

ปัจจัยที่มีผลกระทบต่อประสิทธิภาพตลาดพันธบัตร ไทย

FACTORS AFFECTING BOND MARKET EFFICIENCY IN THAILAND

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บทคัดย่อ

การพัฒนาตลาดพันธบัตรให้มีประสิทธิภาพเป็นสิ่งสำคัญ เนื่องจากตลาดพันธบัตรเป็นแหล่งระดมทุนทางตรงทั้งภาครัฐและภาคเอกชน รวมถึงเป็นทางเลือกในการลงทุนให้กับนักลงทุน งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่มีผลกระทบต่อประสิทธิภาพตลาดพันธบัตรไทย โดยวิเคราะห์ข้อมูลรายเดือนของพันธบัตรรัฐบาลที่ออกในช่วงเดือน มิถุนายน 2549 – 2558 จำนวน 64 รุ่นผลการศึกษาพบว่า การรายงานข้อมูลการซื้อขายถูกต้องและรายในระยะเวลาที่กำหนด จะทำให้ตลาดพันธบัตรมีประสิทธิภาพด้านข้อมูลข่าวสารและราคาสูงขึ้น ความผันผวนของอัตราผลตอบแทนที่ใช้ในการซื้อขายพันธบัตร อัตราดอกเบี้ยนโยบาย และส่วนต่างระหว่างอัตราผลตอบแทนเสนอซื้อและเสนอขาย ส่งผลกระทบในด้านลบกับประสิทธิภาพในด้านการดำเนินงานกับตลาดพันธบัตรไทย ในขณะที่ปริมาณการซื้อพันธบัตรสูงขึ้นนักลงทุนต่างประเทศ ส่งผลกระทบในด้านบวกกับประสิทธิภาพในด้านการดำเนินงานกับตลาดพันธบัตรไทย เมื่อสมาคมตลาดตราสารหนี้ไทยปรับปรุงกระบวนการรายงานข้อมูลการซื้อขายพันธบัตรจะทำให้ตลาดพันธบัตรไทยมีประสิทธิภาพในด้านข้อมูลและราคาสูงขึ้น เมื่อกระทรวงการคลังกำหนดให้พันธบัตรบางรุ่นเป็นพันธบัตรอ้างอิงในการกำหนดราคาพันธบัตรรุ่นอื่น ๆ และธนาคารแห่งประเทศไทยกำหนดให้สถาบันการเงินและนิติบุคคลอื่น ๆ ทำธุกรรมยืมและให้ยืมหลักทรัพย์ได้ จะทำให้ตลาดพันธบัตรไทยมีประสิทธิภาพการดำเนินงานมากขึ้น

ดังนั้น หน่วยงานที่เกี่ยวข้องกับการพัฒนาตลาดพันธบัตรไทย ควรมีนโยบายหรือออกกฎหมายเบียบเพื่อสนับสนุนให้ตลาดพันธบัตรไทยมีประสิทธิภาพมากขึ้น โดยปรับปรุงกฎระเบียบและนโยบายต่าง ๆ ที่เกี่ยวข้องกับการรายงานข้อมูลการซื้อขายให้มีความถูกต้องแม่นยำมากขึ้น และควรลดต้นทุนในการซื้อขาย

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พันธบัตร รวมทั้งลดความผันผวนของอัตราผลตอบแทนที่ใช้ในการซื้อขายในการซื้อขายพันธบัตร และสนับสนุนให้นักลงทุนต่างประเทศหันมาซื้อพันธบัตรไทยมากขึ้น

คำสำคัญ: ตลาดพันธบัตรไทย พันธบัตร ตลาดพันธบัตร

Abstract

The development of bond market toward market efficiency is important because it provides a direct fundraising source for the government and private sector, providing an alternative choice for investors. This paper focuses on factors affecting bond market efficiency in Thailand by analyzing the monthly government bond data from June 2006 to December 2015, during which there was a total issue of 64 bonds series. The evidences as of this study indicate that correct reporting of bond trading information within assigned time periods can increase bond market efficiency. However, bond trading volatility, interest rate policy, and quoted bid-ask spread yield can all negatively affect bond market operational efficiency. Conversely, the net volume of purchases from foreign investors can have a positive effect. If the Thai bond market associations can improve its trading reporting procedure, information and pricing efficiency is likely to ensue. In addition, when the Ministry of Finance issues a benchmark bond series, and the Bank of Thailand issues a policy allowing financial institutions and other entities to carry out the relevant borrowing and lending transactions, the bond market will increase operation efficiency.

The authorities responsible for organizing bond market development should, therefore, focus on issuing new regulations or improving existing policies in order to increase bond market efficiency. In particular, the improvement of regulations or policies in terms of reporting bond trading information should be more accurate and responsive. Furthermore, reducing transaction costs, stabilizing bond trading yield, and stimulating foreign investment in the purchase of large quantities of bonds should be paramount.

Keywords: Thai Bond Market, Bond, Bond Market Efficiency

Introduction

Financial market efficiency benefits the economic system because it supports resource allocation (Woodford, 2002). Fama (1970) defined market efficiency as the effective provision of information whereby the price of the security is fully and accurately reflected in the decision-making process at no transactional cost. O'Hara (1995) defined market efficiency in terms of operational performance, and Megginson (1997) considered it to be based on pricing and allocation, with Samuelson, (1975); Merton, (1992); Dow and Gorton, (1997) adding functionality to the defining factors.

The bond market not only plays an important role in financial resource allocation for the government and private sector, but also offers a significant source of funding

(Aquilina, Butterworth, Suntheim, Winkler, & Ysus, 2015). Bessembinder, Maxwell, and Venkataraman (2006) mentioned that a transparent bond market could increase information efficiency by reducing information asymmetries and helping investors to make better bond trading decisions. Investors will then pay a fair price, resulting from lower transaction costs. Green, Hollifield, and Schurhoff, (2004); Aquilina et al., (2015) found transparency to be an important influential factor on the market behaviors of market participants, creating more competition and reducing collusion.

Three significant characteristics facilitate the operational efficiency in the bond market. First, liquidity creates low transaction cost which is called “tightness” according to the Committee on the Global Financial System (1999); Upper (2000) and Borio (2000). Low transaction cost means low bid – ask spread and the current price must not deviate much from the latest price. According to O’Hara (1995) the transaction cost includes commission, tax, or other expense. Secondly, bond market liquidity must have depth. Mares (2002), Borio (2000), and Harris (2003) defined depth as active transactions where the trading volume has no impact on bond price. When there is a large amount of buying or selling, thereby creating bond market liquidity, the price may not deviate significantly from its usual level. Thirdly, bond market liquidity is associated with two types of activities: the execution of transactions and price adjustment. According to Upper (2000), Borio (2000), and Harris (2003), the speed with which transactions are executed after placing an order can be called “immediacy”. The speed of price adjustment toward the equilibrium when impacted by external factors. Whether the bond price quickly or slowly respond, it depends on internal or fundamental factors of bond issuers. Upper (2000), the Committee on the Global Financial System (1999), Borio (2000) and Sar and Lybex (2002) defined this as “resiliency”.

Thailand is an important South East Asian emerging market with a high average ratio in the value of outstanding government bonds to GDP from 2011 to 2015 (Table 1). Since the financial crisis in 1997, the Thai bond market has grown steadily, with outstanding bond values to GDP reaching 74% in 2015 from 12% in 1997 (Figure 1).

Table 1 The percentage of outstanding government bonds to GDP in the emerging market of South East Asia

Country	The percentage of outstanding government bonds to GDP					
	2011	2012	2013	2014	2015	Average
Malaysia	56.6	64.8	60.6	60.5	52.9	59.1
Philippines	30.3	33.7	33.1	30.8	29.7	31.6
Singapore	47.0	51.8	50.0	49.8	46.4	49.0
Thailand	54.5	62.7	58.7	57.3	55.4	57.5
Vietnam	12.7	16.9	16.5	21.7	19.8	17.5

Source: Asian Bonds Online, 2016

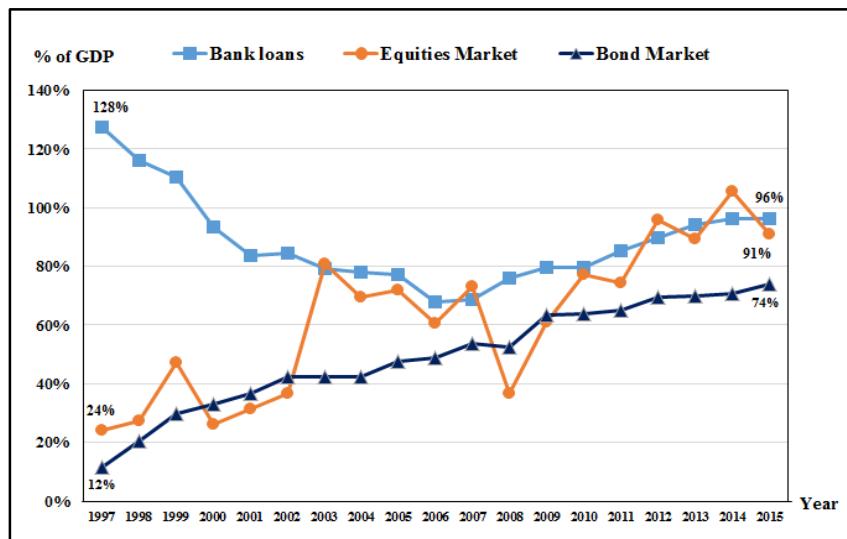


Figure 1 Outstanding bond values compared to GDP

In order to develop the bond market to be more efficient, it involves several factors. The Committee on the Global Financial System (1999), Borio (2000) and Pemberton, Stewart & Watson, (2005) stated that bond market efficiency was affected by the factors such as the trade execution system, transactional costs, design of financial products, risk management systems, well-organized infrastructure management, appropriate regulatory framework, credit rating institutions, and the repurchase market.

This paper focuses on the factors affecting the efficiency of Thailand's bond market in terms of information provision and operational efficiency. It comprises four sections and differs from other studies which merely target the stock market. The first section provides an overview of the Thai bond market, and the second indicates the methodology used to determine factors affecting its efficiency. The results of the study are presented in the third section, before finally presenting the conclusion and policy recommendations.

Overview of the Thai Bond Market

Securities were first issued by the government in Thailand in the form of foreign currency bonds in order to provide continuous international fundraising to develop the country's economic status in 1905. However, in 1923, the Thai government stopped issuing foreign currency bonds and focused instead on the Thai baht, in Thai baht government bonds have been issued since 1933. At that time, the total value of government bonds was USD 312,500 and they continued to be issued from 1990 to 1996 when the economy in Thailand was considered to be moving in a positive direction. During this time, the Thai government operated under a budget surplus policy and stopped issuing government bonds. In 1997, due to the Asian financial crisis, Thai government was needed to help financial

institutes by issuing financial institution development fund (FIDF) bond which was USD 15,625 million enabling the bond market to have potentials the economic system in Thailand

Bond trading in Thailand can be classified into two main markets: primary and secondary. The primary market is where bonds are first issued to raise funds, while the secondary market is for investors who have already purchased bonds and want to exchange them for cash. In Thailand, bond trading in the secondary market is over the counter (OTC) via intermediary bond dealers, authorized by the Stock Exchange of Thailand (SET). Bond dealers include commercial banks, venture capitalists, and securities firms. The income for bond dealers comes from the difference between the buying and selling price. The bond price is negotiated between buyers and sellers. Bond dealers must report information regarding all types of transactions to the Thai Bond Market Association (ThaiBMA), whether outright transaction, outright transaction auctions, financing transaction or derivatives transaction. In the past, outright auctions were classified as outright transactions but there is now a new classification separating outright transactions auction from outright transactions.

Trading bonds can be classified into two main types: government securities consisting of government bonds and treasury bills both issued by the Ministry of Finance, state agency bonds issued by the Bank of Thailand, and state-owned enterprise bonds, including government guaranteed and non-guaranteed issued by State-Owned Enterprises. Private securities are issued by companies authorized by the Stock Exchange of Thailand. The majority of government issued and state-owned enterprise bonds (both guaranteed and non-guaranteed) have more than one year tenor and the coupon payment is available until the bond has expired. However, most treasury bills and state agency bonds have less than one year tenor and can be traded at less than their par values. As to corporate bonds, some have a tenor of less or more than one year, depending on the preference of their issuers.

Since the financial crisis in 1997, the Thai bond market has grown every year that outstanding government bond values have been the highest, followed by state agency bonds, corporate bonds, state-owned enterprise bonds, and treasury bills, respectively (Figure 2).

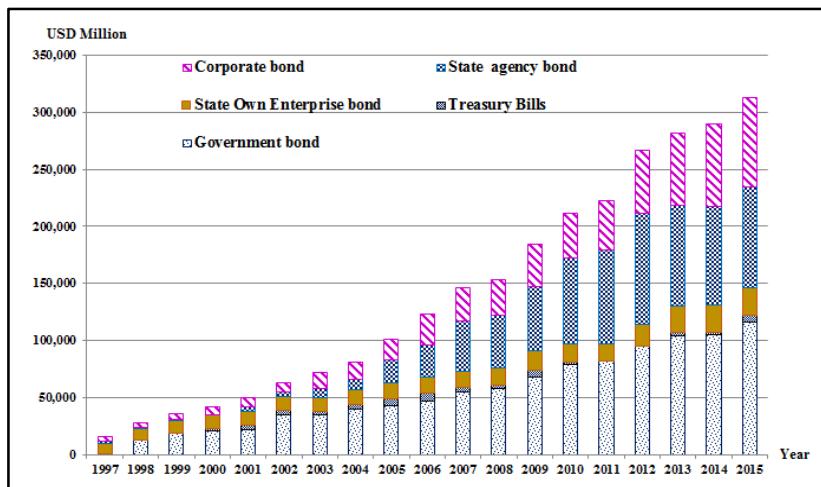


Figure 2 Outstanding bond values classified by type

From 2001 to 2015, the majority of new issues were state agency bonds, followed by treasury bills, government bonds, corporate bonds, and state-owned enterprise bonds (Figure 3). In 2013, the average daily secondary market trading volume was USD 2,586.68 million with the majority of trading taking place in state agency bonds followed by government bonds, treasury bills, corporate bonds, and state-owned enterprise bonds, respectively (Figure 4). Most trading transactions were executed between bond dealers and clients. The majority of trades in the secondary market involved short-term bonds for Asset Management Companies (AMCs), with individual clients having the lowest amount of trading activities (Figure 5).

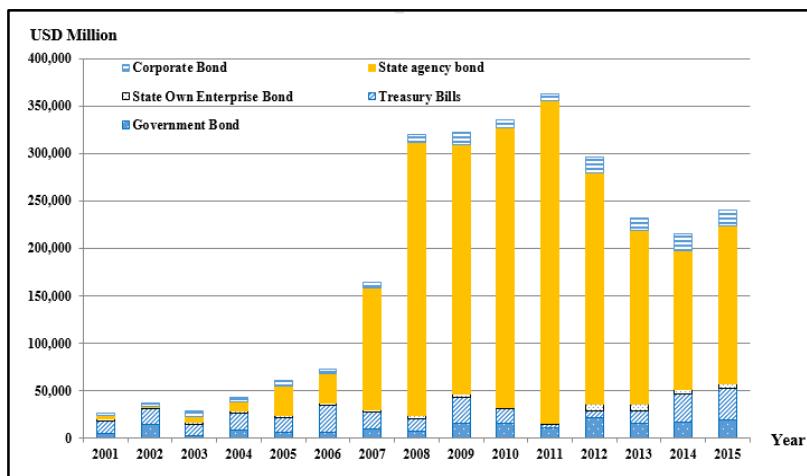


Figure 3 Volume of new bond issues

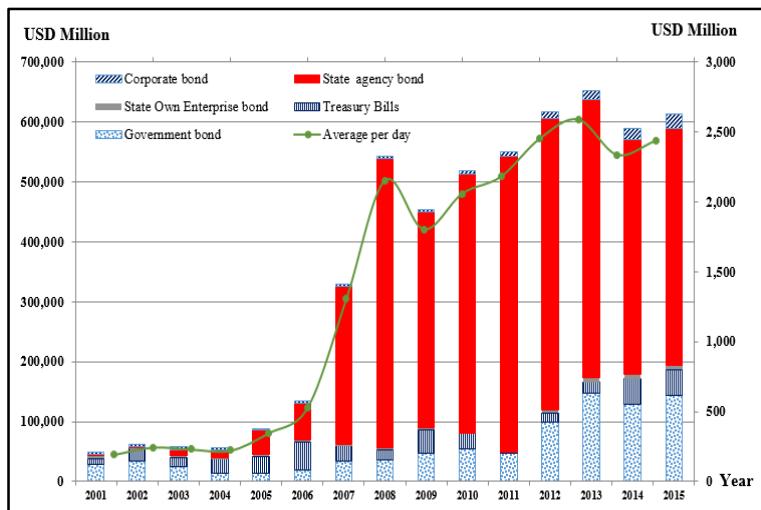


Figure 4 Secondary bond market volume

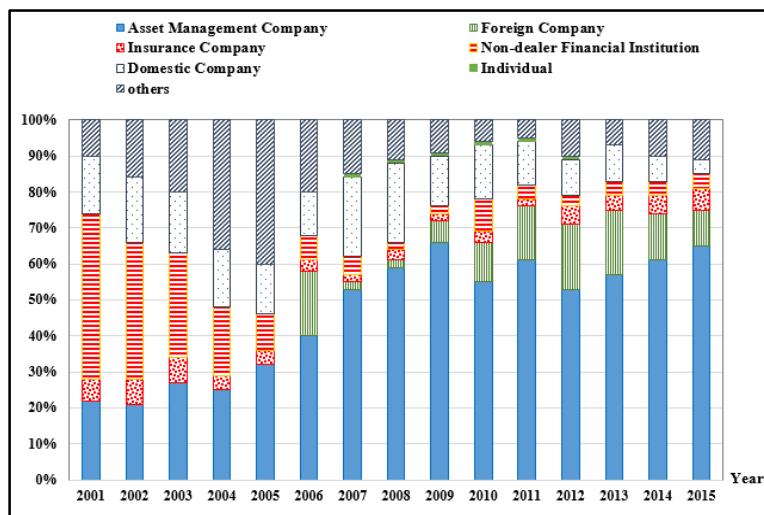


Figure 5 Ratio of secondary market investment

There are three main facilities affecting the direction and control of bond market trading: Ministry of Finance (MOF), Bank of Thailand (BOT), and Stock Exchange of Thailand (SET). Public Debt Management Office (PDMO) founded in 1999 operates under Ministry of Finance. It is tasked with bond market policy and the systematic control and issue of government securities when there is a budget deficit. It is responsible for the planning required for about indebtedness and public debt management according to the government's objectives of national economic and social development. PDMO is responsible for time predictions and the appropriate size of bond issues without generating too much financial cost for the government. Additionally, PDMO also operates proper repayment planning.

BOT is responsible for the operation of national monetary policies and control of inflation, playing a significant role in the bond market. It sets interest rate policies to enable the government, private sector, and financial institutions to acknowledge economic trends and future directions. It is also tasked with underwriting government bonds and treasury bills. Furthermore, it issues bonds to increase or decrease the money supply in the economic system.

SET's function is to manage and develop the national capital market. Its task is to determine policy and regulations in relation to capital market management. In terms of securities, SET controls corporate bond trading in the primary market. In order to issue new bonds, companies must obtain permission from SET in accordance with the designated regulations. In the secondary market, SET appoints ThaiBMA to manage the trading bond business.

Methodology

Data

Monthly data consist of 64 government bond series trades from June 2006 to December 2015. The data were collected from Thai Bond Market Association, Bank of Thailand, and the Stock Exchange of Thailand. This study defines 13 variables to test factors affecting bond market efficiency, namely time taken to report errors (REP_t), the number of bonds registered to the ThaiBMA (RIG_t), trading volume (VOL_t), the number of transactions per month ($TRAN_t$), issue size of the government bond (ISU_t), volume of repurchase order transactions ($VOLR_t$), volatility of bond yield ($VOLA_t$), consumer price index (CPI_t), SET index (SET_t), spot exchange rate of USD/THB (EX_t), net foreign buyers of bonds ($VOLF_t$), quote bid-ask spread yield (BAS_t), and interest rate policy (INR_t).

Dummy variables consist of $D1_t$ representing a new type of trading bond which is an outright auction transaction (OUTA) published by the ThaiBMA. The second dummy variable ($D2_t$) represents the policy issued by the Ministry of Finance determining some series as benchmark bonds. The third dummy variable ($D3_t$) is the government regulation whereby the financial institutions and other corporations are authorized by the BOT for securities borrowing and lending transactions (SBL). The fourth dummy variable ($D4_t$) concerns the issuance of a floating bond, and the final dummy variable ($D5_t$) is a new type of transaction referred to as a bond switching transaction. $D1_t$, $D2_t$, $D3_t$, $D4_t$, and $D5_t$ equal to 0 when such policies are not issued, and equal to 1 otherwise.

Given the unit of SET_t , $VOLR_t$, and $VOLF_t$ is USD billion, the unit of SET_t , is point, the unit of $VOLA_t$, and BAS_t , is a basis point (1 basis point = 0.01%). CPI_t , and INR_t are shown as the percentage.

In this study, using the regression analysis model, the tested and variable selection affecting bond market efficiency relates to three components. When obtaining

variable results from the regression analysis, only those affecting bond market efficiency are used to create the structural equation model (SEM) to estimate the parameters of these variables via seemingly unrelated regression (SUR) for the purposes of explaining the factors affecting efficiency in the bond market as shown in equations (12) to (14).

Proxy of Bond Market Efficiency

Bond market efficiency can be considered by the transparency and liquidity components. The transparency component score of bond market at time t ($MEI_{TR,t}$) considered by the average of observation yield error of all bond series at time t . $OYE_{i,t}$ is calculated using the difference between the expected yield of bond i at time t ($Y^e_{i,t}$) and the actual yield of bond i at time t ($Y_{i,t}$) applied from Diaz and Skinner (2001).

$$OYE_{i,t} = |Y_{i,t} - Y^e_{i,t}| \quad (1)$$

$$MEI_{TR,t} = \frac{\sum_{i=1}^N \left(1 - \frac{OYE_{i,t} - OYE_i^{\min}}{OYE_i^{\max} - OYE_i^{\min}} \right)}{N} \quad (2)$$

$$MEI_{TR,t} = \frac{\sum_i^N \frac{(OYE_i^{\max} - OYE_{i,t})}{(OYE_i^{\max} - OYE_i^{\min})}}{N} \quad (3)$$

$$MEI_{TR} = \frac{\sum_{t=1}^T MEI_{TR,t}}{T} \quad (4)$$

where

OYE_i^{\min} represents the absolute of minimum magnitude of the difference between the actual and expected yield calculated from the yield curve of bond i in T period, while the OYE_i^{\max} refers to the absolute of largest difference between actual and expected yield calculated from the yield curve of bond i in T period. T is the number of the month. N is the number of bond series. The results of $(OYE_{i,t} - OYE_i^{\min}) / (OYE_i^{\max} - OYE_i^{\min})$ will be deleted from 1 to adjust the direction. The $MEI_{TR,t}$ is the total score of the transparency component, range of 0 to 1. The higher the MEI_{TR} value, the greater the transparency.

The efficiency score of the liquidity component consists of two sub-components, namely tightness and depth. Tightness means low bond trading costs and depth refers to the volume of active trading. Tightness is calculated from the quoted bid-ask spread, in similarity to the research carried out by the Committee on the Global Financial System (1999). According to Sarr & Lybek (2002), depth is calculated using the bond turnover ratio.

$$BAS_{i,t} = (Y_{bid,i,t} - Y_{ask,i,t}) \quad (5)$$

$$MEI_{TI,t} = \frac{\sum_{i=1}^N \left(1 - \frac{BAS_{i,t} - BAS_i^{\min}}{BAS_i^{\max} - BAS_i^{\min}} \right)}{N} \quad (6)$$

$$MEI_{TI,t} = \frac{\sum_i^N \frac{(BAS_i^{\max} - BAS_{i,t})}{(BAS_i^{\max} - BAS_i^{\min})}}{N} \quad (7)$$

$$MEI_{TI} = \frac{\sum_{t=1}^T MEI_{TI,t}}{T} \quad (8)$$

$$Tn_{i,t} = \left(\frac{V_{i,t}}{O_{i,t}} \right) \quad (9)$$

$$MEI_{DE,t} = \frac{\sum_i^N \left(\frac{Tn_{i,t} - Tn_i^{\min}}{Tn_i^{\max} - Tn_i^{\min}} \right)}{N} \quad (10)$$

$$MEI_{DE} = \frac{\sum_{t=1}^T MEI_{DE,t}}{T} \quad (11)$$

where

$BAS_{i,t}$ refers to the quoted bid-ask spread yield of bond i at time t . $Y_{bid,i,t}$ refers to the quoted bid yield of bond i at time t and the $Y_{ask,i,t}$ indicates the quoted ask yield of bond i at time t . BAS_i^{\min} is the absolute magnitude of the difference between the average quoted bid-ask spread yield and the minimum value of bond i in T period. T is the number of the month. BAS_i^{\max} is the absolute of difference between the average quoted bid-ask spread yield and the maximum value of bond i in T period. The results of $(BAS_{i,t} - BAS_i^{\min})/(BAS_i^{\max} - BAS_i^{\min})$ will be deleted from 1 to adjust the direction. The $MEI_{TI,t}$ is the total score of the tightness component, range of 0 to 1. The higher the $MEI_{TI,t}$ value, the greater the tightness.

$Tn_{i,t}$ is the turnover ratio of bond i at time t . $V_{i,t}$ is the trading volume of bond i at time t . $O_{i,t}$ is the outstanding value of bond i at time t . Tn^{\min} represents the bond turnover with the minimum value of bond i in T period. T is the number of the month. Tn^{\max} is the bond turnover with the maximum value of bond i in T period. The $MEI_{DE,t}$ is the total score of the depth component, ranges from 0 to 1. The higher the $Tn_{i,t}$ value, the greater the depth.

The efficiency scores of the bond market in terms of transparency, tightness, and depth are classified into five different levels: 0.0000–0.1999 is the lowest, 0.2000–0.3999 is low, 0.4000–0.5999 is moderate, 0.6000–0.7999 is high, and 0.8000–1.0000 is the highest.

Analysis of the Factors Affecting the Bond Market Efficiency

Factors affecting bond market efficiency can be examined by the structural equation model (SEM) via the seemingly unrelated regression (SUR) as follows:

$$MEI_{TR,t} = \alpha_0 + \alpha_1 REP_t + \alpha_2 D1_t + \alpha_3 D1REP_t + \varepsilon_{\alpha t} \quad (12)$$

$$MEI_{TI,t} = \beta_0 + \beta_1 VOLAt + \beta_2 INR_t + \beta_3 D2_t + \beta_4 D2_t VOLAt + \beta_5 D2_t INR_t + \varepsilon_{\beta t} \quad (13)$$

$$MEI_{DE,t} = \lambda_0 + \lambda_1 BAS_t + \lambda_2 VOLF_t + \lambda_3 D3_t + \lambda_4 D3_t BAS_t + \lambda_5 D3_t VOLF_t + \varepsilon_{\lambda t} \quad (14)$$

where

α_0 , β_0 , and λ_0 are estimated parameters. $\varepsilon_{\alpha t}$, $\varepsilon_{\beta t}$, and $\varepsilon_{\lambda t}$ are white noise error.

Results

Thai Bond Market Efficiency

The efficiency of the Thai bond market from June 2006 to December 2015 is examined in terms of transparency, tightness, and depth. Transparency represents information and price efficiency that are important for decision making process in determining the price of bond trading. The operational efficiency is affected by market liquidity, consisting of tightness and depth, while tightness reflects the character of the market by low trading costs, and depth refers to active transactions without the price change impact. The results show that Thai bond market transparency is at the highest level, efficiency in terms of tightness at the high level, and depth at the lowest level (Table 2).

Table 2 Thai bond market efficiency scores from June 2006 to December 2015

Year	MEI _{TR}		MEI _{TI}		MEI _{DE}	
	Score	Level	Score	Level	Score	Level
2006	0.9015	Highest	0.7869	High	0.1979	Lowest
2007	0.8779	Highest	0.7158	High	0.1538	Lowest
2008	0.8451	Highest	0.5593	Moderate	0.1465	Lowest
2009	0.8651	Highest	0.5538	Moderate	0.1529	Lowest
2010	0.8752	Highest	0.5825	Moderate	0.1216	Lowest
2011	0.8727	Highest	0.6078	High	0.0722	Lowest
2012	0.9029	Highest	0.7162	High	0.0993	Lowest
2013	0.8699	Highest	0.7235	High	0.0949	Lowest
2014	0.8788	Highest	0.7306	High	0.0787	Lowest
2015	0.8843	Highest	0.7055	High	0.0854	Lowest
Total	0.8763	Highest	0.6630	High	0.1170	Lowest

Factors Affecting Bond Market Efficiency

In order to examine the factors affecting efficiency in terms of transparency, tightness, and depth in Thai bond market, the parameters for identifying the size and relationship of variables as the efficiency score in each component, including transparency, tightness, and depth ranges between 0 and 1, as shown in Table 3.

Table 3 Factors affecting bond market efficiency in terms of transparency, tightness, and depth

Variables	MEI _{TR}	MEI _{TI}	MEI _{DE}
Constant	0.858839*** (0.009570)	0.454313*** (0.030789)	0.230044*** (0.027317)
REP	-0.000141*** (0.000012)		
VOLA		-0.001632* (0.000830)	
INR		-0.060296*** (0.008426)	
BAS			-0.010306*** (0.003186)
VOL_F			0.002104** (0.000912)
D1	0.027500** (0.012230)		
D2		0.125296*** (0.029535)	
D3			-0.139989*** (0.029071)
D1* REP	0.000032** (0.000069)		
D2*INR		0.020390* (0.011056)	
D3*BAS			0.010416*** (0.003223)
D3*VOL_F			0.002070** (0.000915)
R-squared	0.122461	0.349933	0.466925
Adjusted R-squared	0.098744	0.326077	0.442472
S.E. of regression	0.030559	0.081809	0.038153
Durbin-Watson stat	1.302830	1.511461	1.372689

Remark: * significance at 0.10, ** significance at 0.05, and *** significance at 0.01

According to ThaiBMA rules, when there is a single instance of an incorrect or late report (REP_t), the transparency efficiency score will be reduced by 0.000141 point. However, when an outright auction transaction report is announced as being OUTA by

ThaiBMA ($D1_t$), and there is an error of report the transparency score will be reduced by 0.000109 point when there is a single instance of an error or late report. Thus, this announcement can lower the reduction of transparency efficiency scores when there is an error or late report. REP and $D1$ can indicate the fluctuation of the transparency efficiency by 12.2461 percent. Others depend on other variables which do not belong in this simulation.

Bond yield volatility ($VOLA_t$) and interest rate policies (INR_t) negatively affect bond market efficiency in term of tightness. When the bond yield increases by 1 basis point, it can cause volatility, increasing the risk of a higher bond price. Buyers are required to minimize the risk of such changes by lowering the buying price. Furthermore, sellers are required to sell the bonds at a higher price for increased returns. When interest rates are higher the bond yield increases, resulting in lower bond prices. (The bond price will commonly inverse to the bond yield. If the bond yield increases, the bond price will decrease. In contrast, If the bond yield decreases, the bond price will increase.) Both buyers and sellers prefer the returns higher than the interest rate policy. However, if the BOT subsequently announces an interest rate increase of 1%. when the Ministry of Finance issues a series of benchmark bonds as the reference price of other series of bonds ($D1_2$), the efficiency tightness score will decrease by 0.039906 point. It can be concluded that appointing some series of bonds can increase efficiency scores in term of tightness.

When the quoted bid-ask spread yield increases (BAS_t) by 1 basis point, the bond turnover ratio reduces, resulting in a decrease in depth score efficiency of 0.010306 point. However, when the net volume of foreign bond ($VOLF_t$) purchases increases to USD 1 billion, the depth efficiency score rises by 0.002104 point. This is because bond demand has increased. Therefore, buyers can afford to pay a higher price, resulting in selling more bonds from bond holders. In addition, when BOT appoints financial institutions and other entities can carry out SBL transactions ($D3_t$) และ the quoted bid-ask spread yield increases by 1 basis point, it will be lead to increasing trading volume to outstanding bond values. This contributes an increase in the depth efficiency score of 0.000110 Although SBL transactions also increase the efficiency scores in terms of depth by 0.004174 when the volume of net foreign bond purchases increases to USD 1 billion. It can be concluded that increasing the number of financial institute and other entities to do SBL transaction can increase efficiency scores in term of depth.

Conclusions

The objective of this paper is to analyze the factors affecting Thai bond market efficiency in terms of transparency, reflected by information and price efficiency, with tightness and depth reflected by operational efficiency. The results show that the accurate reporting of bond trading information within a designated period of time facilitates

information and price efficiency. The volatility of bond yield, interest rate policies, and quoted bid-ask spread yield can negatively impact on operational efficiency in the bond market. In contrast, the volume of net foreign bond purchases can positively impact on the bond market's operational efficiency.

When the Thai Bond Market Association improves the reporting procedure for bond trading information, information and price efficiency will increase. In addition, the bond market's operational efficiency will be significantly improved when the Ministry of Finance issues benchmark bonds and the Bank of Thailand establishes a policy enabling financial institutions and other entities to carry out securities borrowing and lending transactions (SBL) transactions. Bond market development should, therefore, focus on new policies for improving efficiency. The correct, accurate, and responsive reporting of bond trading information, and bid-ask spread yield reduction policies for reducing trading costs must be properly addressed, together with bond trading policies for decreasing yield volatility. Foreign investors should be encouraged to buy a larger proportion of bonds, especially when interest rates increase.

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