**査読論文**

# Default Risk of Indonesian Government Bond

Edi TRIANTO *, OTAKE Toshitsugu **, MORISHITA Masaaki ***,
LIU Jung-Ching ****

**Abstract**

This paper is aimed at finding an explanation for fluctuation in Indonesian CDS spread during the period from January 2007 to July 2010. The analysis focuses on macroeconomic variables and market sentiment. For the purpose of selecting the variables and revealing relationships among them, the Symmetric Diagonal VECH GARCH model and the Granger causality test are conducted. The final model proposes that Indonesian credit risk fluctuation can be explained by variability of exchange rates and global market sentiment. It also suggests that financial shock from the developed countries was transmitted to the Indonesian economy in a direct way, resulting in changes to market sentiment, rather than from trade channels.

**Keywords**

Credit Risk, Credit Default Swap, Granger Causality Test, GARCH Model, Market Sentiment

* Edi TRIANTO
Analyst, Center of Policy Analysis and Harmonization, Indonesia's Ministry of Finance
Kementerian Keuangan, Gedung Djuanda I Lantai 5, Jalan Dr. Wahidin No.1, Jakarta 10710, Indonesia

** Correspondence to: OTAKE Toshitsugu
Professor, College of International Management, Ritsumeikan Asia Pacific University
1-1 Jumonjibaru, Beppu, Oita 874-8577, Japan
E-mail:totake@apu.ac.jp

*** MORISHITA Masaaki
Lecturer, College of Asian Pacific Studies, Ritsumeikan Asia Pacific University
1-1 Jumonjibaru, Beppu, Oita 874-8577, Japan

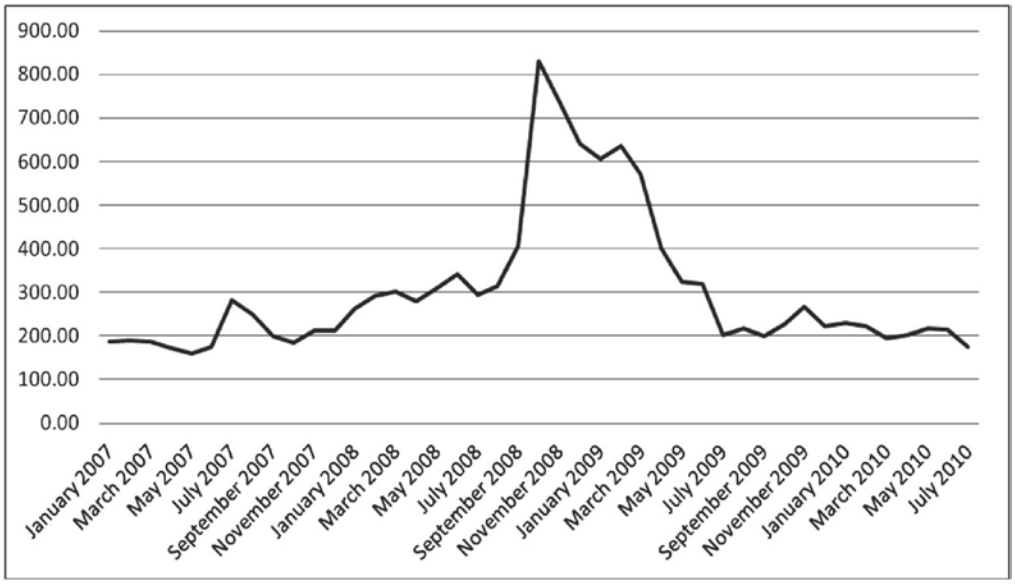
**** LIU Jung-Ching
Associate Professor, College of International Management, Ritsumeikan Asia Pacific University
1-1 Jumonjibaru, Beppu, Oita 874-8577, Japan

## 1. Introduction

Indonesia shifted its budget deficit financing strategy from the multilateral and bilateral foreign debt to the market financing debt in 2005. This strategy was introduced through bond issuance, both in the domestic and global markets. Accumulation of bond issuance from year to year arose many questions about Indonesia‘s ability to manage its debts, especially its ability to pay either the coupon or the principal for a bond. Such ability to pay off debts is reflected on the default risk of the bond issuer. Higher default risk of bonds issued would naturally be compensated by higher bond yield, because of the demand from the investors.

During the financial crisis in the year 2008, the Indonesian Government Bond Credit Default Swap, (CDS) spread - a relatively new derivative instrument – increased significantly comparing it from its levels in the year 2007 (Table1).

Table 1. Indonesian Credit Default Swap Premium: January 2007- July 2010 (basis points)




This instrument offers a pure measurement of default probability of a bond issuer. The CDS spread theoretically only deals with default risk (Beck, 2001; Benkert, 2004). Ericsson, Jacob & Oviedo (2004) also states that default swap spread does not need to be adjusted to reflect default risk since it is already a default risk premium. At the same time, there was a shock in the stock markets all over the world led by the shock in Wall

Street. The previous studies have confirmed that macroeconomic variables are significant in empirically explaining emerging market bond spread (Cantor & Packer, 1996; Amato & Luisi, 1996; Min, 1998; Eichengreen & Mody, 1998). Min (1998) divides explanatory variables of emerging bond spread into two categories: liquidity and solvency, and macroeconomic fundamentals. Beck (2001) argues that emerging market Eurobond spread after the Asian crisis can be almost completely explained by market expectation about macroeconomic fundamentals and international interest rates. Hilscher & Nosbuch (2010) investigate the effect of macroeconomic factors in sovereign risk. The importance of market sentiment for explaining CDS spread is examined by many scholars, amongst others Min (1998), Beck (2001), Norden & Weber (2009), Hilscher & Nosbuch (2010), Tang & Yan (2010), and Pires, Pereira & Martins (2010).

The best-known credit/default risk indicators are credit ratings and bond ratings, which would indicate credit worthiness and the ability of a bond issuer to pay its obligation (Jones, 2010b, p.35). The rating agencies such as Standard & Poor's put emphasis on order and rank of credit worthiness of bond issuers (Standard & Poor's, 2009). Following the financial crisis in 2008 the methodology they use to create credit ratings is questioned by many financial market players (Jones 2010b). Another credit risk indicator is Debt to Gross Domestic Product (GDP) ratio. Jones (2010a) emphasizes the argument that there is not a magic level of Debt to GDP ratio which can be used to predict debt crisis. Economic size, and growth prospect of the country, is considered as the most important elements in measuring government ability to collect taxes and minimize spending (Jones, 2010a p.395). Bond yield spread is another credit risk indicator which measures credit risk in comparison to a risk free instrument such as Treasury Bonds. However, the previous study has revealed that what makes those yields different is not mere default risk (Küçük, 2010).

In this paper, we investigate the role of macroeconomic variables in addition to market sentiment variables to explain variability of Indonesian CDS spread during January 2007 to July 2010 in order to identify credit and default risk in Indonesia. First, statistical tests are conducted so that variables significant enough to be included in the analysis could be identifies. Second, several macro economic variables are investigated using regression analysis to find their explanatory power of Indonesian CDS spread. Finally, macroeconomic variables and market sentiment are examined by means of regression analysis for us to measure their capacity to explain Indonesian CDS spread. Finally, both the macro variables and market sentiment are investigated simultaneously as

independent variables in regression analysis.

## 2. Variable Consideration

Most of the previous studies for credit risk employed panel data in order to analyze a general explanation of sovereign risk as summarized in Table 2 below.

Table 2. Independent Variables Used in Previous Studies

| Independent Variables | | Eichengreen & Mody (1998) | Min (1998) | Goldman Sachs (2000) | Beck (2001) | Abid & Naifar (2006) | Ismailescu (2010) |
|---|---|---|---|---|---|---|---|
| Macroeconomics / Fundamentals | Quarterly/ Annually | Debt/GNP | External Debt/GDP | External debt/ GDP | | | External Debt/GDP |
| | | Growth rate of GDP | International Reserves/GDP | | | | |
| | | | Current Account/GDP | Budget Balance | | | Government Deficit |
| | | | Growth rate of GDP | Real GDP Growth | | | |
| | Monthly | Debt Service/ Exports | Debt Service/ Exports | | Forecast for Current Acoount Deficit | | External Debt/Export |
| | | | Growth rate of Export | | | | |
| | | | Gowth rate of Imports | | | | |
| | | | Terms of Trade(Export/ Import) | | | | |
| | | | Net Foreign Assets | | | | Foreign Reserves |
| | | | Inflation | | Forecast for Inflation | | Inflation Rate |
| | | | Real Exchange Rate | Real exchange rate Misalignment | | | US Dollar Rate |
| | | | | | Forecast for Real GDP Growth | | |
| | | | | | | | Bond Spread |
| Additional | | Credit Rating Residual | | Opennes of the economy | | Rating | |
| | | | | Amortization/ Reserves | | | |
| | | International Interest Rate | International Interest Rate | Long-run LIBOR | LIBOR | Free Risk | Domestic Market |
| | | | | | | Interest Rate | Sentiment |
| | | | Real Oil Price | | | Time to Maturity | Credit Rating Events |
| | | | | | | Slope of the yield curve (long-short Interest rate) | Composite index of Polical risk |
| | | | | | Volatility index | Volatilities of Equities | |

Bond yield spread has been widely used as one of the credit risk indicators of a bond issuer (Eichengreen & Mody, 1998; Beck, 2001). Since bond spread basically measures credit risk of the bond issuer as well as CDS spread, their relationship is expected to be

positive. Wider bond spread intuitively should be accompanied by higher CDS spread and vice versa. Changes in the exchange rate give impact on many economic activities in one country. Revenue and cost for international trade depend heavily on fluctuation of exchange rates (Jones, 2010a). Since higher US Dollar exchange rates give a positive contribution to higher default risk, the expected sign of this variable in regression analysis is positive.

Export generates more money for the economy. Hence, it is expected that there will be a negative relationship between the value of export and default risk of one country. Import activities create cash flow out from the host country to others countries. As a consequence, the relationship between import value and a countries ability to pay its' debt obligation is expected to be in a positive relationship.

Higher foreign reserve levels show a higher ability to pay international financial obligations (Jones, 2010a). In regard to default risk of government bonds, the higher the level of foreign reserves is, the lower the level of default risk is. Consequently, CDS spread as a measure of default risk will be lower.

Inflation rate is one indicator which can be used to measure how well the economy of a country is managed (Jones, 2010a p.202). High inflation tends to show signs of inferior economic management. A positive relationship between the inflation rate and CDS spread can be expected to occur in a regression analysis.

Domestic market sentiment represents investor's sentiment to make investment in the domestic market by buying through local financial instruments. Related to Indonesian CDS spread, it is argued that this sentiment can be used to measure the direct impact of investors desire to invest in Indonesian financial instruments no matter whether they are corporate or government ones. Positive market sentiment is represented by positive changes in the Jakarta Stock Exchange Index, while negative market sentiment is represented by negative changes.

On the other hand, global market sentiment is measured by using developed stock market index changes. Since the United States leads the world financial market, the index changes there are used as a proxy for global market sentiment. The market sentiment represents global investors desire to invest their money in riskier financial instruments around the world. Positive market sentiment would be represented by positive changes in the US market index and vice versa. Therefore, Dow Jones Industrial Average Index is chosen to reflect global market sentiment as far as this paper is concerned.

## 3. Data and Methodology

Indonesian CDS spread data is obtained from Bloomberg. It is spread of a 10-year-contract of CDS span from January 1st 2007 to July 31st 2010. The Ministry of Finance in Indonesia started its financial reform especially in debt financing in 2005. It needs some time to manage the data so that a part of data we would like to use were available during that period. In addition, since our research tried to focus on volatility of CDS premium, especially during the finacial crisis in 2008, data approximately one year before and after the financial crisis will be sufficient.

Bond spread daily data and foreign reserves data are obtained from the central bank of Indonesia's website, www.bi.go.id. It is the daily yield spread of the Government of Indonesia's bond coded INDO'14. Daily data of US Dollar rate is gained from financial data in www. finance.yahoo.com. Monthly data for Indonesian export value in US Dollar, import value in US Dollar and inflation rates are gained from the Indonesia Statistics Agency's (*Badan Pusat Statistik*) website, www.bps.go.id.

Based on those data sets, the GARCH model, one of the econometric models designed to capture volatility clustering, is implemented. This model can capture a characteristic of financial time series, in which are followed by high volatility while low volatility is followed by low volatility (Seddighi, Lawyer & Katos, 2000; Alexander, 2008;Wang, 2009; Francq & Zakoïan, 2010).

Alexander (2008) argues that the GARCH error parameter $\alpha$ would measure how sensitive the conditional covariance is to market shocks. Higher $\alpha$ means that covariance is more sensitive to events in the market. How long the impact of market shock to conditional covariance persists will be measured by parameter $\beta$; higher $\beta$ value means that the impact of market shock to conditional covariance will persist for a longer time. The sum of $\alpha+ \beta$ determines the rate of convergence of the conditional volatility to the long-term average level. When $\alpha+ \beta$ is relatively large above 0.99 then the term structure of volatility forecast from the GARCH model is relatively flat. GARCH constant parameter $\omega$ together with sum of $\alpha+ \beta$ determines the level of the long term average volatility. When $\omega/(1-\alpha- \beta)$ is relatively large then the long-term volatility in the market is relatively high (Alexander, 2008 p.137). Covariance can be used to indicate a linear relationship of two variables. Positive value of covariance indicates a positive relationship between two variables and a negative value indicates the negative relationship. Bigger value indicates stronger linear relationship whether positive or negative (Anderson, Sweeney & Williams,

2011 p. 120).

As defined by Granger (1969), a variable X can be said to be causal of variable Y if past history of X is useful to predict the future state of variable Y over and above knowledge of the past history of Y itself. Granger causality then means a precedence where one time series variable changes before changes in another variable (Studenmund, 2011 p.416). To see if X Granger caused Y, this regression should be run:

$$Y_t=\beta_0+\beta_1 Y_{t-1}+\cdots+\beta_p Y_{t-p}+\alpha_1 X_{t-1}+\cdots+\alpha_p X_{t-p}+\varepsilon_t \quad (1)$$

Before conducting Granger Causality test, all variables included should be in stationary condition. To select appropriate lag length, Schwartz Information Criterion (SIC), which applies the most severe penalty to additional variables and offers a more consistent model, is used as the criterion. The objectives for the GARCH and Granger Causality models are to indicate or to find a better variable to be included in the regression model. Since they uses daily data, they give us a better indication about a relationship amongst variables. In our analysis we focused more on the relationship of the other variables with CDS. Also, the objectives for the regression models in our analysis is to find variable that can best explain variability of Indonesia CDS premium.

## 4. Empirical Result and Managerial Insight

In this section, we illustrate the empirical results and their managerial insights. The variables and acronyms we utilized are shown in Table 3 below:

Table 3. Model Variables and Acronyms

| | |
|---|---|
| CDS | 10 Year Indonesian CDS spreads in basis points |
| USD | Value of Indonesian Rupiah per 1 USD |
| B_SPREAD | Difference of 10 year Indonesian Government Bond yield from 10 Year US Treasury Bond yield in basis points |
| DJIA | Dow Jones Industrial Average Index |
| JKSE | Jakarta Stock Exchange Index/ Jakarta Composite Index |
| DJIACHNGS | Changes in Dow Jones Index ( $DJIA_t - DJIA_{t-1}$) |
| JKSECHNGS | Changes in Jakarta Stock Exchange Index ( $JKSE_t - JKSE_{t-1}$) |

First, the results of Symmetric Diagonal VECH GARCH Model are shown in Table 4 below.

Table 4. Result of Symmetric Diagonal VECH GARCH Model

| No. | | Variables | | $\omega$ (p-value) | A (p-value) | $\beta$ (p-value) |
|---|---|---|---|---|---|---|
| 1 | Variance | B_SPREAD | | 102.35 (0.0000) | 0.8421 (0.0000) | 0.0759 (0.0000) |
| 2 | Variance | CDS | | 46 (0.0000) | 0.8473 (0.0000) | 0.0701 (0.0002) |
| 3 | Variance | DJIA CHNGS | | 556 (0.0000) | 0.0698 (0.0000) | 0.9062 (0.0000) |
| 4 | Variance | JKSECHNGS | | 206 (0.0000) | 0.1721 (0.0000) | 0.6689 (0.0000) |
| 5 | Variance | USD | | 1278 (0.0000) | 0.8698 (0.0000) | 0.0558 (0.0010) |
| 6 | Covariance | CDS | B_SPREAD | -36.52 (0.0000) | 0.8406 (0.0000) | 0.0739 (0.0001) |
| 7 | Covariance | B_SPREAD | DJIA CHNGS | 485.38 (0.0000) | -0.2035 (0.0001) | 0.0817 (0.2639) |
| 8 | Covariance | B_SPREAD | JKSECHNGS | 3.38 (0.0127) | 0.0023 (0.2373) | 0.9503 (0.0000) |
| 9 | Covariance | B_SPREAD | USD | -113.11 (0.0000) | 0.8486 (0.0000) | 0.0699 (0.0001) |
| 10 | Covariance | CDS | DJIA CHNGS | -379.56 (0.0000) | -0.2077 (0.0000) | 0.0286 (0.7199) |
| 11 | Covariance | CDS | JKSECHNGS | -7.79 (0.0257) | 0.0035 (0.1666) | 0.9266 (0.0000) |
| 12 | Covariance | CDS | USD | 134.88 (0.0000) | 0.8455 (0.0000) | 0.0719 (0.0001) |
| 13 | Covariance | DJIA CHNGS | JKSECHNGS | 59.61 (0.3403) | -0.0013 (0.9171) | 0.9193 (0.0000) |
| 14 | Covariance | DJIA CHNGS | USD | -1307.91 (0.0000) | -0.199 (0.0001) | 0.0696 (0.3821) |
| 15 | Covariance | JKSECHNGS | USD | -77.38 (0.0000) | 0.0025 (0.5091) | 0.834 (0.0000) |

Competing variables in daily macroeconomic variables are B_SPREAD and US Dollar rates. It is shown that a constant parameter conditional covariance of B_SPREAD and CDS (-36.52) is lower than conditional covariance of US Dollar rates and CDS spread (134.88). Moreover, a parameter for market sensitivity ($\alpha$) of CDS and USD is higher than that of CDS and B_SPREAD. Therefore, conditional covariance of USD and CDS would suggest a stronger relationship rather than CDS and B_SPREAD. Since conditional covariance also implies a conditional correlation, USD would have a higher correlation with CDS. Hence, USD is a better variable to be included in regression analysis rather than B_SPREAD.

Also, the Granger Causality test result shows in Table 5 that changes in Dow Jones index *Granger causes* changes in Indonesian CDS spreads. On the other hand, changes in Jakarta stock exchange index *does not Granger causes* Indonesian CDS spreads. Changes in Dow Jones index *Granger causes* changes in Jakarta stock exchange index, so we assumed that it would not be good if we include both variables in regression model. Hence, market sentiment to explain Indonesian CDS Spreads will be represented only by

global market sentiment that changes in Dow Jones Industrial Average Index.

Table 5. Granger Causality Test Result

| Pairwise Granger Causality Tests<br>Sample: 1 860<br>Lags: 2 | | | |
|---|---|---|---|
| Null Hypothesis: | Obs | F-Statistic | Probability |
| DJIACHNGS does not Granger Cause CDSCHNGS | 858 | 5.26423 | 0.00534 |
| CDSCHNGS does not Granger Cause DJIACHNGS | | 0.27493 | 0.75969 |
| JKSECHNGS does not Granger Cause CDSCHNGS | 858 | 1.42554 | 0.24095 |
| CDSCHNGS does not Granger Cause JKSECHNGS | | 9.35002 | 9.6E-05 |
| JKSECHNGS does not Granger Cause DJIACHNGS | 858 | 1.51976 | 0.21936 |
| DJIACHNGS does not Granger Cause JKSECHNGS | | 6.26254 | 0.00200 |

Next, Table 6 shows the results of the conditional variance and covariance parameters based on symmetric Diagonal VECH model.

Table 6. Variance and Covariance matrix

| | **CDS** | **DJIACHNGS** | **JKSECHNGS** | **B_SPREAD** | **USD** |
|---|---|---|---|---|---|
| **CDS** | 42170.00 | -1954.339 | -910.233 | -55614.78 | 169641.2 |
| **DJIACHNGS** | -1954.339 | 27368.02 | 930.3497 | 2248.585 | -3602.196 |
| **JKSECHNGS** | -910.233 | 930.3497 | 1489.655 | 800.4125 | -935.018 |
| **B_SPREAD** | -55614.78 | 2248.585 | 800.4125 | 77918.10 | -245723.6 |
| **USD** | 169641.2 | -3602.196 | -935.018 | -245723.6 | 922707.0 |

The parameters of covariance of B_SPREAD and USD show a value higher than those of covariance of B_SPREAD and CDS and of covariance of USD and CDS. This result suggests that both variables in regression analysis should not be included at the same time because of a multicollinearity problem. While parameters of the conditional covariance comparison between B_SPREAD-CDS and USD-CDS can be made in a straightforward manner, those between CDS-DJIACHNGS and CDS-JKSECHNGS cannot. Insignificant parameters would make the comparison more difficult.

Thirdly, Wald test for each parameter is shown in Table 7. Dow Jones Industrial Average index can be used as an independent variable to explain Indonesian CDS. The result also reveals that Jakarta Stock Exchange index depends on CDS and Dow Jones Industrial Average index. However, based on the Granger causality tests it can be concluded that DJIACHNGS is better than JKSECHNGS as a variable to make a prediction of changes in Indonesian CDS spread.

Table 7. Block Exogeneity Wald Test Result

VAR Granger Causality/Block Exogeneity Wald Tests
Sample: 1 860
Included observations: 858

| Dependent variable: CDSCHNGS | | | |
|---|---|---|---|
| Excluded | Chi-sq | df | Prob. |
| DJIACHNGS | 10.357 | 2 | 0.006 |
| JKSECHNGS | 2.699 | 2 | 0.259 |
| All | 13.236 | 4 | 0.010 |
| **Dependent variable: DJIACHNGS** | | | |
| Excluded | Chi-sq | df | Prob. |
| CDSCHNGS | 0.152 | 2 | 0.927 |
| JKSECHNGS | 2.635 | 2 | 0.268 |
| All | 3.185 | 4 | 0.527 |
| **Dependent variable: JKSECHNGS** | | | |
| Excluded | Chi-sq | df | Prob. |
| CDSCHNGS | 17.745 | 2 | 0.000 |
| DJIACHNGS | 11.591 | 2 | 0.003 |
| All | 30.501 | 4 | 0 |

Fourthly, five macroeconomic variables are treated as independent variables in full regression analysis. Those independent variables include Foreign Reserves, Export, Import, Inflation rates, and US Dollar rates. A result of this regression analysis after backward elimination process is shown in Table 8. Severe multicollinearity of two variables is detected by unexpected sign of USD and high variance inflation factors for both USD and Bond Spread. Hence, the final regression model can be described as:

CDS = -1200.893 + 0.156 USD – 0.124 DJIA CHNGS (2)

Table 8. Regression Result

| | **Dependent Variable : Indonesian CDS spread** | | | | | |
|---|---|---|---|---|---|---|
| | **Coefficient** | | **Std. Coefficient** | **t-statistic** | **Sig.** | **VIF** |
| | **B** | **Std.Error** | | | | |
| **Constant** | -1200.893 | 132.644 | | -9.054 | 0 | |
| **USD** | 0.156 | 0.014 | 0.763 | 11.363 | 0 | 1.033 |
| **DJIA CHNGS** | -0.124 | 0.022 | -0.38 | -5.663 | 0 | 1.033 |

| | |
|---|---|
| N= 41 | |
| F-Test | 95.031 |
| Sig. | 0 |
| R | 0.911 |
| $R^2$ | 0.83 |
| Adjusted $R^2$ | 0.821 |
| Durbin-Watson | 1.318 |

Thus fluctuation of stock market index, usually affects the condition of a countries' economy. Jones (2010b pp.334-335) states that stock prices peak typically one year before economic recession. The Granger causality test reveals that changes in Indonesian CDS spread lead to changes in the Jakarta Stock Exchange index. Moreover, the test also confirms a claim that the information flows from developed stock markets to developing stock markets and not vice versa (Soydemir, 2000). The results also should be interpreted that during the sample period the global market sentiment influenced Indonesian CDS spread more than the domestic market sentiment did. Investors in the credit default swap market captured information from the shock in the United States stock market faster than they captured information from the Jakarta stock market. Hence, during the downturn of the United States economy, investors react fast to adjust risk calculation of emerging economies such as the Indonesian economy as reflected in the spread changes (Kim, Loretan & Remolona, 2010).

In this analysis, we used monthly data for the regression model because some macroeconomic data were available only in monthly basis, for example inflation and foreign reserves. To make them in the same level, we converted daily data, which were available for variable we used in the GARCH model, into monthly data by using monthly average .

Country specific fundamentals such as inflation and exports may play a less significant role in explaining bond spread than they did in the past (Mauro, Sussman & Yafeh, 2006 p.104). Analyzing the Indonesian economic resilience during the 2008 financial crisis, Patunru & Zetha (2010) and Siregar & Wiranto (2009) argued that the resilience of the Indonesian economy is caused by a huge domestic market and the fact that relatively, the Indonesian economy is less dependent on export for its' growth. Foreign reserves and import variables are statistically significant in explaining variability of Indonesian CDS spread before the market sentiment variable is included in regression analysis. This phenomenon suggests that variability of those variables is dominated by global market sentiment.

## 5. Summary and Conclusions

Higher US Dollar rate will make nominal amount of foreign currency denominated Indonesian bond, which mostly in US Dollar denomination, also increases. Hence, the problem is finding the cause of exchange rate fluctuation. It is argued that US Dollar rate

fluctuation can be seen from export and import activities, fluctuation in foreign investment, and additional supply of US Dollars from new debt. Since exports and imports did not significantly change during the sample period, the last two factors must have played a critical role. Fluctuation in foreign investment can be seen from decreases of a nominal amount in Indonesian domestic government bonds during September 2008 to March 2009. However, the situation changes again in year 2009 and after. The middle year period of 2009 was a turning point for foreign investment in Indonesia.

Another factor which influences the equilibrium of supply and demand of the United States Dollar in the Indonesian economy is government and private debt in foreign currency. In the year 2007, the Indonesian government started to issue global bonds. All these debts, which were in foreign currencies, helped the government increase the supply of US Dollars to the domestic Indonesian economy. There is a common shock that makes market sentiments change almost in the same direction in both stock markets and emerging credit default swap markets. This relation is intensified during volatile markets. The structure of Indonesian trade, especially of its exports, during the sample period suggests that the direct impact of changes in global market sentiment should have played a more significant role than indirect channels of trade was not an important factor in explaining fluctuation in credit risk indicators.

The Symmetric Diagonal VECH GARCH model has been conducted to reveal relationship amongst variables, and also to do variable selection using daily data. The result of the Granger causality test reveals empirically that changes in the Dow Jones Industrial Average index is a better variable to be used when explaining variability of Indonesian CDS spread. The final model shows that including market sentiment increases the explanatory power of macroeconomic variables in explaining variability of Indonesian CDS spread. The source of Indonesian credit risk then mainly comes from foreign exchange rates and changes in market sentiment. Therefore, the Government of Indonesia can manage its' credit risk by stabilizing the exchange rate. Especially during periods of negative market sentiment, the government needs to act fast in avoiding the Indonesian Rupiah depreciating severely. Central Bank may need to interfere the rate by conducting a market intervention. At the same time, while keeping good economic performance, the government needs to implement an early warning system in financial sector which monitors changes in market sentiment esepecially the negative one.

In further studies, we would like to explore other specific Asian countries such as Taiwan, China, Vietnam, and Thailand, rather than one specific country. Hence, the model

analyzed in this paper may not be applicable to explain CDS spread for any other countries. Moreover, the sample period used is a period dominated by the world financial crisis and its' following effects to markets. Further Research should explore whether the model obtained can be used to explain a longer period as a sample selection using other countries as well.

## REFERENCES


Abid, F. & Naifar, N. (2006). The Determinants of Credit Default Swap Rates: An Explanatory Study. *International Journal of Theoretical and Applied Finance, 9*(1).

Alesina, A., De Broeck, M., Prati, A., Tabellini, G., Obstfield, M. & Rebelo, S. (1992). Default Risk on Government Debt in OECD Countries. *Economic Policy, 7*(15).

Alexander, C. (2008). *Market Risk Analysis: Volume II, Practical Financial Econometrics.* West Sussex: John Wiley and Sons Ltd.

Alexander, C. & Kaeck, A. (2008). Regime Dependent Determinants of CDS Spread. *Journal of Banking & Finance, 32*, 1008–1021.

Amato, J.D. & Luisi, M. (2006). Macro Factors in Term Structure of Credit Spread. *Bank for International Settlement Working Paper No.203*.

Anderson, P.R.D., Silva, A.C. & Rubiano, A.V. (2010). Public Debt Management in Emerging Market Economies: Has This Time Been Different? *The World Bank, Policy Research Working Paper No.5399*.

Anderson, D.R., Sweeney, D.J. & Williams, T.A. (2011). *Essentials of Statistics for Business & Economics*, (6th ed.). Canada: South-Western Cengage Learning.

Arestis, P., Demetriades, P.O. & Luintel, K.B. (2001). Financial Development and Economic Growth: The role of Stock Market. *Journal of Money, Credit and Banking, 33(1)*, 16-41.

Beck, R. (2001). Do Country Fundamentals Explain Emerging Market Bond Spread? Center for Financial Studies, *Working Paper, 2001/02*.

Benkert, C. (2004). Explaining Credit Default Swap Premia. *The Journal of Futures Markets, 24(1)*, 71–92. doi: 10.1002/fut.10112

Bhaskaran, M. & Ghosh, R. (2010). Chapter 4: Impact and Policy responses: Indonesia, Philippines, and Thailand. In Kohli, H.S. & Sharma, A. (Ed.). *A Resilient Asia Amidst Global Financial Crisis: From Crisis Management to Global Leadership,* New Delhi: Asian Development Bank, Sage Publication.

Brooks, C. (2008). *Introductory Econometrics for Finance(2nd ed.)*. London: Cambridge

University Press.

Cantor, R. & Packer, F. (1996). Determinants and Impact of Sovereign Credit Ratings. *Federal Reserve Bank of New York Economic Review*.

Chisholm, A.M. (2010). *Derivatives Demystified: A Step-by-Step Guide to Forwards, Futures, Swaps and Options* (2nd Ed.). West Sussex: John Wiley and Sons Ltd, Publication.

Choi, J.J., Hauser, S. & Kopecky, K.J. (1999). Does the stock market predict real activity? Time series evidence from the G-7 countries. *Journal of Banking & Finance, 23,* 1771-1792.

Comincioli '95, B. (1996). The Stock Market as a Leading Indicator: An Application of Granger Causality. *The Park Place Economist,* 4.

Duffie, D. & Singleton, K.J. (2003). *Credit Risk: Pricing, Measurement, and Management.* New Jersey: Princeton University Press.

Eichengreen, B. & Mody, A. (1998). What Explains Changing Spread on Emerging Market Debt: Fundamentals or Market Sentiment? *The National Bureau of Economic Research (NBER) Working Paper No.6408*.

Ericsson, J., Jacobs, K., & Oviedo, R. (2009). The Determinants of Credit Default Swap Premia. *Journal of Financial and Quantitative Analysis, 44*, 109-132.

Forbes, K.J. & Rigobon, R. (2002). No Contagion, Only Interdependence: Measuring Stock Market Co-movements. *The Journal of Finance, LVII (5).*

Francq, C. & Zakoïan, J.M. (2010). *GARCH Models: Structure, Statistical Inference and Financial Applications.* West Sussex: John Wiley and Sons Ltd Publication.

Frank, N. & Hesse, H (2009). Financial Spillovers to Emerging Markets during the Global Financial Crisis. *International Monetary Fund Working Paper, WP/09/104.*

Goldman Sachs (2000). Introducing GS-ESS: A New Framework for Assessing Fair Value in Emerging Markets Hard-Currency Debt. *Goldman Sachs Global Economics Paper No.45.*

Granger, C.W.J. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica, 37(3),* 424-438.

Hilscher, J. & Nosbuch, Y. (2010). Determinants of Sovereign Risk: Macroeconomic Fundamentals and the Pricing of Sovereign Debt. *Review of Finance 14*, 235-262.

Ismailescu, I. (2010). The Reaction of Emerging Markets CDS spread to Sovereign Credit Rating Changes and Country Fundamentals. *Journal of Banking and Finance, December 2010*, 2861-2873.

Jones, C.I. (2010a). *Macro Economics: Economic Crisis Update. New York:* W.W Norton & Company.

Jones, C.P. (2010b). *Investment, Principles and Concepts, International Student Version* (11th

ed.). West Sussex: John Wiley & Son. Inc.

Kim, D.H., Loretan, M. & Remolona, E.M. (2010). Contagion and risk premia in the amplification of crisis: Evidence from Asian names in the global CDS market. *Journal of Asian Economics, 21*, 314–326.

Küçük, U.N. (2010). Non-default Component of Sovereign Emerging Market Yield Spread and its Determinants: Evidence from Credit Default Swap Market. *The Journal of Fixed Income, 19*, pp. 44-66.

Levine, R. & Zervos, S. (1998). Stock Markets, Banks and Economic Growth. *The American Economic Review, 88(3)*, 537-558.

Ludvigson , S.C. & Ng, S. (2009). Macro Factors in Bond Risk Premia. *The Society for Financial Studies.*

Mauro, P., Sussman, N. & Yafeh, Y. (2006.) *Emerging Markets and Financial Globalization: Sovereign Bond Spread in 1870-1913 and today.* New York: Oxford University Press.

Min, H.G. (1998). Determinants of Emerging Market Bond Spread: Do Economic Fundamentals Matter? *Policy Research Working Paper, The World Bank, Development Research Group.*

Norden, L. & Weber, M. (2009). The Co-movement of Credit Default Swap, Bond and Stock Markets: an Empirical Analysis. *European Financial Management, 15 (3)*, 529-562.

Packer, F. & Suthipongchai, C. (2003). Sovereign Credit Default Swaps. *Bank for International Settlement Quarterly Review.*

Partnoy, F. (2002). Overdependence on Credit Ratings was a Primary Cause of the crisis. In Evanoff, D.D., Hartmann, P. & Kaufman, G.G. (Ed.). *The First Credit Market Turmoil of the 21st Century, World Scientific Studies in International Economics* (Vol.10). Singapore: World Scientific Publishing Co. Pte. Ltd.

Patunru, A.A. & Zetha, E. (2010). Indonesia's Savior: Fiscal, Monetary, Trade, or Luck? *Policy Research Institute, Ministry of Finance Japan, Public Policy Review*, 6(4).

Pires, P., Pereira, J.P. & Martins, L.P. (2010). The Complete picture of CDS Spread: a Quantile Regression Approach. Available at SSRN: http://ssrn.com/abstract=1125265.

Siregar, R. & Wiranto, W. (2009). In the Midst of Global Financial Slow Down: the Indonesia Experience. *MPRA Paper No.19657*.

Seddighi, H.R., Lawler, K.A. & Katos, A.V. (2000). *Econometrics: A Practical Approach.* Routledge

Soydemir, G.E. (2000). International Transmission Mechanism of Stock Market Movements: Evidence from Emerging Equity Market, *University of Texas Pan American, USA, Journal of Forecasting, 19*, 149-176.

Standard & Poor's (2009). Ratings Direct on the Global Credit Portal, General Criteria: *Understanding Standard & Poor's Rating Definitions*, www.standardandpoors.com/ratingsdirect.

Studenmund, A.H. (2011). *Using Econometrics: A Practical Guide, International Edition* (6th ed.). Pearson.

Tang, D.Y. & Yan, H. (2010). Market conditions, default risk, and credit spread. *Journal of Banking and Finance (34)*.

Wang, P. (2009). *Financial Econometrics* (2nd ed.). New York: Routledge.