

Bhattacharyay, Biswa Nath

**Working Paper**

## Bond market development in Asia: An empirical analysis of major determinants

ADB Working Paper, No. 300

**Provided in Cooperation with:**

Asian Development Bank Institute (ADBI), Tokyo

*Suggested Citation:* Bhattacharyay, Biswa Nath (2011) : Bond market development in Asia: An empirical analysis of major determinants, ADB Working Paper, No. 300, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/53738>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



**ADB Working Paper Series**

**Bond Market Development in Asia:  
An Empirical Analysis of Major  
Determinants**

---

Biswa Nath Bhattacharyay

No. 300  
July 2011

**Asian Development Bank Institute**

Biswa Nath Bhattacharyay is a lead professional and advisor to the Dean of the Asian Development Bank Institute (ADBI), Tokyo, and lead professional at the Asian Development Bank (ADB), Manila. The author thanks Jacinta Bernadette I. Rico and Barchinay Toktosunova for excellent research assistance.

The views expressed in this paper are the views of the authors and do not necessarily reflect the views or policies of ADBI, the ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. ADBI encourages readers to post their comments on the main page for each working paper (given in the citation below). Some working papers may develop into other forms of publication.

Suggested citation:

Bhattacharyay, B. 2011. Bond Market Development in Asia: An Empirical Analysis of Major Determinants. ADBI Working Paper 300. Tokyo: Asian Development Bank Institute.  
Available: <http://www.adbi.org/working-paper/2011/07/28/4659.bond.market.development.asia/>

Please contact the author(s) for information about this paper.

Email: [bbhattacharyay@adbi.org](mailto:bbhattacharyay@adbi.org)

Asian Development Bank Institute  
Kasumigaseki Building 8F  
3-2-5 Kasumigaseki, Chiyoda-ku  
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500  
Fax: +81-3-3593-5571  
URL: [www.adbi.org](http://www.adbi.org)  
E-mail: [info@adbi.org](mailto:info@adbi.org)

© 2011 Asian Development Bank Institute

**Abstract**

One of the reasons behind the financial crisis in 1997 was excessive dependence of Asian economies on commercial banks for domestic financing. Banks were the major source of corporate financing because the other major source, bond markets, was underdeveloped and small. On the other hand, the 2008 global financial crisis led to constraints in acquiring local currency and foreign currency liquidity in the corporate sector, as foreign banks withdrew investments from Asia. Furthermore, Asia needs large quantities of capital (US\$750 billion per year for 2010–2020) to develop infrastructure connectivity within and across its economies. Local and regional capital can be channeled for long-term infrastructure projects and other productive investment through bond markets. At this juncture, to enhance bond financing, it is important to examine factors that promote effective development of bond markets. This study attempts to identify the major determinants of bond market development in Asian economies, through examining its relationship with selected key financial and economic factors, and to provide policy recommendations for further developing Asian bond markets. Major determinants for bond market development in Asia include the size of an economy, the stage of economic development, the openness of an economy, the size of the banking sector, and the interest rate spread.

**JEL Classification: F36, O16, G15, O53**

## Contents

1.	Introduction.....	3
2.	Background Literature .....	5
3.	Trends in Bond Market Development in Asia .....	7
4.	Data and Methodology .....	12
	4.1 Compilation and Computation of Data .....	12
	4.2 The Simple Regression Models .....	13
	4.3 Multiple Regression Models .....	13
5.	Results of Empirical Analysis .....	14
	5.1 Simple Regression Analysis.....	14
	5.2 Multivariate analysis .....	16
6.	Conclusion.....	21
	References.....	24
	Appendix 1: Data Sources .....	26
	Appendix 2: The Simple Regression Models .....	27
	Appendix 3: Simple Regression Analysis—Correlation Plots .....	29

## 1. INTRODUCTION

Emerging Asia, as well as Japan and the Republic of Korea, have witnessed rapid and remarkable economic growth over the past three decades. East Asia<sup>1</sup> in particular has been the fastest growing region in the world. During 2003–2008, the People's Republic of China (PRC) exhibited the highest year-to-year gross domestic product (GDP) growth throughout the period, followed by Viet Nam. In spite of the global financial crisis in 2008, these emerging countries witnessed strong growth rates ranging from 1.1% in Singapore to 9.0% in the PRC in 2008 (ADB, 2009).

In the late 1990s, the high growth momentum of East Asian countries, with the exception of the PRC, Japan, and Viet Nam, was perturbed with the onset of the Asian Financial Crisis during 1997–1998. The crisis in 1997 started in Thailand when speculators attacked the Thai baht. As investor confidence in the region waned, several other countries, particularly Indonesia, Malaysia, Thailand, and the Republic of Korea, were also affected. Foreign capital suddenly left. With depleting foreign reserves, these countries eventually abandoned the currency peg to the United States (US) dollar.

Depreciation not only cut the purchasing power of these countries' currencies, it also added to the burden on the corporate sector, which borrowed in foreign currency. To arrest the sudden depreciation that followed from abandoning the peg, these countries increased their interest rate to arrest capital outflow. With this, companies became doubly burdened with their ballooning foreign currency debt due to depreciation on the one hand, and their increasing domestic borrowing costs due to higher interest rates on the other. The percentage of nonperforming loans in the banking sector rose rapidly, resulting in a serious banking crisis. Ultimately, the above economies faced sharp declines in real output resulting in a prolonged recession.

One of the major reasons behind the financial crisis in 1997 was the excessive dependence of the Asian economies on commercial banks for domestic financing. The major source of corporate financing was the banks because the other major source of financing, bond markets, was underdeveloped and small. Furthermore, the de facto peg of these economies' currencies to the US dollar minimized perceived currency risks for both borrowers and lenders. This encouraged local borrowers to take on foreign currency-denominated loans as currency risks were deemed low while there was a significant difference between local and foreign interest rates. From the point of view of lenders, higher growth rates in the region relative to other parts in the world also encouraged this investment, i.e., capital flow, to the Asian region.

The “double mismatch” problem or the “twin risk” problem, namely currency and maturity risk, is one of the reasons behind the crisis. Corporate borrowers predominantly created this problem by raising funds in foreign currency on a short-term basis. The Asian corporate sector borrowed short-term from commercial banks in foreign currency for long-term domestic investment. When credit dried up, these corporate borrowers were not able to borrow capital for their outstanding investments. As default cases increased, it became more difficult and more expensive to access credit. As capital outflow continued, the currency depreciated. The inability of corporate firms and banks to pay became more severe as their debt in terms of the local currency rose significantly (Kawai, 2007; Asian Development Bank, 2002).

Despite its experience in the Asian Financial Crisis, the Asian corporate sector continues to depend significantly on bank lending. Since banks are highly leveraged institutions, economies heavily dependent on bank financing are much more vulnerable to a financial crisis. The presence

---

<sup>1</sup> This study defines emerging East Asian economies as the People's Republic of China (PRC); Hong Kong, China; Indonesia; Malaysia; Philippines; Singapore; Thailand; and Viet Nam.

of such instability in the banking system can halt or delay important investment projects and reduce aggregate demand (Herring and Chatuspriak, 2000).

The continuing double mismatch risk could be reduced if more corporate borrowers finance their needs through well-diversified portfolios, particularly through bonds. This calls for the development of sound and sustainable domestic local currency bond markets in Asia. Developing stable and liquid bond markets will reduce the dependence of the corporate sector on banks and foreign currency financing. Through the local bond markets, the corporate sector can borrow for longer maturity periods in local currency, which matches their investment needs and thus enables them to avoid balance sheet mismatches (Eichengreen and Luengnaruemitchai, 2004).

Asia is once again facing economic difficulties as a consequence of the ongoing global financial crisis, which originated in the United States. While the current situation is different from the Asian Financial Crisis, in that it did not originate locally, investor uncertainty has still caused capital outflow in most Asian economies. Similar to its experience of the Asian Financial Crisis, the corporate sector in Asia is facing severe constraints in securing foreign and local currency financing due to the lack of investor confidence in the financial markets.

Furthermore, Asia needs to mobilize a large amount of capital to finance its huge infrastructure needs to develop connectivity within and across its economies. The financing needs for Asia's infrastructure have been estimated at around US\$750 billion per year in energy, transport, telecommunications, water, and sanitation during 2010–2020 (Bhattacharyay, 2010). Infrastructure projects are usually long-term in nature. Given this huge requirement, one of the possible ways to bridge financial gaps is to tap Asia's large savings and international reserves and to channel them to infrastructure investment. In 2009, the total annual savings of the 11 major Asian economies<sup>2</sup> was approximately US\$3,390 billion, while the stock of total foreign exchange reserves reached US\$4,686 billion. At present, a large portion of these savings is invested in markets of developed economies at a low return. This huge financial resource may provide an effective solution to the financial gap problem. Local and regional capital can be channeled towards long-term infrastructure projects and other productive investments through bond markets.

Strengthening, integrating, and deepening local bond markets, particularly in local currencies, can play a significant role in mobilizing the required funds for enhancing regional demand. The rationale of such investment is that it will not only stimulate domestic economies but also enhance regional connectivity and integration, thereby increasing regional demand and thus rebalancing Asia's growth away from high dependence on exports to advanced economies, such as the United States and the European Union.

At this juncture, it is very timely to examine how to enhance the development of bond markets in Asia. In this regard, it is important to examine the factors or determinants that affect bond financing. The objective of the study is to analyze the trends in bond market development in Asia, and to identify the major determinants of corporate, government, and total bond financing in Asian economies, through examining their relationship with selected key financial and economic factors.

Corporate, government, and total bond financing are measured by the size of total corporate bonds, total government bonds, and total bonds (sum of corporate and government bonds) of an economy, respectively, as a percentage of each economy's GDP. In particular, this study posits and tests the following hypotheses below for selected Asian economies. Corporate, government, and total bonds financing of an economy have a:

- (i) Positive relationship with the size of an economy (measured by GDP);

---

<sup>2</sup> PRC; Hong Kong, China; Japan; Korea; Taipei, China; Indonesia; Malaysia; Philippines; Singapore; Thailand; and India

- (ii) Positive relationship with the openness of an economy (exports as a proportion of GDP);
- (iii) Positive relationship to the stage of development of an economy (per capita GDP);
- (iv) Negative relationship with interest spread;
- (v) Positive relationship with the size of the banking system (domestic credit provided by banking sector related to GDP); and
- (vi) Negative relationship with exchange rate variability.

There are additional factors that can impact bond financing, as explained in the next section. However, comparable time-series data are available only for the above six variables for all ten countries during the study period. Therefore, this study focuses on examining the above six hypotheses.

## 2. BACKGROUND LITERATURE

There are several studies related to bond financing in Asia. Table 1 presents key factors identified by Eichengreen and Luengnaruemitchai (2004) that affect the magnitude of corporate financing through bond markets.

**Table 1: Major Factors that Affect Corporate Financing through Bond Markets**

<b>Factors</b>	<b>Measurement</b>	<b>Expected Relationship</b>
1. Economic size (i)	GDP at purchasing power parity (PPP)	Weakly positive with larger size
2. Natural openness (ii)	Ratio of exports to GDP	Weakly positive with openness
3. Developmental stage of the economy (iii)	PPP GDP per capita (Growth pattern of the economy)	Positive with higher development stage
4. Interest rate (iv)	Level of Interest rates	Negative with high interest rates
5. Size of the banking system (v)	Well developed and competitive banking systems	Positive with size and development of banking system
6. Exchange rate variability (vi)	Variation of monthly exchange rates over one year period	Negative with greater variability of exchange rates
7. Geographical/disease endowments environment	Settler mortality or distance from the equator	Positive with favorable geographical/disease environment
8. Riskiness of investment environment	Credit quality of investors	Negative with lower quality
9. Traditions of legal system	British or French system/investors' right	Positive with higher rights
10. Law and order	Reliability of law enforcement	Positive with higher reliability
11. Corporate governance and transparency	Quality of accounting standards and transparency	Positive with high quality
12. Banking concentration	Banking with market power	No strong relationship
13. Absence of public sector funding needs	Government funding requirements	Negative with low public-sector bond market capitalizations
14. Regulatory enforcement	Bureaucratic quality for clear and consistent implementation	Positive with better quality
15. Interest rate variability	Nominal interest rate volatility	Negative with high interest volatility

Source: Eichengreen and Luengnaruemitchai (2004)



Herring and Chatusripitak (2000) considered the consequences of not having a well-functioning bond market for economic factors, such as savings, the quality and quantity of investment, and risk management. They concluded that the lack of a well-functioning bond market may reduce the efficiency of an economy, and may increase its vulnerability to a financial crisis.

Hakkanson (1999) studied the difference in impact between an underdeveloped corporate bond market and a developed corporate bond market on an economy. He argued that a well-developed corporate bond market fosters an efficient corporate financial structure, the presence of rating agencies, a proliferation of financial derivatives, and other means to reduce systemic risk and avoid crises. On the contrary, the elements of a well-developed bond market such as a financial reporting system, a strong community of financial analysts, a public market with high liquidity, and the existence of a mechanism for efficient reorganization in the case of default, enhance economic welfare. The author determined the principal force behind increasing the relative size of the corporate bond market as “disintermediation”, which means an increasingly direct relationship between corporations and capital markets.

Fabella and Madhur (2003) studied the requirements necessary for development of bond markets in East Asia. They identified eight conditions required for robust domestic bond market development: (i) sustaining a stable macroeconomic environment with low inflation and stable interest rates, (ii) developing a healthy government bond market that would serve as a benchmark for the corporate bond market, (iii) completing the post crisis agenda of banking sector restructuring, (iv) improving corporate governance, (v) strengthening the regulatory framework for the bond market, (vi) rationalizing tax treatment of bonds, (vii) broadening the investor base, and (viii) promoting the growth of regional bond market centers.

Furthermore, Plummer, and Click (2005) highlighted that developing a sound, sustainable, stable, and liquid bond markets will reduce the dependence of the corporate sector on banks and foreign currency financing. Through the local bond market, the corporate sector can borrow for longer maturity periods in local currency, which matches their investment needs and thus enables them to avoid balance sheet mismatches. To attract investment through issuing local bonds, Asian firms have to adopt international accounting practices, and enhance corporate governance, thereby becoming more transparent (Eichengreen and Luengnaruemitchai, 2004).

According to Radelet et al. (1998), information asymmetry in the financial market, lack of adequate competitiveness among the financial institutions, and government intervention were some of the key factors behind the financial market failure during the 1997 Asian crisis. A well-developed, deep, flexible, and highly volatile bond market could provide long-term protection against such a crisis.

With respect to hypothesis (i), it has been argued that the lack of the minimum efficient scale, which is necessary for the development of a stable and large bond markets, is one of the key problems faced by small economies. Thus, multinational corporations and other foreign bond issuers may not be interested as the volume of capital that can be raised may be too insignificant (Eichengreen, Hausmann, and Panizza, 2002).

Hypothesis (ii) postulates that when the economy is open, entrenched interests such as banks, which are usually reluctant to allow bond markets to encroach on their dominant market share, will be less effective in influencing policies that prevent competition from other sources of corporate financing (Rajan and Zingales, 2003).

Furthermore, some emerging Asian economies are still poor compared with developed, industrialized economies, even though they have witnessed high economic growth in recent years. These emerging economies lack institutions that can support financial markets. The unreliability of contract enforcement and uncertainty of investor rights present in these countries are obstacles to developing sound financial markets. Therefore, hypothesis (iii) proposes that

bond market development also significantly depends on the development stage of an economy (Eichengreen and Luengnaruemitchai, 2004).

Hypothesis (iv) suggests that corporate bond market development usually has a negative relationship with interest rate spread. This is mainly due to the significant perceived risk that the purchasing power of fixed-rate long-term bond could be diminished. This may lessen demand for long-term bonds (Eichengreen and Luengnaruemitchai, 2004).

Hypothesis (v) presumes that the presence of a large, well developed, competitive, and well-capitalized banking system is required to develop a liquid and properly functioning bond market. These banks play the role of dealers and market makers (Hawkins, 2002).

The supposition behind hypothesis (vi) is that stable exchange rates pose low risk to investors, particularly foreign investors. Therefore, a stable exchange rate encourages bond market development. The higher the exchange rate volatility of an economy, the lower the state of development of its bond market (Eichengreen and Luengnaruemitchai, 2004).

### **3. TRENDS IN BOND MARKET DEVELOPMENT IN ASIA**

This section presents the trends and structure in bond financing in terms of market capitalization for East Asian economies during 1998–2008, as well as various regional initiatives for bond market development. The East Asian economy has witnessed remarkable growth in bond financing during 1998–2008—a period of 11 years for total bonds (TB), government bonds (GB), and corporate bonds (CB) market capitalizations.

**Table 2: Local Currency Bond Market Size in Selected Asian Economies, 1998–2008**  
(US\$ billion)

Economy		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Growth
													1998 -2008 (in %)
Japan	G	2,763.5	3,491	3,494.2	3,533	4,505.1	5,528.4	6,564.6	6,289.9	6,388.3	6,871.8	8,550.2	209.4
	C	1,093.6	1,213	1,051.6	883.1	897.8	904.9	892.3	742.3	706.8	772.8	961.6	-12.1
	T	3,857.1	4,704	4,545.8	4,416.1	5,402.9	6,433.4	7,456.9	7,032.2	7,095.1	7,644.6	9,511.8	146.6
Indonesia	G	—	46.9	50.8	47.2	53.3	59.1	54.2	48.2	69.9	77.3	62.3	33
	C	1.8	2	2	1.8	2.4	5.4	6.3	5.9	6.8	8.4	6.5	256.4
	T	1.8	48.9	52.8	49	55.7	64.5	60.5	54.1	76.7	85.7	68.8	3,699.4
Republic of Korea	G	71.3	82.1	122.4	135.6	163	205.8	318.7	392.9	480.5	498	368.5	416.8
	C	—	—	232.6	268.6	323	308.1	338	360.8	441	528.7	448.2	92.7
	T	71.3	82.1	355	404.2	486.1	513.9	656.7	753.7	921.5	1,026.7	816.7	1,045.6
Hong Kong, China	G	12.6	13.1	13.9	14.6	15.1	15.5	15.8	16.3	16.9	17.5	20.3	61.7
	C	38.2	43.4	46.6	48.7	53	56.3	62.4	69.3	79.2	80.5	72.1	88.9
	T	50.8	56.5	60.5	63.3	68.1	71.8	78.2	85.6	96.2	98	92.5	82.2
Singapore	G	17.4	21.2	24.9	29.1	33.5	37.1	44.2	46.9	55.9	68.2	72.8	319.7
	C	12.1	16.2	19.6	25.9	27.7	30	35.7	36.2	43.5	53.6	54.2	346.9
	T	29.5	37.4	44.6	54.9	61.1	67.2	79.9	83.1	99.4	121.8	127	330.9
Malaysia	G	—	—	35.7	40	44.3	53.3	57.5	61.3	71	95	90.4	153.3
	C	—	—	33	38.2	34.5	40.4	39.3	45.6	53.7	69.7	76.1	130.4
	T	—	—	68.7	78.1	78.8	93.7	96.8	107	124.7	164.8	166.5	142.3
Philippines	G	—	—	20.8	23.8	27.3	30.7	35.5	41.1	45.1	54.5	52.4	151.6
	C	—	—	0.2	0.1	0.1	0.2	0.6	1	2.1	3.5	4.5	2,873.3
	T	—	—	21	23.8	27.4	30.9	36.2	42.1	47.2	58	56.9	171
Thailand	G	20.3	26.6	25.9	30.1	40.4	46.5	54.5	65	85.5	111.6	112.1	451.6
	C	4	5	5.2	5.7	6.5	11.6	12.2	14.1	24.1	27.7	28.8	621
	T	24.5	31.5	31.1	35.8	46.9	58.1	66.7	79	109.6	139.3	141	476.6
PRC	G	—	156.5	198.8	233.9	333.6	435.2	599.5	835.2	1,078.6	1,533.1	1,957.3	1,150.5
	C	—	2.8	3.5	4.5	8.7	13.3	24.3	64.1	105.6	156.7	256.1	9,111.2
	T	—	159.3	202.3	238.4	342.3	448.5	623.8	899.2	1,184.1	1,689.8	2,213.4	1,289.5
Viet Nam	G	—	—	0.1	0.2	0.3	0.9	1.6	2.6	5	9.6	12.7	14,055.6
	C	—	—	—	—	—	—	—	—	—	0.3	0.6	5400
	T	—	—	0.1	0.2	0.3	0.9	1.6	2.6	5	9.9	13.3	14,666.7
East Asia	G	3,010.6	3,838	3,988.8	4,087.4	5,215.8	6,412.5	7,746	7,799.5	8,296.6	9,336.5	11,299.1	275.3
	C	1,151.6	1,283	1,394.1	1,276.4	1,353.8	1,370.2	1,411.2	1,339.2	1,462.8	1,702	1,908.6	65.7
	T	4,162.3	5,120	5,382.9	5,365.3	6,569.6	7,782.6	9,157.2	9,138.7	9,759.5	11,038.5	13,207.7	217.3

Notes: G = Government; C = Corporate, T = Total; — = no available data; Growth from 1998–2008 computed using the following formula:  $\text{Growth} = (2008x - 1998x / 1998x) \times 100$

Source: AsiaBondsOnline. 2010. Available at: <http://asianbondsonline.adb.org/>. Accessed 27 July

Even though local-currency bond markets in East Asian economies witnessed rapid growth and reached around US\$13 trillion in 2008 from US\$4 trillion in 1998, they still remain very small compared with total local currency bonds worldwide.

The trend in Table 2 indicates that East Asia as a whole has exhibited a sharp rise in bond financing over the study period. Government bond financing rose by 275.3% during this 11-year period, followed by total bond (217.3%) and corporate bond (65.7%) financing. Consistent with significant economic growth, Viet Nam witnessed the highest expansion (14,666.7%) during 2000–2008, followed by Indonesia (3,699.4%), the PRC (1,289.5%), and the Republic of Korea (1,045.6%) during 1998–2008. However, this rapid growth in most markets is predominantly due to the rise of government bonds rather than corporate bonds. Government bonds, in general, grew much faster (4.1 times faster) than corporate bonds, except in the economies of the PRC, Philippines, and Indonesia. This indicates that corporate bond financing needs to be enhanced significantly to reduce corporate sector financing risk as well as to support sustainable growth in bond market development in these economies. Corporate bond financing, on the other hand, expanded very rapidly in the PRC (9,111.2%), particularly during 2006–2008, in the Philippines (2,873.3%), starting from a very low base, and in Indonesia (256.4%). In view of this trend, the current study examines determinants of corporate, government, and total bonds separately.

The above analysis of Table 2 indicates the trends in absolute magnitude of bond financing. However, analysis of the bond financing-to-GDP ratio can reveal the adequacy of bond market size compared to the size of the economy. Table 3 presents the size of the bond market in proportion to size of the economy (GDP). The results indicate that government and total bond financing compared to the size of the economy varies widely among Asian countries, from the lowest level in Viet Nam to the highest level in Japan—in 2008, total bond and government bond ratio varied from 15% and 14% in Viet Nam to 194% and 174% in Japan, respectively. The Republic of Korea witnessed the highest corporate bond ratio of 48% in 2008, while Viet Nam's corporate bond ratio was a mere 1%. Even though Japan, the Republic of Korea, Malaysia, and Singapore have very high ratios for total bonds, amounting to 194%, 88%, 75%, and 70% of GDP, respectively, with the exception of the Republic of Korea, their corporate bond financing sizes are comparatively small, with ratios of 20%, 48%, 34%, and 30%, respectively. Therefore, consistent with hypothesis (i) and (iii), Table 3 indicates that more developed economies in terms of economic size and higher per capita income in Asia, in general, have higher total bond market capitalization.

Government bonds of all Asian economies constitute the major portion of total bonds issued and their role has continued to rise; except for Indonesia which reveals a declining trend in government bonds and Hong Kong, China, with a flat trend. The government bond-to-GDP ratio of East Asian economies as a whole rose from 52% in 1998 to 96% in 2008, whereas corporate bond ratios witnessed a declining trend ranging from 20% to 16% during 1998–2008.

Corporate bond-to-GDP ratios among Asian economies showed a mixed trend during the study period. Hong Kong, China; Singapore; Malaysia; Thailand; and PRC exhibit an increasing trend, whereas Japan displays a decreasing trend. In general, it can be concluded that corporate bond financing is still not a popular financing instrument in Asia. Serious efforts need to be made to enhance its use, and with this in mind, it is essential to identify the key determinants of bond financing—the objective of this paper.

Asia has witnessed various regional initiatives for bond market development undertaken by East Asia's major regional institutions (see Box 1). These major initiatives include:

- (i) Asian Bond Fund (ABF);
- (ii) Asian Bond Market Initiative (ABMI);
- (iii) Executives' Meeting of East Asia-Pacific Central Banks (EMEAP);

- (iv) ASEAN+3 (Association of Southeast Asian Nations, Japan, the Republic of Korea, and the PRC) Finance Ministers Meeting;
- (v) Asia-Pacific Economic Cooperation (APEC) Finance Ministers Meeting; and
- (vi) Asia-Cooperation Dialogue.

Table 3: Bond Market Size (as % of Current GDP) of Selected East Asian Economies, 1998–2008

Economies		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Japan</b>	<b>G</b>	72	80	75	86	115	131	143	138	146	157	174
	<b>C</b>	28	28	23	22	23	21	19	16	16	18	20
	<b>T</b>	100	108	97	108	138	152	162	154	146	174	194
<b>Indonesia</b>	<b>G</b>	—.	34	31	30	27	25	21	17	19	18	12
	<b>C</b>	2	1	1	1	27	2	2	2	2	2	1
	<b>T</b>	2	35	32	31	28	27	24	19	21	20	13
<b>Republic of Korea</b>	<b>G</b>	21	18	23	27	28	32	44	46	50	47	40
	<b>C</b>	—.	—.	44	53	56	48	47	43	46	50	48
	<b>T</b>	21	18	67	80	84	80	91	89	97	98	88
<b>Hong Kong, China</b>	<b>G</b>	8	8	8	9	9	10	10	9	253	8	9
	<b>C</b>	23	27	28	29	32	35	38	39	42	39	34
	<b>T</b>	30	30	36	38	42	45	47	48	51	33	43
<b>Singapore</b>	<b>G</b>	21	26	27	34	38	40	40	39	40	41	40
	<b>C</b>	15	20	21	30	31	32	32	30	31	32	30
	<b>T</b>	36	45	48	64	69	72	73	69	72	73	70
<b>Malaysia</b>	<b>G</b>	—.	—.	38	43	44	48	46	44	46	51	41
	<b>C</b>	—.	—.	35	41	34	37	31	33	29	37	34
	<b>T</b>	—.	—.	73	84	78	85	77	78	80	88	75
<b>Philippines</b>	<b>G</b>	—.	—.	27	34	35	38	41	42	38	38	31
	<b>C</b>	—.	—.	0	0	0	0	1	1	2	2	3
	<b>T</b>	—.	—.	28	34	36	39	42	43	40	40	34
<b>Thailand</b>	<b>G</b>	18	22	21	26	32	33	34	37	41	45	41
	<b>C</b>	4	4	4	5	5	8	8	8	12	11	11
	<b>T</b>	22	26	25	31	37	41	41	45	53	56	52
<b>PRC</b>	<b>G</b>	—.	14	17	18	23	27	372	475	41	45	45
	<b>C</b>	—.	0	0	0	1	1	15	36	4	5	6
	<b>T</b>	—.	15	17	18	24	27	387	511	45	50	51
<b>Viet Nam</b>	<b>G</b>	—.	—.	0	1	1	2	4	5	8	0	14
	<b>C</b>	—.	—.	—.	—.	—.	—.	—.	—.	—.	0	1
	<b>T</b>	—.	—.	0	1	1	2	4	5	8	14	15
<b>East Asia</b>	<b>G</b>	52	58	56	61	77	87	94	90	90	91	96
	<b>C</b>	20	19	20	19	20	19	17	15	16	17	16
	<b>T</b>	71	78	75	81	98	106	112	105	106	108	112

Note: G = Government; C = Corporate; T = Total; —. = no available data

Source: AsiaBondsOnline. 2010. Available at: <http://asianbondsonline.adb.org/>. Accessed: 12 July.

**Box 1: Various Initiatives for the Development of Asian Bond Markets\***

Since the 1997 financial crisis, Asian economies have undertaken various initiatives for developing bond markets in Asia. Asian Development Bank (ADB) has been pioneering the efforts to develop domestic and regional bond markets in Asia. The major regional initiatives are highlighted below.

- **Asian Bond Fund (ABF)**
  - The ABF was established in 2003 by the Executives’ Meeting of East Asia-Pacific Central Banks (EMEAP) with the objective of facilitating bond issuance.
  - To expand the bond market, eight members of the EMEAP (the PRC; Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; Philippines; Singapore; and Thailand) issued sovereign and quasi-sovereign bonds, which were purchased by the foreign exchange reserve of all the members of the EMEAP (including Australia, Japan, and New Zealand).
  - Initial purchase was US\$1 billion of US dollar denominated bonds—called Asian Bond Fund-1 (ABF-1).
  - To avoid the “Twin Risk” problem, ABF-2 was introduced in late 2004 with an initial purchase of \$2 billion of Asian-currency denominated sovereign and quasi-sovereign bonds.
  - ABF-2 introduced two funds:
    - Pan-Asian Bond Index Fund: a single bond fund index investing in local currency bonds issued in eight Asian economies.
    - The Fund of Bond Funds: a parent fund investing in eight sub-funds.
  
- **Asian Bond Market Initiative (ABMI)**
  - Established in 2003 by the ASEAN+3 Finance Ministers
  - To develop local currency denominated bonds.
  - Aims at establishing a national and regional market infrastructure for bond market development.
  - The ABMI created several working groups for conducting studies relating to bond market development, such as:
    - Issuance of new securitized debt instruments;
    - Establishment of a regional bond guarantee agency;
    - Creation of a regional settlement and clearance system; and
    - Strengthening of regional rating agencies.
  - To create synergies between policies and market activities, the working groups ensure consultation with the private sector. Some progress has been made on these studies.

**Other Initiatives**

**Activities**

EMEAP	<ul style="list-style-type: none"> <li>• Strengthen the demand side of bond market development</li> <li>• Establish the Asian Bond Fund (ABF-1, ABF-2)</li> </ul>
ASEAN+3 Finance Ministers Meeting	<ul style="list-style-type: none"> <li>• Strengthen the supply side of bond market development</li> <li>• Study and implement initiatives through working groups on: new securitized debt instruments; credit guarantee and investment mechanisms; foreign exchange transactions and settlement issues; and rating systems</li> </ul>
Asia-Pacific Economic Cooperation (APEC) Finance Ministers Meeting	<ul style="list-style-type: none"> <li>• Study measures to promote regional bond market development</li> <li>• Study securitization, credit guarantee mechanisms and new instruments</li> </ul>
Asia-Cooperation Dialogue	<ul style="list-style-type: none"> <li>• Increase public awareness of the various initiatives and secure political support</li> </ul>

\* This section is based on Kawai (2006, 2007), Asia Sentinel (2010), APEC (2004), and other ADB/ ADBI documents.

ABF and ABMI were launched in 2003–04 for promoting the development of local capital markets. However, progress made with these initiatives has fallen short of expectations.

To further develop and integrate bond markets, Asia needs to promote bond issuers and investors from the region as well as outside the region. This requires a legal and regulatory framework conducive to investors, a regional guarantee mechanism, harmonized credit and trading standards, a regional clearing and settlement system, and an enhanced local and regional credit rating system. Asian Development Bank (ADB), with its specialist knowledge and financial resources, has been playing an important role in developing the aforementioned bond market infrastructure, particularly within the ASEAN+3 ABMI framework. Its initiatives<sup>3</sup> include:

- (i) provision of expert policy advice and support of ABMI through technical assistance and research on regional studies to remove barriers to local bond market development, promote enabling environments, and enhance market infrastructure;
- (ii) creation of an online clearing house such as the “Asian Bonds Online Website” for providing regular information on various bond market initiatives, government policies related to the industry, legal and regulatory frameworks, analysis of bond market trends and patterns through “Asian Bond Monitor”; and
- (iii) promoting national and regional bond market development through the issuance of local currency ADB bonds (in PRC yuan; Philippine peso; Hong Kong, China dollar; Malaysian ringgit; Singapore dollar; Thai baht; and Indian rupee) and providing risk mitigation instruments such as partial credit and political risk guarantees.

## 4. DATA AND METHODOLOGY

The six hypotheses highlighted in the introduction have been tested using simple, multivariate Ordinary Least Squares (OLS), Fixed effect (FE), Random effect (RE) and Generalized Least Squares methods (GLS) based on pooled time-series and cross-sectional data for ten selected Asian economies for the period 1998–2008 at an annual frequency. This section provides the methods used for data compilation and computation for dependent and independent variables used in the regression models as well as econometric methodologies used.

### 4.1 Compilation and Computation of Data

The time-series data for the aforementioned nine variables of ten Asian countries for 1998–2008 have been collected from the following sources: AsiaBondsOnline, ADB's website on Asian Bond Market (2010), the IMF International Financial Statistics (2010), and World Development Indicators of the World Bank (2010). More details on the data sources are given in Appendix 1.

For computation of the bond market size, and export and domestic credit of the banking system as a percentage of the size of the economy, current GDP was used, whereas for computing economy size and per capita economic size, GDP in purchasing power parity (PPP) terms was used instead. The interest spread was computed by taking the difference between the lending and deposit rates. Exchange rate variability for a year was calculated as the standard deviation of the 12 monthly exchange rates for that year.

---

<sup>3</sup> For further details, please see (<http://asianbondsonline.adb.org>)

## 4.2 The Simple Regression Models

In this study, first the relationship between bond financing and individual determinants has been examined using the 18 simple regression models (for details, see appendix 2):

Determinants of bonds (corporate, government, and total)

$$BF_{it} = a + b_{st} X_{it} + E_{it}$$

Where,

$BF_{it}$  is bond market size in proportion to GDP of country  $i$  in year  $t$ ,

$X_{it}$  are the explanatory variables (namely, GDP of country, exports as a proportion of GDP, per capita GDP, interest rate spread, domestic credit provided by banking sector related to GDP, and exchange rate risk index or variability), and

$E_{it}$  are error terms with normal distribution with mean zero.

## 4.3 Multiple Regression Models

The following section explains the multiple regression models used to examine the relationship between bonds financing with six independent variables or determinants simultaneously. It is assumed that the intercept and coefficient of independent variables do not differ from country to country, or over time.

### 4.3.1 Determinants of Bonds Financing Size

The estimated equations are:

$$F_{it} = B_0 + B_{1t}X_{1it} + B_{2t}X_{2it} + B_{3t}X_{3it} + B_{4t}X_{4it} + B_{5t}X_{5it} + B_{6t}X_{6it} + U_{it}$$

Where,

$i$  = country, 1...10;

$t$  = years, 1998–2008;

$F_{it}$  = Total bond market size in proportion to GDP of country  $i$  in year  $t$ ;

$X_{1it}$  = Log GDP in PPP terms of country  $i$  in year  $t$ ;

$X_{2it}$  = Log per capita GDP in PPP terms of country  $i$  in year  $t$ ;

$X_{3it}$  = Exports as proportion of GDP of country  $i$  in year  $t$ ;

$X_{4it}$  = Domestic Credit provided by banking sector related to GDP of country  $i$  in year  $t$ ; and

$X_{5it}$  = Interest rate spread of country  $i$  in year  $t$ ;

$X_{6it}$  = Exchange rate variability of country  $i$  in year  $t$ ;

$B_0$  is the constant or the intercept terms for bond (total, government, and corporate) models;

$B_{it}$  are the coefficients of the independent variables; and

$U_{it}$  are the independent normal distribution error terms with mean zero.



## 5. RESULTS OF EMPIRICAL ANALYSIS

### 5.1 Simple Regression Analysis

This section presents the results of the simple regression analysis of the corporate, government, and total bonds financing vis-à-vis the dependent variables. Table 4 below presents results of simple regression analysis. Correlation plots are shown in appendix 3.

#### **Hypothesis 1:**

The results in Table 4 show that a statistically significant (at a 10% level of significance) positive relationship exists between total and government bonds and the size of an economy, which is consistent with the hypothesis (i) of the study. For the regression equation for corporate bonds, the coefficient is not statistically significant.

#### **Hypothesis 2:**

Results show a relationship between bond financing and the openness of the economy. Hypothesis (ii) states that corporate, government, and total bond financing of an economy has a positive relationship with the openness of an economy measured as exports in proportion to GDP. Consistent with the above hypothesis, there is a positive significant relationship (at a 10% level of significance) between corporate bonds and openness of an economy. However, total bonds and government bonds have a negative relationship with an economy's openness, which is contrary to the hypothesis.

#### **Hypothesis 3:**

Next, we addressed the hypothesis that corporate, government, and total bond financing of an economy have a positive relationship with the stage of development of an economy measured by per capita GDP based on PPP. The result is consistent with the hypothesis that a positive significant relationship exists between the bond market size for total and corporate bonds and the stage of economic development.

#### **Hypothesis 4:**

The results of the test of hypothesis (iv) show that there is a negative relationship between total, corporate, and government bonds and interest rate spread. The interest spread is defined as the difference between the lending rate and the deposit rate. The table indicates that a significant (at a 1% level of significance) negative relationship exists between total, corporate, and government bonds and the interest rate spread. The negative coefficient suggests that higher interest spread is related to a smaller bond financing size as hypothesized.

**Table 4: Simple Regression Results for Total, Government, and Corporate Bonds**

		Total Bonds						
Type of bond								
Size of an economy	0.173 (-0.052) *							
Openness of the economy		-0.155 (-0.105)						
Stage of economic development			0.15 (-0.066) **					
Interest rate spread				-1.94 (.455) ***				
Size of banking system					0.4 (-0.09) *			
Exchange rate variability							-0.0127 (-0.025)	
Intercept	-0.48 (-0.355) ***	0.804 (-0.111) ***	-0.7 (-0.61) ***	1.38 (0.177) ***	0.166 (-0.135)	0.708 (-0.094) ***		
R-squared	0.11	0.023	0.05	0.16	0.17	0.0027		
Degrees of freedom	93	93	93	93	93	93		
		Government Bonds						
Type of bond								
Size of an economy	0.194 (-0.051) *							
Openness of the economy		-0.183 (-0.103) ***						
Stage of economic development			0.062 (-0.067)					
Interest rate spread				-1.37 (0.47) ***				
Size of banking system					0.36 (-0.092) *			
Exchange rate variability							-0.003 (0.025)	
Intercept	-0.783 (-0.347) ***	0.66 (-0.11) ***	-0.066 (-0.624) ***	1 (0.18) ***	0.048 (-0.136)	0.517 (-0.093) ***		
R-squared	0.13	0.033	0.009	0.08	0.14	0.0002		
Degrees of freedom	93	93	93	93	93	93		
		Corporate Bonds						
Type of bond								
Size of the economy	0.0139 (-0.014)							
Openness of the economy		0.1 (-0.023) *						
Stage of economic development			0.12 (-0.01) *					
Interest rate spread				-0.398 (0.111) ***				
Size of banking system					0.04 (-0.023) ***			
Exchange rate variability							-0.015 (0.006) *	
Intercept	0.104 (-0.089) ***	0.115 (-0.024) ***	-0.9 (-0.097) ***	0.341 (0.043) ***	0.148 (-0.034) **	0.234 (-0.021) ***		
R-squared	0.01	0.17	0.59	0.12	0.15	0.073		
Degrees of freedom	93	93	93	93	93	93		

Notes: Significance tests: \*\*\* means significance at a 1% level: p<0.01, \*\* means significance at a 5% level: p<0.05,

\* significance at a 10% level p<0.1 and numbers in parenthesis are standard error

Source: Author

**Hypothesis 5:**

Regarding the size of the banking system, the initial hypothesis suggested that corporate, government, and total bonds financing of an economy have a positive relationship with this variable. The size of the banking system is measured by the ratio of domestic credit of the banking sector to GDP. The domestic credit to GDP ratio has positive, significant (at a 1% and 10% level of significance) relationship with the three types of bond financing. The significant positive coefficients are consistent with the hypothesis of a positive relationship between bond issuance and the size of the banking system.

**Hypothesis 6:**

Finally, we tested the hypothesis that corporate, government, and total bond financing of an economy has a negative relationship with exchange rate variability. The relationship between corporate bonds and exchange variability is significant at the 1% level of significance, and it has a negative sign. This is consistent with the above hypothesis. However, total and government bonds have a positive sign, which is not consistent with our hypothesis.

**5.2 Multivariate analysis**

In this section, the following types of models have been empirically estimated:

1. Multivariate Ordinary Least Squares (OLS – Model 1);
2. Fixed Effects (FE – Model 2) and Random Effects (RE – Model 3);
3. Generalized Least Squares (GLS);
  - a) Simple GLS (Model 4),
  - b) GLS with correction for heteroskedasticity (Model 5); and
  - c) GLS with correction for heteroskedasticity and first order panel specific autocorrelation (Model 6).

The paper also undertook regression analysis using the Generalized Method of Moments. However, only the size of the banking system, i.e., domestic credit provided by the banking sector to the economy has been found to have the expected positive relationship with statistical significance. Due to the insignificance of the other variables, results are not useful and not reported here.

**5.2.1 Ordinary Least Squares Model Analysis**

The results for the multivariate OLS regression are given in Table 5. The regression shows that total bonds, government bonds, and corporate bonds have a positive coefficient for the size of the economy, only government bonds being significant at a 5% level. On the other hand, only corporate bonds have a positive and significant relationship with the stage of economic development at a 1% level of significance, which is consistent with the hypothesis.

There is a significant negative relationship between interest rate spread and all types of bond, though only total bonds and corporate bonds are significant at a 10% and 1% significance level. The size of the banking system (domestic credit to GDP ratio) has a significant positive relationship with government bonds at the 1% level of significance while corporate bonds have a negative sign inconsistent with our hypothesis.

Finally, exchange rate variability has a negative relationship with all types of bonds, but it is not statistically significant. As exchange rates of several economies are pegged to the US dollar or managed against appreciation in relation to the US dollar through market intervention, it is possible that the variability may be low throughout the period.

**Table 5: Model 1—Results of Multivariate Ordinary Least Squares (OLS) Regression**

Variables	Total Bonds	Government Bonds	Corporate Bonds
<b>Size of the economy</b>	.076 (.0615)	.132 (.063)**	.007 (.0094)
<b>Stage of economic development</b>	.039 (.123)	-.109 (.126)	.13 (.018)***
<b>Openness of the economy</b>	-.034 (.206)	.116 (.21)	-.016 (.031)
<b>Interest rate spread</b>	-1.21 (.655)*	-.853 (.67)	-.334 (.1)***
<b>Size of banking system</b>	.173 (.132)	.244 (.135)*	-.083 (.02)***
<b>Exchange rate variability</b>	-.0201 (.026)	-.007 (.027)	-.006 (.004)
<b>Intercept</b>	.093 (1.05)***	.556 (1.08)	-.796 (.162)
<b>R-squared</b>	0.25	0.20	0.68

Notes: Significance tests: \*\*\* means significance at a 1% level:  $p < 0.01$ , \*\* means significance at a 5% level:  $p < 0.05$ , and \* significance at a 10% level  $p < 0.1$  and numbers in parenthesis are standard errors

Source: Author

## 5.2.2 Fixed Effects and Random Effects Models

These two methods are for estimating unobserved effects in the model. The fixed effects method eliminates time-invariant unobserved effects before estimation. The random effects model eliminates unobserved effects in the error term, which are uncorrelated with all the explanatory variables. The results are given in Table 6.

We used a fixed effects model assuming that country-specific time-invariant factors are present in the model. The model explains that 10% of the variation in total bonds, 2% of the variation in government bonds, and 48% of the variation in corporate bonds is related to independent variables. For total and government bonds, economy size (log GDP PPP) has a negative sign and is not statistically significant. Stage of economic development (log GDP PPP per capita) has a positive sign for bond types, being significant for total and government bonds at a 5% and 10% level of significance, which is consistent with our hypothesis. Openness of the economy and domestic credit have a positive sign for all bond types, but with regards to the former, they are only statistically significant for corporate bonds. Interest rate spread and exchange rate variability are negatively correlated with all bond types, which is consistent with the hypothesis, but only government bonds are correlated with exchange rate variability at a 5% level of significance.

**Table 6: Fixed Effects (FE, Model 2) and Random Effects (RE, Model 3) Regression Results**

Variables	Total bonds		Government bonds		Corporate bonds	
	FE	RE	FE	RE	FE	RE
Size of the economy	-.049 (.188)	.096 (.073)	-.041 (.192)	.144 (.069) **	.008 (.017)	.01 (.0131)
Stage of economic development	.923 (.44) **	.074 (.144)	.805 (.454) *	-.095 (.138 )	.026 (.041)	.056 (.029) **
Openness of the economy	.262 (.637)	-.039 (.232)	.656 (.651)	.119 (.225)	.143 (.059) **	.096 (.044) **
Interest rate spread	-.95 (.51)	-1.05 (.698)	-1.09 (.868)	-.827 (.696)	-.045 (.0789)	-.061 (.078)
Size of banking system	.741 (.511)	.156 (.162)	.72 (.52)	.228 (.152)	.047 (.079 )	.039 (.035)
Exchange rate variability	-.02 (.03)	-.015 (.027)	-.023 (.034) **	-.006 (.697 )	-.002 (.003)	-.002 (.003)
Intercept	-8.32 (3.89)	-.402 (1.2)	-7.68 (3.98)	.348 (1.16)	-.252 (.362)	-.497 (.241)
R-squared	0.10	0.24	0.02	0.2	0.48	0.48

Note: Significance tests: \*\*\* means significance at a 1% level:  $p < 0.01$ , \*\* means significance at a 5% level:  $p < 0.05$ , and \* significance at a 10% level  $p < 0$  and numbers in parenthesis are standard errors

Source: Author

If we assume that countries are randomly selected from a population and error term variance is present, then the random effect model is more effective. The random effects model explains 24% variation in total bond issuance, 20% in government bond issuance, and 48% in corporate bond issuance. All types of bonds are positively correlated with the size of an economy, which is consistent with our hypothesis, but only government bonds are significant at a 5% significance level. For the stage of economic development corporate bond issuance has a positive sign and is significant at a 5% level. With regards to openness of the economy, it is positively correlated with corporate bonds and significant at a 5% level. Size of the banking system has a positive sign and interest rate spread has a negative sign with all bond types, but they are not significant. Lastly, exchange rate variability is negatively correlated with all bond types, which is consistent with our hypothesis, with only government bonds being statistically significant at a 5% level. We conducted a Lagrange multiplier test for random effects in error components. The results of the test show that there are random effects, thus we can reject the null hypothesis that variance components for time and groups are zero at a 1% level of significance.

To choose between fixed and random effect models the Hausmann specification test was conducted. We do not reject the null hypothesis that a random effects model is more consistent in estimating total and government bonds, but that the null hypothesis is not rejected at a 10% level for corporate bonds implies that a fixed effects model is consistent for estimating factors influencing corporate bond issuance.

As we can see from the random effects estimation results, many variables are not significant. The model was also regressed using the general method of moments, but most of the dependent variables turned out to be insignificant. So, we can use a generalized least squares (GLS) model instead, which employs a similar method to the random effects model, taking into consideration heteroskedasticity and autocorrelation problems.

### 5.2.3 Generalized least square (GLS) Model

The analyses observed that in multivariate OLS, Fixed Effect, and Random Effect results, some variables are not statistically significant. The GLS model takes into consideration different variability of variables. The GLS model, which is similar to a random effects model, makes it possible to avoid heteroskedasticity and autocorrelation problems.

Similarly, Eichengreen and Leungaruemitchai (2004) applied GLS with corrections for heteroskedasticity and panel-specific autocorrelation in a study on bond markets. The study used a number of variables (see Table 1 in Section 2 of this study) including the six used in our analyses. By using this model we obtained the results presented in Table 7. The results are presented for simple GLS (Model 4), GLS with correction for heteroskedasticity (Model 5), and GLS with correction for heteroskedasticity and first order panel specific autocorrelation (Model 6). The estimation using the GLS model deals with these variances to produce best linear unbiased estimation. Applying the GLS we can take into consideration different variability in variables and estimate corrected variables by using OLS.

For simple GLS, results are identical to results using OLS estimation.

In GLS with correction for heteroskedasticity, economy size is positively correlated with government bonds and corporate bonds, being significant at a 1% level, but total bonds and economy size have no significant negative correlation. Stage of economic development has a positive relationship with total bonds and corporate bonds at a 1% significance level. Openness of an economy has a negative sign in total bonds, being statistically significant at a 5% level. It has the expected positive sign with regards to government bonds, but is not statistically significant. The size of the banking system has a positive relationship with total bonds that is significant at a 1% significance level, which is consistent with our hypothesis. But it has negative correlation with corporate bonds at a 1% significance level. Interest rate spreads and exchange rate variability have a negative sign and are statistically significant at the 1% and 5% levels with all bond types, except for exchange rate variability not being significant for government and corporate bonds.

**Table 7: Generalized Least Squares Regression (GLS, Models 4 to 6) Analysis**

Variables	Total Bonds			Government Bonds			Corporate Bonds		
	GLS(4)	GLS(5) het.	GLS(6) het.& AR(1)	GLS(4)	GLS(5) het.	GLS(6) het.& AR(1)	GLS(4)	GLS(5) het.	GLS(6) het.& AR(1)
<b>Size of the economy</b>	.076 (.059)	-.025 (.037)	-.027 (.041)	.132 (.06)	.142 (.05) ***	.049 (.065)	.007 (.009)	.02 (.007) ***	.017 (.007) **
<b>Stage of economic development</b>	.039 (.118)	.173 (.047) ***	.242 (.046) ***	-.109 (.12)	-.042 (.052)	.006 (.057)	.13 (.018) ***	.138 (.016) ***	.087 (.012) ***
<b>Openness of the economy</b>	-.034 (.198)	-.146 (.072) **	-.103 (.088)	.116 (.202)	.136 (.092)	.092 (.094)	-.016 (.03)	-.017 (.025)	.041 (.021) **
<b>Interest rate spread</b>	-1.21 (.63) *	-.599 (.194) ***	-.281 (.145)	-.853 (.645)	-.335 (.167) ***	-.124 (.133)	-.334 (.096) ***	-.194 (.07) ***	-.033 (.034)
<b>Size of banking system</b>	.173 (.63)	.171 *** (.034)	.055 (.065)	.244 (.129)	.175 (.035)	.053 (.076)	-.083 (.019) ***	-.084 (.017) ***	-.014 (.016)
<b>Exchange rate variability</b>	-.02 (.025)	-.014 (.007) **	-.001 (.004)	-.007 (.026)	-.005 (.007)	-.004 (.004)	-.006 (.004)	.0003 (.003)	.0003 (.001)
<b>Intercept</b>	.09 (1.01)	-.638 (.323)	-1.34 (.3)	.556 (1.04)	-.27 (.325)	-.104 (.386)	-.796 (.155)	-1.044 (.126)	-.771 (.071)
<b>Degrees of freedom</b>	93	93	93	93	93	93	93	93	93
<b>Wald test</b>	0.0000	0.0000	0.0000	0.000	0.0000	0.2657	0.0000	0.0000	0.0000

6

Notes: het- = heteroskedasticity; AR(1) = autocorrelation of order 1. Significance tests: \*\*\* means significance at a 1% level:  $p < 0.01$ , \*\* means significance at a 5% level:  $p < 0.05$ , and \* significance at a 10% level  $p < 0.1$  and standard errors are given in parentheses.

Source: Author

The results of estimating a GLS model with correction for heteroskedasticity and panel specific autocorrelation are as follows. Size of economy has a positive correlation with government and corporate bonds as expected, but it has a negative sign for total bonds. It is statistically significant at 5% level in corporate bonds. Stage of development has a positive sign for all bond types as expected, and it is significant at the 1% level for total and corporate bonds. Openness of an economy is positively correlated with government and corporate bonds as expected, being significant at the 5% level for corporate bonds. But it has a statistically insignificant negative correlation with total bonds. Size of banking system has a positive sign for total and government bonds, but is not significant. Interest rate spread and exchange rate variability have a negative sign for all bond types, except positive correlation between exchange rate variability and corporate bonds.

**Table 8: Comparison of Empirical Results with the Findings of Eichengreen and Luengnaruemitchai (2004)**

	Total Bond						Government bond						Corporate bond						EL (6)
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)	
Size of the economy							✓		✓		✓						✓	✓	✓
Stage of economic development		✓			✓	✓		✓					✓		✓	✓	✓	✓	
Openness of the economy														✓	✓			✓	✓
Interest rate spread	✓			✓	✓						✓		✓			✓	✓		✓
Banking system					✓		✓												✓
Exchange rate variability					✓			✓											

Notes:

✓ means significant with correct sign.

(1) to (6) represent the six multivariate models used in the study.

EL stands for the Eichengreen and Luengnaruemitchai (2004) study, which only performed Generalized Least Squares (GLS) with corrections for heteroskedasticity and panel-specific autocorrelation.

Source: Eichengreen and Luengnaruemitchai (2004), author’s calculations

Eichengreen and Luengnaruemitchai (2006) investigated 41 countries, including Asian economies such as the PRC; Hong Kong, China; India; Japan; Malaysia; Philippines; Singapore; the Republic of Korea; and Thailand, from 1990 to 2001. They employed a panel Generalized Least Squares (GLS) model with corrections for heteroskedasticity and panel-specific autocorrelation. Out of our six variables, Eichengreen and Luengnaruemitchai (2004) found four variables, namely the size of an economy, openness of an economy, interest rate spread, and banking system to be significant. Comparison among the six multivariate models used in the study as well as the results of Eichengreen and Luengnaruemitchai are presented in Table 8.

## 6. CONCLUSION

In view of the Asian crisis in 1997 and the ongoing global financial and economic crisis, the development of bond markets in Asia assumes high importance for financing the region. Even though Asia’s bond market has witnessed considerable growth in recent years, bond market financing size, particularly corporate bond market size, is still quite low. Therefore, it is essential to identify the major determinants of bond market development. This study attempts to identify the major determinants of bond financing for some major Asian economies, namely Hong Kong, China; the PRC; Indonesia; Japan; the Republic of Korea; Malaysia; Philippines; Singapore; Thailand; and Viet Nam, using econometric analysis. The analyses were conducted using simple OLS, multivariate OLS, Fixed Effects, Random Effects, and GLS models.

The simple regression analysis shows a significant relationship with all determinants that are consistent with the hypotheses. Based on the multivariate regression analysis of time-series and cross-section panel data for the period 1998–2008, it can be concluded that the major determinants of bond financing are:

1. The size of the economy for corporate and government bonds;
2. The stage of economic development for total, government, and corporate bonds;
3. Openness of the economy for total and corporate bonds;
4. The size of the banking system for total and government bonds; and
5. Interest rate spread for total, government, and corporate bonds.



According to ordinary multiple regression, random effect, and GLE with correction for heteroskedasticity models, the size of an economy has a significant positive relationship with government bond issuance. Using a GLE model with correction for heteroskedasticity as well as corrections for both heteroskedasticity and autocorrelation, the size of an economy is significantly positively correlated with corporate bond issuance. This implies that economy size has a positive relationship with government and corporate bond market development. The findings on the size of the economy suggest that bond markets of Asian economies should be linked and integrated, to create a minimum efficient scale to attract multinational corporations, financial institutions, and other large bond issuers. The establishment of an ASEAN or East Asian bond market would be one way to achieve this.

Exchange rate variability has the expected significant negative relationship with total bond issuance under the GLE model with corrections for heteroskedasticity. However, it has an insignificant positive relationship with total (for other models) and government bonds, and a negative sign with corporate bonds, but its positive relationship is not consistent with the hypothesis, as shown in the literature. To develop well-functioning domestic and regional bond markets, Asian economies and the region as a whole need to reduce exchange rate volatility within and across economies.

The stage of development (per capita GDP PPP) and banking system (domestic credit/GDP) have a positive relationship with total, government (fixed effect and multiple regressions models respectively) and corporate bonds at a 1% significance level, consistent with our expectation, except that there is a negative relationship between corporate bond issuance and banking system development. In this regard, the following measures that are usually adopted by developed economies are likely to facilitate the development of bond markets in developing Asia: (i) developing strong institutions to support financial markets; (ii) regulatory enforcement/reliable contract enforcement and establishing investors rights; (iii) innovative financial instruments such as GDP and inflation-linked bonds and Asian currency linked bonds; and (iv) better corporate governance and transparency. At the same time, Asian economies need to strengthen and expand the banking system as the amount of available credit can positively influence bond market development. Linking and integrating the banking sectors can also promote bond market development, by creating scale economies.

Interest rate spread exhibits the expected negative relationship with total, government, and corporate bonds under the GLE model with correction for heteroskedasticity. Appropriate policies to stabilize interest spread will promote bond market development.

Openness of an economy has a significant positive influence on corporate (for both GLE; and random and fixed effect models) and total bond issuance (for the GLE model). Therefore, further opening up these economies to trade is important for corporate bond development.

It is to be noted that all the above five determinants have a significant relationship with total bonds—the sum total of government and corporate bonds. But a few determinants do not have a significant and consistent relationship with government bonds, and particularly corporate bonds. As the growth of the corporate bond market is quite slow compared with that of the total bond market, its relationship with some determinants cannot be expected to be significant. To further strengthen bond financing in Asia, individual economies and the region as a whole need to enhance these key determinants.

Well-developed bond markets can provide Asia with alternative sources of financing and at the same time make the region more financially resilient by balancing the dependence on the banking sector. Achieving a better balance between bank finance and bond markets requires a more planned, top-down approach by policymakers through required reforms and appropriate rules and regulations. Asia also needs to utilize its huge savings and international reserves to meet the

large needs for productive investment in the region, particularly in infrastructure through bond market development. Regional cooperation schemes, such as the ABF and the ABMI, are important instruments for facilitating regional bond market development. There is an urgent need to strengthen, expand, and deepen these initiatives and to include other emerging economies of Asia, such as India. In this regard, multilateral development banks such as the ADB have an important role to play in developing Asia's bond markets. New initiatives, such as developing a liquid corporate bond market and broadening the issuer base, may also prove useful. To further integrate and deepen bond markets, Asian economies need to harmonize and strengthen financial regulation as well as the legal and regulatory framework; develop innovative financial instruments; and promote better access to regional and international investors.

## REFERENCES

- Asian Development Bank. 2002. Bond Market Development in East Asia: Issues and Challenges. Regional Economic Monitoring Unit. Manila: ADB
- Asian Development Bank. 2009. Asian Development Outlook. Manila: ADB
- AsianBondOnline. 2009. Manila: Asian Development Bank  
<http://asianbondsonline.adb.org/regional/regional.php>.
- Bhattacharyay B. 2010. Financing Asia's Infrastructure: Modes of Development and Integration of Asian Financial Markets. ADBI Working Paper No. 229. Tokyo: ADBI
- Eichengreen B., and L. Pipat. 2004. Why Doesn't Asia Have Bigger Bond Markets? NBER Working Paper No. 10576. Cambridge, MA: National Bureau of Economic Research  
<http://www.nber.org/papers/w10576>
- Eichengreen B. 2006. The development of Asian bond markets. BIS Paper no. 30. Basel, Switzerland: Bank of International Settlements
- Eichengreen, B., R. Hausmann, and U. Panizza. 2002. Original Sin: The Pain, the Mystery, and the Road to Redemption. Unpublished manuscript. UC Berkeley, Harvard University, and IDB.
- Eschweiler, B. 2006. Bond market regulation and supervision in Asia. BIS Paper No. 30.  
<http://www.bis.org/publ/bppdf/bispap30zb.pdf>
- Herring, R. and N. Chatusripitak. 2000. The Case of the Missing Market: the Bond Market and Why It Matters for Financial Development. Paper presented at The Asian Development Bank Institute / Wharton Seminar, on Financial Structure for Sustainable Development in Post-Crisis Asia. Tokyo. May 26.
- Fabella, R., and M. Shrinivasa. 2003. Bond Market Development in East Asia: Issues and Challenges. ERD working paper No.35. Manila: Asian Development Bank
- Hakansson, N. 1999. *The Role of a Corporate Bond Market in an Economy and in Avoiding Crises. Research Program in Finance*. Berkeley, CA: Institute of Business and Economic Research, UC Berkeley
- Hawkins, J. 2002. Bond markets and banks in emerging economies. BIS Paper No. 11
- International Monetary Fund. 2008. *World Economic Outlook, 2007–2008*. Washington, DC  
<http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/index.aspx>.
- International Monetary Fund. 2009. *International Financial Statistics, 2008–2009*. Washington, DC  
<http://www.imfststatistics.org/imf/>.
- Kawai, M. 2007. Asian Bond Market Development: Progress, Prospects and Challenges. Key Note Speech by the Dean of the Asian Development Bank Institute. High Yield Debt Summit Asia 2007. Singapore, 16–17 May 2007.
- Khalid, A., and G. Rajaguru. 2010. Market Development for Fixed Income Securities: The Role of Socio-economic and Institutional Factors. Bond University Globalisation & Development Centre  
[http://epublications.bond.edu.au/cgi/viewcontent.cgi?article=1041&context=gdc&sei-redir=1#search="gmm/"+"bond+market"/+determinants"](http://epublications.bond.edu.au/cgi/viewcontent.cgi?article=1041&context=gdc&sei-redir=1#search=)

- Plummer, M., and R. Click. 2005. Bond Market Development and Integration in ASEAN. *International Journal of Financial Economics* 10: 133–142.
- Radelet, S., and J. Sachs. 1998. *The East Asian Financial Crisis: Diagnosis, Remedies, and Prospects*. Cambridge, MA: Harvard Institute for International Development
- Rajan, R., and L. Zingales. 2003. *Saving Capitalism from the Capitalists*. New York, NY: Crown Books.
- World Bank. 2008. *World Development Indicators*. Washington, DC: World Bank

## APPENDIX 1: DATA SOURCES

### Variables and Sources

<b>Bond data</b>		<a href="http://www.asianbondsonline.org">www.asianbondsonline.org</a>
<b>Size of the economy</b>	GDP, PPP (current international, in billion \$US) <b>(logs)</b>	World Development Indicators, World Bank
<b>Stage of economic development</b>	GDP per capita, PPP (current international \$) <b>(logs)</b>	World Development Indicators, World Bank
<b>Openness of the economy</b>	Export of goods and services (% of GDP)	International Financial Statistics, International Monetary Fund (IMF)
<b>Interest rate spread</b>	Interest rate spread (lending rate - deposit rate, %)	World Development Indicators, World Bank
<b>Banking system</b>	Domestic credit provided by banking sector (% of GDP)	World Development Indicators, World Bank
<b>Exchange rate variability</b>	Exchange rate index (monthly average, January 2006=100, US\$/local currency)	<a href="http://www.aric.adb.org">www.aric.adb.org</a>

## APPENDIX 2: THE SIMPLE REGRESSION MODELS

The relationship between bonds financing with individual determinants has been examined using the eighteen simple regression models:

### ***Determinants of Total Bonds***

$$\text{Model 1: } TF_{it} = TB_{so1} + TB_{s1t} X_{1it} + TE_{sit1}$$

$$\text{Model 2: } TF_{it} = TB_{so2} + TB_{s2t} X_{2it} + TE_{sit2}$$

$$\text{Model 3: } TF_{it} = TB_{so3} + TB_{s3t} X_{3it} + TE_{sit3}$$

$$\text{Model 4: } TF_{it} = TB_{so4} + TB_{s4t} X_{4it} + TE_{sit4}$$

$$\text{Model 5: } TF_{it} = TB_{so5} + TB_{s5t} X_{5it} + TE_{sit5}$$

$$\text{Model 6: } TF_{it} = TB_{so6} + TB_{s6t} X_{6it} + TE_{sit6}$$

### ***Determinants of Government Bonds***

$$\text{Model 7: } GF_{it} = GB_{so1} + GB_{s1t} X_{1it} + GE_{sit1}$$

$$\text{Model 8: } GF_{it} = GB_{so2} + GB_{s2t} X_{2it} + GE_{sit2}$$

$$\text{Model 9: } GF_{it} = GB_{so3} + GB_{s3t} X_{3it} + GE_{sit3}$$

$$\text{Model 10: } GF_{it} = GB_{so4} + GB_{s4t} X_{4it} + GE_{sit4}$$

$$\text{Model 11: } GF_{it} = GB_{so5} + GB_{s5t} X_{5it} + GE_{sit5}$$

$$\text{Model 12: } GF_{it} = GB_{so6} + GB_{s6t} X_{6it} + GE_{sit6}$$

### ***Determinants of Corporate Bonds***

$$\text{Model 13: } CB_{it} = CB_{so1} + CB_{s1t} X_{1it} + CE_{sit1}$$

$$\text{Model 14: } CB_{it} = CB_{so2} + CB_{s2t} X_{2it} + CE_{sit2}$$

$$\text{Model 15: } CB_{it} = CB_{so3} + CB_{s3t} X_{3it} + CE_{sit3}$$

$$\text{Model 16: } CB_{it} = CB_{so4} + CB_{s4t} X_{4it} + CE_{sit4}$$

$$\text{Model 17: } CB_{it} = CB_{so5} + CB_{s5t} X_{5it} + CE_{sit5}$$

$$\text{Model 18: } CB_{it} = CB_{so6} + CB_{s6t} X_{6it} + CE_{sit6}$$

where,

$TF_{it}$  = Total bond market size in proportion to GDP of country i in year t,

$GF_{it}$  = Government bond market size in proportion to GDP of country i in year t,

$CB_{it}$  = Corporate bond market size in proportion to GDP of country i in year t,

$X_{1it}$  = GDP of country i in year t,

$X_{2it}$  = Exports as a proportion of GDP of country i in year t,

$X_{3it}$  = Per capita GDP of country i in year t,

$X_{4it}$  = Interest rate spread of country i in year t;

$X_{5it}$  = Domestic credit provided by banking sector related to GDP of country i in year t, and

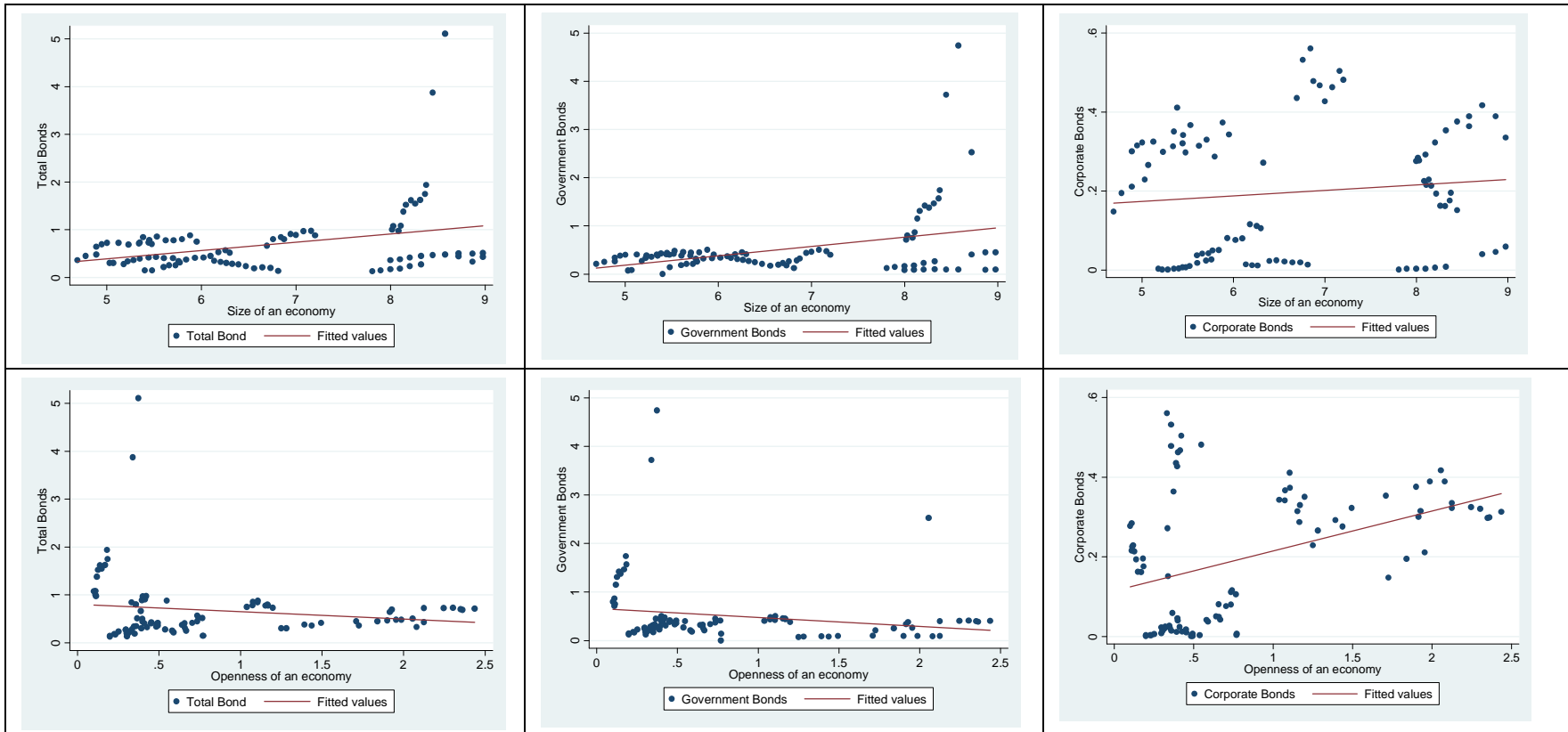
$X_{6it}$  = Exchange rate risk Index or variability of country i in year t

$TB_{sot}$ ,  $CB_{sot}$ , and  $GB_{sot}$  = Intercept terms for total, government, and corporate bond models, respectively

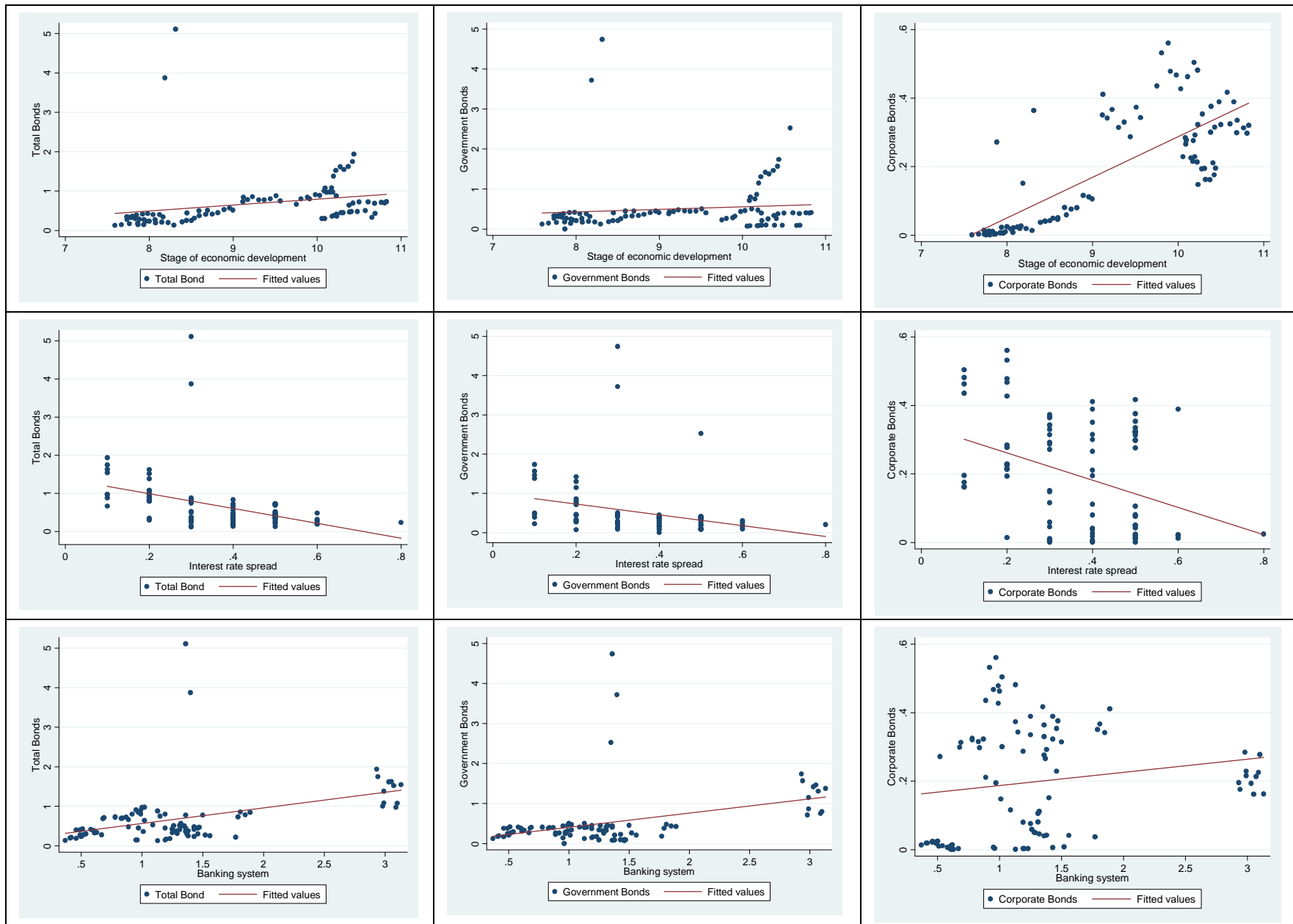
$TB_{sit}$ ,  $CB_{sit}$  and  $GB_{sit}$  = Coefficients for independent variable  $i$  for total, government, and corporate bond models, respectively, and

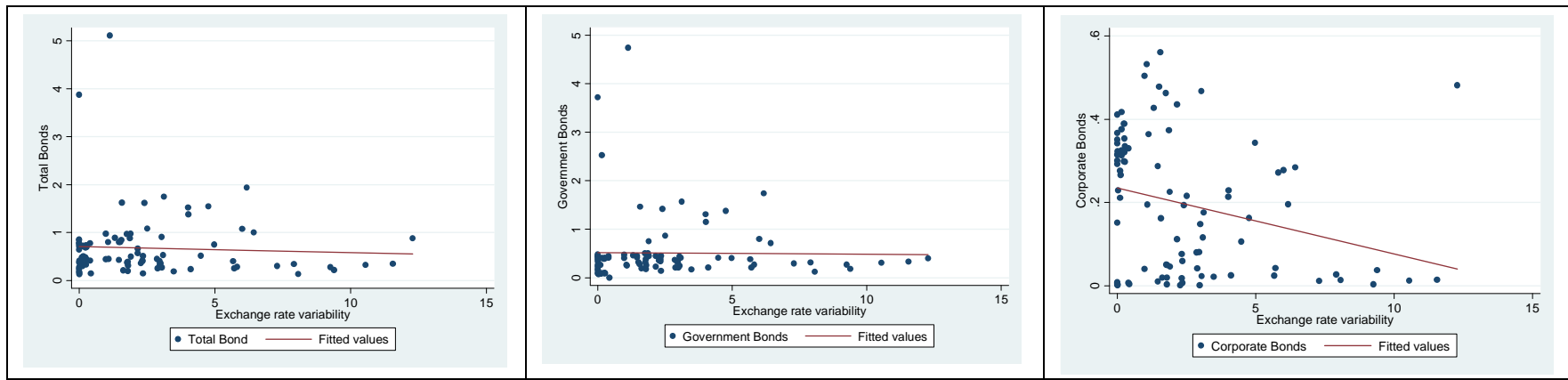
$TE_{sit}$ ,  $GE_{sit}$ ,  $CE_{sit}$  are independent normal distributions error terms with mean zero

### APPENDIX 3: SIMPLE REGRESSION ANALYSIS—CORRELATION PLOTS









Source: Author