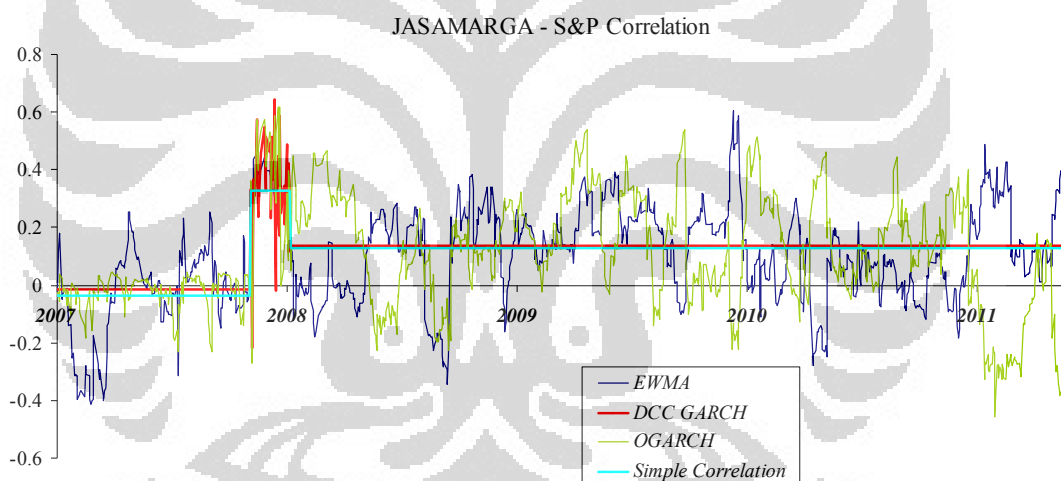


Figure 4-31 Correlation results between Jasamarga and S&P 500

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

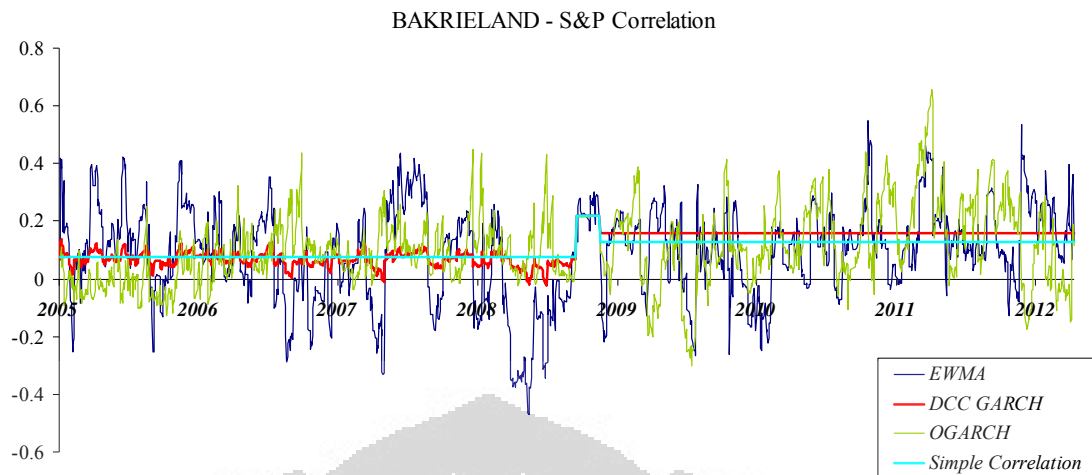


Figure 4-32 Correlation results between Bakrieland and S&P 500

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

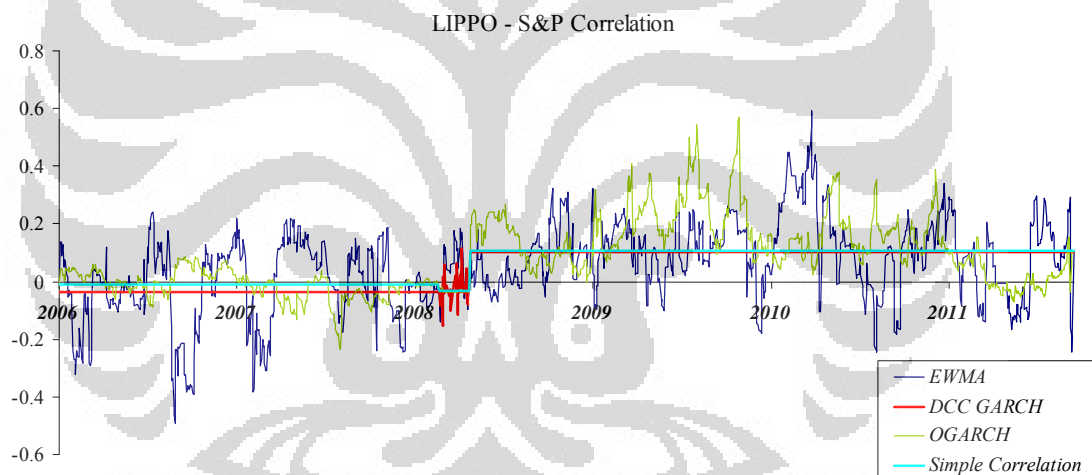


Figure 4-33 Correlation results between Lippo Karawaci and S&P 500

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

The first thing noticeable about the Figure 4-31 to 4-33 above is the negative correlation for the pre-crisis period for JASAMARGA and LIPPO stocks. However, it should be noted that the data of JASAMARGA and LIPPO start in November 2007 and July 2006 respectively.

JASAMARGA is 70% owned by the Indonesian government and is a company providing the service of infrastructure in Indonesia; specifically they are

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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 as shown in the company website (http://www.jasamarga.com/id_/hubungan-investor/ikhtisar-keuangan.html). 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 X+60 period increased quite significantly and dropped afterwards in the post-crisis period and remains positive. From table 4.1 shown earlier, it is observed that the greatest loss (-14.6%) during the analyzed period is during the X+60 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 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

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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.

The next figures show the selected stocks which are commodity/ energy based i.e. PGN and BUMI.

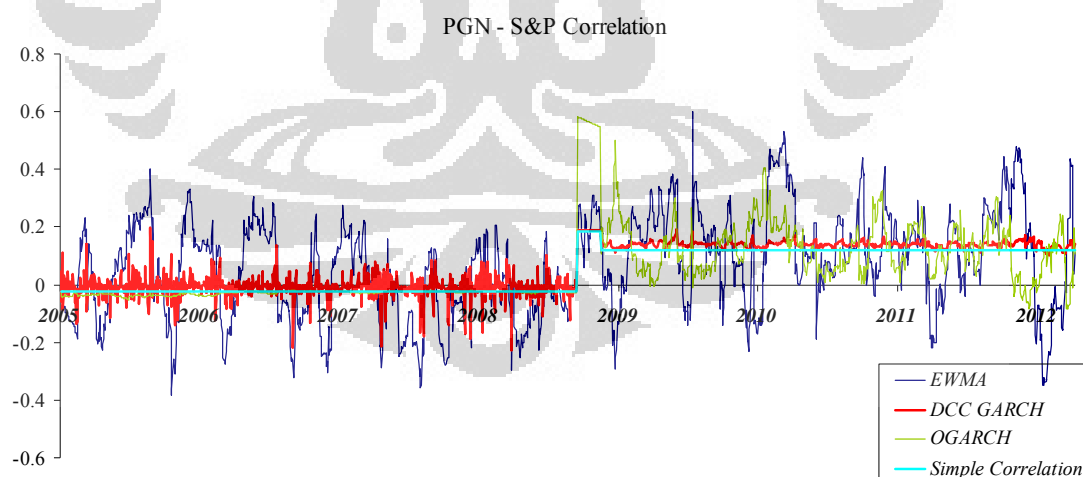


Figure 4-34 Correlation results between PGN and S&P 500

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

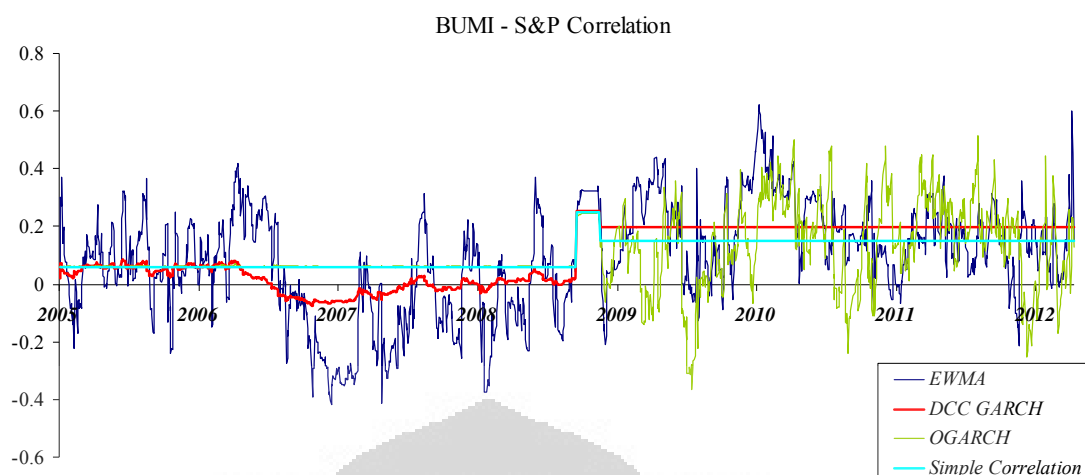


Figure 4-35 Correlation results between Bumi Resources and S&P 500

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

Again, for the purpose of the analysis, this paper chose two commodities/energy stocks which are government linked (PGN) and private (BUMI). 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 (-23.3%). However, it cannot be denied that the crisis is contagious even towards the commodity stocks as shown by the increased correlation.

BUMI, 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 (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 and PGN are comparatively more affected during the X+60 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.

Titiharuw, Soesastro, and Atje (2009) found that out of the 10 companies with the biggest market capitalisation 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.

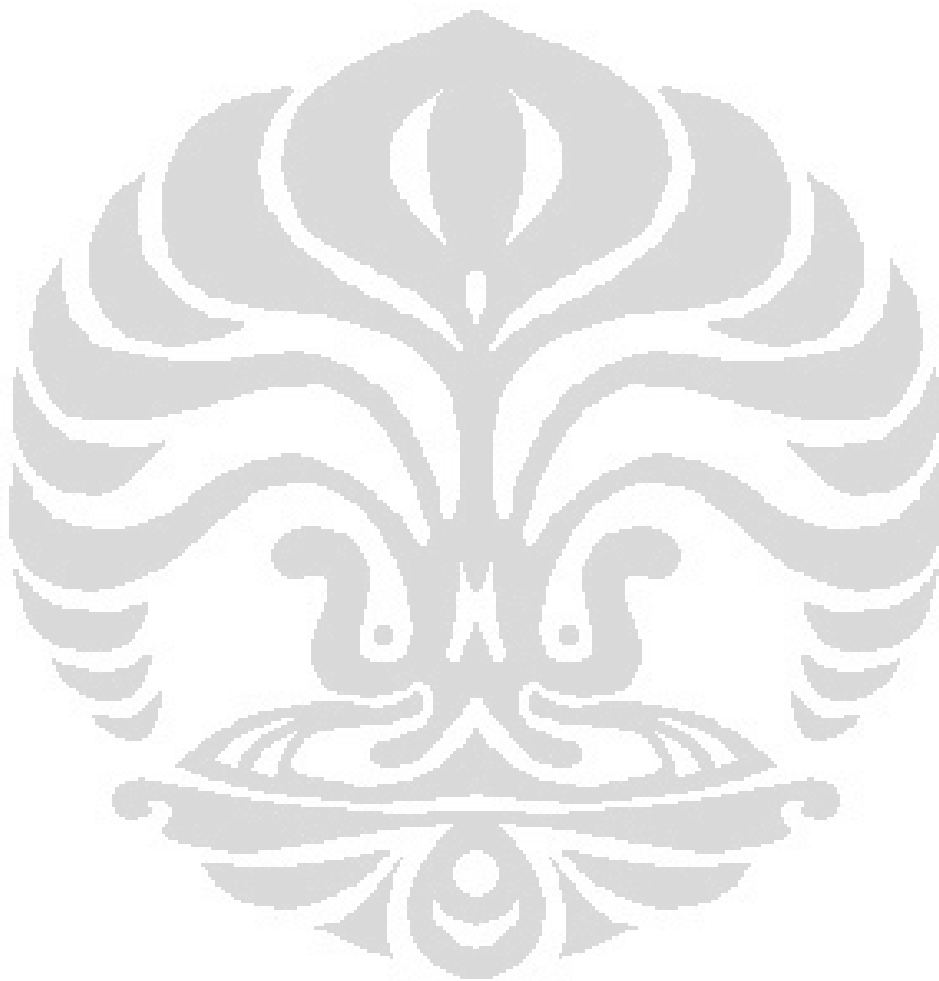
4.8 Decoupling or Lagged Response?

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 (Titiharuw, Soesastro, and Atje, 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.



CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

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.

5.1 Conclusions

Thus, attempting to answer the problems as identified in the first chapter, this paper suggests the followings:

1. Generally, the result shows that there is an increased interdependence between the 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 is 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 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".
2. 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, Soesastro, and Atje (2009).

3. 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.
4. 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, Hevia, and Schmukler, 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.

5.2 Recommendations

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 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 (Titiharuw, Soesastro, and Atje, 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. Titiharuw, Soesastro, and Atje (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.

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