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FACTORS AFFECTING THE YELD CURVE FLUCTUATION OF INDONESIA GOVERNMENT BOND

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Abstract: *This study aims to analyzethe contributions of the factors that influence the movement of the yield curve of government securities (SUN) in Indonesia as integratedpaper of Sihombing et al. (2014).Fundingof Indonesian governmentcontinues to grow through the domestic bond market thatindicated by the issuance of bonds that tends to increase overtime since 2005. The conclusions on yield curve studies usually only imposedthe effect of macroeconomic fundamentals, such as interest rates, inflation, economic growth, money supply and the exchange rate. However, researches on the determinants of the yield curve beyond macroeconomic factors, especially in developing countries such as Indonesia is still limited. This study is using the Vector Error Correction Model (VECM), which is a restricted form of Vector Autoregressive (VAR) to analysis the contributions given by factors that affect the fluctuations of a yield curve.The findings of this study found that the movements of interest rates and stock indices contribute to slope fluctuations. Meanwhile, curvature fluctuations are contributed by the movement of interest rates. Finally, the movements of the exchange rate, inflation, foreign ownership and foreign reserves contribute significantly to the movement of level.*

Keywords: *Forecast Error, Variance Decomposition, Indonesia Government Bonds Macroeconomy, Yield Curve.*

INTRODUCTION

As an alternative source of financing in the current economic growth, the bond market plays very important role. The bond market can also support the government to improve access to financial services, reduce the cost of financial services, and increase the stability of the financial system, as well as providing long-term financing for infrastructure projects and corporations (Sihombing, et al. 2014). In fact, in 1997, the economic crisis in Asia has prompted the development of the domestic bond market need store duce the vulnerability from the uncertainty of exchange rate and maturity (Piesse et al. 2007). Funding of Indonesian government continues to grow through the domestic bond market as indicated by the trends

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in the market values of bond issuance. The values of government bond issuance continue to show a rising trend from year to year. The Compound Annual Growth Rate (CAGR) of outstanding government bonds stands at 13.04 percent per year and 29.23 percent per year for government bond issuance. This is one indication that the Government is serious about advancing the bond market in Indonesia. In fact, the government continuously issues series of bonds with various maturities that can be used as the benchmark for other bonds.

The typical bonds in Indonesia are owned largely by financial institutions, banks and non-banks alike, which place government bonds as assets that can yield capital gain and interest income. Furthermore, the financial institutions set the bonds as secondary reserve. If the banks anad other financial institutions face liquidity problems, the bonds can be sold or subjected to repo to meet their liquidity needs in treasury management. The correlation between bond yields and different maturities is called the term structure interest rate or yield curve (Martellini, 2003). The general guideline used by investors and market players to be able to monitor the development of portfolio values of government bonds at hand is to monitor the progress of the yield curve movement. Yield curve movement will affect the interest liabilities that are to be borne by the government over the issued bonds. For companies, the yield curve serves as a benchmark for issuance of bonds within the same period of time while for investors;the yield curve can serve as a reference for bond yield expectations or for measuring the performance of the bond portfolio at hand.

Bond investors use yield curve as a reference in predicting interest rate, determining bond prices and determining a strategy to generate more profit. On the other hand, monetary policy makers use yield curve to formulate policies on interest rate, conduct inflation targeting and maintain sustainable economic growth. Monetary policy tightening usually results in the entire yield curve shifting upward with faster strengthening of short-term yield. Yield Curve has been modeled in different ways, but the Nelson and Siegel model (1987) is the most commonly used by central banks across the world according to a survey conducted by Bank for International Settlements (1999). Yield curve is identified based on its three factors, namely slope, curvature and level. These factors represent the short-term, medium-term and long-term interest rates. Slope, curvature and level movements of Indonesian government securities (SUN) as shown in Figure 3above strongly inspire researches on Indonesian government securities (SUN) yield curve determinants.

Some studies have been conducted to identify the correlation between fundamental variables of the economy and the bond market. The research conducted by Ang and Piazzesi (2003) spearheaded researches on yield curve. Diebold et al. (2006), Hordahl et al. (2006), Diebold et al. (2006), Cherif and Kamoun (2007) have conducted researches on correlations between yield curve and macroeconomic

factors such as economic growth, inflation, exchange rate, etc. The results of their researches show that macro economy affects the movement of yield curve with different levels of significance for different yield terms. Researches on yield curve often focus only on the effects of macroeconomic fundamentals such as interest rate, inflation, economic growth, unemployment rate, and exchange rate, especially researches on yield curve in advanced countries. However, researches on yield curve in developing countries, especially Indonesia, are still rarely done. This research expands the researches conducted by Ang and Piazzesi (2003), Dewachter et al. (2006), Hordahl et al. (2006), Diebold et al. (2006), and Cherif and Kamoun (2007) by examining the effects of macroeconomic fundamentals, liquidity risk factor, external shock, and market risk. Comprehensive studies on the effects of of macroeconomic fundamentals, liquidity/solvency risk factor, external shock, and market risk have been conducted by Min (1998), Ferrucci (2003), Grandes (2007), Baldacci, Gupta and Mati (2008), Alexopoulou et al. (2010) and Gibson et al. (2012) who studied the yield spread of sovereign bonds. The purpose of this research is to analyze the contributions of factors influencing the yield curve movement of Government Securities (SUN) in Indonesia.

LITERATURE REVIEW

Several researches have been conducted to test the effects of yield curve and macroeconomic fundamentals, namely those by Cherif and Kamoun (2007), Dewachteret al. (2006), Diebold et al. (2006), Hordahlet al. (2006), Ang and Piazzesi (2003). Results of these researches show that macroeconomic factors affect the yield curve with different levels of significance for different maturities. Meanwhile, Cherif and Kamoun (2007) saw a dynamic correlation between the term structure interest rate and macroeconomic variables (GDP and inflation) for euro area using the Vector Auto Regression (VAR). This research uses Euro Interbank Offered Rate (Euribor) and zero-coupon yields with different terms to maturity from 1999 to 2006. The result of the research shows that there is a correlation between the effects of latent factors (level, slope and curvature) of a yield curve and macroeconomic variables. Furthermore, the level and slope of yield curve respond to changes in economic activities and monetary policy shocks.

Dewachteret al. (2006) tested the macroeconomic variables (output gap and inflation) and latent variables in a continuous time term structure model. This model is also used to study real interest rate policies using data output, inflation and term structure interest rate. The main purpose of this research was to identify the cause of term structure interest rate dynamics based on output gap and inflation. They made analysis using monthly data on United States zero coupon bonds of different maturities for the period of 1958 to 1998. Using the Vector Autoregressive (VAR)

model, they concluded thatmacroeconomic dynamics affect the term structure interest rate, but interest rate policies, inflation and economic activities do not affect the yield curve. Long-term interest rate or the level of term structure interest rate could not be explained by the observed macroeconomic variables. Yield curve is affected by risk premiums and excess returns from bonds at hand.

Diebold et al. (2006) estimated yield curve model using latent factors (level, slope and curvature) and macroeconomic variables (economic activities, inflation and monetary policies) from 1972 to 2000 by using the United States bonds. The main purpose of their research was to identify the cause and effect between macroeconomic variables and yield curve. Estimations were made using non-structural VAR representation and the results showed strong correlation between the macroeconomic variables and the future yield curve movements. However, it was found that yield curve does not necessarily affect the future macroeconomic variables. Furthermore, an expectation hypothesis occured in which yield curve can be used to predict the Fed's interest rate during a certain period. The term structure interest rate is affected by the macroeconomic variables in different ways, as was concluded by Hordahlet al. (2006). Their research had the purpose of examining the dynamic relationship between yield curve and risk premia in macroeconomic fundamentals such as inflation, economic activities and short-term interest rate policy. Using data on German bonds (1975 to 1998), it was concluded that monetary policy shock has strong effects on the short-term yield or slope compared to the long-term yield or level. Curvature or medium-term interest rate is affected by inflation and shocks in economic activities (output). Changes in inflation targets significantly affect long-term yield (level). This finding shows the role of premium risk dynamics in determining yield curve dynamics.

How do macroeconomic variables change bond prices and yield curve dynamics? This was the main focus of the research conducted by Ang and Piazzesi (2003), which purpose was to establish the term structure interest rate determinant model with inflation, economic growth and latent variables by using the Vector Auto Regression (VAR) method. This model was tested for the British bonds in 1952 – 2000. This research has concluded that macroeconomic factors play an important role in short-term and medium-term yields (slope and curvature) of a yield curve, whereas factors which cannot be observed affect the long-term yield (level). Inflation shock has the most profound effect on the yield curve's slope. Min (1998) analyzed the determining factors of yield spreads for bonds in US dollars in 11 developing countries from 1991 to 1995. The result concluded that the differences in yield spreads between the countries were determined by debt to GDP, reserves to GDP, debt service to export, export and import growth rate, inflation rate, net foreign asset, term of trade index and real exchange rate. Furthermore, the ability to access foreign market is highly determined by domestic fundamental factors, and therefore, developing countries intending to seek larger

access to international bond markets are strongly suggested to improve their macroeconomic fundamentals.

METHODOLOGY

This research is conducted using the monthly secondary data from July 2003 to September 2012. Data sources are obtained based on the information compiled and published by certain institutions. Secondary data come from Bank Indonesia, Indonesian Stock Exchange (IDX), Central Bureau of Statistics (BPS), Debt Management Office (DMO), and Bloomberg websites. In general, the data used in this research are summarized in Table 1.

Table 1
Types of Data, Symbols, Units and Data Sources

No.	*Type of Variable*	*Symbol*	*Unit*	*Data Source*
1.	Slope	SLOPE	Percent	Bloomberg and processed
2.	Curvature	CURVATURE	Percent	Bloomberg and processed
3.	Level	LEVEL	Percent	Bloomberg and processed
4.	Industrial Production Index	IPI	Nominal	Central Bureau of Statistics
5.	Consumer Price Index	CPI	Nominal	Central Bureau of Statistics
6.	Money supply	M1	Billion IDR	Bank of Indonesia
7.	IDR to USD exchange rate	KURS	IDR	Bank of Indonesia
8.	BIInterest Rate	BIR	Percent	Bank of Indonesia
9.	Jakarta Composite Index	JCI	Nominal	Indonesian Stock Exchange
10.	S&P Volatility Index	VIX	Nominal	Bloomberg
11.	World Oil Price	OIL	USD	Bloomberg
12.	The Fed rate	FFR	Percent	Bloomberg
13.	Foreign exchange reserve	CD	Billion USD	Bank of Indonesia
14.	Foreign participation in government bonds	FP	Trillion IDR	DMO

MODEL SPECIFICATIONS

The Vector Error Correction Model (VECM), which is a restricted form of Vector Autoregressive (VAR), will be used to study the contributions given by factors that affect the fluctuations of a yield curve. This additional restriction must be given since the form of data is non-stationary but cointegrated. When two or more variables in an equation in level data are non-stationary, there's a possibility of cointegration in the equation (Verbeek, 2000). If a cointegrating equation is found in the model that we use after a cointegration test is carried out, it is then recommended to include the cointegrating equation to the model used. Most time series data have I (1) or are stationary at the first difference. Therefore, to anticipate the loss of long-term information, this research will use the VECM model if the data used have I (1). The VECM would then make make use of the cointegration restriction information in its specifications, and thus is often referred to as the VAR design for non-stationary series with cointegration relationship. VECM specifications restrict the long-term relationship between endogenous variables so that the cointegration relationship becomes convergent by sparing short-term dynamics. The term 'cointegration' is also commonly referred to as 'error' due to the deviation from long-term equilibrium being corrected in multiple stages through a series of partial short-term adjustments. The VAR/VECM model is used in this study due to its ability in providing an analytical tool called Forecast Error Decomposition of Variance (FEDV), which is used to estimate the variance percentage contribution of each variable in the change of a certain variable. Generally, the VECM model used in this research refers to Verbeek (2000), which is expressed as follows:

$$\Delta Y_t = \sum_{i-1}^{k-1} \Gamma_t \Delta Y_{t-1} - \gamma \beta Y_{t-1} + \varepsilon_t \quad (1)$$

where:

Γ = short-term correlational coefficient

β = long-term correlational coefficient

γ = speed of adjustment

Y_t = endogenous variables used in the model

Variables used in the above model include Industrial Production Index (IPI), Consumer Price Index (CPI) and Money supply (M1), Rupiah to US Dollar exchange rate (KURS), Bank Indonesia Interest Rate (BIR), Jakarta Composite Index (JCI), S&P 500 Volatility Index (VIX), World Oil Price (OIL), Federal Reserve Interest Rate (FFR), Foreign exchange reserve (CD) and Foreign participation in government bonds (FP). Except for BIR and FIR, all of those variables are stated in natural logarithm form. Meanwhile, the yield curve components are calculated based on the formula used by Afonsodan Martins (2012), whis is as follows: Slope=

[(y_t (3)) - (y_t (120))], Curvature = [2 x (y_t (48)) - (y_t (3)) - (y_t (120))] , andLevel = y_t (120) with y_t representing yield.

RESULTS AND DISCUSSION

In this section we will analyze the contribution of liquidity risk/solvency risk, macroeconomic fundamentals, external factors (external shock), and market risk (market risk) in explaining the variability or fluctuations in the yield curve through variance decomposition (FEVD). FEVD simulation of each yield curve variable is projected for 50 time horizons. Forecasting using variance decomposition provides information on the percentage of the role or contribution of each of the variables used in the modelin the variability of a particular variable. In other words, variance decomposition examines the sources of fluctuations in a particular variable. The results of variance decomposition in predicting the contribution (in percentage) of each yield variable for 50 time horizons can be explained as follows:

1. Variance Decomposition of SLOPE

In the first period, the SLOPE variable gives the largest contribution, which amounts to 66.18 per cent, followed by BIR (17.17 percent), CPI (6.64 percent), CD (3.36 percent), and JCI (1.68 percent), in the fluctuations of SLOPE. But over time, in the long run, the contributions of SLOPE and CPI tend to decrease and them ovesare relatively constantin the range of 29 percentand 2.5 percent, respectively.

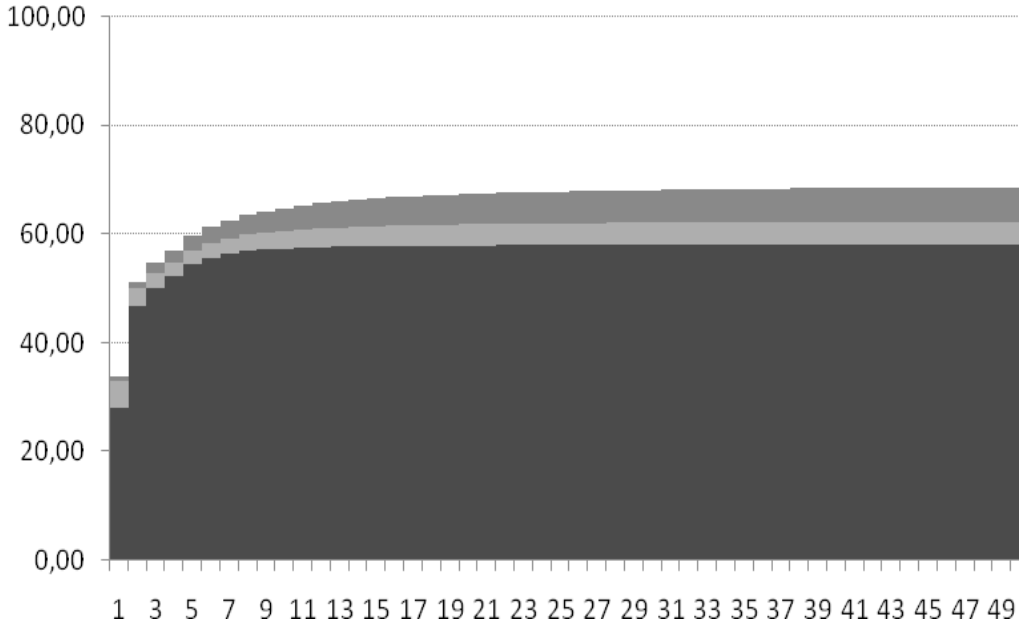
Table 2
Results of Variance Decomposition of SLOPE

Variance Decomposition of SLOPE:														
Period	SLOPE	CURVATURE	LEVEL	VIX	OIL	M1	KURS	JCI	IPI	FP	FFR	CPI	CD	BIR
1	66.17984	0.000000	0.000000	0.115434	0.273795	1.517438	0.963108	1.679131	0.084846	1.552635	0.465687	6.636180	3.357875	17.17403
2	47.07664	1.529645	0.274236	0.069158	0.738824	1.825972	7.555418	5.074253	1.342772	1.600348	0.260361	10.26748	1.742095	20.64279
3	43.90199	1.186529	0.240027	0.142242	1.331407	1.324000	7.399839	7.932346	1.522620	1.203044	0.385344	9.068330	1.553071	22.80921
4	41.85083	0.884578	0.291980	0.122409	1.719174	0.987091	7.529551	10.71242	1.140960	0.907823	0.324887	8.403506	1.740283	23.38451
5	39.18188	0.697256	0.500467	0.119955	2.043185	0.808503	7.832800	12.85965	0.951108	0.700695	0.382626	8.184575	1.947788	23.78951
10	33.36135	0.392898	1.460217	0.098339	3.810288	0.886494	7.748728	16.61058	0.480842	0.327670	0.290139	5.104533	2.905000	26.52292
15	31.11407	0.325335	2.012564	0.088009	4.783551	1.054435	7.596930	17.42393	0.330970	0.272384	0.244291	3.730278	3.385922	27.63733
20	30.04224	0.300248	2.299379	0.084562	5.277611	1.142530	7.503235	17.71609	0.264456	0.262700	0.217957	3.066537	3.630204	28.19225
25	29.43647	0.287063	2.464392	0.082917	5.560546	1.192271	7.447500	17.86786	0.227554	0.259752	0.202279	2.690352	3.770377	28.51066
30	29.05047	0.278784	2.569885	0.081918	5.741261	1.223847	7.411644	17.96290	0.204124	0.258196	0.192169	2.450470	3.859980	28.71435
40	28.58772	0.268881	2.696416	0.080732	5.957983	1.261649	7.368593	18.07650	0.176052	0.256394	0.180021	2.162844	3.967461	28.95876
50	28.32010	0.263155	2.769595	0.080046	6.083321	1.283506	7.343694	18.14218	0.159817	0.255355	0.172994	1.996498	4.029622	29.10012

The opposite is shown by the contributions of BIR and JCI which tend to increase in the long run to about 28.65 percent and 18 percent, respectively. Meanwhile, the contribution of CD to SLOPE fluctuations is relatively constant in

both short term and long term, around 3 percent. In the long term, the variables which contributions to SLOPE fluctuations are also relatively large are KURS (7.4 percent) and OIL (5.7 percent). Meanwhile, other variables such as CURVATURE, LEVEL, VIX, M1, IPI, FP, and FFR contribute only about 0-3 percent to SLOPE fluctuations in both short term and long term.

Figure 1:Variance Decomposition of Macroeconomic, Liquidity, External, and Market Risk Factors against SLOPE



The contribution of each factor to SLOPE fluctuations can also be seen by groups. In the first period, of the four factors, the macroeconomic factors give the largest contribution (28.05 percent), followed by liquidity factor (4.91 percent), and then followed by external factors and market risk factor at 0.74 percent and 0.12 percent, respectively. Meanwhile, the effect of the yield curve variable it self in the first period stands at 61.18 percent. But over time, in the long term, the contributions of external factors and macroeconomic factors move up to about 58 percent and 6.2 percent, respectively. In contrast, market risk factort ends to decrease to around 0.08 percent. Meanwhile, the liquidity factor is relatively table at around 4 percent, and the yield curve factor it self continues to decline to about 32 percent.

Based on the FEVD results above, itcan be seen that the macroeconomic factors contribute dominantly to the slope fluctuations compared to the three other factors

(see Figure 1). When observed in more detail, among these macroeconomic factors, interest rates and stock indexgive the largest contribution to the fluctuations in the slope. This suggests that the movement of the slope is more sensitive to the dynamics of interest rates and stock index. This is because changes in interest rates will be used as a reference for bond investors to invest in short term, while changes in the stock index as a proxy for risky assets will affect investors' portfolio rebalancing. In addition to these two indicators, the research also found that the slope factor itself also contributes significantly to the fluctuations of the slope (see Table 2). This means that slope fluctuations are explained by changes in the amount of coupon ofshort-term bonds.

2. Variance Decomposition of CURVATURE

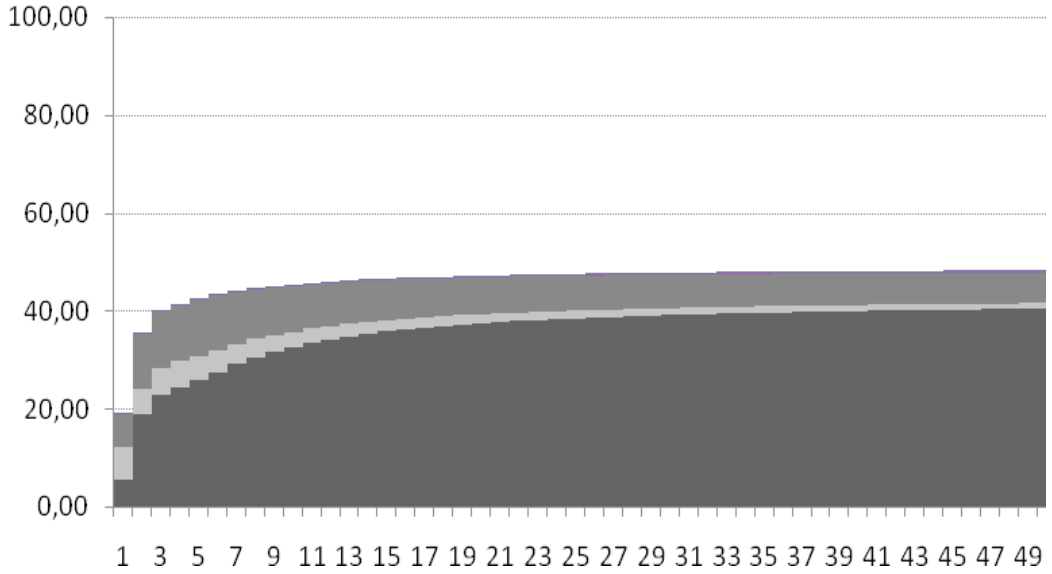
In the first period, the CURVATURE variable gives the largest contribution, which amounts to 55.18 percent, followed by SLOPE (25.62 percent), FP (4.81 percent), OIL (3.18 persen), FFR (2.96 percent), and BIR (2.12 percent), to CURVATURE fluctuations. But over time, in the long run, the contributions of CURVATURE, SLOPE, FPand OIL tend to decline and move relatively constant around 32 percent, 15 percent, 1 percent, and 1,2 percent, respectively.

Table 3
Result of Variance Decomposition of CURVATURE

Variance Decomposition of CURVATURE:														
Period	SLOPE	CURVATURE	LEVEL	VIX	OIL	M1	KURS	JCI	IPI	FP	FFR	CPI	CD	BIR
1	25.62562	55.18975	0.000000	0.008999	3.815464	0.606752	0.196243	0.484151	0.659028	4.814375	2.969506	1.376103	2.136851	2.117160
2	18.78094	45.23175	0.283026	0.018798	3.439502	0.318393	1.364517	0.247365	2.061026	3.865754	8.102083	8.062927	1.456855	6.767064
3	16.47986	43.02884	0.311497	0.084661	3.503311	0.242133	1.450927	0.187549	1.626831	3.794900	8.363263	7.773277	1.421362	11.73159
4	15.72805	42.40769	0.323582	0.092851	3.532045	0.190740	1.240472	0.228390	1.541838	4.038380	8.148913	6.163842	1.249995	15.11322
5	15.38389	41.27578	0.551067	0.094168	3.419525	0.173381	1.187927	0.246796	1.319116	3.841112	8.505405	5.230867	1.068138	17.70282
10	15.46644	36.90221	2.147281	0.236095	2.360384	0.095064	0.980430	0.250499	0.797613	2.548611	7.075728	2.839923	0.562077	27.73764
15	15.62520	34.83301	2.902326	0.299620	1.806345	0.069698	0.928505	0.244166	0.605189	1.908246	6.389659	1.920407	0.395060	32.07257
20	15.71414	33.73056	3.304543	0.334977	1.515945	0.056802	0.901895	0.242262	0.506117	1.570249	6.020691	1.452236	0.312759	34.33682
25	15.76826	33.06201	3.548483	0.356713	1.340307	0.048958	0.885709	0.241422	0.446164	1.365236	5.795782	1.169853	0.263314	35.70779
30	15.80442	32.61504	3.711568	0.371289	1.222914	0.043697	0.874857	0.240916	0.406059	1.228103	5.645224	0.981065	0.230259	36.62459
40	15.84972	32.05502	3.915896	0.389561	1.075831	0.037099	0.861248	0.240296	0.355794	1.056256	5.456541	0.744481	0.188828	37.77342
50	15.87696	31.71826	4.038766	0.400549	0.987382	0.033130	0.853064	0.239924	0.325567	0.952914	5.343075	0.602204	0.163912	38.46429

The opposite is shown by the contributions of FFR and BIR which tend to increase in the long run to about 5.4 percentand 38 percent, respectively. In the long term, the variable which contribution to CURVATURE fluctuations is also relatively large is LEVEL, with contribution amounting to about 4 percent. Meanwhile, other variables such as VIX, M1, EXCHANGE, JCI, IPI, and CD contribute only about 0-2 percent to CURVATURE fluctuationsin both short term and long term.

Figure 2: Variance Decomposition of Macroeconomic, Liquidity, External, and Market Risk Factors against CURVATURE



As with SLOPE, the contribution of each factor to CURVATURE fluctuations can also be seen by groups. In the first period, of the four factors, the liquidity factor contributes the most (6.95 percent), followed by external factors (6.78 percent), macroeconomic factors (5.44 percent) and market risk factors (0.01 percent). Meanwhile, the effect of the yield curve variable it self in the first period stands at 80.82 percent. But over time, in the long run, the contributions of macroeconomic factors and market risk factor move up to about 40 percent and 0.4 percent, respectively. The opposite is shown by external factors that tend to decline to about 6.4 percent. Meanwhile, the liquidity factor tends to decline to about 1.15 percent, and the yield curve factor it self continues to decline to around 51 percent. Macroeconomic factors contribute dominantly to curvature fluctuations compared to the three other factors (see Figure 2). From these macroeconomic factors, interest rates contribute the most to the curvature fluctuations. This also shows that curvature fluctuations are more sensitive to movements in interest rates. Like the previous case, changes in interest rates will be used as a reference for bond investors to invest in medium term. In this case, it was also found that curvature factor also contributes significantly to curvature fluctuations (see Table 3). This explains that curvature fluctuations are also affected by changes in the amount of coupon of medium-termbonds.

3. Variance Decomposition of LEVEL

In thefirst period, the LEVEL variable gives the largest contribution, which amounts to 24.4 percent, followed by KURS (21.99 percent), CD (21.15 percent), VIX, (4.78 percent), OIL (4.78 percent), JCI (4.71 percent), CPI (3.68 percent), FP (3.48 percent) and BIR (2.85 percent),to LEVEL fluctuations. Bu tover time, in the long run, the contributions of LEVEL, KURS, OIL, JCI tend to decline and move relatively constant around 11 percent, 10 percent, 0.4 percent, dan 1.6 percent, respectively.

Table 4
Results of Variance Decomposition of LEVEL

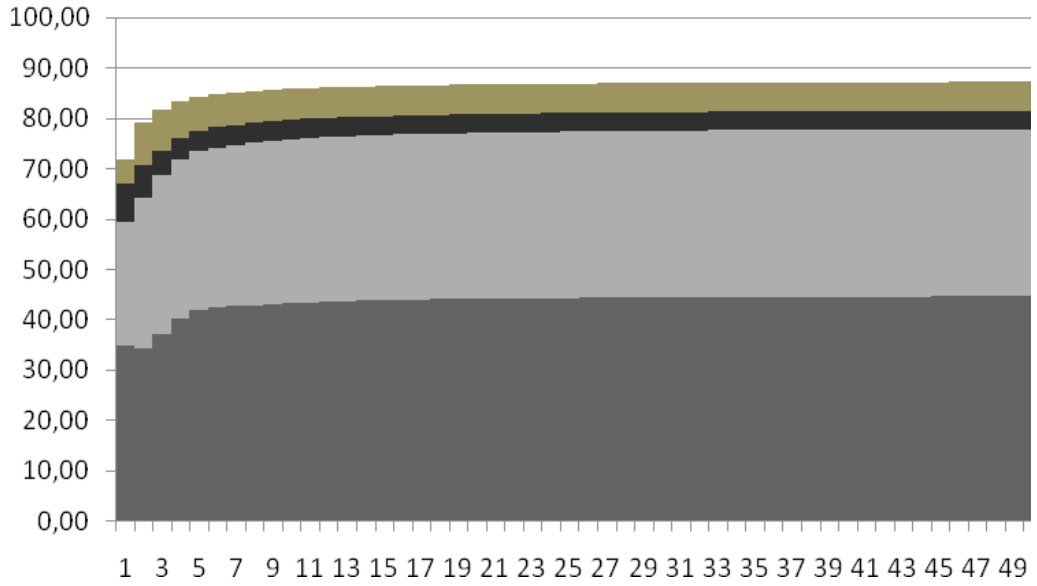
Variance Decomposition of LEVEL:														
Period	SLOPE	CURVATURE	LEVEL	VIX	OIL	M1	KURS	JCI	IPI	FP	FFR	CPI	CD	BIR
1	2.425652	1.265039	24.41762	4.861952	4.781525	0.049516	21.99351	4.710265	1.608940	3.487112	2.712198	3.687619	21.14530	2.853742
2	1.481155	0.533520	18.87106	8.511441	2.587259	0.864891	15.19991	5.245718	1.557531	3.021007	3.710537	5.728352	26.87480	5.812819
3	1.470898	0.733807	15.99853	8.163017	1.910687	1.589044	12.47474	4.857479	1.584470	4.315829	2.933896	9.959759	27.15627	6.851579
4	1.194659	0.931321	14.40703	7.400210	1.557685	1.657784	11.74858	3.974416	1.465299	5.814440	2.612303	14.24865	25.72305	7.264577
5	0.963921	0.970071	13.78514	6.795817	1.293146	1.643880	11.49049	3.299950	1.368495	7.054060	2.719075	16.57656	24.41642	7.622971
10	0.609545	0.881945	12.72267	6.137564	0.737055	1.787768	10.68746	2.272686	1.212701	9.462659	3.080128	19.28167	23.00864	8.117507
15	0.501748	0.862939	12.26506	5.954195	0.572789	1.885549	10.48153	1.911166	1.160674	10.23189	3.168441	20.24188	22.53586	8.226284
20	0.449079	0.853405	12.02603	5.865914	0.492610	1.940525	10.38655	1.728526	1.135161	10.61641	3.212111	20.72195	22.29991	8.271813
25	0.417540	0.847538	11.88093	5.813194	0.444644	1.974472	10.33074	1.618378	1.119952	10.84741	3.238359	21.01079	22.15812	8.297925
30	0.396460	0.843589	11.78374	5.777966	0.412596	1.997271	10.29360	1.544682	1.109808	11.00184	3.255898	21.20400	22.06332	8.315227
40	0.370021	0.838629	11.66180	5.733778	0.372403	2.025883	10.24705	1.452239	1.097092	11.19552	3.277890	21.44637	21.94442	8.336898
50	0.354107	0.835643	11.58840	5.707181	0.348210	2.043105	10.21903	1.396596	1.089438	11.31210	3.291126	21.59225	21.87286	8.349941

The opposite is shown by the contributions of CPI, FP, and BIR which tend to increase in the long run to about 21 percent, 10 percent and 8.2 percent, respectively. Meanwhile, the contribution of CD to LEVEL fluctuations tends to move relatively constant at around 22 percent, in both short term and long term. In the long term, the variable which contribution to LEVEL fluctuations is also relatively large is VIX, with contribution amounting to about 5.7 percent. Meanwhile, other variables such as SLOPE, CURVATURE, and M1 contribute only about 0-3 percent to LEVEL fluctuations in both short term and long term.

As with SLOPE and CURVATURE, the contribution of each factor to LEVEL fluctuations can also be seen by groups. In the first period, of the four factors, the macroeconomic factors contribute the most (34.90 percent), followed by liquidity factor (24.63 percent), external factors (7.49 percent) and market risk factor (4.86 percent). Meanwhile, the effect of the yield curve variable itself in the first period stands at 28.11 percent. But over time, in the long run, the contributions of macroeconomic factors and liquidity factormove up to about 44.4 percent and 33.33 percent, respectively. The same is also shown by the market risk factor that

tends to increase to about 5.8 percent. In contrast, the external factors and the yield curve factor tend to decline to around3.7 percent and 13 percent, respectively.

Figure 3: Variance Decomposition of Macroeconomic, Liquidity, External,and Market Risk Factors against LEVEL



Based on the FEVD results above, we can see that most of the fluctuations in levelare influenced by the dynamics of macroeconomic can dliquidity (Figure 3). When observed in more detail, exchange rate and inflation are the macroeconomic factors which contribute dominantly (see Table 4). The dynamics of exchange rate are quite dominant because changes in exchange rate can affect investors' risk premium, which in turn affects level fluctuations, while movement of inflation will affect the expectations of return earned by investors. This then leads to the movement of level. Meanwhile, the liquidity factors that contribute significantly to level fluctuations are foreign participation and foreign exchange reserves (see Table 4). Here, changes in the portion of foreign participation will affect the risk premium which then causes fluctuations in level. Meanwhile, the movement of foreign exchange reserves (which is a proxy of liquidity) would affect the country's ability to pay its obligations. This also leads to fluctuations in level.

CONCLUSION

This study found that the movements of interest rates and stock indices contribute dominantly to fluctuations in slope. Meanwhile, fluctuations in curvature are

more contributed by the movement of interest rates. Finally, the movements of exchange rate, inflation, portion of foreign ownership, and foreign exchange reserves significantly contribute to the level movement. Development financing policies that make use of government securities (SUN) causes the government bond market to grow significantly throughout the research period. This condition shows that investors already see the Indonesian economic fundamentals as getting better and investment risks in Indonesia therefore decrease from year to year. To the Government, as the economic authority, it is recommended that the issuance of government securities (SUN) is conducted by taking into account the economic needs to achieve a healthy and sustainable economic growth. Issuance of government bonds may take into consideration the inflation rate, Bank Indonesia interest rate, Rupiah exchange rate and foreign exchange reserve in order to obtain low cost of funds, and efficiency in government bond issuance could therefore be achieved.

An understanding of factors that affect the yield curve of government bonds is expected to serve as reference for the Government in creating policies to develop the Indonesian bond market by maintaining the stability of inflation rate, Bank Indonesia interest rate, Rupiah exchange rate and foreign exchange reserve. The Rupiah exchange rate and foreign exchange reserve are very effective ininfluencing investments and economic growth. In terms of fiscal policy,a government policy is required to balance the budget and increase foreign currency income so as not to hamper investment growth due to the high interest rate.Liability management policy and the use of value protectiontransactions can reduce the yield curve fluctuation risks of government securities (SUN). In order for the government bond investors to maximize profit over their investment, they must be able to respond to the fluctuations of bond prices in the market. The research shows that innovations in Bank Indonesia interest rates, inflation rates measured in the consumer price index, Rupiah to US Dollars exchange rates and foreign exchange reserves affect the prices of government bonds. Strategically, the act of selling short-term government bonds and purchasing medium-term government bonds upon receiving news regarding BI interest rate fluctuation is profitable. On the other hand, to generate profit from shocks to Rupiah exchange rates and foreign exchange reserves, investors must sell their long-term obligations upon receiving news on shocks to Rupiah exchange rates and foreign exchange reserves because profits will soon disappear. Investors may opt to purchase short-term government bonds and sell them within three months because the prices of long-term government bond can recover soon. However, risk taker investors may purchase long-term government bonds when Rupiah and foreign exchange reserves grow weaker in order to gain high yields.

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