An analysis of Stock Price, Earning Yield and Long-term Government Bond Yield in Thailand

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ABSTRACT

This paper is to analyze the relationship between stock index price, earning yield and long-term government bond yield in Thailand via using co-integration framework analysis. Our main analysis is to examine the three research questions. First, is there a long-run relationship between the stock index, earning yield and long-term government bond yield? Second, what does the impacts on the stock price while the changes of long-term government bond yield? Third, can the change of long-term government bond yield predict the stock price? However, we also study short-term dynamics to found out if long-term government bond yield could explain the stock price regarding the Fed model. Thus, we get the results from the relationship between stock price and long term government bond yield is negative, and the relationship between stock price and earning yield will be positive.

1. Introduction

Apparently, the stock exchange of Thailand (SET) has relatively small market capitalization per GDP while competing among Asian countries which is at 104 percentages. Despite the small size of securities marker, SET has very high turnover velocity about 63% which can calculate by $\left(\frac{\text{Share Turnover}}{\text{Market Capitalization}}\right)^{12}$. In this year, Index performance of Thai Stock Market competed with other countries (2016 YTD) performed quite well. Generally, the government bond promise to pay an interest payments and the stock probably to pay the dividend. Thus, the investor would compare the return and invest the money in the asset that makes higher comparatively return. Until, this decision making became a valuation methodology which called The FED Model in July 1997. The model compares the stock market's earnings yield (E/P) to the yield on long-term government bonds. The model can be interpreted as a long-term yield spread - the different between earning yields and 10-year Treasury bond yields or we called "the earning yield gap". In this paper, we study the earnings yield of stock market and the 10-year government bond yield in Thailand to explain the movement of SET with the concept of balanced portfolio. Thus, we can apply the Fed model to explain the change of stock price. Moreover, we focus only on the return attributes of Thai stock market. Thus, the objectives of this study are to analyze the relationship between stock price of SET index, earning yield and 10-year government bond yield in Thailand. However, we expected that the variable of stock price can be interpreted and it has short-run or long-run relationship. Considering the basic idea of the Fed approach, when new mode of money has to be invested and interest rate are low trend, the new money is expected to inflow to the stock market so-called carry trade: stock market get indirectly benefit from a low-rate environment.

2. Literature References

Federal Reserve (1996) model addressed a framework in discussing about stock market and undervaluation. The Fed model is an optimal asset allocation between stocks and bonds on the relative yields while the bond yield is too high. Alain Durré, and Pierre Giot (2005) does the study on the relationship between stock index prices, earnings and long-term

government bond yields for a large amount of countries and over a time period that spans several decades by using the Fed model on co-integration framework for analyzing dynamical systems and then utilizing the co-integration tests of the Johansen type, Max Eigenvalues tests, and the VECM model. They found that the Fed model relates a real quantity (the stock index earnings yield) to a nominal bond yield and the coefficients are not significant and take low values, most of long-term interest rate fluctuations and affected the investors' expectations. Javier Estrada (2006) shows the wide acceptance and use of the FED model from 20 international markets by using the unit roots and co-integration from the Fed model as $P/E = 1/Y$. They found The correlations between earnings yields and bond yields at the 5% level of significance of using the test statistics for Engle-Granger co-integration tests and conclude that the Fed model properly describes the relationship between earnings yields and bond yields in only 2 out of the 20 countries considered and can forecast the real stock returns in 17 out of the 20 countries considered. The more expensive stocks are relative to bonds, the lower real stock returns are expected to be.

3. Methodology and Data

We use the vector auto regression (VAR) modeling with co-integration to test for the presence or absence of co-integration of time series. The VAR-based co-integration test was developed by Johansen.

$$y_t = \beta_{1y_{t-1}} + \beta_{2y_{t-2}} + \dots + \beta_{ky_{t-k}} + u_t \quad (1)$$

In order to use the Johansen test, the VAR equation (1) above needs to be turned into a vector error correction model (VECM) of the form

$$Dy_t = P y_{t-k} + G_1 Dy_{t-1} + G_2 Dy_{t-2} + \dots + G_{k-1} Dy_{t-(k-1)} + u_t \quad (2)$$

Where

$$P = \left(\sum_{i=1}^k \beta_i \right) - I_g$$

And

$$G_i = \left(\sum_{j=1}^i \beta_j \right) - I_g$$

Johansen and Juselius (1990) suggest two different methods for the testing of numbers of cointegrating vectors:

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^g \ln(1 - \hat{\lambda}_i) \quad (3)$$

$$\lambda_{\text{trace}}(r, r+1) = -T \sum_{i=r+1}^g \ln(1 - \hat{\lambda}_{r+1}) \quad (4)$$

where λ_{trace} is a joint test where the null is that the number of co-integrating vectors is less than or equal to r against an unspecified or general alternative that there are more than r . λ_{trace} conducts separate tests on each eigenvalue, and has as its null hypothesis that the number of co-integrating vectors is r against an alternative of $r + 1$. We illustrate the methodology of co-integration applied to the testing of Fed model by focusing directly on the variables involved in the model. The variables are $e_t = \ln(E_t)$, the log earnings index, $p_t = \ln(P_t)$, the log stock index and $r_t = \ln(R_t)$, the log government bond yield. (Antti Helkala 2008) Thus, the co-integration model for the Fed model testing can be written as:

$$\Delta e_t = \gamma_e + \alpha_e(e_{t-1} + \beta_p p_{t-1} + \beta_r r_{t-1}) + e + \varepsilon_{e,t}, \quad (5)$$

$$\Delta p_t = \gamma_p + \alpha_p(e_{t-1} + \beta_p p_{t-1} + \beta_r r_{t-1}) + p + \varepsilon_{p,t}, \quad (6)$$

$$\Delta r_t = \gamma_r + \alpha_r(e_{t-1} + \beta_p p_{t-1} + \beta_r r_{t-1}) + r + \varepsilon_{r,t}, \quad (7)$$

The equations shown above illustrate the rationale behind the Fed model testing in co-integration framework. If the Fed model is only partially valid in the sense that long-term government bond yields do not really matter, then β_p should be significantly negative and β_r should not be significant; α_p should be positive. Therefore, this co-integration framework allows the assessment of the Fed model in a straight forward way.

4. Empirical Results

All series are non-stationary in their levels and become stationary when first differenced at 5% significance level. Thus, all time series suitable for co-integration framework. To answer the research question 1, we use the co-integration tests of Johansen approach applied to the stock market variable with the Fed model. We used the trace and Max Eigen values test and also look at the AIC criteria for the selection of lag length because co-integration test are known to have relatively low power in small samples and can depend on the chosen k^* . Since our data sample are also small (201), we used AIC criterion and we found that the optimal lag length (k^*) is 3. The co-integration results for the system of log (stock price), log(earnings yields) and log(long-term government bond yield).

Table 1 Critical Value

Null Hypothesis	Trace Statistic	5% Critical Value	1% Critical Value	Max Eigen Value	5% Critical Value	1% Critical Value
$r = 0$	39.71***	29.80	35.46	29.34***	21.13	25.86
$r \leq 1$	11.77	15.50	19.94	11.18	14.26	18.52
$r \leq 2$	0.59	3.84	6.63	0.59	3.84	6.63

The Johansen test statistics clearly rejects the null hypothesis (at 1% level) of no co-integration ($r=0$) for the log (stock price), log (earnings yield) and log (long-term government bond yield). The trace test value of 39.71*** is greater than the 1% significance level 35.46. The max eigenvalue of 29.34*** is greater than the 1% critical value of 25.86 as presented in the Table 1. The ($r \leq 1$) hypothesis cannot be rejected signifying the presence of only one co-integrating vector in the system these variables. This means that there is long run relationship between stock price, earning yield, and long-term government bond yield.

Finally, the unconstrained equilibrium relationship is :

$-0.0092 \Delta \ln(E) + 0.0038 \Delta \ln(P) + 0.0022 \Delta \ln(R)$ set equal to zero and expressed with respect to P , one has $\Delta P^* = \exp \frac{(0.0092 \Delta \ln(E) - 0.0022 \Delta \ln(R))}{0.0038}$.

Based on the results, a one percent change in 10-year government bond yield is negative associated with 0.58% change in the stock price and a one percent change in earning yield is positive associated with 2.42% change

in the stock price in the long-run. Since p-value of log (gov-yield) is less than significant level at 0.05, this means that the past value of 10-year government bond yield effect the current stock price and can be used to predict in the long-run. The Granger causality result shows that at 5% significance level, the null hypothesis holds in three cases. First, short-run movement in the earning yield does not cause changes in stock price. Second, stock price does not Granger cause earning yield as well. Third, the past short-run change in earning yield does not cause changes in long-term government bond yield. However, for the null hypothesis that do get rejected, we can state that the change in long-term government bond yield does Granger cause stock price with 1% significance level and the past change in stock price also have impact on long-term government bond yield which means the role of bond yields in the Fed model is statistically strong.

5. Conclusions and Policy Recommendation

This paper analyze the long-run relationship between stock index price, earning yield and long-term government bond yield in Thailand by using the Fed model in co-integration framework. In the first part of the result shows that there is long-run relationship between the stock price, the earning yield, and long-term government bond yield at 0.01 significance level which a one percent change in 10-year government bond yield is negative associated with 0.58% change in the stock price and a one percent change in earning yield is positive associated with 2.42% change in the stock price in the long-run. Moreover, the change of earning yield cause more change in the stock price than long-term government bond yield in the long-run. In the second part, we study short-term dynamics whether the change of long-term government bond yield affect fully or partially on the stock prices. We used variance decomposition to examine and we found weak evidence for stock return but there is a short-run dynamic which the movement in stock price can be explained by the movement in long-term government bond yield and do have almost equal impact on stock price in short-run. The third, we estimated granger causality for determining whether long-term government bond yield is useful in forecasting future value of stock prices. Our empirical result shows that long-term government bond yield is statistically significant to predict the stock price and the Fed model is statistically strong. For policy recommendation, we recommend investors to focus on change of the long-term government bond yield for short-term investment and to focus on earning yield when do long-term investment.

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