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DYNAMIC RELATIONSHIP BETWEEN BONDS YIELDS OF MALAYSIA, SINGAPORE, THAILAND, INDIA AND JAPAN

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Abstract

In this paper, we study the dynamic relationship of bond yields of Malaysia, Singapore, Thailand, India, and Japan by using 43 observations for the period of 2007 to July 2010. This study analyzes the government bond returns and the yields curve for the five countries with different term to maturity of 5 years and 15 years. The results indicate that the yields on government bond for the five countries are all consistent with the term structure of interest rate theory where the yields to maturity increase as the term to maturity increase during the period of 2007 to 2010. There is also evidence supporting the yields to maturity for all five countries are significantly stationary at order one or I(1). Moreover, the findings also show that there are a few groups of countries were found co-integration with one vector. In long run, the results find that between the group of countries, Malaysia and India, Singapore and Thailand, and Singapore and India, the bond returns for the 5 and15 years term to maturity are co-integrated with at least one co-integrating vectors.

Key words: Co integration tests, unit root test, dynamics relationship

1.0 Introduction

In finance, securities issuer is a person who owes another person or securities holder a debt and this refer to bond or security. The debt securities or a bond is depending on the terms of the bond. Which mean it is obliged to pay the coupon or to repay the principal at the termed maturity. Thus, at first it is necessary to calculate the bond return and the Yield to Maturity (YTM) with different Time to Maturity (TTM). The different of the bond's TTM become one of the difficult parts to decide year of maturity for investigation.

The common factor which affect the returns on government securities for the five countries; Malaysia, Singapore, Thailand, India, and Japan are analyse in this study. By using the cointegretion concept, this paper estimate that how a change in yields affects different government securities' return. Practitioners are aware, however, that in many episodes yields have changed in ways not fully described by saying only that "yields went up" or "yields went down".

Research Questions

- What is the dynamic relationship of government bond yields for the five Asia countries of Malaysia, Singapore, Thailand, India, and Japan?
- Are there any relationship between the returns of bond in the five countries; Malaysia, Singapore, Thailand, India, and Japan?

2.0 LITERATURE REVIEW

Houweling, Mentink and Vorst, (2005) consider nine different factors which are on-the-run, age, issued amount, missing prices, listed, yield volatility, euro, and number of contributors and yield dispersion, to measure corporate bond liquidity. They use a four-variable model to control for credit risk, term to maturity, interest rate risk, and rating differences between the corporate bonds. By using the Brennan and Subrahmanyam (1996) methodology to test whether the bond market liquidity is priced based on the liquidity proxies: on-the-run, age, issued amount, missing prices, listed, yield volatility, euro, and number of contributors and yield dispersion, to measure corporate bond liquidity. In the two Fama and French (1993) regression models, and augmented with portfolio characteristics where the time series of portfolio yields were used. The results imply that eight out of nine liquidity proxies should be rejected for the H_0 of no liquidity premium. The yield dispersion and proxies' amount outstanding were found with highest premiums. This implies that no proxy stands out from the rest by using pair wise comparison tests.

Priestley and Barr (2004) model the returns on government bonds and expected risks, which allowing for integration of world bond markets. They are using a conditional asset pricing model that permits variation in the price, and exposure to risk. The result shows that the national markets are only partially integrated into world markets. For around three quarter of total expected excess returns is due to world bond market risk and for around one quarter are related to local market risk. A range of parameter stability tests rejected the hypothesis of the time variation in the level of integration. Priestley and Barr (2004) shown that an asset pricing model explained the widely accepted ability of certain information variables to predict excess government returns on bond in which the quantities of risk are driven by ARCH processes and in which the market prices of risk depend on the information variables. There is only 70% of the average contribution of world factors to domestic returns across the 5 countries. In government bond markets, the world price of bond risk is higher than it need be and the benefits of international diversification have not been realized. This implies that the deficit funding is currently paying too high a rate by the governments.

Anders C. Johansson (2008) studies the relationship between the movements of price in different local bond markets; China, South Korea, Malaysia, and Thailand. Result show that the markets exhibit strong long-term interdependencies by using co-integration tests and all markets show signs of short-run cross-dependencies in the mean. Except for in short turbulent periods, the correlations between the markets are time-varying and high. The Johansen cointegration test shows that highly significant the markets are linked in long-term relationships and there are no less than three cointegrating relationships. The mean equations indicate causal relationships running in both directions between most of the market pairs. This means that there are long-run relationship and short-run dependencies among the four bond markets. However, the short-run spillover effects in the mean can be seen as limited in terms of size and impact due to the coefficients for the autoregressive variables are very small. Finally, result show each of the four variables indicates that the correlations are indeed time-varying.

Cheng and Annuar (2010) studied the relationship between yield spreads of Malaysian Government Securities (MGS) and inflation dynamics over the period of 1976 to 2008. The study used various statistical techniques to determine the predictive power of yield spreads between 1-year MGS and 10-years MGS in inflation movement. The quarterly data provide evidences that the cointegration test explains that there is a long-run dynamic relationship between the MGS spreads and GDP deflator. The result is further supported by the Granger causality test where there is a unidirectional relationship running from GDP deflator to spreads. Many previous studies (Mishkin, 1990a, b and 1991), on the inflation time series have shown that there are dynamic relationships across countries. Therefore this paper proceeds to study the bond yield series in these selected countries.

3.0 Research Design

3.1 Descriptive of Design

In our research, only secondary data have been used. It is used to answer a different question than originally intended and it analysis in a different way. Bonds return is examined for the period between 2007 and 2010 using monthly data taken from Data Stream, Central Bank of respective countries, Asian Bond Online, Yahoo Finance and Bond association from respective countries. The five Asia countries used are Malaysia, Singapore, Thailand, India, and Japan.

Transformation of raw data into a form that will make them easy to understand and interpret called descriptive analysis. In this study, the techniques used for analysis are panel unit root test which is either Augmented Dickey-Fuller (ADF) test or Phillips-Perron (PP) test, Johansen Co-integration test and Pairwise Granger Causality Test.

3.2 Unit Root Test

Unit root test are commonly known as the stationary test. Unit Root test is conducted to check the order of the integration of each of the variable that is the number of times them must be differenced before attaining stationary. In this study, the time series properties of the variables in the regression analysis are investigated using the two most popular unit root tests proposed to examine the stationary, which are the Augmented Dickey-Fuller (ADF) and the Phillips Perron tests, in order to avoid the problem of spurious correlation in the regression analysis.

3.3 Augmented Dickey-Fuller (ADF) test

Augmented Dickey-Fuller (ADF) test is named after the statisticians Dickey and Fuller. (1979), who developed the test in the 1970s. In a time series sample, an augmented Dickey-Fuller test (ADF) is use to test the unit root. Augmented Dickey-Fuller (ADF) test is an augmented version of the Dickey-Fuller test for a more complicated set of time series models. In an autoregressive model, the Dickey-Fuller test tests whether a unit root is present. In the test, the augmented Dickey-Fuller (ADF) statistic is a negative number. The stronger the rejections of the hypothesis, the more negative the test show and this implies that there is a unit root at some level of confidence. Both the augmented Dickey-Fuller (ADF) test and Dickey-Fuller test's testing procedure is the same but augmented Dickey-Fuller (ADF) test is applied into the model as below:

$$\Delta q_t = \mu + \alpha q_{t-1} + \sum_{i=1}^{k} c_i \Delta q_{t-1} + \varepsilon_t$$

Where

Δq_t = the first difference of the bond return
μ = intercept
α, c_i = estimator of the parameter
k = the number of lagged first differences
ε_t = error term
t = time or trend variable

3.4 Phillips-Perron (PP) test

By a non-parametric method, Phillips-Perron (1988) (PP) test detecting whether a time series contain a unit root. Phillips and Perron have developed a more comprehensive theory of unit root non-stationary. It can be conducted by using the following equation:

$$y_t = \mu + \alpha y_{t-1} + \varepsilon_t$$

Where,
μ = intercept
α = estimator of the equilibrium parameter
t = time or trend variable
ε = disturbance term

Basically, Phillips-Perron (PP) test are similar to Augmented Dickey-Fuller (ADF) test. Phillips-Perron (PP) test incorporate an automatic correction to the Dickey-Fuller procedure to allow for auto-correlated residuals. Both Phillips-Perron (PP) test and Augmented Dickey-Fuller (ADF) test usually give the same conclusions. While, the null and alternative hypothesis in the unit root test:

H0: y_t is stationary

H1: y_t is non-stationary

3.5 Johansen Co-integration Test

What is co-integration?

The theory of co-integration developed in Johansen and Juselius (1990), Johansen (1995), Engle and Granger (1987) addresses this issue of integrating short-run dynamics with long-run equilibrium. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. In such a stationary, or I(0), linear combination exists, the non-stationary (with a unit root), time series are said to be co-integrated. The stationary linear combination is called the co-integrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

The co-integration explained that if all the components of a vector time series process have a unit root, or *I*(1), there may exist linear combinations without a unit root. These linear combinations may be interpreted as long term relations between the components of a vector time series. In other word, if two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are said to be co-integrated. There are two types of co-integration test; (1) the Johansen Co-integration procedure and (2) the Engle-Granger two-step method

4.0 Results

4.1 Unit Root Test

Table 4.1: Augmented Dickey-Fuller (ADF) Test

Variables	Level		First Difference	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
MGB 5 Years	-3.2838 (1)	-3.2281 (1)	-5.3454*** (0)	-5.2766*** (0)
MGB 15 Years	-2.9079 (1)	-3.3023 (1)	-5.2338*** (0)	-5.1808*** (0)
SGB 5 Years	-0.1004 (0)	-2.1154 (0)	-5.9209*** (0)	-5.9463*** (0)
SGB 15 Years	-2.4646 (0)	-3.6439 (4)	-5.8770*** (0)	-5.8198*** (0)

TGB 5 Years	-1.9537 (0)	-2.1366 (0)	-5.8732*** (0)	-5.8020*** (0)
TGB 15 Years	-2.2398 (0)	-2.8837 (0)	-7.0192*** (0)	-6.9924*** (0)
IGB 5 Years	-2.8489 (2)	-2.9765 (2)	-3.1077*** (1)	-3.0872*** (1)
IGB 15 Years	-2.5291 (0)	-2.5072 (0)	-6.8418*** (0)	-6.7615*** (0)
JGB 5 Years	-0.4871 (0)	-3.0576 (0)	-6.8288*** (0)	-6.8476*** (0)
JGB 15 Years	-1.9397 (0)	-3.4601 (0)	-7.5771*** (0)	-7.5934*** (0)

Note: ***, ** and * denote significant at 1%, 5% and 10% significance levels, respectively. The figure in the parenthesis (…) is referring to the selected lag length which base on the Schwarz Info Criterion (SIC).

M-Malaysia, S-Singapore, T-Taiwan, I-India, J-Japan Government Bonds

Based on the Table 4.1, the variables, returns on bonds of different term to maturities for the five Asia countries; Malaysia, Singapore, Thailand, India, and Japan were statistically insignificant at level with and without trend. This indicates that all the variables have a unit root at I(1) or non stationary at level. However, the results show that bond returns for all five countries were statistically significant at 1% at the first difference, constant no trend and with trend. This means that for the first different test the P-value is less than 0.05 (P-value < 0.05). The results imply that the statistics can reject the Ho and means stationary at order one or I(1). Therefore, the finding could conclude that all the variables were stationary at order one or I(1).

4.2 Johansen Co-integration Test

Table 4.2: Johansen Co-integration Test for Bond Returns in Term to Maturity of 5 years					
Hypothesized		Trace	5 Percent	1 Percent	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value	Prob.**
A. MGB & SGB	Lag Length = 3				
None	0.298312	14.20374	15.49471	20.04	0.0775
At most 1	0.000827	0.033076	3.841466	6.65	0.8556
B. MGB & TGB	Lag Length = 3				
None *	0.297017	16.63646	15.49471	20.04	0.0335**
At most 1	0.061516	2.539582	3.841466	6.65	0.1110
C. MGB & IGB	Lag Length = 2				
None **	0.356207	23.09314	15.49471	20.04	0.0030**
At most 1 *	0.115621	5.037661	3.841466	6.65	0.0248
D. MGB & JGB	Lag Length = 2				
None	0.222999	10.57651	15.49471	20.04	0.2389
At most 1	0.005634	0.231633	3.841466	6.65	0.6303

E. SGB & TGB	Lag Length = 2				
None	0.122647	5.759184	15.49471	20.04	0.7238
At most 1	0.009575	0.394483	3.841466	6.65	0.5300
F. SGB & IGB	Lag Length = 2				
None	0.128929	6.212392	15.49471	20.04	0.6704
At most 1	0.013399	0.553088	3.841466	6.65	0.4571
G. SGB & JGB	Lag Length = 2				
None	0.304062	14.95822	15.49471	20.04	0.0601
At most 1	0.002337	0.095941	3.841466	6.65	0.7567
H. TGB & IGB	Lag Length = 3				
None **	0.311150	20.21012	15.49471	20.04	0.0090**
At most 1 *	0.124116	5.300851	3.841466	6.65	0.0213
I. TGB & JGB	Lag Length = 2				
None	0.125785	5.605706	15.49471	20.04	0.7416
At most 1	0.002293	0.094136	3.841466	6.65	0.7590
J. IGB & JGB	Lag Length = 2				
None	0.093360	4.103279	15.49471	20.04	0.8950
At most 1	0.002068	0.084878	3.841466	6.65	0.7708

Trace test indicates 1 cointegrating equation(s) at the 5% level and no cointegration at the 1% level. Subscripts * and ** denote rejection of the hypothesis at 1% and 5% critical values respectively.

M-Malaysia, S-Singapore, T-Taiwan, I-India, J-Japan Government Bonds

Johansen Co-integration Test for Bond Returns in TTM of 5 years with ten groups of countries was tested and show in Table 4.2. The results show that only in some group of countries, there is evidence of co-integrating vector(s) according to the asymptotic critical values. Between Malaysia with Thailand (Table 4.1 Panel B) the co-integration results indicate that the H_0 of zero can be rejected using the 95% critical value. This implies that bond returns for the 5 years TTM are co-integrated with one co-integrating vectors. Using the 95% critical value, the co-integration results between IGB with MGB and TGB (Table 4.1 Panel C and H) were able to reject the H_0 of zero and at most one co-integrating vector(s). This suggests that the variables in this model are co-integrated with two co-integrating vectors. For the rest of the group countries (Table 4.1 Panel D, E, F, G, I, and J), we found evidence of no co-integration vector since the H_0 of zero and at most one cannot be rejected by using 95% critical value.

Table 4.3: Johansen Co-integration Test for Bond Return in Term to Maturity of 15 years					
Hypothesized		Trace	5 Percent	1 Percent	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value	Prob.**
A. MGB & SGB	Lag Length = 4				
None *	0.302753	16.90911	15.49471	20.04	0.0304*

At most 1	0.070354	2.845087	3.841466	6.65	0.0917
B. MGB & TGB	Lag = 2				
None	0.255883	13.18761	15.49471	20.04	0.1081
At most 1	0.025755	1.069788	3.841466	6.65	0.3010
C. MGB & IGB	Lag = 4				
**None ** **	0.337148	21.98517	15.49471	20.04	0.0046**
**At most 1 * **	0.141457	5.948240	3.841466	6.65	0.0147
D. MGB & JGB	Lag = 4				
**None * **	0.318282	15.83601	15.49471	20.04	0.0444
At most 1	0.022652	0.893569	3.841466	6.65	0.3445
E. SGB & TGB	Lag = 2				
**None ** **	0.340673	25.02075	15.49471	20.04	0.0014**
**At most 1 ** **	0.176116	7.942767	3.841466	6.65	0.0048
F. SGB & IGB	Lag = 3				
**None ** **	0.345352	22.98863	15.49471	20.04	0.0031**
**At most 1 * **	0.140202	6.042299	3.841466	6.65	0.0140
G. SGB & JGB	Lag = 2				
None	0.196602	11.31780	15.49471	20.06	0.1927
At most 1	0.055537	2.342691	3.841466	6.67	0.1259
H. TGB & IGB	Lag = 2				
None	0.144103	8.426051	15.49471	20.06	0.4210
At most 1	0.048683	2.046230	3.841466	6.67	0.1526
I. TGB & JGB	Lag = 2				
None	0.235011	12.65221	15.49471	20.06	0.1282
At most 1	0.039880	1.668578	3.841466	6.67	0.1964
J. IGB & JGB	Lag = 2				
None	0.138020	7.542216	15.49471	20.06	0.5156
At most 1	0.034813	1.452751	3.841466	6.67	0.2281

Trace test indicates 1 cointegrating equation(s) at the 5% level and no cointegration at the 1% level. Subscripts * and ** denote rejection of the hypothesis at 1% and 5% critical values respectively.

M-Malaysia, S-Singapore, T-Taiwan, I-India, J-Japan Government Bonds

In Table 4.3, bond returns in TTM of 15 years for ten groups of countries was tested by using Johansen Co-integration Test. Refer to Table 4.2, this paper find evidence of no co-integration vector for some of the group countries (Table 4.2 Panel B, G, H, I, and J) since the null hypothesis of zero and at most one cannot be rejected using 95% critical value. In the case of group countries between, Malaysia and India, Singapore and Thailand, and Singapore and India (Table 4.2 Panel C, E, and F), the co-integration results indicate that the null hypothesis of zero and at most one are rejected using the 95% critical value. This implies that the bond returns for the 15 years TTM are co-integrated with two co-integrating vectors. For the group countries of

Malaysia and Singapore and Malaysia and Japan (Table 4.3 Panel A and D), the co-integration results were able to reject the null hypotheses of zero co-integrating vector by using the 95% critical value. This implies that the variables in this model are co-integrated with only one co-integrating vectors.

5.0 CONCLUSION

This paper analyzes the return of government securities of different maturities for five Asia countries namely Malaysia, Singapore, Thailand, India, and Japan. By study the government bond returns of mentioned five countries between the period of year 2007 to July 2010 with different TTM of 5 years, and 15 years, this report find that the yields to maturity increased the longer the TTM of the government bonds. Besides, the mean or average return of the government bond for the five countries also shows an upward slopping trend for the period of 2007 to July 2010. The results imply that the government bond return for the five countries is consistent with the term structure of interest rates theory widely accepted. The descriptive statistic tests also support the finding and show that the average returns for all the five countries increase with the TTM of the bond index, except for Thailand government bonds where facing a upward slopping at the beginning and downward slopping at the end of period.

By using ADF test, show that all the variables have a unit root at I(1) or non stationary at level. The results show that the returns on bonds of different term to maturities for the five Asia countries; Malaysia, Singapore, Thailand, India, and Japan were statistically insignificant at level with and without trend. This indicates that all the variables have a unit root at I(1) or non stationary at level. However, the results showed that all the variables were statistically significant at 1% at the first difference, constant no trend and with trend.

The findings show that only in some group of countries, there are evidences of co-integrating vector(s) according to the asymptotic critical values. Between Malaysia with Thailand the co-integration results indicate that the H_0 of zero can be rejected using the 95% critical value. This implies that the Malaysia and Thailand bond returns for the 5 years TTM are co-integrated with one co-integrating vectors and the results show between IGB with MGB and TGB for the 5 years TTM, the variables in this model are co-integrated with two co-integrating vectors.

In long run, the results find that between the group of countries, Malaysia and India, Singapore and Thailand, and Singapore and India, the bond returns for the 15 years TTM are co-integrated with two co-integrating vectors. While, the group countries of Malaysia and Singapore and Malaysia and Japan, the co-integration results were able to reject the null hypotheses of zero co-integrating vector. This implies that in the long run the bond return for the TTM of 15 years are co-integrated with only one co-integrating vectors.

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