WORKING PAPERS IN ECONOMICS

No. 15/17

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DOMESTIC BOND MARKETS IN EMERGING ECONOMIES: CROWDING IN OR CROWDING OUT?

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Domestic bond markets in emerging economies: Crowding in or crowding out?*

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Abstract

Identifying the costs and benefits of domestic debt is necessary to understand the trade-offs between external and domestic debt. However, this is not an easy task, due to the lack of high-quality data. In this paper, I introduce a new detailed dataset on domestic bond markets in 19 emerging economies for the period 1995–2012. The dataset contains public and publicly guaranteed bonds as well as private sector bonds. This enables me to empirically analyze the crowding-out effect of public bonds on private sector bonds. The results are more supportive of crowding in, as well-developed bonds markets and investment-grade firms enjoy more positive spillover effects. Bonds issued by high-risk firms will be crowded out when public issuances increase, while it appears that the effects cancel each other out in small bonds markets.

Keywords: domestic bond markets, crowding–out effect, crowding–in effect, emerging markets

JEL classification: H63, G38

* Special thanks go to Rune Jansen Hagen and Espen Bratberg for continuous advice and useful comments. I would also like to offer my gratitude to Ugo Panizza for valuable suggestions during data collection and to the Department of Economics (UoB) for providing support for the data. I also owe thanks to Ágnes Kovács, Gernot Doppelhofer, Lars Ivar Oppedal Berge, and the participants at the UiB/NHH 14th Joint Ph.D Workshop and Forskermøtet 2015 for their comments. All errors remain my own.

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1. Introduction

The interest in developing countries' public debt has usually focused on external debt, which has been seen as a key driver of financial crises in recent decades. There is a now a growing focus on domestic debt, as we have seen its remarkable increase in emerging markets and low-income countries since the mid-1990s[1]. Several countries have made efforts to expand their local public debt markets to finance budget deficits and adopted policies with the goal of substituting domestic debt for external debt. Domestic debt has several potential costs and benefits, and as a result, it also has important trade-offs compared to foreign debt. These trade-offs should be considered by public debt managers when deciding the optimal structure of public debt (Panizza, 2008).

The advantage of foreign borrowing is that countries can use external debt to supplement scarce domestic savings to finance fiscal deficits without creating inflationary pressure or crowding out domestic lending to the private sector (Panizza, 2008, Bua et al., 2014). On the other hand, international capital flows tend to be volatile, procyclical, and subject to sudden stops (Calvo, 2005). These factors make it difficult for governments to roll over existing foreign debt and were a major factor in the depreciations, external defaults, and costly crises in the 1980s and 1990s (Hanson, 2007). In addition, external debt is usually issued in foreign currency[2], which exposes countries to an aggregate currency mismatch, since revenues to repay the debt are typically in local currency[3]. In the 1980s and 1990s, developing countries usually operated under fixed exchange rate regimes. When they also borrowed severely in foreign markets, this made them vulnerable to both default risk and exchange rate risk.

[1] In late 2007, the stock of domestic debt securities issued by residents of the emerging economies reached USD 5.6 trillion, which is seven times larger than the stock of international debt securities (USD 0.8 trillion) (Mehl and Reynaud, 2010).

[2] Foreign debt is usually issued in dollars, euros, pounds, yen, or Swiss francs. Eichengreen and Hausmann (1999) were the first ones to describe the phenomenon "original sin," which refers to the situation where most countries are not able to borrow abroad in their domestic currency. "Domestic original sin" is the inability of emerging economies to borrow domestically in local currency at long maturities and fixed interest rates.

[3] Countries with original sin and net foreign debt will have a currency mismatch on their national balance sheets, as their external obligations will be disproportionately denominated in foreign currency, unlike the revenues on which they rely to service those debts, which are typically denominated in local currency. Movements in the real exchange rate will then have aggregate wealth effects (Eichengreen and Hausmann, 2005).

One of the advantages of domestic debt is that it is normally issued in local currency and can avoid the currency mismatch. It is also perceived as less volatile than foreign debt and may reduce the problem of volatile and procyclical international credit flows[4] (Hanson, 2007). Mehrotra et al. (2012) argue that monetary policy has become more countercyclical over the last decade as a result of the switch to domestic debt, since heavy burdens of foreign currency debt limit the use of countercyclical monetary policy because of the focus on the exchange rate instead of stabilizing the economy. Establishing local financial markets will also improve the institutional infrastructure of the economy (Presbitero and Arnone, 2006). For these reasons, governments that want to reduce the risks of excessive foreign debt by switching to domestic borrowing should be encouraged. However, the new risks that may follow increased domestic debt also must be considered.

It has been argued that the development of the domestic debt market can only bring benefits if there is a stable macroeconomic environment, political certainty, and a developed financial system (Presbitero, 2012). Domestic debt has its own risks, particularly when it comes to its composition (Mehl and Reynaud, 2010). In most countries, there are difficulties with issuing long-term debt at reasonable costs, and it appears that these countries are trading a currency mismatch for a maturity mismatch[5]. Another important concern regarding the growing domestic debt is the potential crowding-out effect it may have on private sector borrowing. The public sector can claim private savings that might otherwise have been used in the market for private credit (Hanson, 2007, Borensztein et al., 2008, Presbitero, 2012).

Empirical studies on the costs and benefits of a growing domestic bond market are relatively limited. This is partly because the literature is plagued by a lack of high-quality data and partly because the switch to domestic debt is a new phenomenon[6] (Presbitero, 2012). Most

[4] There can be sudden stops caused by excessive debt and negative shocks in the demand for domestic debt as well as in foreign lending.

[5] Long-term domestic currency debt tends to be safer than short-term foreign currency debt. Those that face higher costs when borrowing over the long term in domestic markets will have to choose between currency mismatch and maturity mismatch.

[6] Reinhart and Rogoff (2011) document that domestic debt has played an important role in public debt for the last century. Traditionally, developing countries have used domestic debt markets only when they lacked access to external resources or to sterilize aid flows. What is new since the 1990s is the accumulation of domestic debt while most countries also have access to international capital (Panizza, 2008).

studies focus on the factors that can explain the development of these markets[7] or the determinants of risky debt composition[8]. The objective of this paper is to analyze the crowding-out hypothesis and therefore contribute to the literature on the costs and benefits of domestic bonds. I also add to the literature using a new detailed dataset on domestic bond flows. When focusing on the bond market, I can test the crowding-out effect against the idea that the public and private bond markets are complements. Government domestic bond markets have well-known positive spillover effects in the development of private capital markets; these effects include shared fixed costs, establishment of a yield curve, and credit risk spillovers (Hanson, 2007). Countries such as Chile, Hong Kong, and Malaysia have actually issued public sector bonds mainly for the purpose of bond market development (Luengnaruemitchai and Ong, 2005). By identifying determinants of bond markets, it is possible to find weaknesses that might hinder their growth. Since credit to the private sector has been empirically found to be an important factor of economic growth[9], it would also raise the concern of how increased government debt impacts economic growth. Traditionally, corporate borrowing has been concentrated in the banking sector in most countries, but corporate bonds have gradually become an important source of finance for the private sector in emerging markets since the mid-1990s. After several banking crises in these countries, it has been argued that corporate borrowing should be more diversified (Luengnaruemitchai and Ong, 2005).

I use pooled ordinary least squares (POLS) and fixed effect (FE) estimators with Driscoll and Kraay standard errors[10] to analyze the relationship between the public and private bond markets. The results show more evidence of crowding in; well-developed bond markets and long-term government bond markets are positively related to the size of the market for private sector bonds. Establishing a benchmark yield curve and sovereign credit ratings, which are used as a guiding pricing for private bonds, is an important factor for the development of private bonds. Further results show that only investment-grade bonds are positively affected by these spillover effects and that high-yield bonds are crowded out if the public sector

[7] See, for instance, Essers et al. (2015), Berensmann et al. (2015), Eichengreen et al. (2008), Claessens et al. (2007), and Burger and Warnock (2006).

[8] See Hausmann and Panizza (2003) and Mehl and Reynaud (2010).

[9] See King and Levine (1993), Levine and Zervos (1998), and Levine, Loyaza, and Beck (2000).

[10] These standard errors are heteroscedasticity- and autocorrelation-consistent and robust to general forms of spatial and temporal dependence.

increases bond issuances. I do not find evidence that increasing government bond issuances lead to increased interest rates for the private sector. The results are robust to using different estimators, time periods, and control variables. Therefore, it appears that well-developed bond markets enjoy more of the potential benefits of a growing public bond market.

2. Theoretical considerations and related literature

2.1. Crowding–out effects

The crowding-out effect of government borrowing has been debated for a long time[11]. In theory, the relationship between public borrowing and private credit is ambiguous. The discussion of the existence of the crowding-out effect for bond markets revolves around two competing views: arguments put forth by proponents of the crowding-out effect versus arguments for positive spillover effects. The main argument in the bond market literature is that crowding out might occur through credit allocation from the private sector to the public sector. When a government issues domestic debt, it taps private savings that would otherwise be available as credit for the private sector. This effect will be weakened if firms in the private sector have access to foreign capital. If the private sector can substitute foreign bonds, it will not need to compete with the government for a given amount of domestic savings. Firms are heterogeneous in their financial preferences. While the largest firms may rely on foreign bonds, small firms without an investment grade usually find bond financing very costly or are not seen as creditworthy and may depend on bank loans. Bua et al. (2014) point out that the crowding-out effect will be stronger in low-income countries, where the investor base is concentrated on commercial banks and central banks.

Increased government borrowing can also result in changes in the interest rates, which might reduce both supply[12] and demand of funds for private investment (Bua et al., 2014). The argument for a reduction in the demand of funds has its origin in Keynesian theory, which argues that when prices and wages are sticky, higher debt originated by deficit-financed tax reductions or spending expansions will add to aggregate demand, leading income and output

[11] In the 1970s and 1980s, there was a debate between economists who argued that increased government debt has a negative effect on private sector investment (Keynesian theory) and those who claimed that government debt has no net effect on private sector investment (Ricardian Equivalence).

[12] If lenders are reluctant to raise interest rates, government borrowing in the domestic market can lead to credit rationing and a reduced supply of credit.

to increase in the short run. In the long run, however, larger budget deficits will lead to a reduction in private investment spending, as firms and households face higher interest rates. With higher interest rates, the price of capital to be invested rises, which affects the availability of debt financing instruments to firms. As a result, private investment is crowded out, and capital and output may eventually decline, opposing the short-run expansionary benefits. There are several empirical studies looking at the effect of debt-financed deficits on the interest rate for the private sector. A positive reduced form relationship between the two variables has been viewed as an evidence of crowding out. This literature lacks consensus among the findings (Traum and Yang, 2015). Fayed (2012) argues that the link between government borrowing and equilibrium interest rates is expected to be weaker in developing countries compared to developed countries, because the financial sector in the former countries is usually subject to government interventions. Thus, when studying the effects of government borrowing on private credit in emerging markets, the "availability of credit" argument will be more important, since interest rates are not determined by market clearing. The focus of this study is to shed light on the quantity effects and the volume of private credit[13].

2.2. Crowding–in effects

The opposite view of the crowding-out hypothesis is that the two markets are complements. The growth of government domestic bonds may have positive spillover effects in the development of private bond markets, with one of these being that these systems can create a yield curve. The slope of the yield curve, which is the spread between long- and short-term interest rates, is seen as a forecast of future economic activity and can indicate expectations of inflation in the future. The yield reflects risk perceptions and confidence in the markets. In addition, by providing a benchmark yield curve, government bonds facilitate the pricing of corporate bonds. Secondly, the fixed costs of the establishment and maintenance of a bond market are shared among all issuers, such as by providing crucial infrastructure for trading. Therefore, if the government issues more bonds, the share of fixed costs for firms will decrease (Bolton and Freixas, 2008). Last, there may also be a "credit risk spillover" from government debt to private debt. Research shows that sovereign credit ratings exert a strong influence on the ratings obtained by the private firms and banks (Borensztein et al., 2008).

[13] This is also convenient because the dataset lacks observations on the costs of borrowing.

In the empirical analysis, I use the size of the public bond markets as the main explanatory variable and test how it is correlated to both the size of the private bond markets and the interest rates for the private sector.

2.3. Empirical literature on the crowding–out effect in bond markets

Existing empirical literature on the crowding-out hypothesis for bond markets in developing countries is scant and inconclusive. The most comprehensive study is the one by Eichengreen et al. (2008). They find that the market development effect of having a higher share of public domestic bond financing clearly dominates the crowding-out effect in a sample of both developed and developing countries[14]. Using a similar sample, Eichengreen and Luengnaruemitchai (2004) look at how fiscal policy affects bond markets. Their results show that public sector deficits do not appear to enhance private debt issuances, and they argue that this result is probably because a history of strong fiscal policies has both positive and negative effects for private debt markets. Christensen (2005) documents the existence of a crowding-out effect on private sector borrowing for 27 sub-Saharan countries over the period 1980–2000. The author also shows that government debt with short maturity is a source of rollover risk and macroeconomic instability. Aguilar et al. (2008) study the interplay between the public debt and the corporate bond market in Colombia. Their evidence suggests that the larger the treasury bond market, the lower the probability that a firm will demand financing in the market, indicating that crowding-out effects dominate in this country.

Other studies have looked at the relationship between public and private bonds in the international bond market. Ağca and Celasun (2012) document that corporations face higher borrowing costs when the external debt of the public sector is higher. Dittmar and Yuan (2008) also focus on how sovereign bonds may affect the prices of corporate bonds. Their results, controlling for the endogeneity of market-timing decisions, show that issuance of sovereign bonds reduces corporate yield and bid-ask spreads and acts as a benchmark.

[14] They also take into account that all government debt might crowd out credit to the private sector.

3. The data and descriptive statistics

3.1 The new dataset

Recent efforts to collect data on domestic debt in emerging and developing economies include the contributions of Hausmann and Panizza (2003), Christensen (2005), Burger and Warnock (2006), Guscina and Jeanne (2006), Cowan et al. (2006), Claessens et al. (2007), Hanson (2007), Mehl and Reynaud (2010), and Bua et al. (2014). These datasets vary in terms of the countries studied and how to define the public sector. Hausmann and Panizza (2003), Burger and Warnock (2006), and Claessens et al. (2007) include both advanced and developing countries in their studies. Christensen (2005) looks at 27 sub-Saharan countries, while Cowan et al. (2006) study 25 countries in the Americas. The datasets that are most similar to the one presented here are those by Guscina and Jeanne (2006) and Mehl and Reynaud (2010), which cover 19 and 33 emerging markets, respectively. However, these datasets do not have information on private sector bonds. Most of the datasets only include central government debt because of limited availability of information on local government debt and the debt of other public entities. Data from the Bank of International Settlement are often used in empirical studies that report the stock of domestic debt by different sectors, but only for 15 developing countries.

This paper introduces a new dataset on domestic bonds in 19 emerging markets over the period 1995–2012. The innovations of this dataset are that it includes private sector bonds as well as public and publicly guaranteed bonds and that it is one of the first datasets to include flows instead of stocks. In addition, the dataset contains information on currency, maturity, and whether the bond is zero-coupon, fixed-rate, or floating-rate, among other things. This enables me to achieve a more detailed analysis than the previous literature offers, since I am also able to test the different mechanisms mentioned above.

The distinction between local and international bond markets is blurred, and different definitions are used in practice. One can define whether a bond is domestic or international according to: i) currency, ii) place of issuance/jurisdiction, or iii) the residence of the bondholder. The ideal dataset would contain information on all these variables. However, a feature of the bond market is that the capacity for identifying the holders is very limited for most countries. The residence of the bondholder would be the preferred criterion, because it emphasizes the transfer of resources between residents and nonresidents. Even though this is

the theoretical correct definition, it is not workable in practice for the bond market (Panizza, 2008).

Some previous studies have used local currency to define domestic debt. We see that several countries issue foreign currency debt in the domestic markets and have recently started to issue domestic currency debt in international markets. Although the local currency market is completely dominated by residents in most cases, this definition does not seem appropriate. For example, nonresidents play an important role in the local currency market in Singapore and the Czech Republic, both of which are represented in this dataset (Eichengreen et al., 2008).

The preferred definition is then the place of issuance. A definition based on jurisdiction is feasible and does not give false information as to the supposed holders of the bond. Nevertheless, one should keep in mind that international investors are increasingly entering the domestic bond market of developing countries and that domestic investors also hold bonds in the international market.

In this study, the data on domestic private bonds and some of the public bonds are from the Dealogic database. Dealogic takes the following indicators into account when deciding whether a bond is domestic: the bond is i) in the issuing entity's own currency; ii) underwritten by domestic banks; iii) denominated in domestic currency; iv) governed by domestic law; v) in the domestic stock market; and/or vi) assigned a domestic international security identification number (ISIN[15]). If market participants have confirmed that the bond is sold to domestic investors, then the currency/ISIN code etc. does not matter for the definition. Therefore, the data from Dealogic are characterized by different definitions, which is not ideal. However, this is not uncommon for data on domestic debt.

The data from Dealogic is improved with observations on central government bonds obtained from various national sources. This information is collected from the bond auction results published by central banks or ministries of finance for treasury bonds. If the governments have already defined the bonds as domestic, their definition is used. In most cases, countries define the debt by place of issuance. In cases where the governments have not separated

[15] ISIN codes are international security identification numbers. They give information as to the place of issuance.

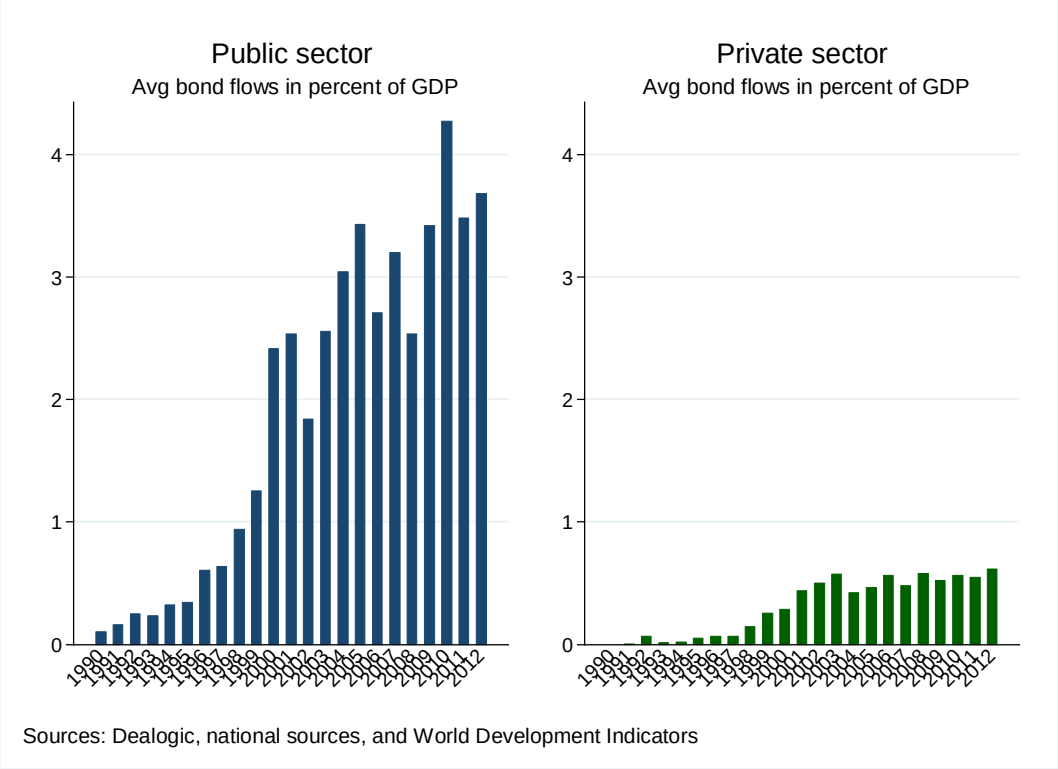
domestic bonds from international bonds, I also use the place of issuance to determine whether a bond is domestic. All sources and definitions are listed in table A.1.

Domestic bonds are divided into public and publicly guaranteed bonds and private bonds. The public sector includes the state itself, central banks, local authorities, state authorities, and other public entities. In total, the sample contains 28,926 public bonds and 5,061 private sector bonds, both of which are aggregated by nationality and quarterly periods. The bonds are reported in current US dollars.

3.2 Descriptive statistics

Before the mid-1990s, the domestic bond markets in emerging economies were almost nonexistent. In figure 1, we see the growth of both the public sector and private sector bond markets. The main explanation for the growing public bond market is that many emerging markets have reduced their external indebtedness over recent years and increasingly depend on domestic borrowing, with the goal of diminishing macroeconomic risks. Even though the private sector market has increased, is it still small, reflecting that these markets are still in their infancy. The growth of the private sector bond markets has flattened after the mid-2000s; a plausible reason for this is that globally active firms have issued external debt to substitute for more costly domestic debt during these years of low international interest rates. Acharya et al. (2015) have shown that foreign currency debt issued by firms based in emerging markets increased dramatically during this period. Also, see figure A.1 in the appendix, which compares the international and domestic bond markets for the private sector for the countries in the sample.

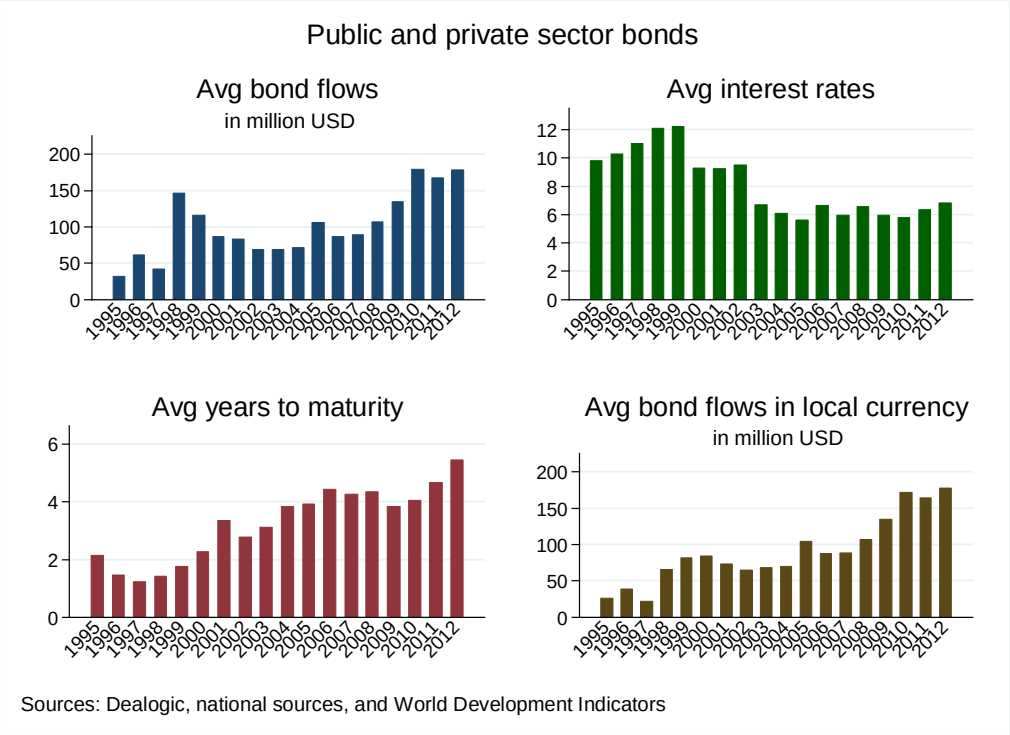
Figure 1 – Growth of the domestic bond markets, 1990–2012



Sources: Dealogic, national sources, and World Development Indicators

In figure 2, I report different measures for the depth of the bonds markets. On average, we see that the maturity has increased substantially across countries. Short maturities contribute to macroeconomic vulnerability, because they increase rollover risks. Thus, being able to issue long-term bonds is seen as an indicator of better-developed markets. The size of local currency bond markets has also increased considerably. The ability to borrow in local currency is an additional indicator for the development stage of bond markets, because it has the potential to reduce the original sin phenomenon (Essers et al., 2015). The average interest rates decreased during the early 2000s and have flattened out, but this could be a consequence of falling interest rates worldwide. This decrease could also be a result of central banks that have been able to keep inflation at low levels such that nominal interest rates have fallen and stabilized. Low and stable inflation has also reduced the preference for foreign currency debt over local currency debt. Foreign currency debt has previously been preferred by investors to hedge themselves against inflation risks (Mehrotra et al., 2012). On the whole, it is clear that there have been improvements in the development of these bond markets since the 1990s. Using a dataset on domestic debt in 36 low-income countries from 1970 to 2011, Bua et al. (2014) show similar results.

Figure 2 – Development of the domestic bond markets, 1995–2012



The correlation between the average ratio of public domestic bond to GDP over the years 1995–2012 and the corresponding ratio of private domestic bonds to GDP is shown in figure 3. The correlation is clearly positive, showing that those countries that have large public bond markets also have larger private sector bond markets. The positive correlation appears to be driven by Asian countries, which are known to have well-developed bond markets. In a sample of both developed and developing countries, Eichengreen and Luengnaruemitchai (2004) also find a positive correlation between private and public domestic debt securities in percent of GDP. Figure 4 illustrates that a larger public bond market is associated with lower interest rates for the private sector. This does not support the idea of the crowding-out effect through higher interest rates.

Figure 3 – Correlation between private and public bond markets, 1995–2012

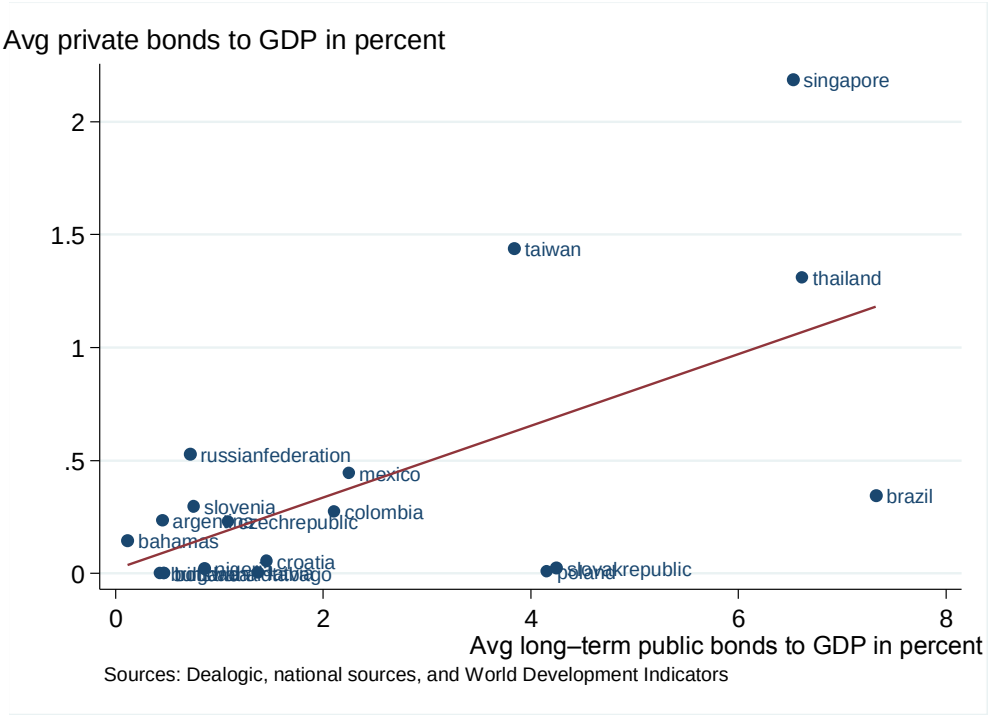
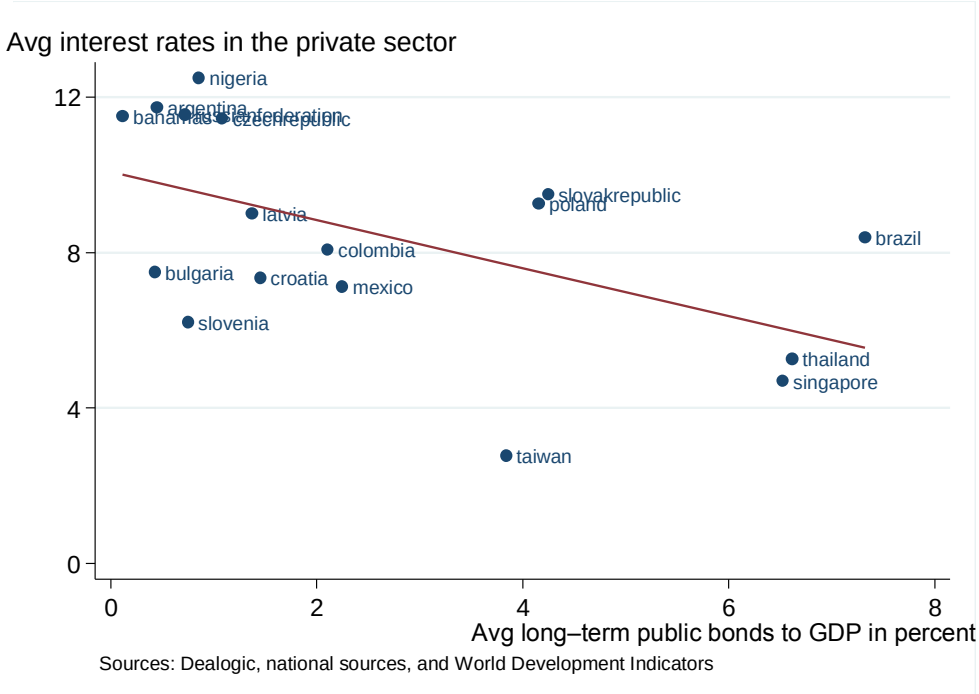


Figure 4 – Correlation between interest rates and public bond markets, 1995–2012



4. Empirical approach

I analyze the relationship between private and public bond markets by employing time-series cross section methods suitable for datasets with small *N* and large *T*. These methods focus on time series properties[16], which should be the addressed in this case, since the bond data contain 72 quarterly time periods and 19 countries. With such a long time dimension, it is plausible that there are problems of nonstationary variables, cross-section dependence (CSD), and serial correlation. With standard panel estimators, one assumes that these problems do not matter.

4.1. Cross-section dependence

Consider the following panel-data model:

$$y_{it} = \beta_0 + x'_{it}\beta + u_{it} \qquad (1)$$

where *i* and *t* represent the cross-sectional and time dimensions, respectively, x_{it} is a vector of explanatory variables, and u_{it} refers to the error term. It is normally assumed that error terms in panel-data models are independent across countries. When panel data have a long time dimension, which is typical in recent macroeconomic data, it is rather unlikely that the unobservables (u_{it}) are uncorrelated across countries. CSD or spatial dependence appears in the data if there are common factors that affect all countries but to a different degree or there are factors that are common to some of the countries in the sample. Typical examples of common factors are global shocks with heterogeneous influence across countries that give rise to correlations across countries, such as the oil crises in the 1970s or the financial crisis from 2007 onwards. Common factors can also be the result of local spillover effects between countries or regions. We can model the error terms for the countries *i* and *j* to see the meaning of CSD:

$$u_{it} = c_i + \lambda_i f_t + \epsilon_{it} \qquad (2)$$

$$u_{jt} = c_j + \lambda_j f_t + \epsilon_{jt} \qquad (3)$$

In these specifications of the error terms, we have time-invariant unobservables (c_i) and common factors (f_t) that affect all the countries in the world. These variables have different effects across countries, called "factor loadings" (λ_i). The common factors (f_t) guarantee that

[16] Panel time series econometrics also focuses on time series properties, but these estimators are more suitable for a dataset with moderate *N* and moderate *T*.

the residuals will be correlated with each other, except if λ_i and λ_j are independent of each other. How strong the correlation is depends on the size of λ_i. CSD will usually not impede consistent parameter estimation. However, techniques that ignore the presence of CSD will lead to inconsistent estimates of the standard errors of these parameters and invalid statistical inference (Driscoll and Kraay, 1998). Heteroscedastic robust standard error estimates, for example, those of White (1980)[17] and Rogers (1994)[18], are still biased under CSD, and hence statistical inference based on these is not valid.

4.2. Stationary variables

I also consider the possibility of unit roots processes in the data. If $\rho = 1$ in the following equation, where e_t is white noise:

$$y_t = \rho y_{t-1} + e_t \qquad (4)$$

the process has unit roots, and it will never forget its initial value (also called "random walk"). Data that contain unit roots (i.e., these roots are nonstationary) will produce misleading results called the "spurious regression" problem. In this problem, it appears that two variables are correlated, but they are in fact independent of each other. Nonstationary data are highly correlated with time and contain a trend. However, the trend is not a result of time; rather, it is due to the way the variables change over time. If the data are not stationary and weakly dependent, the ordinary least squares (OLS) estimates will produce unbiased estimates and spurious correlations.

4.3. Autocorrelation in residuals

In time-series data, we need to assume that there is no autocorrelation in the errors. Formally, we need to assume that, conditional on x', the errors in two different time periods are uncorrelated:

$$corr(u_t, u_s|x') \quad for\ all \quad t \neq s \qquad (5)$$

If this is not true, the errors suffer from autocorrelation and there is trouble with the estimation of standard errors. Autocorrelation might be an indicator of a mis-specified model,

[17] Standard errors are consistent only if the residuals are heteroskedastic.

[18] Standard errors are consistent if the residuals are correlated within clusters but uncorrelated between clusters.

typically caused by omitting lagged values of the dependent variable or explanatory variables or both.

I use various pre-tests to investigate whether the problems mentioned above are present in the data. The details and results of these tests are reported in the Appendix. To summarize, the tests show that there probably is CSD in the data and that residuals suffer from autocorrelation. This is expected, since common factors such as the 2007–2009 global financial crises or the Asian financial crisis in 1997 are likely to have a heterogeneous impact on local credit markets. How I address this is discussed in the next section.

4.4. Estimation

For the baseline estimation, I rely on POLS and FE estimation, as it is interesting to explore variations both between and within countries. FE could potentially reduce the problem of omitted variable bias by controlling for unobserved country FEs, but it has several disadvantages in this setting. With commonality across countries, discarding all the cross-section variation (as with FE estimation) is not an ideal approach. Factors such as regional differences, institutions, and country size are known to be important for bond market development. These factors have very limited within-country variation, and so they will be ignored by FE. Since I have a broad set of explanatory variables, it is likely that I control for most of the country characteristics. With POLS estimation, I will be able to include the time-invariant variables mentioned above and take advantage of both between- and within-country variation. For these reasons, I primarily rely on POLS estimators, but I report FE for comparison and robustness[19].

4.5. Standard errors under cross-section dependence (CSD)

There have been several attempts to account for CSD. Time dummies have typically been used in panel-data models to control for common factors. In this method, one assumes that such events would be identical for all countries in the sample ($\lambda_i = \lambda_j$), which is rather doubtful[20]. For example, a global oil price shock will have different effects depending on

[19] If omitted time-invariant variables are correlated with explanatory variables, then FE estimators should be used to omit biased coefficients. This can be tested for using a Hausman test. In this case, the test did not always produce p-value, so it is not straightforward to conclude that such a correlation exists.

[20] Panel time series methods deal with CSD by modeling the common factors and either differentiate them away or estimate them to use as controls. These methods are more suitable for a panel data set with moderate *T* and moderate *N*.

whether a country is a net importer or net exporter of oil. In a different example, we can also expect the consequences of the 2004 tsunami to differ across countries, depending on which countries were struck directly and which countries had trade relations with those that suffered. The Parks-Kmenta feasible generalized least squares method attempts to account for heteroscedasticity and spatial and temporal dependence, but it has been shown to usually produce inadequate small standard error estimates[21]. To avoid the problem of the Parks-Kmenta method, Beck and Katz (1995) suggest using OLS coefficients with panel-corrected standard errors (PCSEs)[22]. However, estimates of this approach are inaccurate if the *T/N*-ratio is small. Driscoll and Kraay (1998) construct a covariance matrix estimator that is robust to general forms of spatial and temporal dependence as the time dimension becomes large. They depend on nonparametric techniques and thus avoid complications with mis-specified parametric estimators. This approach removes the deficiencies of the Parks-Kmenta method and ameliorates issues with the PCSE approach, which usually becomes inappropriate when the cross-sectional dimension becomes large (Hoechle, 2007). Too large a cross-sectional dimension would likely not be problematic in this analysis, since *N=19*, but I prefer the Driscoll and Kraay approach, because it is suitable for both OLS and FE estimation. Therefore, to ensure valid statistical inference, I use Driscoll and Kraay (1998) standard errors that are heteroscedasticity- and autocorrelation-consistent and robust to general forms of spatial and temporal dependence[23].

An alternative approach to deal with autocorrelation, besides using Driscoll and Kraay standard errors that are consistent under autocorrelation, is to specify a correct dynamic model. However, lagged values of the dependent variable in POLS and FE estimation are known to produce biased coefficients (Nickell, 1981). For that reason, I also run regressions with lagged values of both private and public variables to mitigate autocorrelation in the

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[21] Most empirical studies on determinants of bond market development use this estimator for their baseline results or as a robustness check (Essers et al. (2015), Eichengreen et al. (2008), Claessens et al. (2007), Eichengreen and Luengnaruemitchai (2004)).

[22] This approach is used by Berensmann et al. (2015) and Essers et al. (2015) when studying bond markets in sub-Saharan Africa.

[23] I have compared the baseline results from regression with Driscoll and Kraay corrected standard errors to regression with robust standard errors, and the size of the coefficients are the same, but the size of the standard errors are usually different.

residuals and control for persistence as a robustness check. These results should be interpreted with care.

The results in this analysis will reflect correlations and not causal effects. I cannot rule out the possibility that the variables for public bond markets are endogenous because of reverse causality. This is especially challenging with CSD, since common factors challenge any efforts to find valid instruments. Nevertheless, the results will improve the understanding of the relationship between the public and private bond markets, especially since this analysis is able to obtain more insight into the different mechanisms than previous studies on this topic.

4.6. Model specification and description of variables

I employ a model of the following form:

$$PRIV_{its} = \alpha_1 PUBL_{its-1} + \alpha_2 X_{it} + \delta_t + \gamma_i + u_{its} \qquad (6)$$

where $PRIV_{its}$ is usually the sum of domestic private bond issuances, in percent of GDP, for a country *i* in year *t* and quarter *s*. The data are aggregated to quarterly periods, since there are large seasonal variations in official bond auction calendar years. This also avoids the problem of nonstationary variables in the yearly data[24]. $PUBL_{its-1}$ is the equivalent measure for the public sector, lagged one period. The main coefficient is α_1. A negative α_1 supports the crowding-out effect, and a positive coefficient supports the crowding-in effect. X_{it} is a vector of yearly control variables described in detail below. δ_t and γ_i are time FEs and country FEs, but in the POLS estimation, we assume a common intercept across countries (i.e., γ is equal for all countries). I also use the interest rate for private bonds as the dependent variable, but then there is a substantial reduction in the number of observations. The public bond market is disaggregated into short-term and long-term markets, since each should have different effects on the private sector bond market.

4.7. Control variables

To find suitable controls, I primarily use the literature on the development of local bond markets, which includes variables that describe the economic structure, the soundness of macroeconomic policies, and institutional quality. I also control for foreign bonds issued by the private sector, and time and regional dummies are included in some of the regressions to further mitigate potential omitted variables bias. All data sources and labels are listed in table

[24] Tests indicate that when bond issuances are aggregated to the yearly level, the variables for both the private and sector bond markets are stationary.

A.1 and A.2 in the Appendix, and there is a correlation matrix of the explanatory variables in A.4.

Economic structure

The size of the economy is proxied by the natural logarithm of GDP in constant 2011 international USD (*LnGDP*). Previous studies[25] have found that larger countries have better-capitalized bond markets. A plausible reason for the positive relationship between country size and bond markets is that smaller economies face obstacles because of economies of scale and the large fixed costs of establishing a bond market. Larger economies also have a greater availability of potential buyers and sellers, which can reduce price volatility and encourage investment (Essers et al., 2015). A more developed banking sector may be positively associated with development of bond markets, since banks are important in the development of liquidity and may play a role as dealers and market-makers (Eichengreen et al., 2008). In addition, in developing countries, banks often take up a large share of government bond investors. On the other hand, the relationship between the banking sector and bond markets may be negative, because loans provided by banks may substitute for bond financing. I include domestic credit to the private sector by banks (expressed as a share of GDP) as an indicator of the size of the banking sector (*dom_cred_bank*)[26].

Macroeconomic policies

Sound macroeconomic policies are important for the development of healthy bond markets (Bua et al., 2014). The annual growth rate of GDP per capita (*GDPC_growth*) is included in the regressions to control for business cycles. It is likely that the bond market will expand when the economy is growing. There is substantial empirical evidence that inflation stability and monetary credibility positively affect the bond market[27]. Market participants should not fear that the value of their claims will be inflated away. High inflation could prevent domestic agents from issuing long-term local currency bonds in particular. I control for this using inflation rates measured by annual change in the consumer price index (*inflation*). The current

[25] See, for example, Eichengreen and Luengnaruemitchai (2004), Mehl and Reynaud (2010), and Hausmann and Panizza (2003).

[26] Also used by Essers et al. (2015) and Berensmann (2015).

[27] See, for example, Burger and Warnock (2006), Hausmann and Panizza (2003), Claessens et al. (2007), and Essers et al. (2015).

account balance (*curr_acc_GDP*) is an important measure of macroeconomic performance and is closely related to fiscal balance and private savings. The variable also has implications for the exchange rate and competitiveness[28]. It can be seen as a measure of a country's international competitiveness; it is related to a country's capacity to bring in sufficient foreign currency to service its foreign debt and therefore is also related to foreign investors' attention to the country. I also use the institutional investor's credit ratings (*IIR*), which is usually a measure of a country's creditworthiness. This variable is found to be highly correlated with macroeconomic fundamentals and variables of institutional quality. In this setting, I use the credit ratings to test if these ratings work to identify a spillover effect from the public to the private market.

Institutional quality

It is also established that the quality of political and legal institutions are crucial for bond market development[29]. The quality of the governance of a country is likely to affect its fiscal policies and the risk of default. The development of bond markets requires strong creditor rights so that small creditors can also be assured of being treated fairly (Eichengreen et al., 2008). Legal institutions could be controlled for using *Rule of Law* from the World Governance Indicators (WGI) Database. This variable captures perceptions of the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. However, *Rule of Law* is highly correlated with the credit ratings (0.7442). Thus, I run regressions with either *IIR* or *Rule of Law*, but I use the ones with IIR for baseline results. Instead of measuring only legal rights, I construct a more general measure of the quality of institutions using the average of the six variables in the WGI database. This variable (*WGI*) also accounts for government effectiveness, regulatory quality, and political stability.

[28] I have also considered alternative control variables that are used in the literature for bond market development to control for macroeconomic performance, such as trade, fiscal deficits, and capital account openness. These variables are not used in the main regressions, because they either reduce the number of observations or they are highly correlated with essential control variables.

[29] See, for example, Burger and Warnock (2006) and Eichengreen and Luengnaruemitchai (2004).

Other control variables

One can argue that international bonds and domestic bonds are complements. Issuing bonds internationally can be useful for familiarizing foreign investors and increase the investor base (Eichengreen et al., 2008). On the other hand, they can also be seen as substitutes, in that large firms can substitute with global bonds if there is a shortage of credit in the domestic market or they find domestic bonds too costly[30]. Recently, emerging market firms have borrowed in foreign currency to take advantage of low interest rates. This activity might discourage foreign participation in local markets. To control for this, I use the sum of international bonds issued by the private sector as a share of GDP (*priv_for_GDP*)[31].

Other control variables, such as GDP per capita, trade, exchange rate regime, political institutions[32], sovereign defaults, legal origin, and creditor rights, have been accounted for in the regressions. These variables are also used in the literature for bond market development, and including them does not change the main results. I do not report these results, because the number of observations is reduced or they are highly correlated with other essential control variables, but the results can be delivered upon request.

5. Results

5.1. Baseline results

First, I report regressions with the whole sample and include both long- and short-term bonds (table 1). In table 2, I show specifications with different country samples. The Asian countries[33] have well-developed bond markets, as shown in figure 3, and is it possible that these countries might drive the positive correlation between the two markets in this sample. First, I exclude these countries. It is also interesting to exclude other countries with large public bond markets together with the Asian countries to further test results of very new bond markets. Thus, I also remove those countries that have an average of long–term bond markets

[30] Small and medium-sized firms that are not seen as creditworthy by foreign investors will have to depend on loans from local banks.

[31] While current account indicates foreign investors' interest in the country, the variable for foreign bonds reflects foreign investors' interest in the private sector in the country.

[32] I have used both *polity2* and *icrg*, which are common variables for democracy and political risk.

[33] Singapore, Thailand, and Taiwan

to GDP larger than 4 percentage points[34]. I also separate the public market between long– and short–term bonds (table 3). The characteristics of the long– and short–term bond markets are different and should have diverse effects on the private bond market, which is discussed further when presenting the results.

Table 1 reports positive and significant coefficients for the size of the public bond market in all specifications. We can expect that if the debt ratio for the public sector increases by one percentage point, the debt ratio for the private sector will increase by about 0.01 percentage points on average. The average public bond markets are much larger than the private sector markets. The average size of the debt ratio for private sector is 0.4 percent of GDP, and for the public sector it is about 7 percent of GDP. Thus, at first sight it is not surprising that the size of the coefficient is not large. The small correlations indicate either that crowding-in effects do not have a large impact on the private sector or that crowding-out effects reduce the overall impact.

Table 1 — Crowding in or crowding out
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*0.0191****	*0.0188****	*0.0106****	*0.0129****	*0.0130****
	(0.0017)	*(0.0017)*	*(0.0026)*	*(0.0025)*	*(0.0028)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*992*	*992*	*992*	*992*	*992*
R^2	*0.379*	*0.394*	*0.418*		

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table 2 shows that the estimates change considerably when using different samples. Removing the countries with large public bond markets leads to coefficients that are no longer significant[35]. In countries with small bond markets, it appears that the crowding-out effect and market development effect cancel each other out and that the crowding-in effects have a larger impact in well-developed bond markets. This is not surprising, because spillover effects

[34] Brazil, Poland, and the Slovak Republic.

[35] The coefficient for public bonds is significant and positive in specification (5), but this is not confirmed when changing the time period to 2000–2012.

such as creating a benchmark yield curve require long-term bond markets.

Table 2 — Crowding in or crowding out, different samples
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*		
Excluded		*Asia*	*>4*		*Asia*	*>4*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
publ_GDP$_{s-1}$	*0.0106****	*0.0033*	*0.0054*	*0.0130****	*0.0164***	*0.0116*
	(0.0026)	*(0.0049)*	*(0.0067)*	*(0.0028)*	*(0.0070)*	*(0.0090)*
Control variables	*yes*	*yes*	*yes*	*Yes*	*Yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*Yes*	*Yes*	*yes*
Region dummies	*yes*	*yes*	*yes*			
No. of countries	*19*	*16*	*13*	*19*	*16*	*13*
N	*992*	*872*	*708*	*992*	*872*	*708*
R^2	*0.418*	*0.137*	*0.162*			

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, * p<0.1, ** p<0.05, *** p<0.01

5.2. Mechanisms

When I separate long– and short–term bonds (table 3)[36], the coefficients for both markets are still significant and positive, but the effect of long-term bonds is much larger than for short-term bonds. This indicates that long-term bond markets have stronger spillover effects than short-term bonds, which is as expected. As previously mentioned, short-term bonds produce macroeconomic vulnerability, because they increase rollover risk. Increased rollover risk might generate higher interest rates, which increase the costs of borrowing for the private sector. If governments only issue short-term bonds, this might obstruct the development of secondary markets, because investors prefer to hold their papers until maturity. The positive coefficient for the short-term market still reflects that money markets are a crucial first step in developing bond markets for the private sector, as argued by Luengnaruemitchai and Ong (2005). Short term markets can also prevent the establishment of a yield curve. Thus, without secondary markets and a yield curve for sovereign bonds to guide pricing of corporate bonds, expansion of private sector bond markets is difficult. This result confirms the argument that a benchmark yield curve is important for the development of local corporate bond markets (Luengnaruemitchai and Ong, 2005)[37]. The difference in the coefficients of long- and short-term bonds might also suggest that short-term markets absorb more liquidity than long-term

[36] Since short-term markets work as catalysts for long-term markets, I also run regressions controlling for both.

[37] Opinion surveys of investors from six Latin-American countries show a consensus that a yield curve is a crucial element for pricing corporate bonds (Borensztein et al., 2008).

bonds, since the former is larger than long-term bond markets (see figure A.2 in the appendix)[38]. Governments should therefore aim to enhance longer maturities. This relates to the literature on domestic original sin, which contains an ongoing debate as to how to overcome difficulties issuing long-term bonds at high costs. Some studies have found that maturity mismatches arising from risky debt compositions can be alleviated through better monetary policies (Mehl and Reynaud, 2010, Hausmann and Panizza, 2003).

Table 3 — Crowding in or crowding out, compare long- and short-term public bonds
Dependent variable: Private domestic bonds in percent of GDP

	POLS	*FE*	*POLS*	*FE*	*POLS*	*FE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
long_publ_GDP$_{s-1}$			*0.0346****	*0.0521****	*0.0262****	*0.0423****
			(0.0077)	*(0.0084)*	*(0.0085)*	*(0.0088)*
short_publ_GDP$_{s-1}$	*0.0104****	*0.0122****			*0.0084***	*0.0094****
	(0.0029)	*(0.0030)*			*(0.0031)*	*(0.0030)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies	*yes*		*yes*		*yes*	
N	*992*	*992*	*992*	*992*	*992*	*992*
R^2	*0.415*		*0.413*		*0.419*	

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

In table 4, I use the interest rate for the private sector as the dependent variable. The estimates are negative, but this is only significant in models (1) and (2). The result is not robust, and the number of observations is reduced. Thus, it is not clear whether there is a negative association between larger public bond markets and interest rates for the private sector. However, the estimates do not give any support for the idea that crowding out occurs because of higher interest rates.

[38] Unfortunately, the analysis will not be able to conclude much about the role of sharing fixed costs among issuers, because it is not clear how this should be measured.

Table 4 — Crowding in or crowding out
Dependent variable: Interest rates for private bonds

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*-0.0181**	*-0.0301***	*-0.0150*	*-0.0009*	*-0.0071*
	(0.0091)	*(0.0112)*	*(0.0108)*	*(0.0081)*	*(0.0096)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*324*	*324*	*324*	*324*	*324*
R^2	*0.515*	*0.578*	*0.626*		

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

To further explore the possibility that changes in the interest rates might be the channel for crowding out, I add interest rates as a control variable in the main specifications (table 5). The results show that interest rates do not correlate with the size of the private bond markets. In addition, the positive correlation between the public sector and the private sector remains the same. This does not give any support to the argument that changes in interest rates will crowd out credit to the private sector.

Table 5 — Crowding in or crowding out
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*0.0125****	*0.0112****	*0.0105****	*0.0144****	*0.0108***
	(0.0027)	*(0.0029)*	*(0.0032)*	*(0.0044)*	*(0.0050)*
interests_priv	*0.0261*	*0.0082*	*0.0468*	*0.0002*	*-0.0035*
	(0.0390)	*(0.0315)*	*(0.0326)*	*(0.0226)*	*(0.0232)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*324*	*324*	*324*	*324*	*324*
R^2	*0.299*	*0.341*	*0.400*		

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Luengnaruemitchai and Ong (2005) argue that relentless government borrowing may reduce the supply of corporate bonds. Domestic investors may prefer government bonds, since these are usually characterized by low credit risk, secondary market liquidity, and protection against the risks of exchange rates, inflation, and interest rates. In table 6, I separate the private bond issuances between bonds with and without an investment grade. High-yield (non–investment

grade) bonds are issued by firms that are considered to be at greater risk of default. Consequently, the issuer will offer a higher yield and coupon rate than a similar bond of a higher credit rating to attract investors to take on the added risk[39]. Interestingly, low risk corporate bond issuances will increase as a result of increased public bond issuances, while high-yield corporate bonds will decrease[40]. This suggests that investment-grade corporate bonds and public bonds are complementary, and the others are substitutes, as expected. It is possible that when there is harder competition for domestic credit firms, high-risk firms[41] are crowded out, because investors prefer safer bonds. Sovereign credit ratings and the size of the bank sector are significantly correlated with high-yield bonds but not investment-grade bonds. This shows that high-risk firms probably depend more on credit from banks and that credit ratings influence their possibility to issue bonds. Thus, a government can help high-risk firms to issue bonds by improving their credit ratings. Governments can also offer guarantees to corporate bonds to make them more attractive to investors, as has been done in Brazil[42].

Table 6 — Crowding in or crowding out, private bonds with and without an investment grade
Dependent variable: Private domestic bonds in percent of GDP

	High-yield bonds			*Investment-grade bonds*		
	POLS		*FE*	*POLS*		*FE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$publ\_GDP_{s-1}$	*-0.0028****	*-0.0041***	*-0.0021*	*0.0180****	*0.0133****	*0.0146****
	(0.0007)	*(0.0019)*	*(0.0019)*	*(0.0016)*	*(0.0021)*	*(0.0022)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies		*yes*			*yes*	
N	*992*	*992*	*992*	*992*	*992*	*992*
R^2	*0.106*	*0.115*		*0.438*	*0.460*	

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

[39] A high-yield bond is a bond with a lower credit rating than investment-grade corporate bonds and sovereign bonds. High-yield bonds hold a rating below "BBB" from S&P and below "Baa" from Moody's. Bonds with ratings at or above these levels are seen as investment grade.

[40] I also controlled for the average interest rate in the private sector. The number of observations falls substantially, but the results remain approximately the same, except for the coefficient in specification (2), which is no longer significant.

[41] Issuers of high-yield debt tend to be start-up companies or capital-intensive firms with high debt ratios.

[42] Brazilian authorities have taken an active role to help corporations raise capital through the Banco de Desenvolvimiento Economico e Sosial (BNDES). The BNDES has shifted from direct lending support to firms to providing guarantees, expertise, and a stamp of quality to issuers (Luengnaruemitchai and Ong, 2005).

Full tables that report the coefficients of all the controls are in the Appendix[43]. The control variables usually have the expected signs, but not all of them are statistically significant. The ones that show significant correlations throughout are the size of the economy, credit ratings, and rule of law. These results conform to the literature on the determinants of bond market development. The robust and positive coefficients on credit risk ratings imply that there are spillover effects through these ratings, as suggested by the literature. The credit ratings can also guide investors on both the macroeconomic situation in the country and the pricing of private bonds. Surprisingly, the coefficient of *WGI* is significant and negatively correlated with private bond markets. I have also replaced this variable with *polity2*, which measures democracy, and found the same result. Therefore, it appears that legal institutions and political institutions have the opposite effect on private sector bonds. Other studies have found that political institutions are positively correlated with larger bond markets (Essers et al., 2015). The result here might be a consequence of a small country sample, particularly since the coefficients for *WGI* are positive and significant when excluding Asian countries and countries with larger public bond markets. Both region dummies and country FEs also appear to matter for the variation in the size of private sector bonds markets. The coefficients for public bonds are very similar when FEs are included, but the other control variables vary.

To summarize, there is more support for crowding in than crowding out. The results show that it is unlikely that expanding public bond markets increase interest rates and therefore crowd out credit for the private sector. If there is crowding out because of a shortage of private sector credit, it appears that in small bond markets it is canceled out by spillover effects. In larger and more developed bond markets, it appears that the spillover effects dominate crowding-out effects. This is as expected, since long–term debt is necessary to create a yield curve, as discussed earlier. The results also show that high-risk firms tend to be crowded out when there is a shortage of domestic credit, but this effect does not appear to be large. Since credit risk ratings and long-term markets are positively correlated with private bond issuances, this suggests that information to guide the pricing of bonds for the private sector is a crucial factor for corporate bond market development. The coefficients are not large in magnitude, which probably reflects that the private sector markets are still small in the countries included in the sample. In addition, even though crowding-in effects are present, the

[43] When using specifications with only public sector bonds and FEs on the right side, the coefficients are higher in magnitude and still significant.

crowding-out effects might reduce the overall effect.

5.3. Robustness checks

I tested these results against a variety of robustness checks as well as using different control variables, and the results are reported in the Appendix. First, the time period is changed to 2000–2012, because of data coverage. Secondly, I measure bond market size without the ratio to GDP. Third, I do not use a lagged variable for public bond markets. The main results are robust to all of these changes.

Since bond market capitalization is a cumulative process, dynamic models should be taken into consideration. However, it is not straightforward to use dynamic models with POLS and FE estimation, because the results are likely to be biased (Nickell, 1981). This could be investigated in future research, particularly since my results show that the main coefficients are no longer significant when using lagged variables for public sector bonds.

6. Conclusion

This paper has investigated the relationship between public domestic bonds and private sector bond markets in emerging markets in light of the crowding-out hypothesis. As many emerging markets increasingly aim to trade external debt for domestic debt, it is important to get an overview of potential risks of domestic debt. The development of local bond markets is also seen as an advantage for financial development. The majority of the literature on bond market development looks at factors that are directly related, while this study analyzed the link between the public and private bond markets in more detail than previous studies. The results support the idea that public bond markets do work as a catalyst for private sector bond market development. Establishing a benchmark yield curve and credit ratings that work to guide the pricing of private bonds appear to be important factors. Crowding-in effects dominate crowding-out effects. However, based on the results, I cannot rule out the possibility that public bond issuances can also be a hindrance to corporate bonds. Estimates show that high-yield bonds are crowded out, probably because investors prefer safer bonds such as government securities and private bonds with an investment grade. It is important to establish short-term bond markets, but these most likely do absorb more liquidity than long-term bond issuances. To avoid crowding-out effects, governments should therefore aim to enhance longer maturities and offer guarantees to private sector bonds.

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Appendix

Table A.1. Data sources and definition of central government debt

Nationality	Time span	Source: central government debt	Definition of domestic debt
Argentina	2002–2011	The National Office of Public Debt (www.mecon.gov.ar), Central Bank of Argentina (www.bcra.gov.ar)	Defined by government
Bahamas	2001–2008	The Central Bank of the Bahamas (www.centralbankbahamas.com)	Place of issuance
Botswana	2008–2012	Bank of Botswana (www.bankofbotswana.bw)	Place of issuance
Brazil	2000–2012	National Treasury (www.stn.fazenda.gov.br)	Place of issuance
Bulgaria	1999–2009	Ministry of Finance (www.minfin.government.bg)	Defined by government
Colombia	1998–2012	Banco Central de Colombia (www.banrep.gov.co)	Defined by government
Croatia	2005–2012	Ministry of Finance (www. mfin.hr)	Defined by government
Czech Republic	2009–2012	Ministry of Finance (www.mfcr.cz)	Defined by government: place of origin of debt instrument
Latvia	1996–2012	Financial Resource Department of State Treasury (www.kase.gov.lv)	Defined by government
Mexico	1982–2012	Banco de Mexico (www.banxico.org.mx)	Place of issuance
Nigeria	2001–2012	Central Bank of Nigeria (www.cenbank.org)	Place of issuance
Poland	1994–2012	Ministry of Finance (www.mofnet.gov.pl)	Place of issuance
Russian Federation	2004–2012	Ministry of Finance (www.minfin.ru)	Defined by government
Singapore	1990–2012	Singapore Government Securities (www.sgs.gov.sg)	Place of issuance
Slovak Republic	1992–2011	National Bank of Slovakia (www.nbs.sk), Debt and Liquidity Management Agency (www.ardal.sk)	Place of issuance
Slovenia	2000–2012	Ministry of Finance (www.mf.gov.si)	Place of issuance
Taiwan	1991–2012	Central Bank of China (www.cbc.gov.tw)	Place of issuance
Thailand	1999–2012	Bank of Thailand (www.bot.or.th)	Place of issuance
Trinidad and Tobago	2009–2012	Central Bank of Trinidad and Tobago (www.central-bank.org.tt)	Place of issuance

Table A.2. Variables, labels, and data sources

Variable	Label	Data source
priv_GDP	Sum of private bond issuances in a qtr (% of GDP)	Dealogic (2012), National Sources (2014)
interest_priv	Avg interest rates in a qtr, private sector	
maturity_priv	Avg maturity in a qtr, private sector	
publ_GDP	Sum of public bond issuances in a qtr (% of GDP)	
publ_long_GDP	Sum of long-term public bond issuances in a qtr (% of GDP)	
publ_short_GDP	Sum of short-term public bond issuances in a qtr (% of GDP)	
interest_publ	Avg interest rates in a qtr, public sector	
maturity_publ	Avg maturity in a qtr, public sector	
priv_for_GDP	Sum of foreign private bond issuances (% of GDP)	
GDPC_growth	GDP per capita growth (annual %)	World Development Indicators, World Bank (2014)
LnGDP	Log of GDP, PPP (constant 2011 international $)	
dom_cred_bank	Domestic credit provided by banking sector (% of GDP)	
inflation	Inflation, consumer prices (annual %)	
curr_acc_GDP	Current account balance (% of GDP)	
exp_GDP	Exports of goods and services (% of GDP) [NE.EXP.GNFS.ZS]	
trade	Trade (% of GDP)	
M2toGDP	Money and quasi-money (M2) as % of GDP	
WGI	Avg of all WGI indicators	World Governance Indicators (2014)
Corruption_est	Control of corruption: estimate	
Govt_eff_est	Government effectiveness: estimate	
Pol_stab_est	Political stability and absence of violence/terrorism: estimate	
Reg_est	Regulatory quality: estimate	
Rule_est	Rule of law: estimate	
Voice_est	Voice and accountability: estimate	
IIR	Institutional investors country credit rating, 1–100	Institutional Investor (2013)
default	Dummy = 1 when country is in domestic or external default	Standard and Poor's (2012), Reinhart and Rogoff (2012)
icrg	ICRG, political risk (average of monthly scores)	PRS Group (2012)
exch_rate	Annual fine classification	IMF (2009)
cr	Creditor Rights Index, 0 (weak) to 4 (strong)	Djankov et al. (2007)

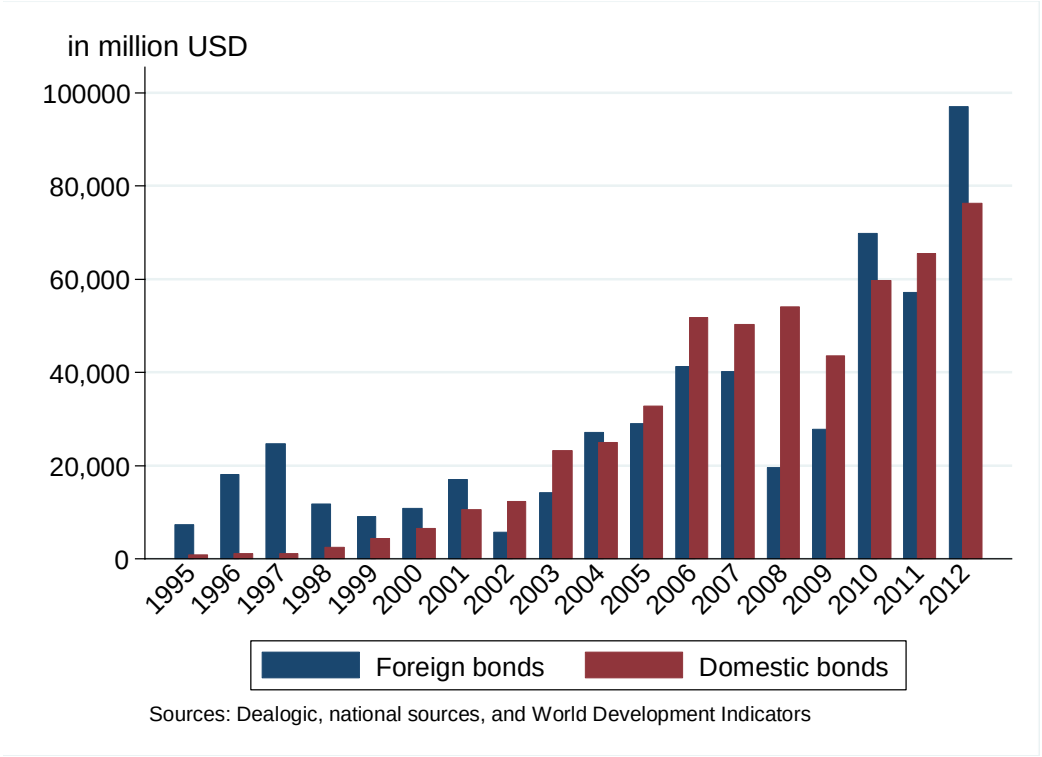
Table A.3. Summary statistics

		mean	sd	Min	max	N
Main variables	priv_GDP	0.397	0.989	0.000	12.610	1368
	interest_priv	7.361	3.815	0.000	22.917	444
	maturity_priv	5.568	2.827	1.357	30.008	482
	publ_GDP	7.623	16.193	0.000	126.451	1368
	publ_long_GDP	2.382	3.534	0.000	21.636	1368
	publ_short_GDP	5.241	14.146	0.000	119.554	1368
	interest_publ	6.510	5.644	0.000	50.282	654
	maturity_publ	3.398	2.994	-1.843	23.000	924
Main controls	GDPC_growth	3.009	4.508	-17.545	30.344	1268
	LnGDP	25.917	1.681	22.547	28.836	1224
	dom_cred_bank	51.692	37.032	-79.092	177.577	1280
	Inflation	11.185	59.161	-1.167	1058.374	1348
	curr_acc_GDP	0.279	9.045	-25.549	38.787	1292
	IIR	55.454	17.670	15.000	92.500	1348
	WGI	1.962	0.944	0.000	3.379	1140
	priv_for_GDP	0.453	1.615	0.000	25.574	1368
	Default	0.059	0.235	0.000	1.000	1296
Controls for robustnes s tests	Icrg	70.976	10.034	38.792	89.125	1208
	exch_rate	8.615	3.407	1.000	15.000	936
	Cr	2.015	1.156	0.000	4.000	540
	exp_GDP	49.096	39.981	6.730	230.269	1296
	Trade	102.731	81.168	14.933	562.060	1280
	M2_GDP	52.258	26.906	13.231	137.571	1280
	Corruption_est	0.189	0.783	-1.333	2.417	988
	Govt_eff_est	0.434	0.680	-1.201	2.430	988
	Pol_stab_est	0.122	0.932	-2.390	1.341	988
	Reg_est	0.515	0.656	-1.323	2.205	988
	Rule_est	0.179	0.754	-1.523	1.772	988
	Voice_est	0.387	0.577	-1.216	1.222	988

Table A.4. Correlation matrix of explanatory variables

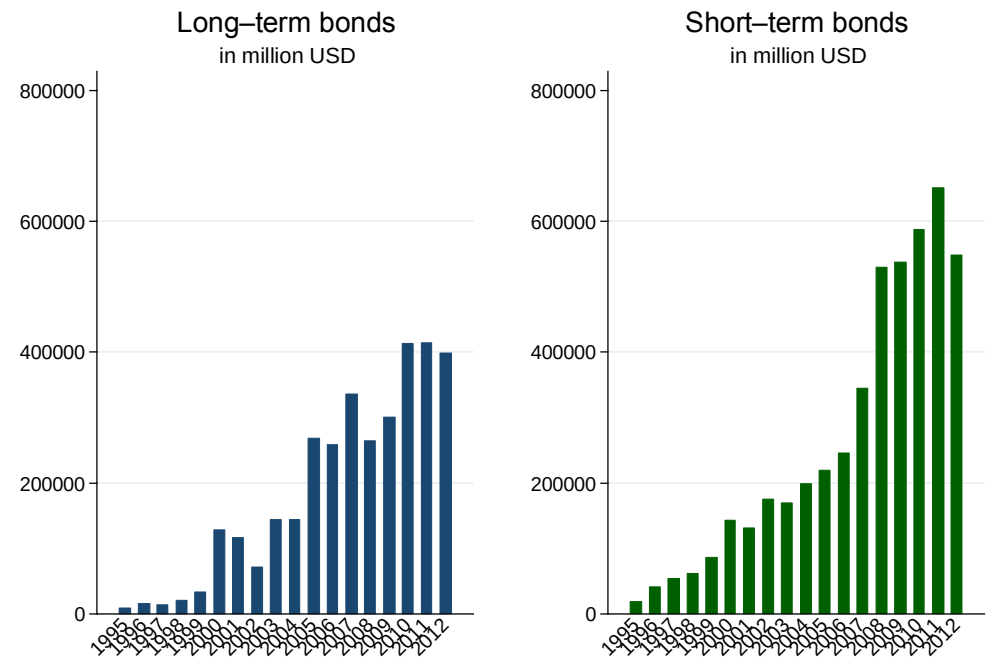
	GDPC_ growth	LnGDP	dom_cred_ bank	inflation	curr_acc_ GDP	IIR	WGI	priv_for_ GDP	default	icrg	exch_rate	cr	exp_GDP	trade	M2_GDP	Rule_est
GDPC_growth	1.0000															
LnGDP	-0.0247	1.0000														
dom_cred_bank	-0.1726	0.1692	1.0000													
inflation	-0.0824	0.0119	-0.0783	1.0000												
curr_acc_GDP	0.0514	0.1739	-0.1831	0.0351	1.0000											
IIR	-0.0266	-0.0664	0.3334	-0.2068	0.0889	1.0000										
WGI	0.0487	0.0652	0.2076	-0.2492	-0.0541	0.5265	1.0000									
priv_for_GDP	-0.0440	0.0282	0.1282	-0.0136	0.0694	0.1834	0.0237	1.0000								
default	-0.0785	0.0797	-0.0825	0.0679	0.0175	-0.3621	-0.0898	-0.0471	1.0000							
icrg	-0.0179	-0.4593	0.1505	-0.0808	-0.1890	0.6800	0.2776	0.1514	-0.1776	1.0000						
exch_rate	-0.1230	0.5958	-0.0031	-0.0483	0.3237	-0.1055	-0.0203	-0.0727	0.1182	-0.3881	1.0000					
cr	0.1901	-0.5381	-0.0594	-0.1106	0.1828	0.0955	0.0600	-0.0276	-0.0266	0.1493	0.0191	1.0000				
exp_GDP	0.0534	-0.1388	0.2210	-0.0355	0.4914	0.5782	0.2154	0.2364	-0.1441	0.4197	0.0981	0.4168	1.0000			
trade	0.0349	-0.1987	0.2249	-0.0352	0.3696	0.5634	0.2031	0.2233	-0.1531	0.4503	0.0298	0.4381	0.9355	1.0000		
M2_GDP	-0.0973	0.0004	0.7401	-0.0953	0.1576	0.6280	0.2719	0.1960	-0.2263	0.4227	0.0098	0.2140	0.6819	0.6686	1.0000	
Rule_est	-0.1247	-0.5329	0.2890	-0.5520	-0.0886	0.7442	0.5068	0.1363	-0.2362	0.8503	-0.2760	0.3299	0.6183	0.5997	0.5712	1.0000

Figure A.1. Domestic and foreign bonds for private sector, 1995-2012



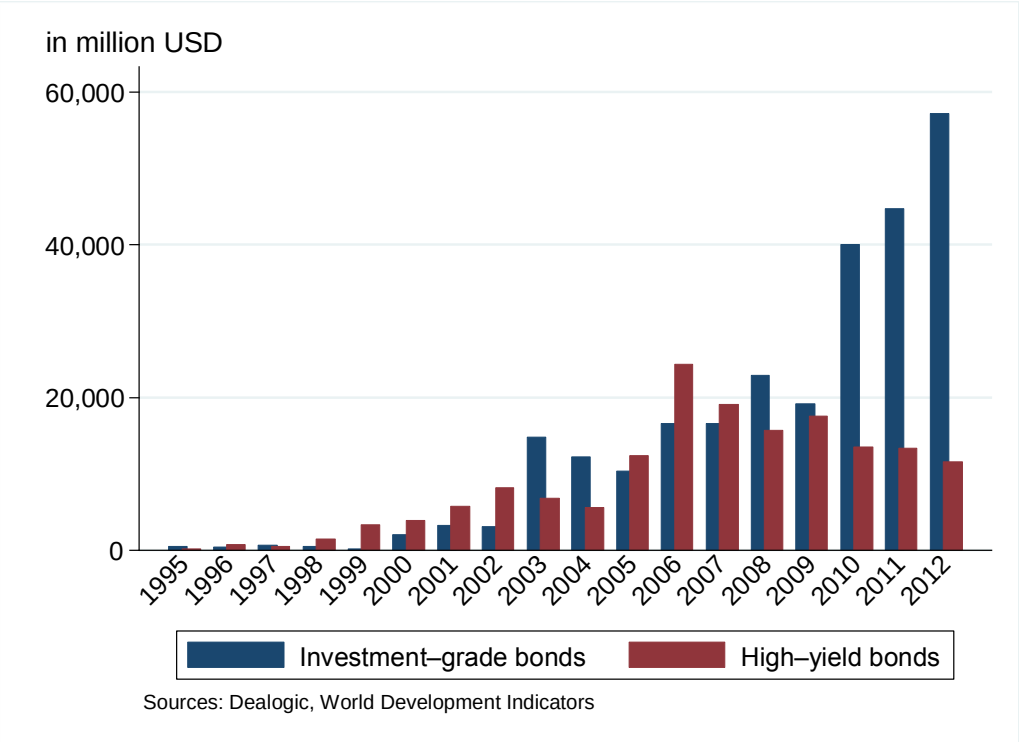
Sources: Dealogic, national sources, and World Development Indicators

Figure A.2. Long– and short–term public bonds, 1995-2012



Sources: Dealogic, national sources, and World Development Indicators

Figure A.3. Private sector domestic bonds, 1995-2012



Pre-tests

Cross-section dependence

I use the Breusch and Pagan (1980) and the Pesaran (2004) CD tests for CSD in panel data. The latter can be applied to a variable series as a pre-estimation analysis of CSD in the data, and both can be used for post-estimation of CSD in residuals. The tests employ pair-wise correlation coefficients (ρ_{ij}) between the residual series (or country variables) to indicate systematic correlation across countries. The null hypothesis of cross-section independence in the residuals is:

$$H_0:\ \rho_{ij} = \rho_{ji} = corr(u_{it}, u_{jt}) = 0 \qquad for \quad i \neq j$$

versus

$$H_1: \rho_{ij} = \rho_{ji} \neq 0 \qquad for\ some \quad i \neq j$$

where

$$\rho_{ij} = \rho_{ji} = \frac{\sum_{t=1}^{T} u_{it} u_{jt}}{\left(\sum_{t=1}^{T} u_{it}^2\right)^{1/2} \left(\sum_{t=1}^{T} u_{jt}^2\right)^{1/2}}$$

The test statistic for Pesaran (2004) is:

$$CD = \sqrt{\left(\frac{2}{N(N-1)}\right)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \sqrt{T_{ij}}\ \hat{\rho}_{ij}$$

where *N* refers to the number of countries, and T_{ij} specifies the number of observations in the calculation of the pair-wise correlation coefficient between the series of countries *i* and *j*. The test is robust to nonstationarity, parameter heterogeneity, or structural breaks. It also performs well in small samples.

The LM statistic in Breusch and Pagan (1980):

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2$$

Table A.5 reports the results of the pre-estimation test of variables. Almost all the p-values show that there is CSD in the explanatory variables. The test could not produce values for priv_GDP, priv_int_GDP, and default_all.

Table A.5. Average correlation coefficients & Pesaran (2004) CD test

variable	CD test	p-value	corr.	abs. (corr)
priv_GDP	.	.	.	.
publ_GDP	20.23	0.000	0.182	0.256
publ_long_GDP	20.54	0.000	0.182	0.210
publ_short_GDP	9.97	0.000	0.090	0.237
GDP_ growh	36.07	0.000	0.350	0.371
LnGDP	94.07	0.000	0.848	0.848
dom_cred_bank	31.22	0.000	0.296	0.489
Inflation	28.52	0.000	0.253	0.399
CA_GDP	3.40	0.001	0.033	0.277
IIR	75.78	0.000	0.695	0.722
Corruption_est	6.40	0.000	0.068	0.327
Govt_eff_est	4.78	0.000	0.051	0.394
Pol_stab_est	4.27	0.000	0.045	0.349
Reg_est	-2.31	0.021	-0.024	0.385
Rule_est	3.58	0.000	0.038	0.491
Voice_est	1.17	0.241	0.012	0.420
WGI	96.47	0.000	0.952	0.952
priv_for_GDP	.	.	.	.

To test residuals after estimation, I used both tests. I can use the Pesaran (2004) after both POLS and FE estimation, but it is only suitable for panel data where $T < N$. When $T > N$, the Lagrange multiplier test developed by Breusch and Pagan (1980) is recommended (De Hoyos and Sarafidis, 2006), but this test can only test residuals after FE estimation. The results are reported in tables A.6 and A.7 and indicate CSD, but they are somewhat inconclusive. The Pesaran test does not show clear indication of CSD, while the Breusch and Pagan (1980) test clearly supports the presence of CSD in the residuals.

Table A.6. Average correlation coefficients & Pesaran (2004) CD test

residuals	CD test	p-value	corr.	abs. (corr)
POLS res	1.12	0.264	0.014	0.179
FE res	1.79	0.073	0.022	0.155

Table A.7. Breusch and Pagan (1980) test of residuals

Breusch-Pagan LM test of independence: chi2 (120) = 273.617, Pr = 0.0000

Correlation matrix of residuals:

	__e3	__e4	__e5	__e6	__e7	__e8	__e9	__e10	__e11	__e12	__e13	__e14	__e15	__e16	__e18	__e19
__e3	1.0000															
__e4	0.0735	1.0000														
__e5	0.1535	-0.4956	1.0000													
__e6	0.2085	0.0272	-0.2703	1.0000												
__e7	0.0556	0.5694	-0.2537	-0.0648	1.0000											
__e8	0.0964	-0.0652	0.3511	-0.0640	0.0245	1.0000										
__e9	0.3190	-0.1810	0.3202	0.2725	-0.1491	0.1661	1.0000									
__e10	0.2668	0.3076	-0.5774	0.4330	0.2084	-0.0592	0.0408	1.0000								
__e11	0.1333	0.1393	0.1471	0.0690	0.1989	0.1509	-0.0697	-0.1125	1.0000							
__e12	0.6581	0.0572	0.3261	0.2260	0.0688	0.2106	0.4361	0.1991	0.0363	1.0000						
__e13	-0.2577	0.1409	-0.0744	0.0898	0.0329	0.1423	-0.2424	0.0785	0.3240	-0.1662	1.0000					
__e14	-0.2351	-0.1550	0.0422	0.0135	-0.1249	-0.0935	-0.0468	-0.1383	-0.0159	-0.2627	-0.0054	1.0000				
__e15	0.1349	-0.3063	0.5650	-0.3194	-0.0445	0.3109	0.1400	-0.3076	-0.0625	0.1556	-0.2340	-0.0224	1.0000			
__e16	0.0708	0.1861	-0.0242	-0.2972	-0.1337	0.0272	-0.0351	-0.0646	-0.3560	0.1203	-0.1391	-0.0098	0.1834	1.0000		
__e18	0.0897	-0.0064	-0.1049	-0.0902	-0.2785	-0.1898	0.0547	0.2524	-0.1500	0.0508	-0.0221	-0.0157	-0.1595	0.2076	1.0000	
__e19	0.5959	-0.0018	0.1289	0.3691	0.1096	0.1710	0.2861	0.3430	0.3742	0.4580	-0.1531	-0.2177	0.0081	-0.0977	-0.0577	1.0000

Stationary variables

To test for nonstationary variables, I test whether or not $\rho = 1$ in

$$y_t = \rho y_{t-1} + e_t$$

There are several available tests for this. I use the Levin-Lin-Chu (2002) test, because the option[44] to subtract cross-sectionally can mitigate the impact of CSD (Levin et al., 2002). I also use the t-test proposed by Pesaran (2007) for unit roots in heterogeneous panels with CSD.

The null hypothesis in both tests states that all the panels contain a unit root.

$$H_0: \rho = 1$$

The results are reported in tables A.8 and A.9 and show that both the private bond ratio and public bond ratio are stationary, except for the 3rd and 4th lags of public bonds in the Levin-Lin-Chu unit-root test without a trend. This is not confirmed by the Pesaran (2007) test.

Table A.8. Levin-Lin-Chu unit-root test

Specification without trend							
variable	lags	adj t	p-value	variable	lags	adj t	p-value
priv_GDP	1	-11.8002	0.0000	publ_GDP	1	-3.4570	0.0003
priv_GDP	2	-6.8281	0.0000	publ_GDP	2	-2.1352	0.0164
priv_GDP	3	-4.4848	0.0000	publ_GDP	3	-1.2643	0.1031
priv_GDP	4	-3.9669	0.0000	publ_GDP	4	-1.0808	0.1399
Specification with trend							
variable	lags	adj t	p-value	variable	lags	adj t	p-value
priv_GDP	1	-26.4356	0.0000	publ_GDP	1	-6.8614	0.0000
priv_GDP	2	-22.6396	0.0000	publ_GDP	2	-6.0978	0.0000
priv_GDP	3	-20.0281	0.0000	publ_GDP	3	-3.1871	0.0007
priv_GDP	4	-18.1376	0.0000	publ_GDP	4	-1.9754	0.0241

[44] It requests that xtunitroot first subtract the cross-sectional averages from the series. When specified for each time period, xtunitroot computes the mean of the series across panels and subtracts this mean from the series.

Table A.9. Pesaran (2007) panel unit-root test (CIPS)

Specification without trend

variable	lags	Zt-bar	p-value	variable	lags	Zt-bar	p-value
priv_GDP	0	-14.740	0.000	publ_GDP	0	-13.643	0.000
priv_GDP	1	-9.534	0.000	publ_GDP	1	-8.780	0.000
priv_GDP	2	-4.597	0.000	publ_GDP	2	-5.859	0.000
priv_GDP	3	-2.717	0.003	publ_GDP	3	-3.656	0.000

Specification with trend

variable	lags	Zt-bar	p-value	variable	lags	Zt-bar	p-value
priv_GDP	0	-14.879	0.000	publ_GDP	0	-12.611	0.000
priv_GDP	1	-9.451	0.000	publ_GDP	1	-6.939	0.000
priv_GDP	2	-4.156	0.000	publ_GDP	2	-4.075	0.000
priv_GDP	3	-1.809	0.003	publ_GDP	3	-2.113	0.000

Serial correlation

I use the Wooldridge (2002) test for autocorrelation in panel-data models, which employs a Wald test of the null hypothesis that there is no serial correlation in the residuals. Residuals from the regression of the first-differenced variables should have an autocorrelation of -0.5, which implies that the coefficients on the lagged residuals in a regression of the lagged residuals on the current residuals should be -0.5. P-values show that the null hypothesis is rejected, and it appears that there is autocorrelation in the residuals.

Table A.10. Wooldridge test for autocorrelation in panel data

Specifications	F	P-value
Controls	3.487	0.0815
Controls and time dummies	4.856	0.0436
Controls and time and region dummies	4.856	0.0436

Full Tables

Table 1– Crowding in or crowding out
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*0.0191****	*0.0188****	*0.0106****	*0.0129****	*0.0130****
	(0.0017)	*(0.0017)*	*(0.0026)*	*(0.0025)*	*(0.0028)*
GDPC_growth	*0.0110**	*0.0144**	*0.0104*	*0.0105**	*0.0151**
	(0.0057)	*(0.0080)*	*(0.0071)*	*(0.0051)*	*(0.0079)*
LnGDP	*0.0698***	*0.0789****	*0.0773****	*-0.3947*	*-0.3108*
	(0.0242)	*(0.0215)*	*(0.0205)*	*(0.3892)*	*(0.4858)*
dom_cred_bank	*0.0033****	*0.0036****	*-0.0011*	*0.0011*	*0.0017*
	(0.0011)	*(0.0011)*	*(0.0015)*	*(0.0026)*	*(0.0030)*
Inflation	*-0.0034**	*-0.0015*	*0.0014*	*-0.0068***	*-0.0042*
	(0.0017)	*(0.0024)*	*(0.0024)*	*(0.0026)*	*(0.0034)*
curr_acc_GDP	*0.0157***	*0.0153***	*0.0023*	*0.0003*	*0.0019*
	(0.0055)	*(0.0055)*	*(0.0029)*	*(0.0033)*	*(0.0046)*
IIR	*0.0178****	*0.0222****	*0.0166****	*0.0170***	*0.0240***
	(0.0031)	*(0.0031)*	*(0.0039)*	*(0.0078)*	*(0.0093)*
WGI	*-0.1772****	*-0.2069****	*-0.1821***	*-0.0716*	*-0.1311*
	(0.0527)	*(0.0560)*	*(0.0760)*	*(0.0644)*	*(0.2298)*
priv_for_GDP	*0.0606*	*0.0583*	*0.0548*	*0.0360*	*0.0351*
	(0.0412)	*(0.0414)*	*(0.0415)*	*(0.0410)*	*(0.0416)*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*992*	*992*	*992*	*992*	*992*
R^2	*0.379*	*0.394*	*0.418*		

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table 2 — Crowding in or crowding out, different samples
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*		
Excluded		*Asia*	*>4*		*Asia*	*>4*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
l1publ_GDP	*0.0106****	*0.0033*	*0.0054*	*0.0130****	*0.0164***	*0.0116*
	(0.0026)	*(0.0049)*	*(0.0067)*	*(0.0028)*	*(0.0070)*	*(0.0090)*
GDPC_growth	*0.0104*	*0.0018*	*0.0073**	*0.0151**	*0.0078**	*0.0133****
	(0.0071)	*(0.0034)*	*(0.0033)*	*(0.0079)*	*(0.0038)*	*(0.0041)*
LnGDP	*0.0773****	*0.0808****	*0.1066****	*-0.3108*	*-0.0034*	*-0.0686*
	(0.0205)	*(0.0236)*	*(0.0241)*	*(0.4858)*	*(0.2862)*	*(0.2614)*
dom_cred_bank	*-0.0011*	*-0.0007*	*-0.0007*	*0.0017*	*-0.0024***	*-0.0037****
	(0.0015)	*(0.0012)*	*(0.0011)*	*(0.0030)*	*(0.0011)*	*(0.0011)*
inflation	*0.0014*	*0.0007*	*-0.0015*	*-0.0042*	*-0.0073****	*-0.0067****
	(0.0024)	*(0.0023)*	*(0.0024)*	*(0.0034)*	*(0.0020)*	*(0.0017)*
curr_acc_GDP	*0.0023*	*0.0007*	*-0.0008*	*0.0019*	*0.0031*	*0.0034*
	(0.0029)	*(0.0020)*	*(0.0017)*	*(0.0046)*	*(0.0035)*	*(0.0036)*
IIR	*0.0166****	*0.0086****	*0.0118****	*0.0240***	*0.0131***	*0.0180***
	(0.0039)	*(0.0026)*	*(0.0029)*	*(0.0093)*	*(0.0054)*	*(0.0059)*
WGI	*-0.1821***	*-0.0888**	*-0.0669*	*-0.1311*	*0.2196***	*0.3153****
	(0.0760)	*(0.0452)*	*(0.0505)*	*(0.2298)*	*(0.0865)*	*(0.0960)*
priv_for_GDP	*0.0548*	*0.0115*	*0.0077*	*0.0351*	*-0.0033*	*-0.0080*
	(0.0415)	*(0.0100)*	*(0.0075)*	*(0.0416)*	*(0.0144)*	*(0.0144)*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies	*yes*	*yes*	*yes*			
No. of countries	*19*	*16*	*13*	*19*	*16*	*13*
N	*992*	*872*	*708*	*992*	*872*	*708*
R^2	*0.418*	*0.137*	*0.162*			

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, * p<0.1, ** p<0.05, *** p<0.01

Table 3 — Crowding in or crowding out, compare long- and short-term public bonds
Dependent variable: Private domestic bonds in percent of GDP

	POLS	*FE*	*POLS*	*FE*	*POLS*	*FE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
publ_short_GDP$_{s-1}$	*0.0104****	*0.0122****			*0.0084***	*0.0094****
	(0.0029)	*(0.0030)*			*(0.0031)*	*(0.0030)*
publ_long_GDP$_{s-1}$			*0.0346****	*0.0521****	*0.0262****	*0.0423****
			(0.0077)	*(0.0084)*	*(0.0085)*	*(0.0088)*
GDPC_growth	*0.0109*	*0.0152**	*0.0113*	*0.0168***	*0.0102*	*0.0156**
	(0.0072)	*(0.0080)*	*(0.0070)*	*(0.0077)*	*(0.0070)*	*(0.0077)*
LnGDP	*0.0850****	*-0.3265*	*0.0652****	*0.0182*	*0.0671****	*-0.1763*
	(0.0204)	*(0.4834)*	*(0.0192)*	*(0.4947)*	*(0.0194)*	*(0.4629)*
dom_cred_bank	*-0.0010*	*0.0012*	*-0.0020*	*0.0013*	*-0.0014*	*0.0022*
	(0.0016)	*(0.0031)*	*(0.0017)*	*(0.0034)*	*(0.0016)*	*(0.0031)*
inflation	*0.0010*	*-0.0039*	*0.0029*	*-0.0040*	*0.0021*	*-0.0045*
	(0.0023)	*(0.0035)*	*(0.0025)*	*(0.0034)*	*(0.0023)*	*(0.0033)*
curr_acc_GDP	*0.0020*	*0.0010*	*0.0019*	*0.0013*	*0.0025*	*0.0029*
	(0.0029)	*(0.0046)*	*(0.0033)*	*(0.0049)*	*(0.0030)*	*(0.0045)*
IIR	*0.0164****	*0.0230***	*0.0164****	*0.0169*	*0.0168****	*0.0227***
	(0.0039)	*(0.0093)*	*(0.0044)*	*(0.0098)*	*(0.0040)*	*(0.0090)*
WGI	*-0.1641***	*-0.1436*	*-0.2303***	*-0.1718*	*-0.2105***	*-0.1304*
	(0.0771)	*(0.2302)*	*(0.0802)*	*(0.2194)*	*(0.0822)*	*(0.2291)*
priv_for_GDP	*0.0558*	*0.0366*	*0.0543*	*0.0321*	*0.0538*	*0.0322*
	(0.0416)	*(0.0416)*	*(0.0410)*	*(0.0412)*	*(0.0412)*	*(0.0414)*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies	*yes*		*yes*		*yes*	
N	*992*	*992*	*992*	*992*	*992*	*992*
R^2	*0.415*		*0.413*		*0.419*	

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets,* p<0.1, ** p<0.05, *** p<0.01

Table 4 — Crowding in or crowding out
Dependent variable: Interest rates for private bonds

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*-0.0181**	*-0.0301***	*-0.0150*	*-0.0009*	*-0.0071*
	(0.0091)	*(0.0112)*	*(0.0108)*	*(0.0081)*	*(0.0096)*
GDPC_growth	*-0.1641****	*-0.1405**	*-0.1726***	*-0.1974****	*-0.1996***
	(0.0517)	*(0.0758)*	*(0.0584)*	*(0.0392)*	*(0.0774)*
LnGDP	*0.5540****	*0.2250*	*0.6514***	*-2.7957**	*2.8143*
	(0.1143)	*(0.1371)*	*(0.2312)*	*(1.5115)*	*(2.1385)*
dom_cred_bank	*-0.0306****	*-0.0254****	*0.0034*	*-0.0147*	*0.0220*
	(0.0065)	*(0.0076)*	*(0.0075)*	*(0.0132)*	*(0.0179)*
inflation	*0.0118*	*0.0153*	*-0.0161*	*-0.0217*	*-0.0354*
	(0.0458)	*(0.0361)*	*(0.0221)*	*(0.0267)*	*(0.0331)*
curr_acc_GDP	*0.0375*	*0.0525*	*0.1064**	*0.0444*	*0.0105*
	(0.0335)	*(0.0405)*	*(0.0548)*	*(0.0469)*	*(0.0569)*
IIR	*-0.0821****	*-0.0664***	*-0.0458*	*-0.0291*	*-0.0744*
	(0.0207)	*(0.0279)*	*(0.0306)*	*(0.0543)*	*(0.0676)*
WGI	*0.0573*	*-1.8648****	*-1.1648*	*0.3144**	*-0.2231*
	(0.1865)	*(0.5303)*	*(0.7405)*	*(0.1540)*	*(1.1084)*
priv_for_GDP	*-0.0856**	*0.0164*	*0.0369*	*-0.0648*	*-0.0294*
	(0.0470)	*(0.0532)*	*(0.0557)*	*(0.0466)*	*(0.0495)*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*324*	*324*	*324*	*324*	*324*
R^2	*0.515*	*0.578*	*0.626*		

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table 5 — Crowding in or crowding out, firms with and without an investment grade
Dependent variable: Private domestic bonds in percent of GDP

	High-yield bonds			*Investment-grade bonds*		
	POLS		*FE*	*POLS*		*FE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
publ_GDP$_{s-1}$	*-0.0028****	*-0.0041***	*-0.0021*	*0.0180****	*0.0133****	*0.0146****
	(0.0007)	*(0.0019)*	*(0.0019)*	*(0.0016)*	*(0.0021)*	*(0.0022)*
GDPC_growth	*0.0048*	*0.0027*	*0.0051*	*0.0125***	*0.0107**	*0.0125**
	(0.0044)	*(0.0042)*	*(0.0058)*	*(0.0053)*	*(0.0054)*	*(0.0062)*
LnGDP	*0.0501****	*0.0589****	*-0.1370*	*0.0117*	*0.0083*	*-0.1289*
	(0.0152)	*(0.0158)*	*(0.3007)*	*(0.0099)*	*(0.0086)*	*(0.2091)*
dom_cred_bank	*0.0019****	*0.0020**	*0.0045***	*0.0022***	*-0.0007*	*-0.0026**
	(0.0006)	*(0.0010)*	*(0.0020)*	*(0.0008)*	*(0.0007)*	*(0.0014)*
inflation	*-0.0006*	*-0.0007*	*-0.0054**	*0.0004*	*0.0022***	*0.0015*
	(0.0019)	*(0.0019)*	*(0.0030)*	*(0.0010)*	*(0.0010)*	*(0.0013)*
curr_acc_GDP	*0.0066***	*0.0047****	*0.0053*	*0.0037*	*-0.0037**	*-0.0019*
	(0.0026)	*(0.0015)*	*(0.0037)*	*(0.0033)*	*(0.0021)*	*(0.0032)*
IIR	*0.0120****	*0.0134****	*0.0188***	*0.0053**	*0.0015*	*0.0062*
	(0.0031)	*(0.0034)*	*(0.0079)*	*(0.0027)*	*(0.0023)*	*(0.0052)*
WGI	*-0.1873****	*-0.2394****	*-0.1861*	*-0.0470*	*-0.0170*	*0.0896*
	(0.0504)	*(0.0506)*	*(0.1417)*	*(0.0412)*	*(0.0462)*	*(0.0781)*
priv_for_GDP	*0.0119*	*0.0130*	*-0.0040*	*0.0016*	*-0.0008*	*0.0077*
	(0.0156)	*(0.0155)*	*(0.0178)*	*(0.0092)*	*(0.0093)*	*(0.0111)*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies		*yes*			*yes*	
N	*992*	*992*	*992*	*992*	*992*	*992*
R^2	*0.106*	*0.115*		*0.438*	*0.460*	

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Robustness Tests

Table A.10. Crowding in or crowding out, same period
Dependent variable: Private domestic bonds to GDP

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP	*0.0185****	*0.0182****	*0.0095****	*0.0118****	*0.0119****
	(0.0016)	*(0.0016)*	*(0.0025)*	*(0.0024)*	*(0.0027)*
Controls	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*992*	*992*	*992*	*992*	*992*
R^2	*0.375*	*0.390*	*0.415*		

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table A.11. Crowding in or crowding out
Dependent variable: Sum of private domestic bonds

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$publ\_sum_{s-1}$	*0.0228****	*0.0216****	*0.0244****	*0.0265****	*0.0245****
	(0.0026)	*(0.0028)*	*(0.0031)*	*(0.0028)*	*(0.0029)*
Controls	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*992*	*992*	*992*	*992*	*992*
R^2	*0.416*	*0.467*	*0.474*		

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table A.12. Crowding in or crowding out, dynamic model
Dependent variable: Private domestic bonds to GDP

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$priv\_GDP_{s-1}$	*0.1719**	*0.1564*	*0.1193*	*0.0821*	*0.0801*
	(0.0894)	*(0.0907)*	*(0.0881)*	*(0.0891)*	*(0.0878)*
$publ\_GDP_{s-1}$	*0.0159****	*0.0159****	*0.0094****	*0.0119****	*0.0121****
	(0.0024)	*(0.0024)*	*(0.0027)*	*(0.0027)*	*(0.0030)*
Controls	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*992*	*992*	*992*	*992*	*992*
R^2	*0.397*	*0.409*	*0.426*		

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table A.13. Crowding in or crowding out, dynamic models
Dependent variable: Private domestic bonds to GDP

	POLS			*FE*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
priv_GDP$_{s-1}$	*0.1193*			*0.0801*		
	(0.0881)			*(0.0878)*		
publ_GDP$_{s-1}$	*0.0094****	*0.0066*	*0.0064*	*0.0121****	*0.0083*	*0.0079*
	(0.0027)	*(0.0062)*	*(0.0061)*	*(0.0030)*	*(0.0066)*	*(0.0065)*
publ_GDP$_{s-2}$		*0.0043*	*0.0035*		*0.0051*	*0.0034*
		(0.0062)	*(0.0101)*		*(0.0061)*	*(0.0100)*
publ_GDP$_{s-3}$			*0.0011*			*0.0023*
			(0.0081)			*(0.0083)*
Controls	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies	*yes*	*yes*	*yes*			
N	*992*	*992*	*992*	*992*	*992*	*992*
R^2	*0.426*	*0.418*	*0.418*			

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets,* p<0.1, ** p<0.05, *** p<0.01

Table A.14. Crowding in or crowding out, 2000–2012
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*0.0175****	*0.0169****	*0.0081****	*0.0101****	*0.0109****
	(0.0016)	*(0.0017)*	*(0.0026)*	*(0.0024)*	*(0.0028)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies		*yes*	*yes*		*yes*
Region dummies			*yes*		
N	*864*	*864*	*864*	*864*	*864*
R^2	*0.413*	*0.430*	*0.458*		

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table A.15. Crowding in or crowding out, long- and short-term public bonds, 2000–2012
Dependent variable: Private domestic bonds in percent of GDP

	POLS	*FE*	*POLS*	*FE*	*POLS*	*FE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
long_publ_GDP$_{s-1}$			*0.0213****	*0.0436****	*0.0152**	*0.0349****
			(0.0060)	*(0.0090)*	*(0.0072)*	*(0.0099)*
short_publ_GDP$_{s-1}$	*0.0081***	*0.0104****			*0.0072***	*0.0082***
	(0.0030)	*(0.0031)*			*(0.0032)*	*(0.0032)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies	*yes*		*yes*		*yes*	
N	*864*	*864*	*864*	*864*	*864*	*864*
R^2	*0.456*		*0.453*		*0.458*	

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table A.16. Crowding in or crowding out, different samples, 2000–2012
Dependent variable: Private domestic bonds in percent of GDP

	POLS			*FE*		
Excluded		*Asia*	*>4*		*Asia*	*>4*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
publ_GDP$_{s-1}$	*0.0081****	*0.0026*	*0.0061*	*0.0109****	*0.0109*	*0.0097*
	(0.0026)	*(0.0057)*	*(0.0070)*	*(0.0028)*	*(0.0068)*	*(0.0084)*
Control variables	*yes*	*Yes*	*yes*	*yes*	*yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies	*yes*	*yes*	*yes*			
No. of countries	*19*	*16*	*13*	*19*	*16*	*13*
N	*864*	*760*	*620*	*864*	*832*	*676*
R^2	*0.458*	*0.147*	*0.168*			

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, * p<0.1, ** p<0.05, *** p<0.01

Table A.17.Crowding in or crowding out, private bonds with and without an investment grade
Dependent variable: Private domestic bonds in percent of GDP

	High-yield bonds			*Investment-grade bonds*		
	POLS		*FE*	*POLS*		*FE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
publ_GDP$_{s-1}$	*-0.0032****	*-0.0042**	*-0.0022*	*0.0167****	*0.0112****	*0.0128****
	(0.0006)	*(0.0020)*	*(0.0020)*	*(0.0017)*	*(0.0023)*	*(0.0023)*
Control variables	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Region dummies		*yes*			*yes*	
N	*864*	*864*	*864*	*864*	*864*	*864*
R^2	*0.109*	*0.117*		*0.451*	*0.477*	

Driscoll and Kraay standard errors in parentheses, time period: 2000–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

Table A.18. Crowding in or crowding out, 2000–2012
Dependent variable: Interest rates for private bonds

	POLS			*FE*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
publ_GDP$_{s-1}$	*-0.0081*	*-0.0164**	*-0.0061*	*0.0093*	*0.0023*
	(0.0066)	*(0.0084)*	*(0.0085)*	*(0.0061)*	*(0.0068)*
Control variables	*yes*	*Yes*	*yes*	*yes*	*yes*
Time dummies		*Yes*	*yes*		*yes*
Region dummies			*yes*		
N	*301*	*301*	*301*	*301*	*301*
R^2	*0.594*	*0.640*	*0.665*		

Driscoll and Kraay standard errors in parentheses, time period: 1995–2012, sample consists of 19 emerging markets, * p<0.1, ** p<0.05, *** p<0.01

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