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Contents

Abstract

We investigate the development of corporate bond markets in 10 Asian countries from 1995 to 2014. Using data on outstanding value and total issue of bonds by financial and non-financial companies, we confirm that macroeconomic and institutional factors are related to the depth of the corporate bond market. We show that creditor rights and institutional quality are important in explaining the size of outstanding value and issuance of corporate bonds. Furthermore, we determine a strong positive association between the level of domestic credit and the outstanding value and issue of corporate bonds. From the results, we surmise that there is a positive relationship between the development of the corporate bond market and the banking sector. These findings indicate that increased demand for bank loans induced the issuance of bonds by financial institutions, which, in turn, might have led to the development of corporate bond markets in Asia. Finally, we document that the development of corporate bond markets might have helped mitigate the outcome of the financial crisis of 2008 in Asia.

Keywords: corporate bond market, bond issuance, crisis, banking sector, Asia

JEL codes: F36, O16, G15, 053

1 Introduction

In the last 2 decades, corporate bond markets in Asia have expanded rapidly. Since the global financial crisis of 2008, the issuance of corporate bonds in Asia has grown fourfold. In addition, corporate bond market capitalization increased from almost 17% in 2008 to more than 24% of the region's GDP by 2012. The growth of the corporate bond market accelerated after 2009, mainly driven by Asian domestic corporate bond markets (Levinger and Li, 2014). The corporate bond market is viewed nowadays as a "spare tire" for Asian firms, substituting for the decline in lending by Western European and US financial institutions during the global financial crisis of 2008. Indeed, we document that the development of the corporate bond market in Asia might have helped to mitigate the outcome of the recent global financial crisis.

Creating a spare tire was one of the main aims of various government initiatives that were undertaken to create domestic bond markets after the Asian financial crisis of 1997 (for overviews, see Plummer and Click, 2005; Packer and Remolona, 2012; Park, 2016). However, the development of corporate bond markets is uneven across the Asian region. Therefore, the question of what drives the development of the corporate bond market in some Asian countries arises. In this study, we attempt to answer this question by providing insight into the growth of Asian corporate bond markets following the crisis of 1997.

Empirical studies investigating the determinants of the development of domestic corporate bonds markets in Asia are limited. Of those recent studies that exist, most underline the importance of the economic indicators and legal rights as drivers of bond market development.

We extend existing research and employ a larger variety of factors that may influence corporate bond market development in 10 Asian countries, using panel regression. In the study, we use data on the size of the corporate bond market as well as on the issuance of corporate bonds in the years 1995–2014. Hence, the data cover the periods following the Asian financial crisis of 1997 and the global financial crisis of 2008. We confirm the importance of economic performance and institutional quality for the development of corporate bond markets in Asia. We find that stronger

creditor rights and quality of regulations are associated with deeper local bond markets. We report that in countries with better creditor rights, more corporate bonds are issued. In addition, we find a positive association between bank credit growth and corporate bond market issuance. Burger and Warnock (2006) argue that the necessary conditions for bond market development are very similar to those that foster the development of the banking system. We argue that dynamic growth in bank lending can imply an increase in the issuance of bonds by financial institutions, which may lead to the growth of the corporate bond market in terms of size. Hence, we consider that the growth of the financial bond market may positively influence corporate bond market development.

More importantly, we find evidence that Asian bond markets acted as a spare tire during the global financial crisis of 2008. We observe a significant increase in the outstanding value and the issuance of corporate bonds during the crisis period. The results of the study are robust and do not change when the regression is altered. Meanwhile, we find no evidence that the corporate bond market provided an offset to reductions in bank lending during previous systematic banking crises in the Asian economies at the country level. We interpret our results to mean that the countries developed the necessary infrastructure during the last 2 decades, and nowadays, most Asian countries have mixed financial systems. More importantly, the existence of a developed corporate bond market may be one reason that Asian countries were not strongly affected by the global financial crisis of 2008.

Our study extends the existing literature in three ways. First, we present an updated analysis of the development of the corporate bond market. Indeed, many studies use the total outstanding sovereign and corporate debt to study the development of the bond market. We regard these two markets as diverse and possibly driven by other factors. Samaoui et al. (2017) argue that the issuance of sovereign bonds may foster the development and supply of corporate bond securities. We find, however, that a large sovereign bond market has a negative effect on the issuance of a corporate bond market. The results confirm that the markets are diverse, whereas we investigate only factors that may determine the development of the corporate bond market. Moreover, in our study, we control for crisis periods, including the global financial crisis of 2008.

market. Moreover, in our study, we control for crisis periods, including the global financial crisis of 2008.

Second, we focus not only on the size of the bond market, but more importantly, on the volume of capital raised by companies in the bond market. The existing studies use the outstanding value of the sovereign and/or corporate debt to GDP as a measure of bond market development. A significant drawback of this measure is that it captures the amount of debt outstanding, not the amount of debt raised in a given year. Consequently, the increase of debt in previous years may have given the impression of a well-functioning corporate bond market even when the amount of new funds raised in the debt market is tiny. We tackle this problem by focusing on the factors determining the issuance of the corporate bond markets. Doing so allows us to study the issuance behavior of companies during the systematic banking crises as well as the financial crisis of 2008. In addition, we attempt to establish the determinants of bond issues by financial and non-financial companies. Indeed, our results indicate that the determinants explaining the development of the corporate bond market in terms of size and issuance differ. Moreover, we find differences in the factors determining the volume of issuance of bonds by non-financial and financial companies.

Last, we present strong evidence that the corporate bond market may have acted as a spare tire during the global financial crisis. Meanwhile, during the previous systematic banking crisis, the corporate bond market did not provide any stabilization in Asian countries. Hence, we document that the initiatives undertaken by governments since the Asian financial crisis might have helped develop corporate bond markets, which nowadays provide stability to the financial sector and economic development.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 summarizes the development of the corporate bond market in selected Asian countries since 1997. Section 4 describes the data and discusses the factors affecting the size and issuance of corporate bond markets. Section 5 discusses the empirical strategy and shows the estimation results for various factors, whereas Section 6 discusses the results from the 'horse race' regression and present the results of the robustness test. We conclude in Section 7.

2 Literature review

This section outlines the few studies that investigate the determinants of the development of domestic corporate bonds markets in Asia.

Eichengreen and Luengnaruemitchai (2004) consider a broad set of determinants of bond market development using panel data for 41 countries for the period from 1990 to 2001. They find that larger economies with stronger institutions, less volatile exchange rates, and more competitive banking sectors tend to be positively associated with bond market capitalization. Claessens et al. (2007) focus on public bond market development in 35 countries over the period 1993–2000. They find that economies that are larger and have greater domestic investor bases, measured by the size of the financial system, have larger domestic bond markets. They show that less flexible exchange regimes are associated with less domestic debt relative to foreign borrowing. In addition, they report that the development of the government bond market is determined by the level of inflation, fiscal burden, legal origin, and capital account openness. Burger and Warnock (2006) analyze the development of bond markets in 49 countries. Their main findings suggest that countries with stable inflation rates and stronger creditor rights have more developed bond markets. In addition, their results indicate that bond markets and banking systems share some fundamental factors. Bae (2012) investigates the determinants of government, financial, and corporate bond market development using data from 43 countries over the period 1990–2009. He reports that the degree of economic development is the most important variable in explaining cross-country variation in all three types of bond markets. He finds no other variable that is robustly related to the financial bond market. In addition, he reports that the fiscal balance, interest rate, domestic credit provided by banks, and existence of a well-developed government bond market matter for the development of corporate bond markets. Recently, Samoui et al. (2017) analyze the development of the government and corporate bond market in 42 countries over the period 1990–2013. Using the generalized method of moments (GMM) procedure, they address the problem of endogeneity of explanatory variables and

confirm that a combination of structural, financial, and institutional factors seems to exert a significant effect on bond markets.

Bhattacharyay (2013) analyzes the development of the government and corporate bond markets in 10 Asian countries over the period 1998–2008. His results suggest that size and economic development in addition to openness and variability in interest rates are good predictors of the development of corporate bond markets. Burger et al. (2015), in a study of 42 smaller Asian countries, document that their economies may enable bond market development by lowering inflation and strengthening the legal rights of borrowers. In line with this finding, Park (2016), who also investigates the development of corporate bond markets in Asia, finds that better macroeconomic performance with stronger institutions contributes to the development of corporate bond markets in terms of size.

3 Background

The East Asian financial crisis of 1997 is sometimes called the "crisis of success." The crisis was the result of a boom of international lending followed by an abrupt capital outflow in 1997. On one hand, a capital inflow should be treated in general as a sign of good perceptions and trust in a country. On the other hand, the structure of incoming capital is of crucial importance. In the case of East Asia, capital inflow was not stable (in the short term), and most debt was incurred in foreign currency. This was a vulnerability in the financial system rather than a strength. The openness to capital flows had been seen as a beneficial strategy for emerging economies, yet after 1997, this paradigm came to be questioned, and the role of the structure of foreign capital (in the long term or short term) as well as the importance of domestic capital were underlined (Weisbrot, 2007).

International banks provided a significant amount of capital to domestic banks and non-financial companies in Asia before the crisis of 1997. The features of capital inflow were quite differentiated among Asian countries. For example, in Korea, lending was mainly to banks, and in Indonesia, lending was mainly to non-financial companies. The structure of the foreign capital created the problem of "double mismatch." First, the problem was related to the fact that short-term and volatile loans were used by East Asian entities to finance long-term investments in the real sector. Second, double mismatch refers to currencies; that is, there was a mismatch between the currency of a loan that was obtained by an Asian company/bank and the currency of its income. In 1997–1998, the withdrawal of foreign capital resulted in the depreciation of exchange rates (Radelet and Sachs, 2000).

The East Asian financial crisis was a sophisticated phenomenon and created double mismatch; these factors, however crucial, are not enough to understand the complexity of this crisis. Apart from excessive leverage, a rising fraction of non-performing loans and the role of poor regulatory and institutional environments in some countries are among the sources of the turmoil that researchers underline, especially in the Philippines, Thailand, and Malaysia. It is worth paying attention to the cases of particular countries. In Korea, for example, the key problem related to

excessive lending to large companies by banks that were effectively controlled by those companies (chaebols). In Indonesia, the important vulnerability was related to the fact that capital requirements were not strictly obeyed (Corsetti et al., 1998).

The strong dependence of economies on commercial banks for domestic financing is highlighted as one of the most important vulnerabilities of the Asian countries in 1997 (Bhattacharyay, 2013). In addition, the lack of well-developed and liquid corporate bond markets was an important factor that reinforced the escalation of risks before the Asian crisis of 1997, which made the final consequences more severe. As Greenspan (1999) figuratively says, "*The lack of a spare tire is of no concern if you do not get a flat. East Asia had no spare tires*."

According to the "spare tire view," a financial crisis can be mitigated if a country has the legal and market infrastructure that allows the capital market to provide alternative financing to firms when their banking systems cannot be used. A corporate bond market may be a substitute for bank lending and make the system more resistant to financial crisis. The role of developing local financial markets in emerging economies is still being underlined as a vital factor reinforcing stability. According to the IMF (2017), the governments in emerging economies should pay particular attention to domestic financial markets (equity- and bond-market depth and liquidity), because they provide a chance to increase resilience to global financial shocks.

Eichengreen and Luengnaruemitchai (2004), and Bhattacharyay (2013) argue that corporate bonds may be treated as diversification tools that make investors independent from sovereign bonds and other tools. This leads to the conclusion that the development of local currency corporate bonds may be—at least in theory—the perfect solution for improving the stability of East Asian financial systems. Consequently, policymakers undertook several regional initiatives to create and encourage the growth of corporate bond markets following the crisis of 1997.

In 2003 and 2004, the Executives' Meeting of East Asia-Pacific Central Banks (EMEAP) launched two projects, namely, Asian Bond Funds 1 and 2 (ABF 1 and 2), which were aimed at promoting regional bond markets. Another important project was the Asian Bond Market Initiative (ABMI), which was launched by the

Association of South-East Asian Nations to establish effective market infrastructure[1]. Among the ABMI projects were the establishment of a regional bond guarantee agency, the creation of a regional settlement and clearance system for bonds, and the strengthening of regional rating agencies (Bhattacharyay, 2013).

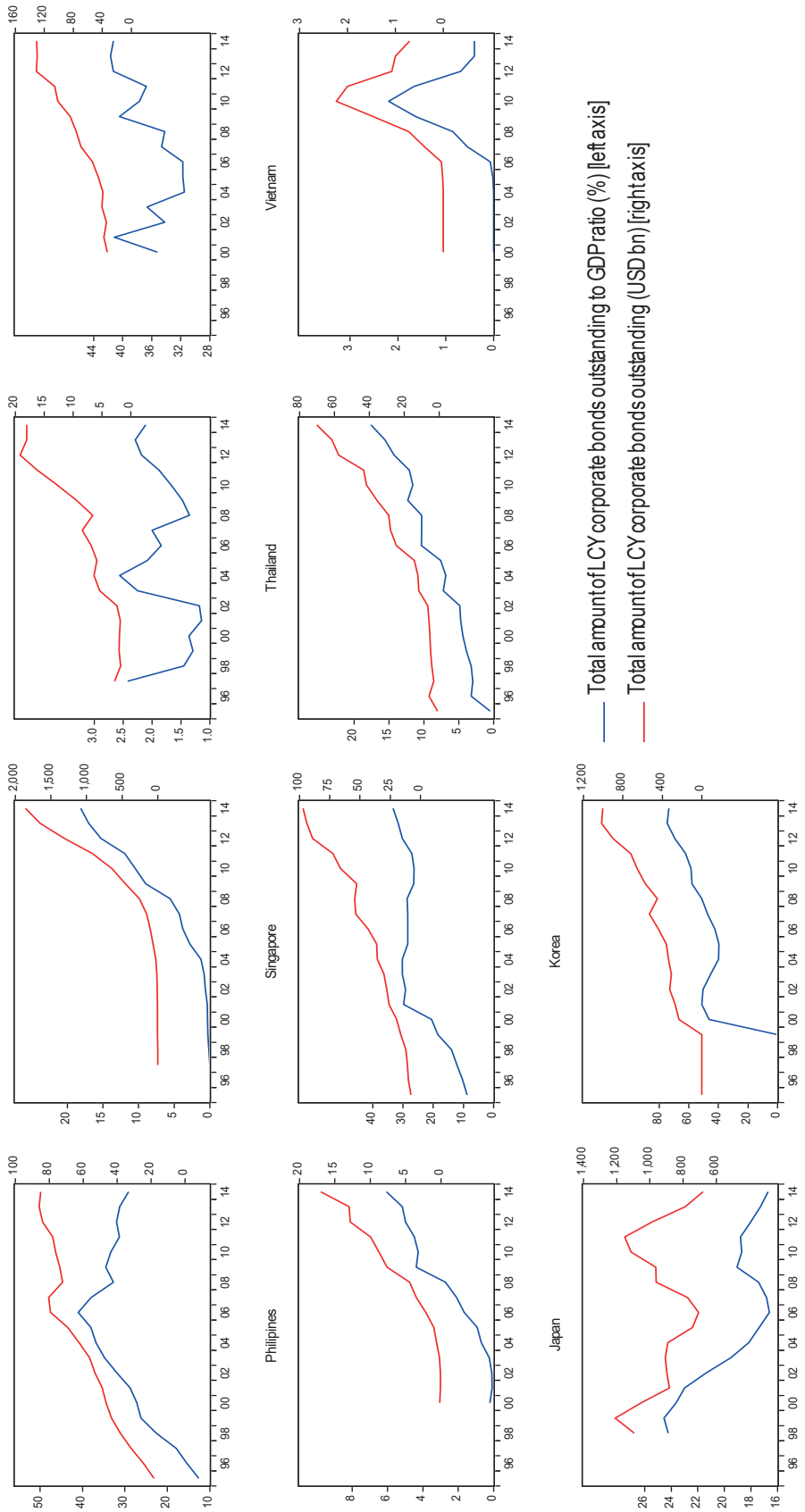
Mizen and Tsoukasy (2014) evaluate the impact of ABF, ABF2, and the ABMI policies on corporate bond market size and liquidity in Asia using the difference-in-differences model. In their study, they examine whether companies in the nine countries that took part in the aforementioned policy projects were more likely to issue corporate bonds, compared to a control group of companies from Taiwan. The results show that ABF, ABF2, and ABMI had a positive impact on the probability of issuance. Indeed, one can state that the initiatives undertaken in Asia ended with success, whereas East Asia faced significant growth in bond financing in the years 1998–2008. The total bond market increased by more than 217% during that period, the sovereign bond market by more than 275%, and the corporate bond market by almost 66% (Bhattacharyay, 2013). The numbers illustrate a significant shift in the Asian financial systems toward capital markets in the last 2 decades. The Asian corporate bond market relative to the economy is significantly larger than the market in South America nowadays, yet is still small in comparison to developed economy markets (Burger et al., 2015).

Figure 1 shows the development path of the total corporate bond market in the 10 Asian countries in our sample in terms of the total amount of corporate bonds outstanding and relative to GDP[2]. On one hand, the countries differ significantly in terms of economic and financial development. On the other hand, in all but Japan, we can observe a dynamic growth of the corporate bond market in the last two decades.

[1] Members of ASEAN are Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam in partnership with China, Japan and South Korea.

[2] Hong Kong, People's Republic of China, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Japan, and Korea.

Figure 1 **Amount of corporate bonds outstanding to GDP (in %)**



Figures 2-3 present detailed development paths for the corporate bond issuances in countries in our sample. Figure 2 illustrates the development of the corporate bond issuances relative to GDP in two series, i.e., with and without bonds issued by financial institutions. Figure 3 shows the annual volume of total corporate bond issuance from 1995 to 2014.

Figure 2 **Corporate bonds annual issuance volume to GDP (in %)**

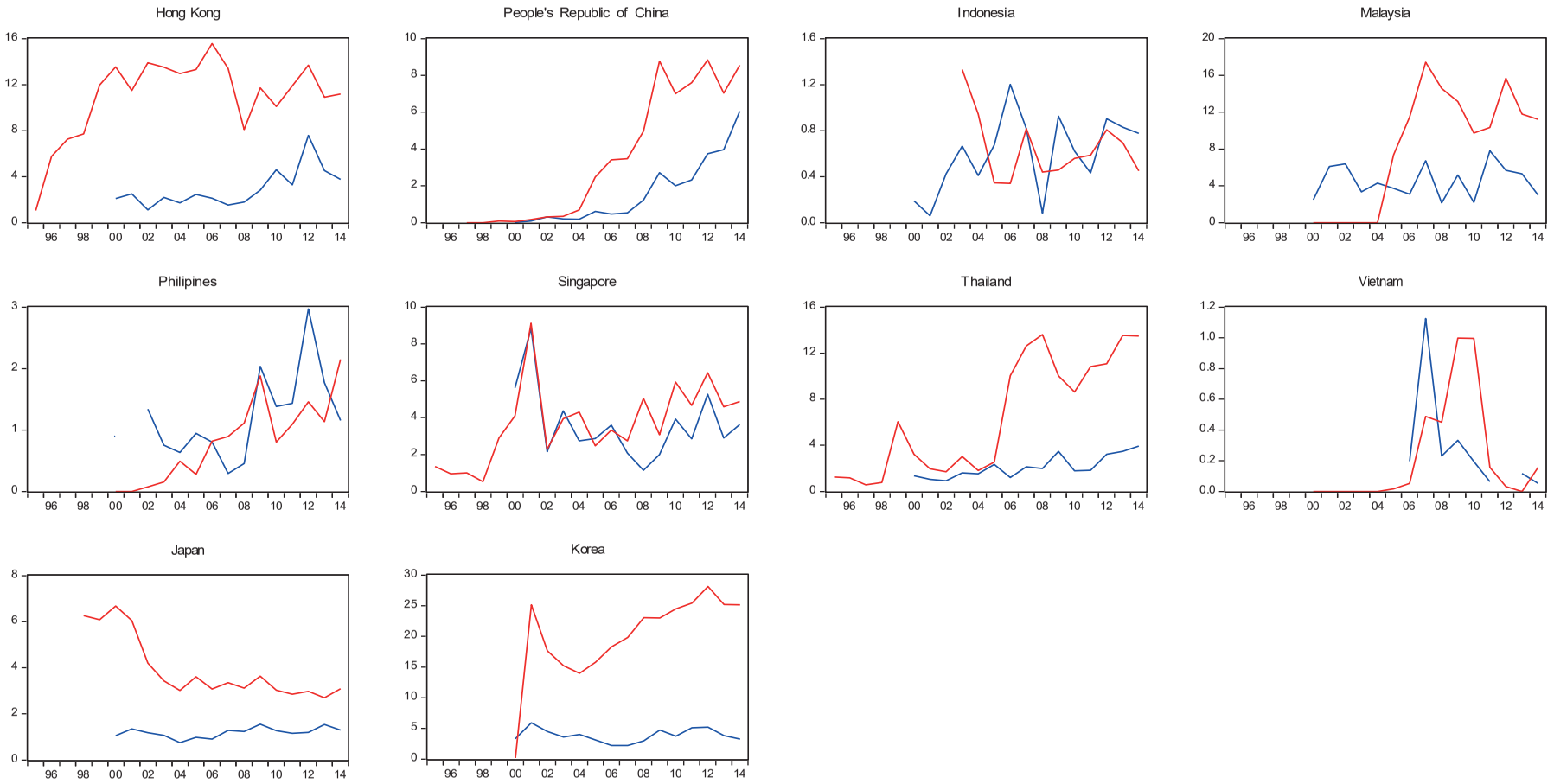
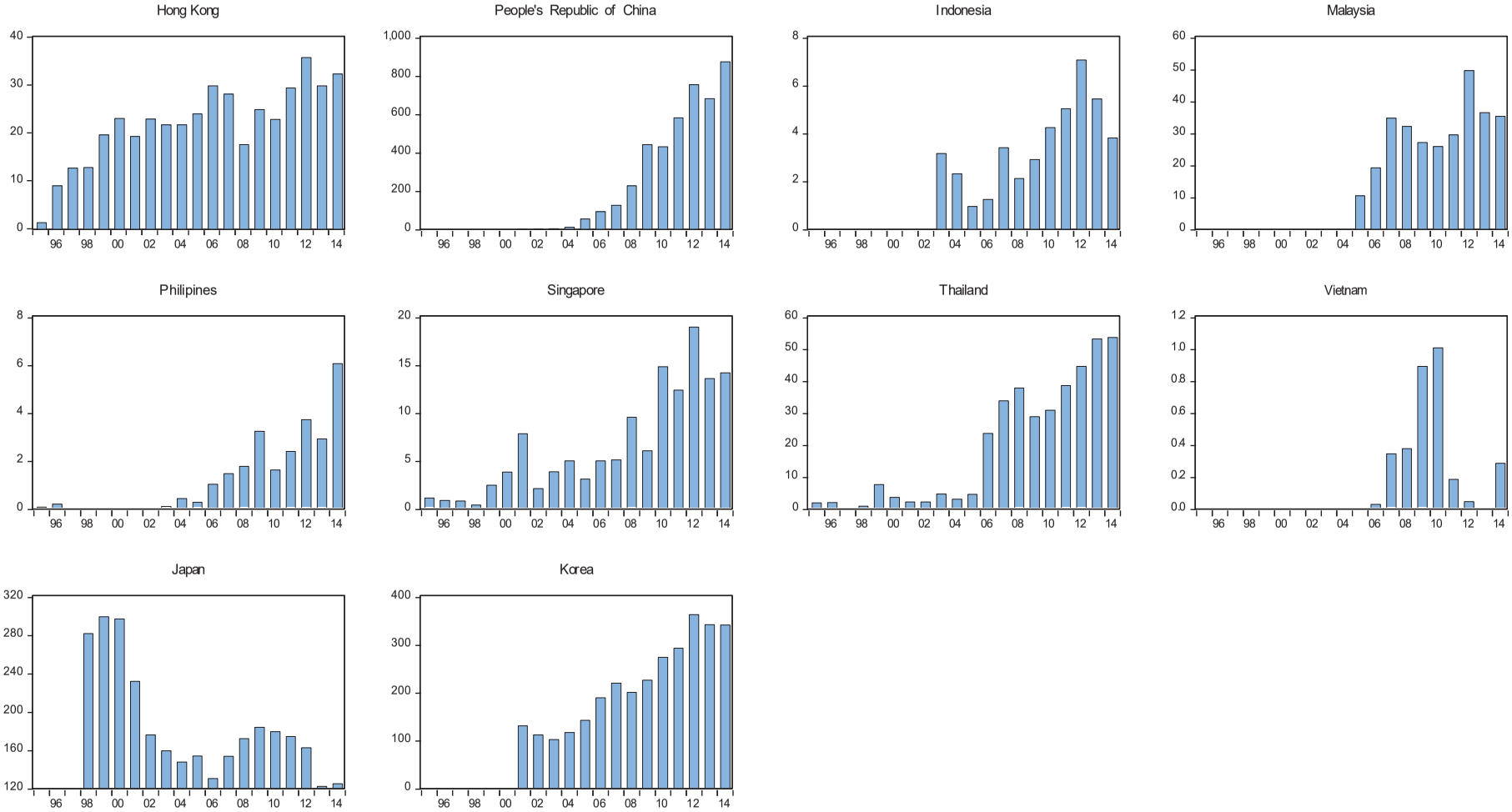


Figure 3 **Total issuance of corporate bonds in USD billions in the years 1995-2014**



Interestingly, in spite of the global financial crisis in 2008, the amount of emerging Asian corporate bond issuances unrated or rated by local credit agencies increased in the period 2005–2009 by approximately 331% (Shim, 2012). The increase of issuance may indicate that the corporate bond market fulfilled the spare tire function in East Asia during the recent financial crisis. Jeasakul et al. (2014) indicated that the East Asian economies showed relatively high resilience during the recent financial crisis, whereas Rai (2011) underlines the relative stability of their currencies. The question, however, remains whether the changes in the structure of the financial system helped to mitigate the financial crisis in Asia and what the actual channels of potential positive impact were. We leave those questions for further research, whereas in this study, we focus mainly on the factors behind the rapid growth of the Asian corporate bond market in the last 2 decades.

4 Data and descriptive statistics

We use a panel data set with annual observations from 1995–2014 for the following the Asian countries: China, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. The country coverage and time dimension choices are based primarily on the availability of data on corporate bond markets in the AsianBondsOnline database, which tracks the bond market in Asian countries. In addition, we supplement the data using the World Bank database, from which we retrieve most of the independent variables. The definitions of the variables with its data sources are presented in in Table A.1 in the Appendix.

4.1 Variable definitions

4.1.1 Corporate bond market development

In this study, we employ several dependent variables to measure the development of a corporate bond market. In the literature, the most widely used measure is the ratio of total corporate bonds outstanding to GDP. A drawback is that this measure captures the amount of debt outstanding, not the amount of funds raised by companies. Thus, the ratio may show a large value of debt raised in the past, whereas the amount of capital raised currently may be small. However, we employ this widely used variable, as it is less cyclical than total bond issue and thus, is better for making comparisons across countries and across time periods.

Our second measure of the development of a corporate bond market is the ratio of total bond issue to GDP during a year. A drawback of this measure is that corporate debt is strongly influenced by the business cycle (Bernanke and Gertler, 1989). Moreover, Becker and Ivashina (2014) show that companies are more likely to issue public debt during a contraction of bank credit supply. Consequently, the authors find a substitution effect between bank credit and public debt and present a strong pro-cyclical pattern in the debt financing mix of the companies.

The ratio of total bond issue includes debt issued by financial and non-financial companies, whereas both types of firms differ strongly in their capital needs. Thus, we use two additional measures to control for the corporate bonds issued by non-financial and financial companies to GDP. We retrieve the data on the volume of corporate bond issues by non-financial companies and their average maturity from the World Bank.

In addition, the value of the bond issued by financial companies is the total corporate bonds issued minus the bonds issued by non-financial companies. We find some discrepancies in the information about the value of the total corporate bonds issued retrieved from AsianBondsOnline and the value of non-financial company bonds issued retrieved from the World Bank. In those cases, we prioritize the information provided by the AsianBondsOnline. We consider that the existing discrepancies between the two datasets do not affect the results of this study.

In measuring both corporate bonds outstanding and bond issues, we restrict our focus to public debt issued in local currency. We do so because we are especially interested in the determinants of the development of the domestic public bond market, which helps a country's companies raise funds for future development and potentially decrease the double mismatch dilemma.

4.1.2 Independent variables

Based on the existing empirical research, we identify several factors that may determine the development of the bond markets in Asian countries. We group those factors in four broad categories characterizing the country, namely, economy, financial system, banking sector, and institutional framework.

We follow mainly Eichengreen and Luengnaruemitchai (2004) in the choice of economic variables that may determine the development of the corporate bond market. We use a country's *GDP* as a proxy for economic size. It is assumed that small countries may have a problem in developing an efficient bond market because they are not able to attract large companies (even domestic ones), which in turn may lead to lower coverage by analysts and investment bankers. Therefore, it is assumed that small countries may have a problem in developing a deep and liquid corporate bond market. We also control for the development stage of the economy using the variable *GDP per capita.* Less developed countries are more likely to have a more volatile investment environment and weaker institutional framework. Indeed, Bhattacharyay (2013) indicates that there is a positive association between the level of economic development and bond market development in Asia. Rajan and Zingales (2003) indicate that countries' openness to international competition increases domestic competition, which may positively affect financial system development. Moreover, an open economy in principle may broaden the investor base for local currency corporate bonds owing to the substantial presence of

foreign investors. We measure a country's *Openness* using the ratio of total exports of goods and services to GDP. Bhattacharyay (2013) argues that a stable exchange rate encourages bond market development. We control for the stability of the *Exchange rate* volatility of a country using the standard deviation of the 12-monthly exchange rates over a 1-year period. Burger et al. (2010) show that countries with better historical inflation performance have more developed local bond markets. Hence, we employ the annual change of consumer price index to control for the level of inflation. Lastly, we control for the recent global *Financial crisis* using a dummy variable, which takes the value 1 for the years 2008–2009 and 0 otherwise. The crisis affected Asian economies through both trade and financial channels, whereas export and stock prices declined by more than 30% and 60%, respectively (Keat, 2009). On one hand, a financial crisis may result in the decline of the corporate bond market. On the other hand, the corporate bond market may substitute a bank's long-term lending during a financial crisis. According to Tendulkar and Hancock (2014), an additional key driver of the development of the corporate bond market following a crisis may be the "search for yield" by investors. Hence, the financial crisis may have a positive impact on the growth of the corporate bond market in Asia.

We control for the structure of the country's financial system by adding the variable stock market capitalization (*Market cap*) to GDP. A sizeable stock market may signal a market-based financial system, which may positively determine the development of the corporate bond market. However, a large stock market may still be shallow, which would result in high volatility of returns, thereby weakening the development of the corporate bond market. We control for *Market volatility* using a variable presenting the average of the 360-day volatility of the national stock market index.

A sizeable domestic government debt market may have a negative impact on the development of the private bond market. The variable *Public debt* controls for the size of public debt, especially the government debt market. The variable is calculated as the ratio of the total amount of domestic public debt securities to GDP. Eichengreen and Luengnaruemitchai (2004) claim that an active corporate bond market needs a benchmark yield curve that is provided by a government bond market. Aschauer (1989), however, states that increased public capital crowds out private investment. Hence, we expect that a significant increase in government domestic debt may negatively affect private credit.

Cowan et al. (2008) find that a large domestic investor base in the form of well-developed private pension funds has a positive impact on the development of the corporate bond market in Latin America. Hence, we employ the variable *Pension funds*, which represents the assets of pension funds to GDP.

Becker and Ivashina (2014) find strong evidence of substitution between bank credit and private debt, which occurs when the availability of bank credit declines or the performance of banks deteriorates. We control for the credit supply in the banking sector using the ratio of domestic credit provided by the banking sector to GDP (*Bank credit*). In addition, we use return on equity (*ROE*) and bank interest spread (*Bank spread*) to control for bank performance. The existing research suggests that banks may use their power to suppress the development of capital markets (Benston, 1994). Beck et al. (2006), however, present strong evidence that concentrated banking systems are more stable. Consistent with these findings, Schaeck et al. (2009) find that concentration decreases the crisis probability and increases time to crisis. Hence, we expect that banking sector concentration is positively related to the size of the country's corporate bond market. We proxy for the power of banks in a country by means of the combined market share using the assets of the five largest banks (*Concentration*).

Lastly, we include a dummy variable, *Banking crisis*, which takes a value of 1 during a systematic banking crisis and 0 otherwise. Allen et al. (2012) find that the corporate bond market moves in the same direction as bank credit during a bank crisis.

Burger et al. (2010) document that countries with stronger legal institutions have more developed local bond markets than do those with weaker institutions. In line with this finding, Gu and Kowalewski (2016) find that a country's level of creditor protection determines corporate bond market development. We control for creditor protection using the *Creditor rights index* of Djankov et al. (2007) as a proxy for country-level bondholder protection. The index, which ranges from 0 (weak) to 4 (strong), measures the laws and regulations that limit expropriation from secured creditors in a country.

Improved information disclosure may overcome adverse selection in the credit market and contribute to credit market development (Jappelli and Pagano, 2002). We proxy for information access using a dummy *Public registry*, which equals 1 if a public credit registry operates in the country and 0 otherwise. Djankov et al. (2008) document that the efficiency of debt enforcement is an economically and statistically significant predictor of the development of debt markets across countries. We control for this by employing

the variable *Enforcement*, which measures the days required to enforce a contract. Allen et al. (2012) suggest that financial regulation affects the structure of financial systems during both normal and crisis periods. We use an index for *Regulatory quality,* which captures perceptions of the ability of the government to formulate and implement sound policies and regulations that promote private sector development. The index ranges from 0 to 100.

4.2 Descriptive statistics

In Table 1, we present the descriptive statistics, which show a noticeable variation in the capital market measures across countries. The variable *Corporate bonds outstanding* exhibits high cross-sectional variability, ranging from 0.00 to 74.53% with a mean of 17.55%. The results indicate that there are significant differences in the development of the corporate bond markets across countries. As expected, the alternative variable *Corporate bond issue*, which shows the amount of capital raised, exhibits lower variation, ranging from 0.00 to 28.15% with a mean of 5.80%. A closer analysis of the corporate bond issuance shows that the market is dominated by the issuance of bonds by financial intermediaries. The variable *Corporate bond issuance of financial sector* ranges from 0.004% to 22.97% with a mean of 6.01%, whereas the variable *Corporate bond issuance of non-financial companies* ranges from 0.007% to 8.833% with a mean of 2.29%. The independent variables also exhibit high cross-sectional variation, confirming the different economic, financial, and institutional frameworks among the countries in our sample.

Table 1. **Descriptive statistics**

Variables	N	Mean	Std dev	Min	Max
Corporate bond outstanding	178	17.55	17.31	0	74.53
Corporate bond issuance	172	5.802	6.644	0	28.15
Corporate bond issuance (financial sector)	108	6.01	5.986	0.004	22.97
Corporate bond issuance (non-financial sector)	142	2.29	1.838	0.007	8.833
Maturity	142	6.756	1.987	2.727	13.17
GDP	200	26.54	1.434	23.77	29.93
GDP per capita	200	19,155	17,584	1,489	83,689
Openness	200	75.1	62.75	9.053	230.3
Exchange rate	190	0.0275	0.0378	0	0.252
Inflation	199	3.851	5.437	-4.023	58.39
Financial crisis	200	0.1	0.301	0	1
Market cap	191	132.5	205.5	0.409	1,086
Market volatility	187	23.68	9.412	7.772	68.02
Public debt	175	34.61	38.42	0.429	190.8
Pension funds	119	21.2	20.62	0.305	61.94
Bank credit	200	96.96	46.71	18.16	233.4
Concentration	184	64.4	20.6	31.76	100
ROA	190	0.783	2.214	-16.44	6.493
Interest rate spread	197	3.477	1.47	0.167	7.681
Banking crisis	170	0.153	0.361	0	1
Creditors rights	200	2.325	0.918	1	4
Public registry	200	0.5	0.501	0	1
Regulations	160	0.522	0.869	-0.781	2.247
Enforcement	200	304.4	150.1	69	570

Table 2 presents a matrix of the pairwise correlation between the explanatory variables. We examine the correlation between the dependent variables and the control variables but do not report the results for brevity[3]. The results of the descriptive statistics are consistent with the existing literature showing that more developed countries with higher institutional frameworks have better developed financial systems, including corporate bond markets. As expected, some proxies for a country's economic development are highly correlated. Similarly, the variables presenting the institutional framework in a country are highly correlated. Hence, in the regressions, we use the variables separately.

[3] The results are available upon request.

Table 2. **Pairwise correlation of explanatory variables**

	GDP	Gpc	O	ER	CPI	FC	MC	MV	PD	PF	BC	ROA	C	BS	BC	CR	PR	R
GDP	1																	
GDP per capita	0.14	1																
Openness	-0.44	0.71	1															
Exchange rate	0.02	-0.11	-0.23	1														
Inflation	-0.23	-0.29	-0.12	0.36	1													
Global crisis	0.08	0.06	0.03	0.11	0.05	1												
Market cap	-0.16	0.56	0.70	-0.23	-0.14	0.04	1											
Market volatility	-0.03	-0.23	-0.14	0.11	0.23	0.29	-0.08	1										
Public debt	0.50	0.30	-0.23	-0.01	-0.25	0.06	-0.08	-0.16	1									
Pension funds	-0.31	0.52	0.61	-0.19	-0.35	0.01	0.30	-0.35	0.19	1								
Bank credit	0.32	0.49	0.39	-0.13	-0.31	-0.02	0.52	-0.02	0.08	0.29	1							
ROA	0.03	0.07	0.11	-0.43	-0.29	0.06	0.10	-0.38	-0.03	-0.03	-0.13	1						
Concentration	-0.30	0.29	0.45	-0.15	-0.17	-0.06	0.17	-0.12	-0.29	0.41	0.07	0.01	1					
Bank spread	-0.49	0.03	0.40	-0.13	0.05	0.04	0.29	-0.05	-0.44	-0.03	-0.24	0.24	0.13	1				
Banking crisis	-0.05	-0.20	-0.20	0.57	0.19	-0.16	-0.17	0.27	-0.01	-0.07	0.01	-0.50	-0.11	-0.07	1			
Creditors rights	0.03	0.61	0.62	-0.05	-0.21	-0.01	0.62	-0.03	-0.22	0.51	0.63	-0.05	0.28	-0.06	-0.15	1		
Public registry	0.29	-0.38	-0.45	0.02	0.15	0.00	-0.32	-0.04	0.32	0.14	-0.15	0.05	-0.28	-0.21	0.07	-0.34	1	
Regulations	0.03	0.88	0.72	-0.13	-0.35	-0.01	0.63	-0.13	0.23	0.60	0.59	-0.07	0.31	-0.02	-0.09	0.78	-0.52	1
Enforcement	-0.05	-0.60	-0.54	0.22	0.33	0.00	-0.29	-0.02	0.18	-0.33	-0.47	-0.07	-0.55	0.18	0.23	-0.57	-0.65	0.53

5 Methodology and results

5.1 Methodology

We estimate all equations using the random-effects model. Our regression takes the following form:

$$Corporate\ bond\ _{i,t} = \alpha_i + \beta_1 E + \beta_1 X_{i,t} + \varepsilon_{i,t},$$

where $Y_{i,t}$ is one of the variables presenting the development of the domestic private bond market. The variable $E_{i,t}$ denotes the set of proxy variables for a country's economic condition, $X_{i,t}$ denotes a vector of conditioning information that controls for the financial system, banking sector, and institutional factors, variable α_i is the year fixed effects, $\varepsilon_{i,t}$ is the error term, and *i* and *t* denote the country and time period, respectively.

Random-effects estimates are more efficient than pooled ordinary least square estimates are, and assume that country effects are uncorrelated with regressors, whereas fixed-effects models allow country effects to be correlated with regressors. Fixed-effects estimation requires significant within-group variations in the independent variable to generate a consistent and efficient estimator (Wooldridge, 2002). Moreover, the advantage of using the random-effects panel estimator is that it allows us to estimate the effect of variables as institutional quality, which is constant across countries over time.

We follow Samoui et al. (2017) and employ a group-wise regression model whereby each group is composed of a set of variables related to an explanatory feature. In the following subsections, the explanatory feature is macroeconomic determinants and then we add the financial system and banking sector characteristics, and finally, we control for the quality of a country's institutions. We add the additional control variables independently, which allows us to deal with the problem of relatively high collinearity of the variables. In the following Section 6, we do a horse race and report the results of the regression with the significant variables, which are employed in the group-wise regression models.

5.2 Economic determinants

Based on the literature, we expect that the macroeconomic situation of the country determines the growth of the corporate bond market. The results of the random-effects estimations are presented in Table 3. In specifications (1) and (2), the explanatory variable is corporate bond outstanding to GDP, whereas the control variables GDP per capita and openness are employed interchangeably, as they are highly correlated. In the next two columns, we regress the total volume of corporate bonds outstanding to GDP on the macroeconomic control variables. Once more, we repeat the regressions, using as explanatory variables the total volume of bonds outstanding of non-financial and financial companies to GDP. The results are presented in Table 3 in columns 4–5 and 6–7, respectively.

We find only weak evidence that better economic performance contributes to the development of the corporate bond market in terms of market size. The coefficient for inflation enters negatively and is significant, but only in the regression in which the dependent variable is the total volume of bonds outstanding. Park (2016) suggests that low inflation may be connected with effective monetary policy, which encourages corporate bond issues. Similarly, we find that the proxies for a country's openness are positively related to the market size and the volume of issues of corporate bonds by non-financial entities, yet the results are significant only at the 10% and 5% levels, respectively.

In line with Bhattacharyay (2013), we find weak evidence that the size of the economy or exchange rate variability determines the development of the corporate bond market. The coefficient for GDP and GDP per capita is positive, yet insignificant in almost all the specifications. GDP per capita is positive only in the specifications in which the dependent variable is the issuance of corporate bonds by financial institution.

More importantly, we find that the coefficient for the dummy variable for financial crisis is positive and statistically significant in almost all the specifications. Thus, the results indicate that the bond market may have acted as a spare tire during the financial crisis of 2008. In Asia, however, the banks were not as strongly affected by the financial crisis as the US or European banks. We examine more closely the impact of

the financial system and banking sector on the development of the corporate bond market in the next subsection.

On one hand, we find that most of the coefficients remain stable and do not change their signs across all the specifications. On the other hand, we find some variation across the results when the explained variables are the corporate bonds outstanding and the volume of debt issued by corporations. In addition, the results document that different factors determine the development of the issue of corporate bonds by financial institutions and non-financial corporations. In the last case, it is worth noting that the maturity of the corporate bonds does not determine the volume of the issue by non-financial corporations. The coefficient for the variable maturity is insignificant in all the specifications.

Table 3. **Corporate bond market and economic development**

This table presents coefficients from random effects regressions models of corporate bond outstanding and issue to GDP on economic control variables. Year dummies and constants are not shown for brevity. Variables definitions are in Appendix in Table A1. Full results are available from the authors upon request. Robust standard errors are presented in parentheses, and ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

	Corporate bond				Issuance			
	Outstanding		Total		non-financial		financial	
GDP	2.338	3.691	0.506	1.053	0.0430	0.399	-0.647	0.716
	(2.963)	(2.853)	(0.754)	(0.771)	(0.349)	(0.323)	(0.961)	(0.676)
GDP per capita	0.00026		0.0001		-0.000004			0.0006***
	(0.00025)		(0.0001)		(0.00009)			(0.0001)
Exchange rate	4.058	5.967	-4.520	-2.642	-3.065	-2.393	27.38	12.34
	(30.07)	(26.75)	(10.02)	(8.617)	(5.063)	(5.091)	(76.43)	(32.98)
Inflation	0.107	0.0658	-0.379**	-0.383**	0.0653	0.0540	-0.474*	-0.297
	(0.107)	(0.141)	(0.183)	(0.178)	(0.0513)	(0.0359)	(0.269)	(0.204)
Openness		0.0879*		0.0195		0.0134**		-0.00269
		(0.0530)		(0.0211)		(0.00541)		(0.0271)
Global crisis	20.61*	21.51*	7.462***	7.865***	0.919*	0.602	2.299	11.52**
	(10.59)	(11.27)	(2.548)	(3.053)	(0.477)	(0.649)	(2.635)	(5.395)
Maturity					0.00624	0.00448		
					(0.115)	(0.114)		
Observations	168	168	162	162	132	132	99	99
R^2 within	0.452	0.442	0.414	0.417	0.318	0.319	0.173	0.171
R^2 between	0.238	0.254	0.0654	0.0515	0.439	0.212	0.0915	0.0891
R^2 overall	0.287	0.278	0.219	0.210	0.0332	0.250	0.0896	0.0898

5.3 Financial system and banking sector

Following Eichengreen and Luengnaruemitchai (2004) and Bhattacharyay (2013), we decide to include additional variables that may determine the development of corporate bond markets in Asia. We assume that macroeconomic performance may still play an important role in shaping the development of corporate bond markets across countries. Hence, in all the following specifications, we control for the macroeconomic characteristics of countries as in the baseline model in Table 3. Once again, in the regression, we use GDP per capita and openness interchangeably. In all the specifications, the coefficients for the economic variables remain mostly unchanged; however, for brevity's sake, we do not present them in Tables 4 and 5.

In Panel A of Table 4, we include the regression variables to control for the country's financial system development. In line with our expectation, we find that stock market development is positively associated with corporate bond market development. The coefficient for market capitalization is positive but only significant in three of the eight specifications. The volatility of the market is negatively related to the development of the bond market, yet the coefficient is insignificant in all the specifications.

In all the specifications, we find that the coefficient for the variable public debt is negatively related to the value of corporate bonds outstanding and the issue of corporate bonds. The coefficient is highly significant in most of the specifications. Thus, the results support the hypothesis that government debt may crowd out private debt. The results also indicate that the development of corporate bond markets is strongly influenced by demand. The coefficient for the variable pension funds is positively and significantly related to the value of corporate bonds outstanding and the issue of corporate bonds by non-financial companies.

In Panel B of Table 4, we employ variables controlling for the banking sector, because bank loans can be a direct substitute for corporate bonds. In contrast to our expectation, we find that the size of domestic bank credit and bank concentration is positively related to the value of corporate bonds outstanding and the issue of corporate bonds. The coefficients for bank credit are highly significant in all the

specifications. Meanwhile, the coefficient for concentration is significant in almost all the specifications in which the dependent variable is corporate bond issue. The results are in line with Eichengreen and Luengnaruemitchai (2004), who report a positive relationship between the level of domestic credit, bank concentration, and the size of the corporate bond market. Park (2016) argues that the positive coefficient for bank lending suggests an increase in demand for debt financing and hence, is positive for local currency bond issuance. Hence, our results may indicate that financial institutions issue bonds to provide loans to non-financial institutions. Consequently, banks may directly compete and crowd out non-financial companies from the corporate bond market, while simultaneously offering bank loans as a substitute. Indeed, we assume that mainly large banks can crowd out smaller companies, which would explain the significant coefficient for bank concentration in some specifications. Beck et al. (2006), however, document that crises are less likely in economies with more concentrated banking systems, which might encourage the development of their corporate bond markets.

We find that the variables bank profitability, bank spread, and bank crisis are not statistically significant. Consequently, we do not find support for the substitution effect reported by Becker and Ivashina (2014) between bank loans and bonds of non-financial companies when banks perform poorly. It should be noted, however, that the crisis dummy covers the systematic banking crisis mainly prior to governments' efforts to develop corporate bond markets in Asia. Similarly, as Table 3 shows, we find that the global crisis dummy is positive and significant in most of the regression. Hence, the results suggest once again that nowadays, corporate bond markets might act as a spare tire in Asia during periods of financial crisis.

Table 4. **Corporate bond market and financial system development**

This table presents coefficients from random effects model regressions of corporate bond outstanding and issue to GDP on financial system (Panel A) and banking sector (Panel B) control variables. All of the regressions include all variables as specified in Table 3. The explanatory variables GDP per capita and openness are used in the first and second column, respectively. Year dummies and constants are not shown to save space. Variables definitions are in Appendix in Table A1. Full results are available from the authors upon request. Robust standard errors are presented in parentheses, and ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

	Corporate bond				issuance			
	outstanding		total		non-financial		financial	
Panel A: Financial system								
Market cap.	0.0087	0.025***	0.003	0.011***	-0.001	0.000	0.004	0.010***
	(0.0189)	(0.0096)	(0.008)	(0.004)	(0.001)	(0.001)	(0.007)	(0.003)
Market volatility	-0.195	-0.290	0.085	-0.128	-0.051	0.0231	0.131	-0.133
	(0.741)	(0.500)	(0.212)	(0.187)	(0.076)	(0.044)	(0.277)	(0.130)
Public debt	-0.0754	-0.219*	-0.075	-0.119***	-0.0073	-0.023***	-0.089**	-0.103***
	(0.119)	(0.128)	(0.047)	(0.043)	(0.007)	(0.006)	(0.040)	(0.038)
Pension funds		0.380***		0.025		0.068***		-0.018
		(0.122)		(0.034)		(0.019)		(0.045)
Observations	147	108	141	107	123	105	93	84
R^2 within	0.376	0.208	0.364	0.270	0.138	0.242	0.171	0.251
R^2 between	0.427	0.616	0.268	0.671	0.597	0.844	0.506	0.600
R^2 overall	0.414	0.449	0.320	0.451	0.360	0.544	0.299	0.432
Panel B: Banking sector								
Bank credit	0.158***	0.141**	0.0795***	0.0969***	0.0115**	0.0111*	0.107***	0.146***
	(0.0494)	(0.0624)	(0.0200)	(0.0251)	(0.0058)	(0.0066)	(0.0345)	(0.0446)
ROA	0.606	0.514	0.296	0.420	0.516	0.494	0.562	0.582

	(0.426)	(0.459)	(0.230)	(0.286)	(0.396)	(0.405)	(1.533)	(1.483)
Concentration	0.131	0.136	0.0572	0.0740*	0.0197***	0.0202**	0.0451	0.0647**
	(0.0847)	(0.109)	(0.0405)	(0.0405)	(0.00740)	(0.00876)	(0.0315)	(0.0282)
Bank spread	-2.560	-3.178	-0.128	0.160	-0.341	-0.358	-0.278	0.502
	(2.116)	(2.146)	(0.736)	(0.627)	(0.240)	(0.232)	(0.910)	(0.719)
Bank crisis	-2.024	-2.228	0.485	0.283	-1.255	-1.264	0.516	0.266
	(4.699)	(5.488)	(1.855)	(1.796)	(1.082)	(1.099)	(3.379)	(2.963)
Observations	137	137	132	132	108	108	80	80
R^2 within	0.497	0.435	0.463	0.477	0.0997	0.0986	0.0747	0.0794
R^2 between	0.765	0.745	0.565	0.595	0.786	0.784	0.680	0.789
R^2 overall	0.691	0.652	0.512	0.534	0.498	0.492	0.460	0.525

5.4 Institutional quality

La Porta et al.'s (2006) results suggest that a country's legal system determines the development of its stock market. Gu and Kowalewski (2016) show that creditor rights and institutional quality determine the development of the corporate bond market relative to the equity market. In addition, Park (2016) finds that in Asia, in addition to economic development, countries with stronger institutions have larger domestic corporate bond markets in terms of share of GDP. Thus, in the following regression, we control for the institutional quality in the Asian countries. We decide to run separate regressions for the different aspects of institutional quality because our proxies for institutional quality are strongly correlated with each other.

In Panel A of Table 5, we employ a proxy for the level of protection of creditors and a dummy variable that takes the value of 1 if a public registry exists in a country and 0 otherwise. In all the regressions, the coefficient for creditor right is positive and significant at the 1% level. The results are in line with those of Gu and Kowalewski (2016) and confirm the importance of the level of creditor rights in the development of the corporate market. By contrast, the coefficient for public registry is negative in almost all the specifications. In addition, the coefficient is statistically significant in the regressions in which the dependent variable is the total issuance of corporate bonds as well the issuance of bonds by financial institutions. The results contradict the findings of Djankov et al. (2007), who report that the ratio of private credit to GDP rises following either improvements in creditor rights or the introduction of credit registries. One of the explanations for the results is the low variation of the variable, as public registries are present in all the countries by the end of the sample period. Moreover, Gu and Kowalewski (2016) find that information sharing is important only in countries characterized by high investor protection. Consequently, our proxy may indicate the development of corporate bonds in countries characterized by low-quality institutions in the past.

In Panel B of Table 5, we present the results, controlling for the quality of regulations. In line with the previous findings, we find that the coefficient is positive but insignificant in almost all the specifications. Thus, the results indicate that the

countries whose governments had the ability to encourage the development of the private sector had only a weak impact on the development of the corporate bond markets in Asia. A possible explanation for this result is the relatively strong initial role for the private sector in most of the Asian countries in our sample, especially in Singapore, Hong Kong, Korea, and Japan. Hence, further government changes in polices might not strongly affect private sector development, and consequently, the corporate bond markets.

In Panel C of Table 5, we employ a variable that controls for contract enforcement. Djankov et al. (2008) document that a low level of contract enforcement is correlated with underdeveloped debt markets. The result confirms that inefficiency in contract enforcement discourages lending. The coefficient of contract enforcement is negatively and statistically related to the size of the corporate bond market. Similarly, the coefficient for contract enforcement is negatively related to bond issuance and is statistically significant at the 1% level in almost all the specifications

Table 5. **Corporate bond market and institutional development**

This table presents coefficients from random effects model regressions of corporate bond outstanding and issue to GDP on variables proxing for creditor rights (Panel A), regulatory quality (Panel B), and enforcement (Panel C). All of the regressions include all variables as specified in Table 3. The explanatory variables GDP per capita and openness are used in the first and second column, respectively. Year dummies and constants are not shown for brevity. Variables definitions are in Appendix in Table A1. Full results are available from the authors upon request. Robust standard errors are presented in parentheses, and ***, **, and * denote statistically significance at 1%, 5% and 10%, respectively.

	Corporate bond				issuance			
	Outstanding		total		non-financial		financial	
Panel A Creditor rights								
Creditor rights	11.90***	15.02***	4.720***	5.791***	1.022**	1.173**	6.134***	7.492***
	(4.192)	(5.474)	(1.181)	(1.321)	(0.494)	(0.562)	(1.402)	(1.124)
Public registry	-2.822	-4.176	-4.818*	-4.496**	0.0522	0.00835	-6.030**	-5.626***
	(8.262)	(7.489)	(2.497)	(1.962)	(0.925)	(0.837)	(2.858)	(1.456)
Observations	168	168	162	162	132	132	99	99
R^2 within	0.457	0.443	0.412	0.404	0.237	0.224	0.120	0.0651
R^2 between	0.738	0.741	0.724	0.798	0.694	0.715	0.781	0.885
R^2 overall	0.641	0.636	0.571	0.608	0.478	0.483	0.636	0.713
Panel B Regulatory quality								
Regulations	10.28	10.52	3.706	3.669	1.107*	0.589	8.140**	3.882
	(10.08)	(9.965)	(2.798)	(4.114)	(0.576)	(0.456)	(3.486)	(4.326)
Observations	141	141	138	138	124	124	93	93
R^2 within	0.466	0.462	0.424	0.428	0.369	0.383	0.103	0.114
R^2 between	0.461	0.464	0.250	0.230	0.281	0.259	0.374	0.216
R^2 overall	0.460	0.459	0.308	0.298	0.308	0.287	0.265	0.178
Panel C Enforcement								

Enforcement	-0.057***	-0.0619**	-0.0239**	-0.0237*	-0.0084***	-0.0058***	-0.0297**	-0.0296**
	(0.021)	(0.0314)	(0.0117)	(0.013)	(0.0029)	(0.0022)	(0.014)	(0.013)
Observations	168	168	162	162	132	132	99	99
R^2 within	0.452	0.447	0.407	0.414	0.318	0.313	0.174	0.133
R^2 between	0.538	0.503	0.411	0.404	0.450	0.512	0.429	0.417
R^2 overall	0.521	0.496	0.388	0.387	0.411	0.430	0.405	0.407

6 What drives the development of the corporate bond market?

Table 6 presents the results of a horse race between economic development, financial system development, banking sector, and institutional quality. In the regression, we employ only the significant variables from the previous regression. Nevertheless, the results must be interpreted with caution owing to the relatively high and significant collinearity among some of the explanatory variables.

The results confirm the ambiguous impact of the economic variables on corporate bond markets. With regard to the size of a corporate bond market and issuance of bonds by non-financial companies, the coefficients for GDP are negative and significant in most of the specifications at the 1% level. In line with the previous results, we find only weak evidence that exchange volatility or inflation has an impact on the development of corporate bond markets in Asia.

More importantly, we again find that the coefficient for the variable financial crisis is positively and statistically significantly related to the development of the corporate bond markets. Thus, the results document that the issuance of corporate bonds as well the value of corporate bonds outstanding increased in Asia during the financial crisis of 2008. Interestingly, the coefficient for the crisis is larger when the dependent variable is issuance of bonds by financial institutions then when it is by non-financial institutions. One explanation could be that during the financial crisis, it was easier for financial institutions in Asia to raise funds in the debt market than in the equity market.

Indeed, we find a strong and negative relationship between the development of the equity market and the corporate bond market. In all the specifications, the coefficient for market capitalization is negatively related to the development of the corporate bond market and significant when the dependent variables are issuance of bonds by financial and non-financial institutions. On one hand, we may assume that the equity market is a substitute for the debt market. On the other hand, we find that the coefficient for domestic credit is positive and significant in almost all the specifications, at least at the 1% level. Thus, the results do not support the hypothesis that domestic credit can be a substitute for corporate debt in the long term. Moreover, in all the specifications, the coefficient for public debt is negative although insignificant in most of them. As a result, we find no strong evidence that public debt is crowding out corporate bonds in Asia.

Interestingly, the coefficient for bank concentration is now negative and significant in the specification for the issuance of corporate bonds by financial institutions, while it is positive and statistical significant for the issuance of corporate bonds by non-financial institutions. On one hand, highly concentrated banking markets are less prone to financial crisis (Beck et al., 2006), which may benefit the development of the corporate bond markets of non-financial institutions. On the other hand, the results indicate that in less concentrated banking markets, corporate bond markets for financial institutions are more likely to develop, which could be the result of higher competition among banks for funds. This is consistent with the fact that banks play a crucial role in organizing and providing services in the process of bond issuance, acting as dealers and market makers (Eichengreen and Luengnaruemitchai, 2004). Potential competition between those two financing sources, that is, banking loans and corporate bonds, is covered in East Asia by interlinkages and complementarities that are present between traditional banking lending and corporate bonds.

Lastly, in line with the previous results, the coefficients for creditor rights are positive and significant in almost all the specifications. Meanwhile, the coefficient for enforcement is again negative, but insignificant in all the specifications. We interpret this as indirect confirmation of the finding of Djankov et al. (2007), who document that legal creditor rights are quantitatively important determinants of private credit. We assume that in countries with high creditor rights, banks finance loans by issuing corporate bonds, which would explain the positive correlation between domestic credit and issuance of bonds. Our hypothesis is strengthened by the fact that the coefficient for creditor rights is positive and statically significant at the 1% level for the specifications issuance of bonds by financial corporations. Indeed, we consider that the increase of the issuance of the bonds by financial institutions may positively determine the development of the corporate bond market for non-financial institutions. A similar situation was observed in Japan, where financial liberalization aimed at the development of the government bond market induced the growth of the corporate bond market (Abiad and Mody, 2005). Consequently, we assume that the rapid development of financial institutions induced the development of non-financial corporate bonds markets. This view is strengthened by the results presenting slightly different determinants for the issuance of bonds by financial and non-financial corporations.

Table 6. **Determinants of the corporate bond market**

This table presents coefficients from random effects model regressions of corporate bond outstanding and issue to GDP on economic, financial and institutional control variables. The explanatory variables creditor rights and enforcement are used in the first and second column, respectively. Year dummies and constants are not shown for brevity. Variables definitions are in Appendix in Table A1. Robust standard errors are presented in parentheses, and ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

	Corporate bond				Issuance			
	Outstanding		total		non-financial		Financial	
GDP	-2.148	-3.347	-0.282	-0.595	-0.670***	-0.724***	0.291	-0.489
	(2.210)	(3.144)	(0.855)	(0.984)	(0.160)	(0.253)	(0.669)	(0.837)
Exchange rate	-15.37	55.57	16.41	24.90	-10.16	-3.887	115.7	163.1*
	(50.11)	(52.97)	(26.44)	(27.01)	(6.933)	(7.810)	(80.44)	(87.33)
Inflation	0.207	0.267	-0.393*	-0.299	0.114	0.126*	-0.286	-1.075**
	(0.201)	(0.300)	(0.202)	(0.419)	(0.0856)	(0.0672)	(0.408)	(0.477)
Global crisis	25.83***	20.73***	8.781***	8.149**	1.435*	1.539*	5.418***	6.738***
	(5.442)	(6.458)	(2.073)	(3.176)	(0.787)	(0.879)	(1.635)	(2.281)
Market cap.	-0.0221	-0.000112	-0.00863	-0.00431	-0.00400***	-0.00286**	-0.0149**	-0.00458
	(0.0170)	(0.0148)	(0.00633)	(0.00419)	(0.00117)	(0.00127)	(0.00684)	(0.00390)
Public debt	0.102	0.0906	-0.0346	-0.0345	0.00989**	0.00937*	-0.0540***	-0.0674**
	(0.0654)	(0.0747)	(0.0270)	(0.0285)	(0.00501)	(0.00482)	(0.0204)	(0.0299)
Bank credit	0.138*	0.198**	0.0740***	0.0928***	0.0229***	0.0271***	0.108***	0.125**
	(0.0769)	(0.0861)	(0.0210)	(0.0196)	(0.00516)	(0.00978)	(0.0338)	(0.0516)
Concentration	0.0418	0.000989	-0.0261	-0.0368	0.0133**	0.0122	-0.111**	-0.0549
	(0.0631)	(0.112)	(0.0424)	(0.0622)	(0.00644)	(0.00752)	(0.0458)	(0.0632)
Creditor rights	12.95**		2.856		0.674*		5.918**	
	(5.362)		(1.988)		(0.344)		(2.620)	
Enforcement		-0.0434		-0.00949		-0.00198		-0.00602

		(0.0292)		(0.0150)		(0.00205)		(0.0172)
Observations	142	142	136	136	118	118	88	88
R^2 within	0.494	0.555	0.564	0.559	0.191	0.207	0.323	0.290
R^2 between	0.802	0.690	0.613	0.580	0.932	0.880	0.806	0.684
R^2 overall	0.704	0.642	0.577	0.552	0.594	0.574	0.650	0.533

6.1 Robustness check

We check the robustness of our results in several ways. To check the robustness of our main results, we conduct a wide array of additional analyses; however, for brevity we do not report all of them.[4] First, we check the consistency of the results using different estimation techniques. We follow Eichengreen and Luengnaruemitchai (2004) and Samaoui et al. (2017), and estimate all equations using panel generalized least squares and system GMM methodology. We find that the coefficients on the variables of interest do not change materially. Employing the GMM procedure allows us to tackle the problems of endogeneity among the explanatory variables. We decide, however, not to use it as our main methodology, as our sample is relatively small, which may lead to biased results even when we do the estimation using small-sample correction (Windmeijer, 2005; Roodman, 2009).

Second, we change the set of explanatory variables and add variables for country GDP growth, current account balance, and rating. The results are presented in Table A.1 in the Appendix. We find that including these variables does not affect either the significance level or the sign of the estimated coefficients. The coefficient for the global crisis variable remains significant in the specification for the total value of outstanding and issue of corporate bonds, at least at the 5% level.

Third, we divide the countries in the sample into two groups based on the gap in the current account, which we calculate as the difference between gross domestic savings and gross capital formation to GDP. On one hand, Sachs (1981) emphasizes the intertemporal nature of the current account, especially in developed economies. He argues that to an extent, higher current account deficits reflect new investment opportunities, and there is no reason to be concerned about them. On the other hand, research shows that countries with current account deficits relay more on international markets and thus, are more prone to international shock transmissions (Frankel and Rose, 1996). The results are presented in Table A.2 in the Appendix. In the first column, we present countries with current account surpluses, and in the second column, countries with current account deficits. We find that the results for the subsample are mostly in line with our main results. However, a striking difference is that for the subsample of countries with current account

[4]These robustness results are available on request.

deficits, the coefficients for GDP are now negative and statistically significant at the 1% level in all the specifications. Hence, the results indicate that the corporate markets are less likely to develop in developing countries with current account deficits.

In line with the previous results, we find that the coefficient for global crisis is positively related to the total value of outstanding and issue of corporate bonds, and is highly significant. Interestingly, we find that in countries with surplus current accounts, the coefficient is statistically significant when the dependent variable is issue of corporate bonds by non-financial corporations. Moreover, we find that the crisis coefficient is significant in deficit countries, but not when the dependent variable is issue of corporate bonds by financial institutions. Consequently, the results indicate that financial institutions were able to refinance themselves using the bond market during the crisis, yet only in countries with high domestic savings.

Lastly, we divide the sample into developing and developed countries using the level of GDP per capita as the factor to distinguish the two groups. We decide to use a threshold of 12,000 USD to classify a country as a developed economy. Using the two separate samples, we again compute the baseline regressions and the results are shown in Table A.3 in the Appendix. The first column shows the results for developed countries, and the second column for developing economies. Once more, we find that the results of the robustness test lead to materially the same results as those in Table 6.

Finally, the results of the robustness test using different methods, variables, and subsamples confirm our main results. However, our empirical analysis has limitations. The data for our study are available only for a short period, which prevents us from applying a causality test, such as the Granger test. Consequently, although we interpret our results as a causal relationship, we are aware that we have not precisely tested the direction of the relationship.

7 Conclusions

In the aftermath of the Asian crisis of 1997, the role of corporate bond markets received increased attention. A common view was that the development of debt markets might mitigate the adverse impact of financial crises in the future. The reasoning is that corporate bond markets can provide an alternative source of financing if other financing channels, such as bank financing, dry up during a financial crisis. This view was shared by Asian policymakers, who promoted the development of private debt markets issued in local currencies as part of the response to the Asian crisis of 1997. Since then, various initiatives have been undertaken, and corporate bond markets have grown dynamically in the Asian region. Nevertheless, their growth has been mixed.

In this study, we attempt to shed light on the drivers of the corporate bond markets of 10 Asian countries in recent years. We analyze different factors associated with the development of these markets. We find that countries with stronger legal institutions have more developed corporate bond markets in terms of size and total issuance. Moreover, we find a positive association between bank credit growth and corporate bond market issuance. Burger and Warnock (2006) argue that the necessary conditions for bond market development are very similar to those that foster development of the banking system. We argue further that increased bank credit growth may lead to an increase in the volume of bond issues by financial institutions, which results in larger corporate bond markets. However, we find no evidence that bank loans may be a substitute for corporate bonds. Indeed, our results indicate that good performance by banks is positively related to the volume of issuance by non-financial corporations. Hence, our results indicate that the banking sector and corporate bond market for non-financial companies develop simultaneously. One interpretation of the results is that the existence of a sound banking sector is much more of a condition to foster corporate bond market development than is competition. This implication arises from the significant role of banks in organizing and providing services in the process of bond issuance, acting as dealers and market makers.

By contrast, we find that an increase of the government bond market has a negative impact on the market and issue size of corporate bonds in Asia. Thus, the supply side may strongly determine the structure of bond markets. However, we also find that the demand side plays an important role in explaining the growth of corporate bond

markets. Our results show a positive association between the assets of pension funds and the market and issue size of corporate bonds.

More importantly, we find that the bond market was an important spare tire in Asia during the financial crisis of 2008. The results are in line with Levine et al. (2016), who show that in countries with stronger shareholder protection laws, firms increase the volume of equity issuances in response to systematic banking crises. Hence, Levine et al.'s (2016) results show that equity markets may ameliorate the adverse effects of banking crises by providing alternative financing. Meanwhile, we argue that bond markets also may help mitigate the negative impact of a financial crisis. In our view, the improvement of the banking sector—together with the abovementioned other factors—opened the possibility of corporate bond market development, which in turn may act as additional, supportive source of debt financing for the economy, but only during crisis or economic downturn. In Asia, over the long term, those two financing channels had been developing simultaneously.

We conclude that the development of the corporate bond market may provide a sustainable "spare tire" during a crisis. However, how and to what extend corporate bond markets would mitigate the effects of a banking crisis remain unanswered questions, which we leave for further research.

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Appendix

Table A1 **Definitions of the main variables**

Variable	Definition	Source
Corporate bond outstanding	Corporate bond market outstanding to GDP	Asian Bonds Online
Corporate bond issuance	Total issuance of corporate bonds to GDP	Asian Bonds Online
Corporate bond issuance of financial institutions	Total issuance of corporate bonds by financial institutions to GDP	
Corporate bond issuance of non-financial institutions	Total issuance of corporate bonds by non- financial institutions to GDP	
GDP	Logarithm of gross national product (in billions US dollars)	World Bank
GDP per capita	Logarithm of gross national product per capita (US dollars)	
Openness	Export of goods and services to GDP	
Exchange rate	Standard deviation of the 12 monthly exchange rates over 1- year period	Asia Regional Integration Center
Inflation	Annual growth rate of consumer price index	
Global crisis	A dummy variable that equals 1 for the years 2008-20009 and 0 otherwise.	
Market cap	Total value of listed shares to GDP	
Volatility	Average of the 360-day volatility of the national stock market index.	
Public debt	Total amount of domestic public debt securities (amount outstanding) issued in domestic markets as a share of GDP.	World Bank
Pension funds	Assets of pension funds to GDP. Any plan, fund, or scheme that provides retirement income.	
Bank credit	Private credit by deposit money banks to GDP.	
ROA	Commercial banks' pre-tax income to yearly averaged total assets.	
Concentration	Ratio of the five largest banks' assets to total banking assets.	

Bank spread	Difference between the lending rate and deposit rate. The lending rate is the rate charged by banks on loans to the private sector, and the deposit interest rate is the rate offered by commercial banks on three-month deposits.	
Banking crisis	Dummy variable that equals 1 during a severe systematic banking crisis and zero otherwise.	
Creditors rights	Index aggregating creditor rights. The index ranges from 0 (weakest creditor rights) to 4 (strongest creditor rights)	Djankov, Mcliesh, and Shleifer (2007)
Enforcement	Number of days to resolve a payment dispute through courts.	
Public registry	Dummy variable that equals 1 if a public credit registry operates in the country and 0 otherwise.	
Regulations	Index for regulatory quality that captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development, ranging from 0 to 100.	World Bank

Table 1A**. Robustness of the determinants of the corporate bond market**

This table presents coefficients from random effects regressions of corporate bond outstanding and issue to GDP on economic, financial and institutional control variables. In the first column we employ additionally the variables Growth that represents country's economic growth and Balance that shows the country's current account. In the second column we employ Country rating, which is defined as the worst credit rating of a country in a given year. The remaining variables definitions are in Appendix in Table A1. Year dummies and constants are not shown to save space. Full results are available from the authors upon request. Robust standard errors are presented in parentheses, and ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

	Corporate bond				Issuance			
	outstanding		total		non-financial		Financial	
GDP	-1.130	-0.267	-1.130	-2.112	-0.496**	-0.583***	0.269	-0.0968
	(2.626)	(0.872)	(2.626)	(2.260)	(0.226)	(0.178)	(0.826)	(0.790)
Growth	-71.62		-71.62		-6.987		-69.32**	
	(71.31)		(71.31)		(5.874)		(33.29)	
Balance	14.01		14.01		3.113		-24.60*	
	(29.45)		(29.45)		(2.766)		(13.42)	
Inflation	0.0336		0.0336		0.0826		-0.259	
	(0.232)		(0.232)		(0.0815)		(0.267)	
Country rating		0.179		-0.106		-0.0430		0.556
		(0.283)		(0.488)		(0.0538)		(0.339)
Global crisis	17.97**	9.912***	17.97**	25.64***	0.976	1.395	0.814	5.110***
	(7.215)	(3.375)	(7.215)	(4.778)	(0.778)	(0.855)	(2.643)	(1.688)
Market cap.	-0.0220	-0.00904	-0.0220	-0.0231	-0.00364***	-0.00368***	-0.0140**	-0.0152**
	(0.0174)	(0.00664)	(0.0174)	(0.0174)	(0.00119)	(0.00124)	(0.00618)	(0.00734)
Public debt	0.0486	-0.0165	0.0486	0.0831	0.00105	0.00185	-0.0638**	-0.0101
	(0.0868)	(0.0270)	(0.0868)	(0.0668)	(0.00619)	(0.00440)	(0.0256)	(0.0220)
Bank credit	0.135*	0.0896***	0.135*	0.132*	0.0251***	0.0192***	0.0635***	0.113***
	(0.0730)	(0.0239)	(0.0730)	(0.0757)	(0.00682)	(0.00739)	(0.0236)	(0.0290)

Concentration	0.0655	-0.0110	0.0655	0.0497	0.0111	0.00984	-0.0455	-0.0751**
	(0.0561)	(0.0425)	(0.0561)	(0.0676)	(0.00711)	(0.00622)	(0.0389)	(0.0315)
Creditor rights	12.32**	3.049	12.32**	12.94**	0.439	0.568	5.333**	5.731**
	(5.507)	(2.081)	(5.507)	(5.271)	(0.365)	(0.347)	(2.333)	(2.624)
Observations	148	144	148	150	126	126	95	95
R^2 within	0.504	0.543	0.504	0.497	0.193	0.182	0.273	0.244
R^2 between	0.810	0.614	0.810	0.794	0.928	0.910	0.881	0.752
R^2 overall	0.709	0.568	0.709	0.696	0.568	0.557	0.691	0.598

Table 2A. **The impact of current account deficit on corporate bond market size and issuance**

This table presents coefficients from random effects regressions of corporate bond outstanding and issue to GDP on economic, financial and institutional control variables. The first column show the results for countries with a current account surplus, while the second columns show countries current account deficit. Year dummies and constants are not shown for brevity. Variables definitions are in Appendix in Table A1. Full results are available from the authors upon request. Robust standard errors are presented in parentheses, and ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

	Corporate bond				Issuance			
	outstanding		total		non-financial		Financial	
GDP	2.181	-8.595***	0.227	-4.896***	-0.264	-0.589***	-0.679	-3.938***
	(2.080)	(3.311)	(1.468)	(0.779)	(0.177)	(0.143)	(1.573)	(1.251)
Exchange rate	-23.08	-77.87	6.589	24.53	-13.05**	-11.01***	47.75	5.319
	(48.95)	(61.73)	(26.46)	(25.33)	(5.226)	(2.070)	(95.68)	(23.26)
Inflation	0.417	0.252	-0.432*	-0.103	0.113***	0.0146	0.544	-0.907*
	(0.267)	(0.268)	(0.258)	(0.171)	(0.0437)	(0.0880)	(0.460)	(0.497)
Global crisis	21.09***	28.63***	12.05***	10.03***	0.704	1.031**	10.29***	5.952
	(7.804)	(5.899)	(2.655)	(0.840)	(1.189)	(0.409)	(3.568)	(8.249)
Market cap.	-0.0315*	0.223***	-0.0185**	0.0546***	-0.00356**	0.0226***	-0.0280***	0.0182
	(0.0186)	(0.0831)	(0.00747)	(0.0173)	(0.00158)	(0.00490)	(0.00770)	(0.0962)
Public debt	0.562***	0.0192	-0.0478	-0.0119	0.0607**	-0.00109	-0.198	-0.0427
	(0.101)	(0.0359)	(0.113)	(0.00932)	(0.0274)	(0.00134)	(0.123)	(0.0277)
Bank credit	0.0837	0.327***	0.0734***	0.167***	0.0161***	0.0145***	0.131***	0.134**
	(0.0514)	(0.0569)	(0.0191)	(0.0159)	(0.00438)	(0.00487)	(0.0341)	(0.0583)
Concentration	-0.115	-0.101	-0.0783	-0.0617**	0.00230	0.00341	-0.123**	-0.101*
	(0.0806)	(0.123)	(0.0587)	(0.0261)	(0.0110)	(0.00565)	(0.0545)	(0.0561)
Creditor rights	23.68***	16.82***	7.484**	6.180***	1.112**	0.894***	9.714***	5.661**
	(6.141)	(4.358)	(3.109)	(0.500)	(0.451)	(0.326)	(2.859)	(2.863)
Observations	113	59	107	53	91	50	71	29

R^2 within	0.575	0.864	0.628	0.951	0.232	0.444	0.470	0.948
R^2 between	0.949	0.998	0.756	1.000	0.980	0.997	0.930	1.000
R^2 overall	0.818	0.937	0.668	0.972	0.624	0.871	0.736	0.993

Table 3A. **Determinants of the corporate bond market in developed and emerging economies**

This table presents coefficients from random effects regressions of corporate bond outstanding and issue to GDP on economic, financial and institutional control variables. The first column show the results for developed countries, while the second column for developing countries. The regressions control for year effects, which are not reported for brevity. Robust standard errors are presented in parentheses, and ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

	Corporate bond		issuance					
	outstanding		total		non-financial		Financial	
GDP	2.593	-0.679	2.693***	-2.317**	-0.801**	-0.367*	4.184***	-2.930***
	(1.854)	(0.715)	(0.480)	(1.078)	(0.406)	(0.202)	(1.322)	(0.629)
Exchange rate	-39.53	-50.16***	-6.092	-39.06**	37.55**	-9.360*	83.27	-99.84**
	(48.31)	(13.81)	(8.239)	(18.30)	(17.90)	(5.290)	(80.85)	(49.81)
Inflation	-0.454	0.260***	-0.450***	-0.320	0.425**	0.0990***	-0.615	0.220
	(0.860)	(0.0568)	(0.127)	(0.288)	(0.173)	(0.0311)	(0.480)	(0.268)
Global crisis	35.86***	17.16***	11.29**	13.70***	-1.063	2.029***	6.556**	9.742***
	(11.54)	(2.110)	(5.188)	(4.345)	(2.003)	(0.490)	(2.781)	(1.222)
Market cap.	-0.0286**	0.109**	-0.0142**	-0.0943**	-0.00216	0.0107	-0.0126*	-0.0490**
	(0.0138)	(0.0467)	(0.00626)	(0.0479)	(0.00274)	(0.00954)	(0.00767)	(0.0194)
Public debt	-0.268***	0.365***	-0.135***	0.101	0.00636	0.0304***	-0.139***	-0.142*
	(0.0609)	(0.0636)	(0.0350)	(0.124)	(0.0193)	(0.00968)	(0.0357)	(0.0765)
Bank credit	0.162***	0.0294**	0.0838***	0.0773***	0.0133	0.0148***	0.0965*	0.0679***
	(0.0312)	(0.0149)	(0.0266)	(0.0197)	(0.0116)	(0.00409)	(0.0512)	(0.00611)
Concentration	-0.118	0.0451	-0.0823**	0.0386	-0.0123	0.00852	-0.0797	-0.0159
	(0.0908)	(0.0393)	(0.0332)	(0.0376)	(0.0173)	(0.0113)	(0.0675)	(0.0217)
Creditor rights	0.978	9.798***	3.512**	3.629**	0.709	0.602**	5.377***	4.274***
	(5.172)	(1.279)	(1.777)	(1.573)	(1.256)	(0.279)	(1.260)	(0.474)
Observations	63	79	63	73	49	69	44	44

R^2 within	0.773	0.611	0.786	0.695	0.447	0.471	0.543	0.737
R^2 between	0.968	0.999	0.984	0.978	0.971	0.999	0.999	1.000
R^2 overall	0.806	0.965	0.857	0.787	0.681	0.796	0.902	0.845

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