Bond Market Development and Economic Growth: Experience of East Asian Economies

By

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Abstract

Prior to Asian financial crisis of 1997, East Asian economies grew at a remarkable speed with industry-led development strategy yet with little scope of capital market development. Experience of Asian crisis shaped the regional cooperation to build structure for long term capital markets, which led to strong tailwinds of policy structures through ASEAN Plus Three (APT) to promote bond financing. In this regard, this study uses Autoregression model, first difference of panel regression and granger causality to i) determine the direction of causality between bond market development and economic growth ii) analyze the effect of bond market development on economic growth for ten East Asian economies for the period of 2004-2016. Two categories of bond market size are used to determine bond market development, namely local currency bond market and foreign currency bond market to explore the bond market development. The result shows that while bond market has positive and significant effect on economic growth in the regional economies, it was also discovered that the causality flows from economic growth to bond market development. It is recommended that with continued development of capital markets, economic growth could continue in same path while at the same time, economic growth policies should bring greater emphasis to capital market deepening for strengthening symbiotic relationship between bond markets and growth of the region.

Keywords: Bond market development; Economic growth, East Asia, ASEAN Plus three

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List of abbreviations

ASEAN: Association of Southeast Asian Nations

APT: ASEAN Plus Three

GMM: Generalized Method of Moments

ABMI: Asian Bond Markets Initiative

PCA: Principal Component Analysis

LS: Least Squares

AR: Autoregression

IPS: Im–Pesaran–Shin (unit root test)

ADF: Augmented Dickey–Fuller

PP: Phillips-Perron

AIC: Akaike Information Criterion

SC: Schwarz (Information) Criterion

VECM: Vector Error Correction Model

VAR: Vector Autoregression

Introduction

Prior to Asian financial crisis of 1997, East Asian economies grew at a remarkable speed with the policy measures of adopting technologies from the advanced countries for growing industrial sectors. This industry-led development strategy promoted by trade openness led to emergence of the region as one of the fastest growing markets during the period where each of the major markets like Malaysia, Thailand, Singapore, Korea and Indonesia, all on average grew at a growth rate of around 7%, giving them the name "East Asian Tigers[1]" . During the period, respective markets also underwent financial liberalisation which was till then largely dominated by bank loans and minimum or no scope of long term capital market.

When the financial crisis of 1997 struck, over dependence on foreign currencies through bank borrowings aggregated problems of currency mismatch, contributing to financial contagion. Over reliance on bank financing whilst having inconsistency in capital account policies has been condemned as one of the major shortcomings of financial liberalisation of East Asian market during the period.

Since the financial crisis of 1997, a stronger sense of regionalism emerged among the regional markets, with the primary aim to establish closer partnership to strengthen the financial grounds in terms of international monetary market. This regionalism gave rise to to strong tailwinds promoting policies for capital market deepening through bond financing. Bond market

[1] Four original East Asian Tigers were south Korea, Taiwan, HK, and Singapore

development helps to diversify securitization as well as support markets in terms of long term capital requirements.

One of the cornerstones of Asian regionalism is the Association of Southeast Asian Nations[2] (ASEAN) which initially invovled ten East Asian countries as its members which later convened into ASEAN Plus Three[3] (APT) framework, with addition of China, Japan and South Korea as its three added members. With fresh sore from Asian crisis of 1997, APT was sought as an institution to undertake financial governance within the region, correct the mistakes of the broad economic policies of early 1990s and support the process of financial deepening.

This paper aims to explore a relationship bond market and economic growth since the advent of policies that promote bond market development in East Asian economies. Based on the broader concepts of theoritical literatures that have proposed different hypothesis on the type of relationship between components of financial market and economic growth, this paper assumes an existence of some form of relationship between economic growth and bond market, as one of the important subcomponents of financial markets. There are some literatures by (Said, 2012), Fink et al., (2006), Pradhan et al., (2016), Ocbio et al., (2016) that have explored similar problem. Major claim of most of these papers have been positive effect of bond market development on economic growth and presence of causality flowing from either one of these components to another.

[2] ASEAN Member countries: Malaysia, Thailand, Singapore, Korea, Indonesia, Vietnam, Brunei, Cambodia, Laos and Myanmar

[3] ASEAN Plus Three (APT) Also written as ASEAN+3

The objectives of this paper are: i) to find what type of impact bond market development has had on economic growth for East Asian market ii) to determine what type of causal relationship exists between economic growth and bond market development. To be more specific, the objective of impact of one component on another tries to answer if increase in bond market development is associated with increase in economic growth, what is the magnitude of that association and if that association shows causal relationship.

The structure of this paper is as following: chapter 1 reviews the theoretical aspects of relationship between financial market development and economic growth and discusses the existing empirical evidence on relationship between bond market development and economic growth. Furthermore, it reviews ASEAN regionalism and status of bond market structure in the region. Chapter 2 outlines the empirical methodology used to test the relationship between bond market and economic growth, followed by Chapter 3 which presents the results for different models. Chapter 4 provides discussion of the results and limitations of empirical models and suggestions for further research. Lastly, Chapter 5 presents conclusion and proposes policy suggestions.

1. Literature Review

1.1. Theoretical aspects

Financial globalization has changed the face of global income distribution since the dawn of third wave of globalization starting from 1990s. One of the hallmark features of financial globalisation has been *financialization* which Epstein (2005) explains as a process led by increasing role of financial system in bringing operational changes in domestic and international markets that has transformed motives of every economic agent. For this very reason, market economic system becomes a hub for financial system to undertake every economic transaction which enables financial development contribute to economic growth either through positive or negative processes.

There have been particularly four possible hypotheses that describe a causal tie between financial market and real sectors: 1) *Supply-leading* 2) *Demanding-following* 3) *Feedback* 4) *Neutrality.* These hypotheses have been tested for overall financial sectors as well as its sub-components, one being bond market.

Supply leading hypothesis argues that a unidirectional relationship is present from financial market development to economic growth. Contrary to this*, Demand-following hypothesis* points out that real economy drives the growth of financial sectors in unidirectional manner, hence financial market development is endogenously determined by economic growth. Thirdly, *feedback hypothesis* rather shows a bidirectional relationship between financial market development and economic growth, where each factors are considered indispensable to contribute for growth of another. Lastly, *neutrality hypothesis* argues that there is no causality

running from any direction, rather each financial market development and economic growth are independent of one another (Pradhan et al., 2015).

Earliest arguments in favor of this hypothesis is presented by Shaw (1973) where the author supports the financial liberalisation as a cornderstone to stabilising economic growth in real sector while financial repression is argued to only fraustrate economy through excessive government intervention. Supporting supply-leading hypothesis, study by Agbetsiafa (2004) on 6 countries from Sub-Saharan Africa for the period of 1963-2001 shows that economies with better financial system will have smooth progress of economic growth through the means of advancing savings, liquidity and reduced risks, all of which will contribute positively to real sector growth.

Drawing a nexus between capital market and economic growth, Coskun et al., (2017) test for the nature of relationship between capital market sub-components and economic growth, with sub-components[4] including mutual funds, pension funds, corporate bonds and stock markets. The result shows a positive effect, long run cointegration and unidirectional causality flowing from capital market development to economic growth, therefore supporting supply-leading hypothesis.

Demetriades & Andrianova (2004) document several empirical literatures which demonstrate the importance of institutional factors such as financial liberalisation, repressions, government control of banking systems and political economic factors that affect financial development

[4] Sub-components capital market—mutual funds, pension funds, corporate bonds and stock markets in Coskun et al., (2017) are formed into a composite index using principal component analysis (PCA)

and economic growth. Following the same line of thought, Law et. al (2015) utilizes panel cointegration and granger causality test to test for long run relationships between globalisation, institutional reforms and financial development among 8 Asian countries, namely China, Indonesia, Japan, Malaysia, the Philippines, Singapore, South Korea and Thailand from 1984-2008. Granger causality test shows that there is a causality flowing from globalisation to institutional reforms and financial development, particularly private sector credit and stock market capitalization which causes economic growth.

To test for evidence of supply-leading hypothesis in developing economies, Adeyeye et al., (2015) tested for relationship between economic growth and financial development, using Nigeria as a focal country from the period 1981 to 2013. Paper demonstrates mixed results, with weak presence of supply leading hypothesis arguably due to presence of government intervention and low financial intermediation**,** whilst demand-following hypothesis dominating the result by economic growth having greater influence on financial sector deepening, credit to private sector and financial institutional credit provision. Hence, this study shows a *feedback relationship* with presence of bi-directional causality between the explored variables.

Bond market development, like any other financial sector development has been measured based on four important indicators—size, access, efficiency and stability. As size indicator, which uses proxy of ratio of bond market to GDP of the market has been commonly used by multiple studies which is why this study utlisies same indicator to represent the bond market development via the variable Composite Bond Market[5] (The World Bank, 2006).

[5] see Chapter 3:CBM- composite of TFB and TLB

1.2.Empirical Review

With the Asian Financial crisis of 1997, Asian economies learnt harsh lessons on the need to have long term financing as an alternative to foreign currency denominated money market loans. In their paper, Eichengreen & Luengnaruemitchai (2004) answer the question of why bond market is not well developed in Asian economies on the grounds of institutional underpinnings such as crony capitalism, corruption and low bureaucratic qualities, in addition to structural and financial underpinnings through dominance of banking sectors, such as domestic credit by banking sector a resulting in poor bond market development.

In the same line of thought, Bhattacharyay (2013) explores the determinants of bond financing for ten regional economies used for this study. The paper finds that size of economy (GDP, Current US$), stage of economic development (GDPPC, PPP) and variability of interest rates have positive impact on total bond financing, openness of economy has positive impact on corporate bonds and size of banking system has positive impact on government bond financing.

Following the *supply-leading hypothesis*, Pradhan et al., (2016) demonstrate causal link between bond market development and economic growth while considering four macroeconomic covariates namely—*inflation rate*, *real effective exchange rate, real interest rate,* and *trade openness*; using the technique of panel Vector autoregressive (VAR) and granger causality. The paper explores this relation amongst 35 countries from the period of 1993-2011 and confirms the long run causality from bond market development and macroeconomic variables to economic growth.

For the case of South Africa, Kapingura & Makhetha-Kosi (2014) draw a relationship between bond market capitalization and economic growth from the period 1995-2012. Also using

granger causality test, paper tests for the presence of bi-directional relationship between the variables. The results show dominance of supply-leading characteristics in the relations yet with weaker presence of demand-following hypothesis. This nevertheless supports *feedback hypothesis* for the given economy.

Likewise, showing a mixed result of supply leading and demand following hypothesis, Pradhan et al., (2015) investigated the relationship between bond market development and economic growth amongst G-20 countries and found different results for causality amongst different countries. The authors form a composite index using PCA, a technique that I have used in this paper too, out of (four) categories of bond market size for—*Domestic debt securities* and *International Debt securities*. Country specific heterogeneity is argued for difference in results[6] between different countries, difference in the stage of development and stage of individual securities market could be factored into that heterogeneity. The empirical result of the paper shows the presence of long run and short run direction of causality between the bond market and economic growth. In the same line, Panizza & Presbitero (2014) demonstrate rather inconclusive evidence of presence of causality from public debt to economic growth in 17 OECD advanced economies as a sample.

Fink et al., (2006) utilize granger causality technique to ascertain the positive relationship between net issue on different types of bonds and economic growth for short-run, instead of

[6] Country specific results show—Mexico and Japan showed no granger causality between growth and domestic public debt, Turkey showed no causality between growth and international private debt and France had no causality result between growth and international public debt in the study of Pradhan et al., (2015)

long run relationship. The studied countries[7] include Belgium, Denmark, Germany, Finland, France, Italy, the Netherlands, Norway, Austria, Portugal, Sweden, Switzerland, Spain, the United Kingdom, the USA, and Japan for the period of 1994 to 2003. The empirical result finds causality running from *economic growth to net issuance of public bonds* while causality running from *corporate bond and financial institutional bonds issuance to economic growth*.

Gómez-Puig & Rivero (2015) focuses on the relationship between public debt (sovereign debt) and economic growth amongst 11 EMU countries, utilizing granger causality approach and using structural diagnostics test of break point, to test for bi-directional causality between the stated variables from the period of 1980 to 2013. The paper shows a mixed result with the influence of break-point which occurs between 2007 and 2009 for this study; with *positive granger causality* between changes in sovereign debt and growth until the breakpoint of 2009, while negative granger causality between the variables that there is no negative causality. The policy analysis of the paper posits the importance of fiscal balance for economies of Italy, Greece and Spain with the history of sovereign debt crisis as higher pubic debt does not contribute to economic growth and there could be underlying effects of quality of public debt to determine the relationship.

Ocbio et al., (2016) carried out the relationship study between bond market development and economic growth for Nigeria from the period of 1982-2013 using generalized method of moments (GMM) in addition to granger causality. While the paper demonstrates positive

[7] Fink et al., (2006) uses quarterly data with time series analysis and cross country analysis.

impact of financial market components, such as bond market size, credit to private sector and equity market size, granger causality showed no result of causality between the main variables under study. The paper argues that infancy state of bond market of the economy could be responsible for this result.

Using similar technique of GMM, Thumrongvit et al., (2013) showed how government and corporate bonds respectively contribute positively to economic growth, when simultaneous expansion of other financial structures in terms of size and efficiency. The paper utlisies stock market development and banking sector credit to economy as important confounders to check for relationship between bond market development and economic growth.

1.3.Regional review on ASEAN regionalism and bond market

Considering the speed and magnitude of the contagion during the Asian crisis of 1997, it is highly likely that stronger policies of financial regionalism could help the countries establish closer partnership to strengthen the financial grounds in terms of international monetary market.

One of the cornerstones of Asian regionalism is ASEAN Plus Three (APT) framework which involves ten members of ASEAN plus China, Japan and South Korea. APT was sought as an institution to undertake financial governance within the region, correct the mistakes of the neoliberalism policies of early 1990s and support the process of financial deepening (ADB, 2008).

Furthermore, Asian Bond Markets Initiative (ABMI) became one of the important steps within APT framework to speed through financial governance in the region. Major objective under this initiative was to promote issuance of local currency bonds and improve regulatory framwork for strengthening bond market development. Dent (2004) explains that with regions' huge potential to amass domestic saving and reserves, bond market would provide opportunity for diversification of currencies. By institutionalising bond market, these emerging economies have gained momentum of growth of long term funding in their domestic currencies.

Sukcharoensin (2018) points out strategic positions of bond market structures among ASEAN-5 markets which includes Malaysia, Philippines, Thailand, Singapore and Indonesia. The paper shows that Malaysia, Singapore and Thailand are in leading terms through aggressive growth strategy with promising financial stability through bond markets; while Philippines remains in conservative position with economy not drawing a significant benefit from bond market and

Indonesian bond market showing unattractive and unstable conditions for the same. The paper argues, for a well developed regional bond markets, these heterogeneity of strategic positions should be eliminated and more competitiveness should be adopted.

Presence of positive and significant impact of ASEAN policies such as ABMI on bond market development is empirically shown by Mizen & Tsoukas (2013). The paper controls for firm specific characteristics and general bond market characteristics to assess the impact of policy tools under ASEAN Bond Market Initiative which contribute to the bond market development. The results also show that firm specific characters such as ability to influence investors compliments the policy tools to improve the state of bond market.

2. Research Methodology

The countries included in the analysis are China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Thailand and Vietnam covering the period of 2004 to 2016; and data on the countries are obtained from World Bank Indicators and Asian Bond Monitor.

2.1.Data

Table 1 Variable Description

Variable Code	Variable Definition
EG	Logged GDP per capita converted into constant 2011 international dollars using PPP rates.
CBM	Composite Index of bond market development which is the composite index of indicators of local and foreign (logged) bond market size, TLB and TFB respectively.
Control Variables	
DCF	Domestic credit provided by financial sector (% of GDP) is defined as credit coming from financial sectors used as a proxy for financing from banking sector
DCP	Domestic credit to private sector, calculated in the % of GDP
Stock	Stock traded, in % of GDP, it is the proxy for equity market size.

Note: Variables defined above are available from World Bank Indicators and Asian Bond Online

Considering main task force under ABMI was implemented in 2003, period thereafter saw growth of bond market in East Asia which is why this study has chosen the period of 2004-2016 to study the association of bond market with economic growth. Data for year 2003 were largely missing for most of the samples therefore 2003 year was omitted during data cleaning.

The variables used in this paper are GDP per capita, (variable: *EG*), bond market development (variable: *BMD*), and other control variables[8] domestic credit from financial sector (variable: *DCF*), Domestic credit to private sector (variable: *DCP*), Stock market size (variable: *Stock*). Economic growth variable, which is the dependent variable for the regression, is in the natural log form of GDP per capita measured in constant international USD using PPP formula.

Using the technique of (Pradhan et al., 2016) this paper utilizes Principal Component Analysis (PCA)[9] to form a composite index (variable: *CBM*)[10] representing our proxy for (independent variable) bond market development is represented by bond market size[11] which includes *total local currency denominated bond size (*variable: *TLB*) and *total foreign currency denominated bonds (*variable: *TFB*), are in absolute amount. The trend of TLB and TFB are yearly trend represented by respective Fig 1 and 2. (Note: A separate regression relationship between TLB, TFB and EG will be carried out to check for their individual effect on EG variable.)

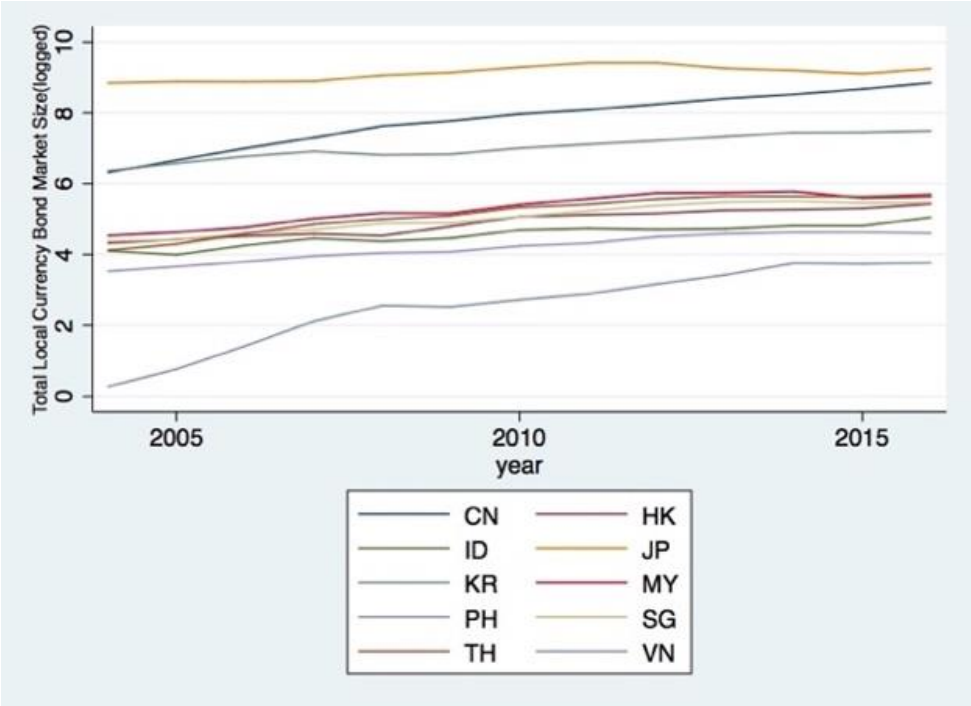
[8] Additional control variables have been used to check for "good-fit" model, but due to higher value of on Schwarz Criterion and Akaike Info criteria, they have not been used in the main model.

[9] PCA technique forms a new variable in the form of components, through linear combinations of set of variables which is formed in to factor score to be used as a interpretational observation. Abdi & Williams(2010) explain it provides an important information through compressing only important infromation, and simplifying the dataset.

[10] Formulation of Composite Bond Index with PCA is depicted on Appendix 1

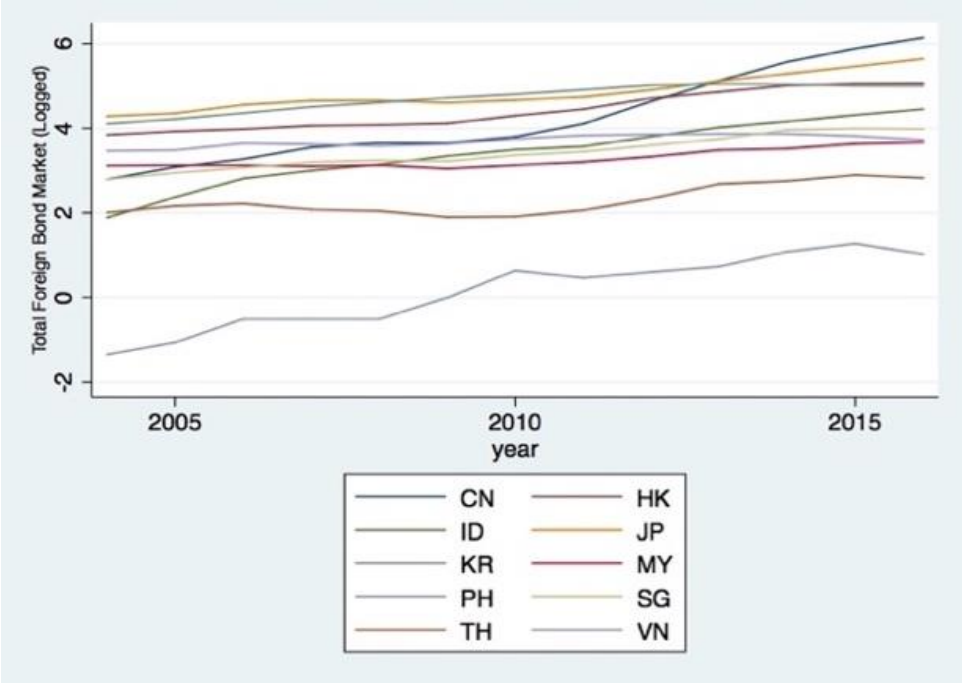
[11] ADB (2017) explains bond market size in terms of total bond obligations, issued by government, financial and corporate sectors. The CBM index is formed with the use of total local currency denominated bond size and total foreign currency denominated bond size.

Figure 1 Trend of Total local currency bond size for sample countries



Source: Author's computation

Figure 2 Trend of Total foreign currency bond size for sample countries



Source: Author's computation

Considering results of Bhattacharyay (2013), Eichengreen & Luengnaruemitchai (2004) which have utilized financing by banking sector and equity market size as important determinants of bond market development, this paper utilizes confounding variables—*Domestic credit provided by financial sector* (DCF) which is deposits made by financial corporation and banking systems into the various sectors of the market; this variable includes the credit in the form of bank deposits and monetary deposits made by other financial corporations including insurance, pension funds and FX companies.

Likewise, another control variable *Stock market size (*Variable*: Stock)*, as a proxy of equity market size which is an important measure of financial market development. *Domestic credit to private sector (*Variable*: DCP)* is the financial credit in the % of GDP coming from the financial systems which could include monetary authorities and banking systems which the private sector has to repay. Third variable under consideration is and can have considerable influence in determining the development of bond market through possibility of scale economy which is also discussed by Bhattacharyay (2013). Table 2 provides the descriptive statistics of all the variables used in this study.

Table 2 Variable Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EG	125	9.94	0.78	8.30	11.31
CBM	125	0.11	0.84	-2.75	1.86
DCF	125	136.9	77.6	34.2	345.7
DCP	125	111.03	49.32	23.1	233.2
Stock	125	115.6	164.1	3.54	952.67

Source: Author's computation

2.2. Empirical Model Specification

The relationship between variables defined above are modelled into four stepwise tests for the purpose of analysis. Firstly, a set of tests for stationarity in the panel data are run through unit root tests, followed by cointegration test to check the presence of long run equilibrium relationship between the variables used in the specified model. A regression with first difference and lagged effect is also carried out to determine possible relationship that is expected to be present amongst the variables, followed by granger causality test to determine the direction of causality between the variables.

2.2.1. Regression with First difference in Panel data

Regression with first difference using the method of Least Squares(LS) intends to see if an increase in bond market development is associated with an increase in economic growth and what would be the magnitude of that association, hence the effect of bond market development on economic growth.

To test the effect of bond market development on economic growth, we utilize first difference with lagged effects. Firstly, using the first difference in this case allows us to override the problem associated with autocorrelation and secondly helps to uncover the long run association/effect amongst the variables. A basic relationship[12] for this step is defined by the equation below:

[12] Extended model with addition of **TradeOpenness** and **Inflation** is tabulated and explained on Appendix 2.

Note: Model selection with defined explanatory variables is done based on Schwarz Criterion and Akaike Info criteria. In addition to Stock market size, DCP and DCF as other explanatory variables, Inflation and Openness to trade have been used to form the model (table and explanation attached on Appendix)

$$\mathbf{E[\Delta EG_{it} | \Delta CBM_{it}, \Delta CBM_{i(t-2)} .. \Delta CBM_{i(t-6)}] = \beta_0 + \beta_1 \triangle CBM + \beta_2 \triangle CBM_{i(t-2)} + \beta_3 \triangle CBM_{i(t-4)} + \beta_4 \triangle CBM_{i(t-6)} + \beta_5 \triangle DCF_{it} + \beta_6 \triangle Stock_{it} + \beta_7 \triangle DCP_{it}} \quad \text{Eq. (1)}$$

Secondly, yet another important Autoregression (AR) model specifications, implicit model specified below is to be estimated as Eq. (2)

$$\mathbf{\triangle EG = \beta_0 + \beta_1 \triangle EG_{(t-1)} + \beta_2 \triangle CBM + \beta_3 \triangle DCF + \beta_4 \triangle Stock + \beta_5 \triangle DCP} \quad \text{Eq. (2)}$$

2.2.2. Granger Causality Test

Granger causality test runs with the basic assumption: if y is granger caused by x, past values of x can forecast future values of y. According to the explanation by Demetriades & Andrianova (2004),

> "*granger causality is grounded on a basic premise that if one variable(X) predicts another(Y), it does not necessarily imply it is sole cause for it rather there could be another variable(Z) which might be the true cause of both X and Y but because X has shorter response link to Z, which makes it an indicator of presence of Y*". (p. 42-43)

As the LS method would not define the direction of causality, using granger causality test could ascertain the causal relationship between the definitive variables. For the estimation of relationships between finance and growth components, granger causality test is considered as an important tool amongst economic literatures according to Levine (2005).

Granger causality model, also used by Pradhan et al., (2016), Fink et al., (2006), Hoffmann et al., (2005), Awe (2012), shows the *direction of causality rather than presence of causal relationship* between economic growth and bond market size index, with control variables

used—DCF, Stock, DCP each of which have been important determinants of bond market development.

Much simplified version of equations of AR framework are as following:

$$\mathbf{GDP_t} = \sum_{j=1}^{k} \boldsymbol{\beta_j}\ \mathbf{CBM_{t-j}} + \sum_{j=1}^{k} \boldsymbol{\rho_j}\ \mathbf{GDP_{t-j}} \quad \text{.....Eq. (3)}$$

$$\mathbf{CBM_t} = \sum_{j=1}^{k} \boldsymbol{\beta_j}\ \mathbf{GDP_{t-j}} + \sum_{j=1}^{k} \boldsymbol{\rho_j}\ \mathbf{CBM_{t-j}} \quad \text{.....Eq. (4)}$$

3. Empirical Results and Analysis

3.1. Unit root test

Theoretically, unit root test is used to identify presence of stationarity amongst the variables. The null hypothesis of this test assumes presence of unit roots and non-stationarity amongst the series, hence H_0. Hoang & Mcnown (2006) contend that Im–Pesaran–Shin (IPS) and Fisher-type (ADF[13] and PP[14]) tests are best suitable for unbalanced data types which is why the variables are tested using these two tests. Tests find the presence of unit roots under the level conditions of the variables but stationary at the first difference depicted with unit root inference as I (1), as depicted on the Table 3.

Table 3 Panel Unit Root Test

H_0= Series contains unit roots H_1= Series is stationary				
Variable in their first difference	**P-value**			
	Fisher-Type Test		**Im, Pesaran and Shin W-stat**	**Unit Root Inference**
	ADF	**PP**		
EG	0.76	0.00	0.80	-
△EG	0.00	0.00	0.00	I(1)
CBM	0.90	0.11	0.93	-
△CBM	0.01	0.001	0.000	I(1)
DCF	0.99	0.99	0.99	-
△DCF	0.00	0.00	0.00	I(1)
DCP	0.73	0.52	0.96	-
△DCP	0.00	0.00	0.00	I(1)
Stock	0.03	0.01	0.01	-
△Stock	0.00	0.00	0.00	I(1)

Source: Author's computation

[13] ADF: Augmented Dickey–Fuller unit root test

[14] PP: Phillips-Perron (PP) unit root test

3.2. Panel Cointegration test

Panel data cointegration test is used as a next step to determine the presence of long run equilibrium relationship between the variables. Results of both *Kao Residual cointegration test* and *Johansen Fisher Panel cointegration test*, show that the null hypothesis of no cointegration can be rejected at the 5% level of significance. This demonstrates that the variables used in the model observes long run relationship amongst the variables. This further supports the next step to ascertain type of relationship these variables have amongst them through regression in the next section.

Table 4 Kao Residual Cointegration Test

Kao residual test	ADF: Augmented Dickey-Fuller Test Equation	
	t-Stat	**Prob**
EG, CBM, DCF, DCP Stock	-3.73	0.001
Null Hypothesis: No cointegration **Trend Assumption:** No deterministic trend		

Source: Author's computation

From Table 4 of Kao Residual cointegration test we can reject the null hypothesis of non cointegration with 5% level of significance with the P-value of 0.001, which gives us a strong evidence of long run relationship between variables.

Table 5 Johansen Fisher panel cointegration test

No. of CEs	**Fisher Stat (from trace test)**	**Prob**	**Fisher stat (max eigen test)**	**Prob**
None	12.48	0.8217	12.48	0.000
At most 1	80.61	0.000	80.61	0.000
At most 2	2371	0.000	2371	0.000
Null Hypothesis: No cointegration				

Source: Author's computation

From Table 5 of Johansen Fisher cointegration test, both trace and max-eigen test show high level of significance of 5% level of confidence at most 2 variables with P-value 0.00, which also gives the evidence of long run relationship.

3.3. Panel Regression in First Differences

This section covers the results of regression models specified by Eq. (1) and Eq. (2). While our large results are focused on the entire region (Panel A), covering ten countries, some separate regressions are run to test for narrow markets such as ASEAN-5[15] and Plus-3[16], henceforth known as Panel B, in order to show more diversified results, which is why a four different part of regression results are depicted below:

Part A: Result of panel regression for Eq. (1) for the entire region (Panel A)
Part B: Result of panel regression for Eq. (2) for the entire region (Panel A)
Part C: Result of panel regression for Eq. (2) for the ASEAN-5 and Plus-3 (Panel B)
Part D: Result of panel regression with TLB, TFB and EG for the ASEAN-5 and Plus-3 (Panel B)

3.3.1. Result of panel regression for Eq. (1) for the entire region (Panel A)

A change in size of bond market in a particular year would affect the economic growth in the subsequent years which is estimation of regressions with lags within CBM (bond market development) variable becomes impetus, regression model specification is shown by Eq. (1)[17]. The Table 6 shows the result with FD, 2, 4 and 6 lags, along with the other explanatory variables.

[15] ASEAN-5: Malaysia, Thailand, Philippines, Singapore and Indonesia.

[16] Plus-3 China, Japan and Republic of Korea

[17] $E[\Delta EG_{it} | \Delta CBM_{it}, \Delta CBM_{i(t-2)} .. \Delta CBM_{i(t-6)}] = \beta o + \beta_1 \triangle CBM + \beta_2 \triangle CBM_{i(t-2)} + \beta_3 \triangle CBM_{i(t-4)} + \beta_4 \triangle CBM_{i(t-6)} + \beta_5 \Delta DCFit + \beta_6 \Delta Stock_{it} + \beta_7 \Delta DCP_{it}$…….Eq. (1)

Table 6 First Difference with lagged effects of CBM of Eq. (1)

△EG	1	2	3	4
Cons	0.029**	0.024**	0.017**	0.014**
t-stat	8.76	5.53	3.51	3.88
△CBM	0.103**	0.102**	0.101**	0.08**
t-stat	3.74	3.62	2.87	2.81
△CBM lag 2		0.057*	0.039	0.01
t-stat		1.99	1.03	0.19
△CBM lag 4			0.077*	0.065*
t-stat			2.7	3.02
△CBM lag 6				0.082*
t-stat				3.30
△DCF	-0.0018**	-0.0021*	-0.003**	-0.001
t-stat	-3.09	-3.64	-4.6	-1.30
△Stock	0.0001	0.00004	0.00003	0.0001***
t-stat	1.37	1.16	0.6	1.93
△DCP	0.0016*	0.0022*	0.003	0.0011***
t-stat	1.97	2.64	4.24	1.83
Adj- R^2	0.214	0.26	0.34	0.38
N	114	95	75	56
Schwarz Criterion	-4.18	-4.14	-4.26	-5.16
Akaike Info Criterion	-4.30	-4.30	-4.47	-5.50
Period	2005-2016	2006-2016	2009-2016	2011-2016

**P<0.05 **P<0.01 ***P<0.1*

Output after running for white standard errors
Source: Author's computation

According to the result of column (1) from Table 6, in years when bond market size increased by 1% more, economic growth increased by 0.11% more on average. The constant for this relation is 0.03, which shows that economic growth grew by 0.03% on average when bond market size remained the same. Result also shows that coefficient of △CBM is statistically significant at 1% level.

Column 2, 3 and 4, in Table 6 depict the result of regressions as we add 2, 4 and 6 lags of CBM respectively, which simultaneously reduces the number of observations and periods under

consideration. Considering the six lag effect in column (4), economic growth increases by 0.08% more on average when bond market increases by 1% more; average increase in economic growth is 0.01% two years later, 0.065% after 4 years and 0.08% after 6 years. Extended model of this specification with lagged effects of CBM on economic growth, with additional control of Trade openness and inflation variables are explained on Appendix 1.

Table 7 Cumulative coefficient of △CBM

△EG	**1**	**2**	**3**	**4**
Cumulative coefficient of △CBM	0.109	0.159	0.217	0.237
No of lags	0	2	4	6
R^2	0.214	0.26	0.34	0.38
N	114	95	75	56

Cumulative coefficient, Table 7 on △CBM is 0.237% after addition of all coefficients of △CBM, which means comparing countries and years with 1% increase in bond market size, increases economic growth by 0.24% more on average after 6 years, when and where bond market size increases by 1% more. The R^2 also considerably improves as the number of lags are increased, with highest at 0.38 in model with six lags of △CBM, which shows that 38% of variations in economic growth are expressed by variables used.

3.3.2. Result of panel regression for Eq. (2) for the entire region (Panel A)

In addition to model with lagged effect of main independent variable △CBM, using lagged dependent variable as a part of regressor forms a dynamic relationship within the model and supports the claim on long run association, both Achen (2001), Luke & Kelly (2005) point out arguments on the same ground. This AR model when dependent variable becomes independent

variable in the lag form, hence forms a dynamic model. The result of the model is explained below:

Table 8 Regression result for Eq. (2)

Number of obs 105 **Periods included** 11 **Prob > F** 0.0000 **R-squared** 0.307 **Adj R-squared** 0.272 **Root MSE** 0.0268 White diagonal standard errors and Covariance (d.f. corrected)				
△EG	**Coef.**	**(White) Std. Err.**	**t**	**P>|t|**
cons	0.021**	0.006	3.48	0.000
$\triangle EG_{(t-1)}$	0.261*	0.134	1.95	0.054
△CBM	0.084**	0.025	3.26	0.002
△DCF	-0.002*	0.0006	-2.51	0.013
△Stock	0.0001	0.00003	1.37	0.17
△DCP	0.0014	0.00090	1.60	0.11
Schwarz Criterion -4.20 **Akaike Info Criterion -4.34**				

**P<0.05 **P<0.01 ***P<0.1*
Source: Author's computation

According to the result of Table 8, which follows the regression result of Eq. (2), in years when bond market size increased by 1% more, economic growth increased by 0.084% more, on average, controlling for one-year lagged economic growth, △DCF, △stock and △DCP. The constant for this relation is 0.021, which shows that economic growth grew by 0.021% on average when bond market size remained the same. The R^2 for this model is 0.27. Extended model of this specification with effects of △CBM on economic growth, with additional control of Trade openness and inflation variables are explained on Appendix 2.

3.3.3. Result of panel regression for Eq. (2) for the ASEAN-5 and Plus-3

Furthermore, a separate regression for *Eq. (2)* is run, as shown by Table 9, to account for difference in the bond market structure with a new Panel B specified to show the estimation for ASEAN-5 and Plus-3 countries to get more heterogeneous insight. While Panel A, is the same as Table 8. Plus-3 includes China, Japan and Republic of Korea while ASEAN-5 includes, namely Malaysia, Thailand, Philippines, Singapore and Indonesia.

Table 9 Regression result for Eq. (2) for Panel A and B

Country		**Constant**	**△EG$_{(t-1)}$**	**△CBM**	**△DCF**	**△Stock**	**△DCP**	**R^2**
PANEL A[a]								
	Coef	0.021**	0.261*	0.084**	-0.002*	0.0001	0.0014*	0.27
	t-stat	3.48	1.95	3.26	-2.51	1.37	1.60	
PANEL B								
ASEAN-5[b]	Coef	0.03**	-0.07	0.07	-0.003*	0.001*	0.002	0.24
	t-stat	4.06	-0.45	1.53	-2.30	2.52	1.22	
Plus-3[c]	Coef	0.01	0.66**	0.06***	-0.001	0..00005	0.001	0.62
	t-stat	1.10	3.68	1.6	-1.47	0.85	0.48	

**P<0.05 **P<0.01 ***P<0.1*

[a] Period: 11, no. of observations: 105 | [b] Period: 11, no. of observations: 55 | [c] Period: 11, no. of observations: 33
Source: Author's computation

According to the result from Panel B for ASEAN-5, in years when bond market size increased by 1% more, economic growth increased by 0.07% more on average, controlling for one-year lagged economic growth, △DCF, △Stock and △DCP. The coefficient for this category is significant at 10% level of confidence. This effect demonstrates that higher issuance of bond has contributed to growth in the region.

For the Plus-3 as a region, there is a positive but insignificant effect of bond market size increase on economic growth. This shows that the general pattern represented by the data,

economic growth is in the confidence interval with a 90% certainty, for the markets that have growth in bond market size by 1% more, on average.

3.3.4. Result of panel regression for Eq. (2) for the ASEAN-5 and Plus-3

Table 10 shows the effect of *total local currency bond market size (TLB)* and total *foreign currency bond market size (TFB)* on economic growth are tested through FD regression for both the panels. For all the panels (and respective regions), both local currency bond market size and foreign currency bond market size contribute positively and significantly but effect of local currency bond size is seen higher than foreign currency bonds for all panels. This indicates that policy programs run to promote local currency bond markets in ASEAN region has come in effective form to translate to economic growth.

Table 10 Regression result for Panel A and B, with △TFB and △TLB

Country		**Constant**	**△TFB**	**△TLB**	**△Control**	**R^2**
PANEL A[a]						
	Coef.	0.017**	0.06**	0.12**	Yes	0.37
	t-stat	4.82	4.02	5.48		
PANEL B						
ASEAN-5[b]	Coef.	0.02**	0.05***	0.07*	Yes	0.31
	t-stat	4.25	1.85	2.33		
Plus-3[c]	Coef.	0.008	0.11**	0.20*	Yes	0.66
	t-stat	1.58	3.55	5.75		

**P<0.05 **P<0.01 ***P<0.1*

[a] Period: 12, no. of observations: 114 | [b] Period: 12, no. of observations: 60 | [c] Period: 12, no. of observations: 36

3.4. Granger Causality Test

This test indicates the direction of causal relationship between two variables X and Y, with hypothesis defined in following ways:

H_0=X does not granger cause Y

H_1=X granger causes Y

Hence to reject H_0 at 5% level of significance, p value should be less than or equal to 0.05 (*calculated Degree of freedom in appendix* 4). As the non-stationary variables will present spurious results, VAR model is conducted using variables at their stationarity attained through first difference. In order to determine the best lag length for the causality model, lag order selection criterion is chosen based on Akaike Information Criterion (AIC) and Schwarz Information Criterion (SC) (*See Appendix 5*), hence **lag length of 6** has been chosen for the study, which brings down the number of observation to 56.

Table 11 Result of Pairwise Granger Causality Test

Null Hypothesis	Obs	F-stat	Prob	Decision	Type of causality
CBM does not Granger cause EG	56	0.96	0.47	Accept	No causality
EG does not Granger cause CBM		2.81	0.021	Reject	Unidirectional
DCF does not Granger cause EG	56	2.40	0.044	Reject	Bidirectional
EG does not Granger cause DCF		2.90	0.020	Reject	Bidirectional
DCP does not Granger cause EG	56	2.72	0.024	Reject	Bidirectional
EG does not Granger cause DCP		2.94	0.017	Reject	Bidirectional
Stock does not Granger cause EG	56	1.20	0.33	Accept	No causality
EG does not Granger cause Stock		0.26	0.95	Accept	No causality
DCF does not Granger cause CBM	56	1.19	0.33	Accept	No causality
CBM does not Granger cause DCF		0.93	0.48	Reject	Unidirectional
DCP does not Granger cause CBM	56	1.71	0.14	Accept	No causality
CBM does not Granger cause DCP		0.72	0.63	Accept	No causality
Stock does not Granger cause CBM	56	0.63	0.70	Accept	No causality
CBM does not Granger cause Stock		4.16	0.002	Reject	Unidirectional
DCP does not Granger cause DCF	56	5.47	0.000	Reject	Bidirectional
DCF does not Granger cause DCP		4.58	0.001	Reject	Bidirectional
Stock does not Granger cause DCF	56	4.01	0.003	Reject	Unidirectional
DCF does not Granger cause Stock		1.72	0.140	Accept	No causality
Stock does not Granger cause DCP	56	3.40	0.008	Reject	Bidirectional
DCP does not Granger cause Stock		2.83	0.021	Reject	Bidirectional

Source: Eviews output

The result from Table 9 shows a unidirectional causality running from economic growth to bond market development, while bi-directional causality runs between economic growth and domestic credit to private sector, as well as economic growth and domestic credit from financial sectors. Additionally, a unidirectional causality runs from bond market development to domestic credit from financial sectors and Stock. This presents that economic growth has greater predictive power for bond market development for the region studied.

4. Discussion of results

The result from different model specifications demonstrate statistically strong association between yearly changes in bond market development and subsequent changes in economic growth, controlling for three different variables.

With the results from Part A model, considering the lagged effects of Bond market development with first difference, we understand that an increase in bond market size produces positive and significant increase in economic growth, referring to Table 6. The second dynamic model also supports this result with positive and significant relationship; with 1% increase in economic growth on previous year would lead to 0.26% increase in economic growth for the current year in the overall sample. But considering ASEAN-5 and Plus-3 separately, we get interesting result (Table 9). For the case of ASEAN-5, result is negative and insignificant for relationship between lagged economic growth and current economic growth.

Furthermore, controlling for stock market size, credit to private sectors and proxy for banking sector, both bond markets—total local currency bond market and total foreign currency bond markets have positive and significant in ASEAN-5, Plus-3 and aggregate sample economies, Local currency denominated bond market tends to have greater effect on economic growth compared to foreign denominated bonds, reflecting the success of ASEAN Bond Market Initiatives (ABMI) on contributing positively and significantly on economic growth of the region.

Amongst all variables for financial indicator, domestic credit from financial sector, hence proxy variable for banking sector shows negative and highly significant relationship with the economic growth. This would be representation of effect a 1% change in size of domestic financial institutions, particularly credit from banking sector has on economic growth, with

approximately 0.002% reduction in economic growth, on average, when controlled for all other variables. This result could be in line with paper by Felman, et al., (2011) where authors claim large share of domestic investor base for ASEAN economies still come from domestic financial intermediaries, banking sectors and mutual sectors particularly. This could have been an impediment for financial market deepening, and development of bond market particularly as expansion of investors base for bond market is affected by over exposure to money market.

The granger causality result shows interesting turns on the direction of causality flow, where stock market granger causes domestic credit to private sector, domestic credit to private sector granger causes economic growth, economic growth granger causes bond market development and bond market granger causes stock market development. This implies that whilst also considering growth of bond market through economic growth, stock market should be deepened through bond market development to promote economic growth.

Limitations of models and suggestion for further research

The result thus produced are based on the analysis of ten East Asian economies, all of which are the members of ASEAN+3 (APT). Although the region has been fast in its growth prospect, not all economies have same speed for economic growth or financial development. Japan, China and South Korea belong to different growth paradigm, primarily considering their political economic structures, models of capitalism and development models.

Vietnam is amongst the lowest among ten economies used in this study in terms of bond market size which is still growing. Brunei, Cambodia, Laos and Myanmar have been omitted from this examination due to very poor data on bond market size. Additionally, due to missing variables for the case of Vietnam, dropping of variables reduced number of years, which prohibits

estimation for 12 periods. Although Panel B accounts for more narrowed down samples, replicating same models for individual country would give us more country-specific result.

Furthermore, the paper only estimates composite bond market index based on local currency denominated bonds and foreign currency denominated bonds and has not considered International bonds. Primary reason for this was unavailability of data for balanced time periods for all markets considered. International bond size for some markets are really low compared to the rest, which would have become a problem with the estimation. The bond market size used in this study gives more edge to domestic bond market rather than overall bond market size, which could be an area for further research.

Another important area for further research would be independent study on the progress of corporate bond market and government bond markets, which have been growing in different proportions, and not in much satisfactory manner in the case of ASEAN+3. This study uses only size indicator of bond market development which limits its capacity to cover secondary characteristics of bond market development, such as liquidity aspects. Further scope to find the relationship between economic growth and bond market development on the grounds of cost of capital, ease of obtaining capital, yield components remains.

For more advanced take on finding the causality relationship, much superior tests in comparison to granger causality should be considered such as Toda Yamamoto used by Coskun et al., (2017), Vector Error Correction Model (VECM), Vector Autoregression (VAR). Considering granger causality only shows the direction of causation instead of true cause, there could always be potential estimation bias.

Finally, issue of endogeneity could be our concern when it comes to reverse causality between economic growth and bond market development which has not been explored here. Alternative model such as Generalized Method of Moments which employs instrumental variable for treatment, as employed in papers by Ocbio et al., (2016) and Thumrongvit et al., (2013) could give us deeper insight into the problem.

5. Concluding remarks and policy recommendations

The main purpose of this study has been to find the nexus between bond market development and economic growth in East Asian economies or more specifically selected countries of ASEAN+3. This study has used ten important markets from the region for the period of 2004-2016. In order to determine the relationship in this subject, this paper has utilized cointegration test, panel regression with first difference technique with different model specifications, including lagged regressions and AR models and granger causality test. These models have been tested for all sample as well as subsamples for more robustness check. The subsamples of ASEAN-5 and China, Japan and South Korea (Plus3) were formed based on the level of bond market development of markets included in each subsample.

The paper has considered local currency bond market and foreign currency bond market size respectively as a composite indicator of domestic bond market and relations have been derived both for composite index and two bond market size separately. The main results from different specifications of regression shows presence of positive and significant effect of composite bond market development on economic growth of the region, with existence of long run relationship present between variables studied.

Considering impact of capital market on economic growth, both bond market composite index and equity market shows positive influence on economic growth which means the region can accrue more benefits through capital market deepening for the growth of real sectors. Interestingly, result of granger causality shows the direction of causality from economic growth to bond market development which also demonstrates that economy's economic growth potential is rudimentary for financial market development.

This result is in line with many researches which support *demand-following hypothesis* where economic growth is responsible for causing financial growth. Credit to good economic progress of economics of this region goes to lessons these markets could timely derive since financial contagion of 1997 which drew attention to improving macroeconomic stability, financial liberalisation and regional as well as global openness. East Asian growth paradigm, which initially emerged with trade openness, could give credit to the strength of regionalism which has in the recent years translated to cooperation for financial development. In this respect, results of this paper demonstrates how region has followed that development path with causality directed from economic growth to bond market growth, while at the same time, bond market development having positive effect on economic growth in return.

These results lead us to exploring important policy implications for further growth of the East Asian market. Firstly, East Asia still has huge potential to amass long term funds through corporate sector bond market, yet government bond market dominates the market. But bigger size of government bond markets for both local currency and foreign currency denominated bonds should not be considered as an impediment. Improvements in the scope and issuance of government bonds could be a steppingstone for improving liquidity as well as conducting investment activities in different areas of development. Local currency debt market can see its growth when the government debt management system stands out as credible agent of change.

Stability of interest rates and more importantly a liberalised interest rate regime is important for market oriented growth for bond market or overall capital market development in this regard. Liberalisation of interest rate should be promoted along with a close regulatory watch as it would promote true market prices and work in accordance to demand and supply of market

capital. In addition to this, it would also encourage growing investors base with more credit flowing into private and public sectors.

Furthermore, bond financing for regional infrastructural projects would particularly be important streamline to promote issuance of domestic bond market. PWC (2017) report points out that growth in infrastructural spending is expected to grow by 7.8% on average amongst Singapore, Vietnam, Thailand, Philippines, Malaysia and Indonesia till 2025. This void in infrastructure development could be supplanted by bond issuance, which will contribute to economic development as well as bond market development simultaneously.

Another important policy framework should be built on agenda of growing investors base—at domestic, regional and international domain. Improving investors base relies in both macroeconomic and microeconomic features of the economy. While macroprudential policies that control fluctuations of exchange rate regime and interest rates safeguards economy from sudden changes in financial market conditions, firm-level conditions such as innovation, profitability and growth prospects determine growth potential of investors base for both local currency debt and foreign currency debt. East Asian region should promote stability of political economy, institutional qualities by reducing corruption, cronyism, all of which will build on investors' trust in the domestic and regional market.

To conclude, empirical findings of this study finds positive nexus between financial market development and economic growth and signals higher economic growth potential with further advancement of size of bond markets. Investigation on other parameters of bond market development such as efficiency, stability and accessibility and their relationship with economic growth of this region requires further investigation.

Appendix

Appendix 1 Formulation of Principal Component analysis

A basic Stata code for Principal Component analysis is run using two variables TLB and TFB which then forms two components, where component with eigenvalue more than 1 is chosen, and in our case, Component 1 has 1.69 eigenvalue with proportion of 0.85. This way two different variables are summarized through few factors which are supposed to capture variation in data through 85%. Note: PCA comes with its set of limitations

PCs	**EigenValue**	**Difference**	**Proportion**	**Cumulative**
Component 1	1.69	1.39	0.85	0.85
Component 2	0.30	-	0.15	1

PCs	**Component 1**	**Component 2**
TLB	0.71	0.70
TFB	0.7	-0.70

Appendix 2 Extension of Eq. (1) with addition of Trade Openness and Inflation

△**EG**	**1**	**2**	**3**	**4**
Cons	0.03**	0.024**	0.021**	0.014**
△CBM	0.09**	0.09**	0.068*	0.076**
△CBM lag 2		0.055***	0.06***	0.011
△CBM lag 4			0.085*	0.065*
△CBM lag 6				0.079*
△DCF	-0.0013**	-0.0018*	-0.002**	-0.0007
△Stock	0.0001	0.00004	0.00006	0.00005
△DCP	0.001*	0.0018*	0.002	0.0011
△Open	0.0004	0.0003	0.001**	0.0002
△Inflation	0.001	0.0011	0.001*	-0.0001
Adj- R^2	0.23	0.27	0.46	0.36
N	114	95	75	56
Schwarz Criterion	-4.14	-4.08	-4.37	-5.03
Akaike Info Criterion	-4.31	-4.30	-4.64	-5.40
Period	2005-2016	2006-2016	2009-2016	2010-2016

According to the result of column (1) from Appendix 2, in years when bond market size increased by 1% more, economic growth increased by 0.09% more on average. The constant for this relation is 0.03, which shows that economic growth grew by 0.03% on average when bond market size remained the same. Result also shows that coefficient of △CBM is statistically significant at 5% level.

This relation has been drawn including Trade Openness and Inflation as control variables, in order to check if controlling for these variables would lead to any changes in our new specification. Although the coefficient on main independent variable △CBM remains largely same in this table and Table 6, this paper opts to choose specification of Table 6 due to better value on Schwarz Criterion and Akaike Info Criterion, for every models in column 1,2,3 and 4.

Appendix 3 Extension of Eq. (2) with addition of Trade Openness and Inflation

Number of obs 105 **Periods included** 11 **Prob > F** 0.0000 **R-squared** 0.34 **Adj R-squared** 0.30 **Root MSE** 0.0264				
△EG	**Coef.**	**Std. Err.**	**t**	**P>|t|**
cons	0.021**	0.0044	4.95	0.000
$\triangle EG_{(t-1)}$	0.260**	0.086	3.04	0.003
△CBM	0.081**	0.027	3.02	0.002
△DCF	-0.0011**	0.0005	-1.98	0.004
△Stock	0.00005	0.00003	1.66	0.15
△DCP	0.001*	.000697	1.12	0.05
△Open	0.0003	0.0002	1.67	0.09
△Inflation	0.001	0.001	1.34	0.18
Schwarz Criterion -4.15 **Akaike Info Criterion -4.35**				

Compared to the result of Table 8, result of Appendix 3 shows regression result of Eq. (2) but adding two more control variables for Trade openness (△Open) and Inflation (△Inflation). The result shows that in years when bond market size increased by 1% more, economic growth increased by 0.081% more, on average, controlling for one-year lagged economic growth, △DCF, △stock, △DCP, △Open and △Inflation. Coefficients for this result is very close to that on Table 8, yet this paper opts the model without controlling for Openness and Inflation, because value on Schwarz Criterion and Akaike Info Criterion for Table 8 is better specification, hence better fit model.

Appendix 4 Autoregression lag order selection criteria

Sample: 2004 2016
Included observations: 45

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-357.8395	NA	6.936869	16.12620	16.32694	16.20103
1	-307.0205	88.08629	2.219515	14.97869	16.18313	15.42769
2	-276.2186	46.54511	1.789526	14.72082	16.92897	15.54400
3	-229.4287	60.30695	0.759827	13.75239	16.96423	14.94973
4	-191.5731	40.37934	0.539549	13.18102	17.39657	14.75254
5	-145.9051	38.56404*	0.328405	12.26245	17.48170	14.20813
6	-89.80748	34.90520	0.175597	10.88033	17.10328	13.20019
7	-8.902365	32.36205	0.060350*	8.395661*	15.62231*	11.08968*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix 5 Degree of freedom

Calculating the degree of freedom,

Degree of freedom(df) for F-tab= (V_1, V_2)

V_1=K-1=5-1=4 | V_2=n-k=56-5=51

F tab at (4,51) df is 2.55~2.6

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