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The macroeconomic factors affecting government bond yield in Indonesia, Malaysia, Thailand, and the Philippines

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THE MACROECONOMIC FACTORS AFFECTING GOVERNMENT BOND YIELD IN INDONESIA, MALAYSIA, THAILAND, AND THE PHILIPPINES

Abstract

The government bond (GB) has become the most attractive investment portfolio option, even though many macroeconomic factors affect the bond yield. This paper aims to investigate the determining factor of local currency government bond yield by considering the inflation rate, credit default swap, stock market index, exchange rate, and volatility index. This study used 240 data panel from the Bloomberg stock market in the form of data panel covering Southeast developing countries, namely Indonesia, Thailand, Malaysia, and the Philippines, for five years or sixty months from January 2015 to December 2019. Data analysis used recursive models and multivariate regression techniques using EViews software. The random effect model results revealed that change in the foreign exchange rate and volatility indexes affected, partially and simultaneously, the changes in the stock market index. The result also showed that changes in the stock market index, inflation rate, and credit default swap affected, partially and simultaneously, government bond yield changes. These results suggest that the government bond yield could be managed by controlling volatility index, foreign exchange rate, stock market index, inflation rates, and credit default swaps. This finding could provide an insight into the policymaker and fiscal authority on managing the risk of government bonds under control during high volatility or even making it reasonably lower. This result could contribute to the current research in the field of financial management.

Keywords inflation, monetary policy, financial market, stock market, international financial forecasting

JEL Classification C58, E44, F37

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INTRODUCTION

For many years, government bonds (GB) have been widely considered the most attractive options for some emerging economies to finance their fiscal deficits due to expansive fiscal policy during near-zero interest rates. This issue has also coincided with massive liquidity flows from global funds, looking for higher yields from riskier assets, and has been part of "the fourth wave of debt accumulation" (Kose, Nagle, Ohnsorge, & Sugawara, 2020). This phenomenon, on the other hand, has created a rapid hike in the sovereign bonds to gross domestic product (GDP) ratio in several countries, including those countries in the Association of Southeast Asian Nations (ASEAN) such as Indonesia, Malaysia, Thailand, and the Philippines (ASEAN-4). In recent decades, the issue of government bonds has been one of the significant interesting research subjects due to the government capital requirement, particularly for developing countries. There have been numerous studies on factors influencing the yield of local currency sovereign debt in emerging countries, covering from a single country to panel country studies and short-term to long-term determinants analysis. Some works suggest that government bond yield is influenced by monetary factors, macroeconomic indicators (expected inflation, exchange rates), and global factors

(volatility index). The above description has noticed that several macroeconomic factors influence Government Bond Yield (GBY). This study aims to investigate the determining factors of GBY in emerging markets by applying panel data regression using a sample of ASEAN-4 countries throughout 2015–2019. This research's originality is the research model, which will be applied to four ASEAN countries and a period of five years. This study's expected novelty is an econometric model that could be used as an approach to explain the influence of macroeconomic factors on the government bond yield (GBY). Apprehending what causes the movement of the GBY in emerging markets could provide useful policy recommendations for fiscal authorities to keep the risk premium during high volatility or even make it lower in benign circumstances.

1. LITERATURE REVIEW

Numerous studies have attempted to explain the relationship between foreign exchange rate (FX) and stock market index (INDEX), and there is a consensus that the foreign exchange rate and the stock market index have a significant relationship. Lin (2012) found that the crisis period and quiet period as a comparison show an effect of the exchange rate on stock prices, wherein the influence of the crisis period is more substantial. A similar study by A. Sensoy, Sobaci, S. Sensoy, and Alali (2014) found a two-way interaction between the exchange rate and stock prices, especially in the post-crisis period. In contrast to the results of Lin's (2012) and Sensoy et al.'s (2014) research, Chkili and Nguyen (2014) concluded that during periods of calm and turmoil, the INDEX had a more considerable influence on the FX. Besides, Kumar (2013) also concluded that there is a two-way interaction between FX and the INDEX related to returns in India, Brazil, and South Africa. Tsagkanos and Siriopoulos (2013) in the European Union (EU) and the United States of America (USA) also concluded that there is a causal relationship between stock prices and exchange rates.

Meanwhile, Tsai (2012), who examined the Asian market, concluded a negative relationship between the stock market index and foreign exchange rate. In contrast to previous studies, this study takes data in Southeast Asia to confirm the relationship between foreign exchange rate and stock market indices in Southeast Asia, namely in Indonesia, Thailand, the Philippines, and Malaysia. Hence, the following first hypothesis is proposed.

H1: The foreign exchange rate affects the stock market index.

On the macroeconomic factor, the volatility index, various studies have investigated the effect of volatility indexes and the stock market in recent years. Bekaert and Hoerova (2014) concluded that the volatility index (VIX) has a negative effect on excess return. Furthermore, Shaikh and Padhi (2014) also concluded a long-term relationship between volatility index and stock market returns, while Rosillo, Giner, and de la Fuente's (2014) findings show that in the bearish period, the effect of the volatility index is very significant. The studies related to the VIX in the stock markets in various countries have also been conducted. Besides, Sarwar (2012) shows a strong relationship between VIX in the USA stock market returns, as is the case with China and India, the more volatile the market, the effect of the volatility index on stock returns is higher than others. Also, Mensi, Hammoudeh, Reboredo, and Nguyen (2014) also concluded that the Chicago Board Options Exchange (CBOE) Volatility Index and global commodities affect the stock index of Brazil, Russia, India, China, and South Africa (BRICS members). During the research on European stock markets, Chang, Hsieh, and McAleer (2016) concluded that the volatility index had a very significant effect on European Exchange Traded Fund (ETF) returns and Standard and Poor's (S&P) 500 returns. This study takes data in Southeast Asia to confirm the relationship between the volatility index and the stock market index in Southeast Asia, namely in Indonesia, Thailand, the Philippines, and Malaysia. The above arguments lead to the second hypothesis:

H2: Volatility index affects the stock market index.

Indonesia and Malaysia have the most notable growth in GB outstanding to GDP ratio from

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Source: Bloomberg, Asian Development Bank (ADB).

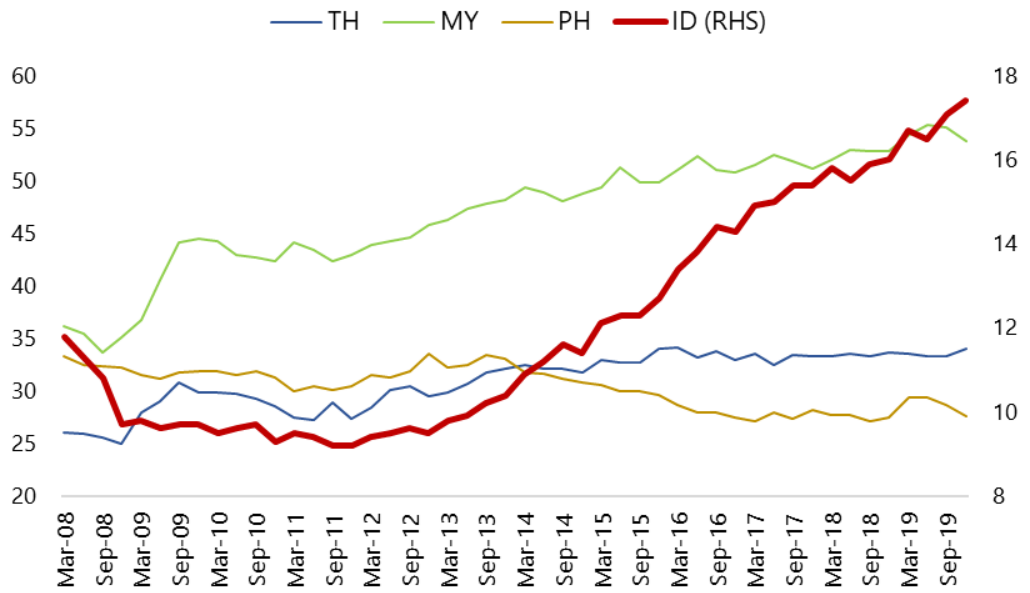

Figure 1. The GB as a percentage of GDP (2008–2019)

2010 to 2019, rising around 9.3 and 7.7 percentage points, respectively (see Figure 1). Moreover, mounting government debt-to-GDP and foreign ownership on GB might expose such countries to the higher cost of debt due to the risk premium paid to the investors.

Indonesia seems to pay higher GBY (see Figure 2) than its neighboring countries in Southeast Asia, averaging at 7.5% over the 2015–2019 period, much higher than Thailand (2.4%), Malaysia (3.9%), and the Philippines (5.3%).

Gruber and Kamin (2012) examined government bond yield in countries that are members of the Organization for Economic Co-operation and Development for 20 years using panel data and found a significant influence between fiscal performance and bond yield Since the fiscal policy also influences the inflation rate. This study takes

Source: Bloomberg.

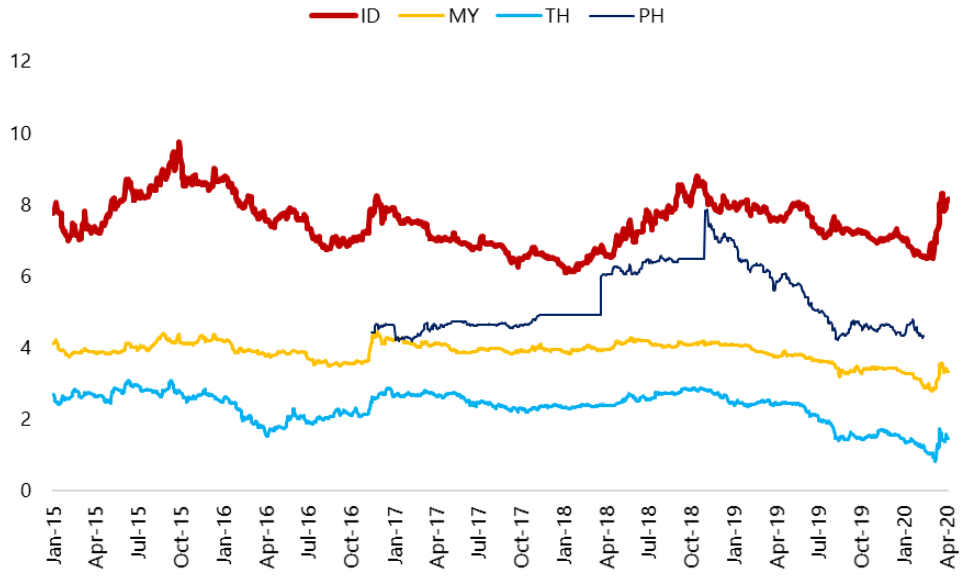

Figure 2. Government bond yield (10 years, 2015–2019)

a proxy of inflation's effect on government bond yield for Southeast Asian countries. Various studies have examined the effect of inflation on government bond yield, such as Poghosyan (2014), who concluded that bond yield changes influence inflation. These conclusions are similar to the results of Jaramillo and Weber's research (2013) and the results of research by Hautsch and Ou (2012). This finding supports the third hypothesis as follows:

H3: The inflation rate affects the government bond yield.

The study by Christopher, Kim, and Wu (2012) found a negative relationship between sovereign rating and regional bond markets, especially in countries with substantial foreign debts. Delatte et al. (2012) concluded that the relationship between bond spreads and CDS is not linear because it depends on the market conditions. Besides, Oehmke and Zawadowski (2015) found a negative relationship between CDS and bond yield. Also, Calice and Ioannidis (2012) found that the effect of CDS is more significant on banks in certain countries compared to the USA. There are discrepancies in the conclusions and the inequality of the effect of CDS between one country and another. Therefore, this study focuses on examining the effect of the relationship of credit default swap (CDS) on GBY in ASEAN countries, namely Indonesia, the Philippines, Thailand, and Malaysia. Based on the above argument, the fourth hypothesis is proposed as follows:

H4: Credit default swap influences the government bond yield.

According to Chiang, Li, and Yang (2015), stocks and bonds have both negative and positive correlations that depend on market conditions. One of their findings is to prove the effect of default risk on bond-stock correlations. Similarly, Hong, Lin, and Wu (2012) show that stock market returns with bond yield have a relationship where stock market returns can predict bond yield. Besides, Koijen, Lustig, and Van Nieuwerburgh (2017) found a positive correlation between the bond yield curve slope and the stock price return. Also, Bianconi, Yoshino, and De Sousa (2013) stated that there is evidence of significant stock and bond return correlations, especially for Russia and Brazil. In this study, the authors use the stock market index of Southeast Asian countries, namely Indonesia, Thailand, Malaysia, and the Philippines, to test whether there is a significant effect of the stock market index on bond yield in each of these countries. Based on the argument, as mentioned earlier, the following fifth hypothesis is proposed.

H5: The stock market index affects the government bond yield.

Previous studies state that the volatility index affects the stock market index (Mensi et al., 2014; Chang et al., 2016; Bekaert & Hoerova, 2014; Shaikh & Padhi, 2014; Rosillo et al., 2014; Sarwar, 2012) and that the foreign exchange rate also affects the stock market index (Sensoy et al., 2014; Lin, 2012; Chkili & Nguyen, 2014; Kumar, 2013; Tsagkanos & Siriopoulos, 2013; Tsai, 2012). Based on the above relationship, the authors postulate the sixth hypothesis as follows:

H6: Foreign exchange rate and volatility index simultaneously affect the stock market index.

As has also been noticed, the change in the stock market index influences the government bond yield (Chiang et al., 2015; Hong et al., 2012; Koijen et al., 2017; Bianconi et al., 2013). Furthermore, other researchers also found that the credit default swap affects the government bond yield (Christopher et al., 2012; Delatte, Gex, & López-Villavicencio, 2012; Calice & Ioannidis, 2012). Besides, the research suggested that the inflation rate influences the government bond yield (Gruber & Kamin, 2012; Poghosyan, 2014; Jaramillo & Weber, 2013; Hautsch & Ou, 2012). Based on those previous findings, the authors postulate the seventh hypothesis as follows:

H7: Stock market index, credit default swap, and inflation rate simultaneously influence the government bond yield.

Based on those hypotheses previously developed, the present work aims to investigate whether changes in credit default swaps, inflation rates, and the stock market index affect changes in government bond yield; and whether changes in market stock indexes are affected by changes in foreign exchange rates and volatility indexes. Figure 3 describes the research model describing the relationship between variables.

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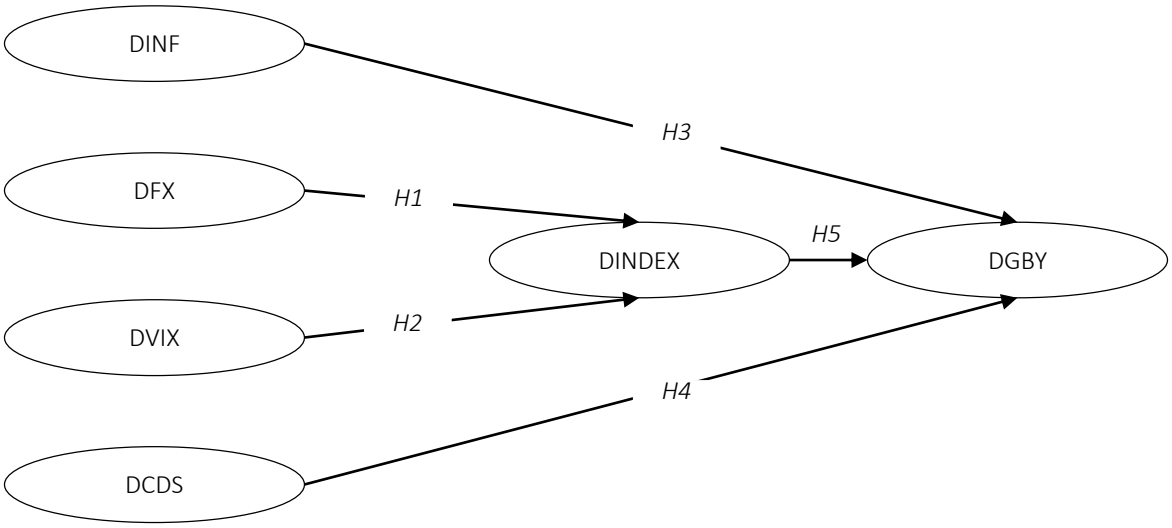

Notes: DINDEX: change in the stock market index, DFX: change in the foreign exchange rate, DVIX: change in the volatility index, DGBY: change in government bond yield, DINF: change in the inflation rate, DCDS: change in credit default swap. *H6* and *H7* are not shown.

Figure 3. Research model framework

2. METHOD

This study aims to examine the influence of various macroeconomic factors on the stock market index and government bond yield for the groups of countries with similar economic levels in Southeast Asia. There are ten countries in the Southeast Asia region. Of the ten countries, there are nine developing countries and one developed country, namely Singapore. This study excludes Singapore as this country is considered to have a higher level in terms of economics. Of the remaining nine countries, this study includes only four countries, namely Indonesia, Malaysia, Thailand, and the Philippines, because those countries have had stock exchanges for more than two decades.

This study's dependent variable is the change in government bond yield, and the independent variables are the change in volatility index, change in foreign exchange, change in the stock market index, changes in inflation rates, and changes in credit default swaps. This study's data analysis uses recursive models and multiple regression equations with a significance level of 1%, 5%, and 10% for the t-test. The data processing utilized EViews software.

2.1. Sampling method

This study uses macroeconomic data obtained from the Bloomberg stock exchange covering four ASEAN countries, namely Indonesia, Malaysia, Thailand, and the Philippines, from 2015 to 2019 (5 years). The combination of the time-series data (60 months) and cross-section data (four countries) resulted in a 240 data panel to be used for further analysis.

Table 1. Variable operationalization

No.	Variable	Concept	Scale	Measure
1	Government Bond Yield (DGBY)	The return for investors on debt security issued by the government to support government spending (Hull, 2011)	Ratio	Percentage
2	Inflation Rate (DINF)	Assessment of price level increases (Mishkin, 2015)	Ratio	Percentage
3	Credit Default Swap (DCDS)	A guarantees the risk of default issued by specific companies or countries.(Hull, 2011)	Ratio	Real number
4	Stock Market Index (DINDEX)	Indicator to observe the price movements of securities (Jogiyanto, 2015)	Ratio	Real number
5	Exchange Rate (DFX)	Rating of prices of USD against local currency (Mishkin, 2015)	Ratio	Percentage
6	Volatility Index (DVIX)	A sentiment indicator of market optimism (Hull, 2011)	Ratio	Real Number

2.2. Operational definition

The operational definition of each variable should be defined to allow assessing each variable. Table 1 shows the operational definition of each variable in terms of concept, scale, and measure.

2.3. Econometrics model

As indicated by the hypothesis, this study examines the influence of changes in independent variables on the dependent variable. For that purpose, this study uses two econometrics models, which are defined as follows:

$$DINDEX_{it} = \beta_0 + \beta_1 DFX_{it} + \\ + \beta_2 DVIX_{it} + e_{it}, \quad (1)$$

where $DINDEX$ – change in the stock market index, DFX – change in the foreign exchange rate, $DVIX$ – change in the volatility index, β_0 – constant, β_1, β_2 – coefficient of DFX and DVIX, e – error term, i – cross-section data, t – time-series data.

$$DGBY_{it} = \gamma_0 + \gamma_1 DINDEX_{it} + \\ + \gamma_2 DINF_{it} + \gamma_3 DCDS_{it} + e_{it}, \quad (2)$$

where $DGBY$ – change in government bond yield, $DINDEX$ – change in the stock market index, $DINF$ – change in the inflation rate, $DCDS$ – change in credit default swap, γ_0 – constant, γ_1, γ_2, γ_3 – coefficient of DINDEX, DINF, and DCDS, e – error term, i – cross-section data, t – time-series data.

3. RESULTS

The discussion of the results begins with the examination of the first model. There are several models to test the equation, namely: the common effect model, the fixed effect model, and the random effect model (Gujarati & Porter, 2009). After going through the Chow and Hausman test, it turns out that the panel data are more suitable to use the random effect model. The table attached in Appendix B demonstrates the detailed result of the analysis. The results of panel data analysis using the random effect model are shown in Table 2. The results supported the hypothesis *H1* that the DFX has a very significant effect on the DINDEX with a negative correlation of –0.694 and the *p*-value < 0.01). This result also supported the second hypothesis *H2*. The DVIX has a significant effect on the DINDEX with a negative correlation value of –0.016469 and the *p*-value < 0.10). Furthermore, Table 2 also indicated that this study supported the hypothesis *H6* stating that the DFX and DVIX have a significant simultaneous effect on the DINDEX. As shown with the *F*-value of 8.521745, and the *p*-value of 0.00 < 0.01. Hence, from these test results, the following equation, based on Model 1, can be formulated as follows:

$$DINDEX_{it} = 0.273256 - \\ -0.694058 DFX_{it} - 0.01649 DVIX_{it}.$$

Based on the analysis result demonstrated in Table 3, the Model 2 equation can be expressed as follows:

Table 2. Cross-section random effects test equation for Model 1

Sample	2015M01 – 2019M13		
Periods included	60		
Cross-sections included	4		
Total balanced panel observations	240		
Dependent variable	DINDEX		
Independent variable	**C**	**DFX**	**DVIX**
Coefficient	0.273256	–0.694058	–0.016469
Std. error	0.187727	0.129744	0.009065
t-statistic	1.455604	–5.349457	–1.816652
Prob.	0.1468	0***	0.0705*
Adjusted R-squared	0.135964		
F-statistic	8.521745		
Prob(F-statistic)	0		

Note: *, **, *** denote significance level at 10%, 5%, and 1%, respectively.

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Table 3. Cross-section test equation for the random effect for Model 2

Sample	2015M01 – 2019M13			
Periods included	60			
Cross-sections included	4			
Total balanced panel observations	240			
Dependent variable	DGBY			
Independent variable	**C**	**DINDEX**	**DINF**	**DCDS**
Coefficient	–0.258147	–0.432607	0.008572	0.000831
Std. error	0.295186	0.094906	0.002986	0.000313
t-statistic	–0.874525	–4.558264	2.870366	2.654481
Prob.	0.3827	0***	0.0045***	0.0085***
Adjusted R-squared	0.116326			
F-statistic	11.4434			
Prob(F-statistic)	0			

Note: *, **, *** denote significance level at 10%, 5%, and 1% respectively.

$$DGBY_{it} = -0.258147 - 0.432607 DINDEX_{it} + 0.008572 DINF_{it} + 0.000831 DCDS_{it}.$$

The result empirically supports the simultaneous effect of the stock market index, credit default swap, and the inflation rate on the government bond yield (*H7*) with the *F*-value of 11.4434 and the *p*-value of 0.00. Changes in the stock market index, inflation rates, and credit default swaps affect government bond yield changes in Indonesia, Thailand, Malaysia, and the Philippines simultaneously.

The partial test results show that the DINDEX has a significant effect on the DGBY with a negative correlation value of –0.432607, and the *p*-value of 0.00 < 0.01. This finding supports the hypothesis *H5* that the stock market index influences the government bond yield. The partial effect test also supports the hypothesis *H3* that change in the inflation rate (DINF) affects the government bond yield (DGBY) with a positive correlation value of 0.008572, and the *p*-value of 0.0045 < 0.01). An increase in inflation will cause investors to demand a higher return rate for bonds sold by the government because investors will take into account the real rate of return, as stated in the Fisher effect.

The DCDS has a significant effect on the DGBY with a positive correlation value of 0.000831 and a *p*-value of 0.0085 < 0.01. This finding supported the hypothesis *H4* stating that change in credit default swap (DCDS) influence the change in government bond yield (DGBY). An increase in credit default swaps indicates a situation of high uncertainty, and the investors perceive it as an increase in potential risk. Increasing the country's potential investment risk will increase the requested rate of return for various investments in the country, including government bond yield. However, this study concludes that there is a positive relationship between credit default swaps with bond yields, which contrasts with the study by Christopher et al. (2012) and Oehmke and Zawadowski (2015), which found a negative relationship between CDS and GBY. Besides, this result confirms the statement of Delatte et al. (2012), which concluded that the relationship between government bond yield (DGBY) spreads and DCDS is not linear because it depends on market conditions.

4. DISCUSSION

This study reveals that those seven hypotheses were empirically supported. The results are also consistent with previous research, such as the study by Tsai (2012), which concluded a negative relationship between foreign exchange rate and the stock market index in Asian stock markets. This finding implies that the investors will divert their investment into financial instruments that are more profitable than the stock indexes when the foreign exchange rate, such as the USD, is strengthening. The opposite will also occur when the USD exchange rate weakens against the local currency, and the investors will switch to buy local currency and invest their money in various shares in the country.

Besides, the findings are also consistent with Bekaert and Hoerova's (2014) study, which concluded that the volatility index has a negative effect on excess return. This result implies that the investors feel that high volatility impacts the higher level of risk as well. The higher level of risk is considered not commensurate with the increase in returns from the shares that they have, and then in the short term, investors will sell their shares to switch to investments. The investor will sell the shares rather than buys, putting pressure on the overall stock market price index. The change in stock market index (DINDEX), credit default swap (DCDS), and the inflation rate (DINF) simultaneously affect the government bond yield (DGBY). This result revealed that a change in the stock market index, inflation rate, and credit default swap simultaneously influence the government bond index.

Furthermore, this study's finding also supports the previous research that a change in the stock market index influences the government bond yield (Chiang et al., 2015). The stocks market index and bond yield have a negative and positive correlation that depends on market conditions. This study also is consistent with the study by Poghosyan (2014), Jaramillo and Weber (2013), and Hautsch and Ou (2012) who concluded that changes in stocks market index influence the government bonds yield. Strengthening in the stock market index will increase investor confidence in the country's economy, thereby reducing the level of risk, and they are willing to accept a lower rate of return for bonds sold by the country's government.

One of the most interesting findings revealed that the change in foreign exchange index and volatility index change affected the stock market index simultaneously. This result implies that the combination of these two macroeconomic factors results in the net change in the stock market index. In case the volatility index changes in a negative direction while the foreign exchange change in the opposite direction, the result will be the net effect of the two factors. Similarly, the second exciting finding is that result demonstrating that change in the stock market index, changes in the inflation rate, and change in credit default swap determined the government bond yield simultaneously. These three macroeconomics factors may affect the yield as a result of the net effect of each factor.

Those findings discussed earlier provided a new insight for the investor on managing their investment by taking into account the changes in macroeconomic factors. Furthermore, the government could use this research model to control and manage the government bond yield. This result also could contribute to the ongoing research in the financial management theory.

CONCLUSION

This study investigates the macroeconomic factors affecting government bond yield in Indonesia, Malaysia, Thailand, and the Philippines. The result of the analysis has proved that those seven hypotheses were supported. The changes in foreign exchange and volatility indexes affect changes in the stock market index partially and simultaneously. The changes in foreign exchange have a very significant effect on changes in the stock market index with a negative correlation, meaning that an increase in the foreign exchange rate against the local currency will impact the decline in stock indexes. Besides, the change in the volatility index has a significant effect on changes in the stock market index with a negative correlation, meaning that the higher the volatility index will impact the decline in stock indexes and vice versa. The stock market index changes, inflation rates, and credit default swaps affect changes in government bond yields simultaneously. Furthermore, the stock market index changes have a significant effect on government bond yield changes with a negative correlation. The inflation rate changes have a significant effect on changes in government bond yields with a positive correlation. An increase in inflation will cause investors to demand a higher return rate for bonds sold by the government because investors will take into account the real rate of return, as stated in the Fisher effect. The last result found that the changes in credit default swap significantly influence changes in government bond yields.

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This study could pave the government or fiscal authorities' guidelines on how to control the government bond yield and stock market index by controlling other macroeconomics factors, namely, the volatility index, foreign exchange, stock market index, inflation rates, and credit default swaps. These findings also contribute to ongoing research in the field of financial management.

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AUTHOR CONTRIBUTIONS

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Supervision: Ferry Jie.
Writing – original draft: Benny Budiawan Tjandrasa.
Writing – review & editing: Benny Budiawan Tjandrasa, Hotlan Siagian, Ferry Jie.

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APPENDIX A

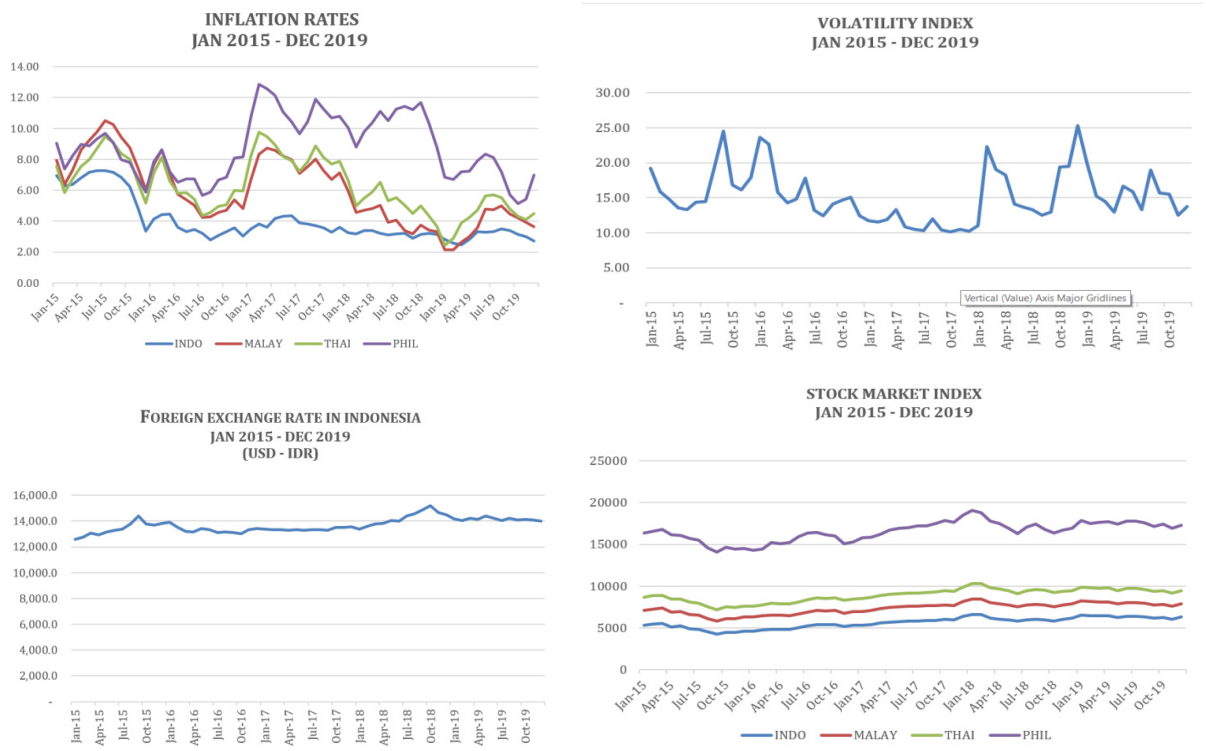

Figure A1. Graph of inflation rates, foreign exchange rates, volatility index, credit default swap, and stock market index in Indonesia, Malaysia, Thailand, and the Philippines from January 2015 to December 2019

APPENDIX B

Table 1B. Likelihood ratio result for redundant fixed test effects of Model 1 (Chow test)

Test summary	Chi-squared statistic	Chi-squared degree of freedom	Probability
Test cross-section fixed effects	1.1077	3	0.0077
Hausman test result for correlated random effects of Model 1			
Test summary	**Chi-squared statistic**	**Chi-squared degree of freedom**	**Probability**
Cross-section random effects	0	2	1
Likelihood ratio result for redundant fixed test effects of Model 2 (Chow test)			
Test summary	**Chi-squared statistic**	**Chi-squared degree of freedom**	**Probability**
Test cross-section fixed effects	2.243817	3	0.005
Hausman test result for correlated random effects of Model 2			
Test summary	**Chi-squared statistic**	**Chi-squared degree of freedom**	**Probability**
Cross-section random effects	2.188355	3	0.5342