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Domestic Debt Structures in Emerging Markets : New Empirical Evidence

Arnaud MEHL, Julien REYNAUD

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DOMESTIC DEBT STRUCTURES IN EMERGING MARKETS: NEW EMPIRICAL EVIDENCE

Arnaud MEHL* and Julien REYNAUD#

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Abstract

This paper explains why public domestic debt composition in emerging economies can be risky, namely in foreign currency, with a short maturity or indexed. It analyses empirically the determinants of these risk sources separately, developing a new large dataset compiled from national sources for 33 emerging economies over 1994-2006. The paper finds that economic size, the breadth of the domestic investor base, inflation and fiscal soundness are all associated with risky public domestic debt compositions, yet to an extent that varies considerably in terms of magnitude and significance across sources of risk. Only inflation impacts all types of risky debt, underscoring the overarching importance of monetary credibility to make domestic debt compositions in emerging economies safer. Given local bond markets' rapid development, monitoring risky public domestic debt compositions in emerging economies becomes increasingly relevant to global financial stability.

JEL Classification: F34; F41; G15

Key words: public domestic debt, composition, risk, emerging economies

Résumé

Cet article étudie les déterminants de la composition de la dette publique domestique de 33 économies émergentes sur la période 1994-2006. À l'aide d'une nouvelle base de données construite par les auteurs, les composantes risquées de la dette sont décomposées en trois catégories : la dette émise en devise étrangère, celle émise à court terme et enfin celle indexée, que ce soit à un taux d'intérêt ou encore à l'inflation. Nos résultats soulignent tout d'abord que des facteurs tels que la taille économique des pays, la profondeur de la base domestique d'investisseurs ainsi qu'une politique fiscale saine sont associés à des niveaux moins élevés de risque de la dette publique domestique. En particulier, seule l'inflation a un impact significatif sur tous les types de risques.

Classification JEL: F34; F41; G15

Mots-clés: dette publique domestique, composition, risque, économies émergentes

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The views expressed are our own and do not necessarily reflect those of the European Central Bank.

1 Introduction

A major reason why emerging economies are more prone to financial crises than mature economies is the atypical composition of their debt. Thus far, the literature has largely focused on external debt, notably on the inability of emerging economies to borrow in international capital markets in their domestic currency, which is sometimes coined the *external* dimension of “original sin” (see e.g. Eichengreen and Hausmann, 1999, 2005; Zettelmeyer and Jeanne, 2002; Tirole, 2003; Eichengreen, Hausmann and Panizza, 2003; Hausmann and Panizza, 2003; Bordo, Meissner and Redish, 2003; Flandreau and Sussman, 2004; McKinnon and Schnabl, 2004; Mehl and Reynaud, 2005).

Since the turn of the millennium, however, many emerging economies have retired their external debt and substituted it with domestically issued debt (IMF, 2002, 2003, 2005 and 2006). Late 2007, the stock of domestic debt securities issued by residents of the emerging economies reporting data to the Bank for International Settlements (BIS) reached USD 5.6 trillion, which is seven times larger than the stock of international debt securities (USD 0.8 trillion). Domestic debt securities issued by emerging economies accounted for 46% of their combined GDP in 2007, twice the share of 1994.

The conscious nurturing of public domestic debt markets has become a major objective of financial policy in many emerging economies, an orientation that has been supported by international financial institutions (BIS, 2007). Domestic debt markets are seen as an alternative source of financing that helps soften the impact of “sudden stops” (Calvo and Reinhart, 2000) in external funding (IMF, 2003). Local currency bond markets are further believed to contribute to financial stability by reducing currency mismatches and lengthening the duration of debt.¹

¹ Illustrative of the rising interest they create, investors worldwide have allocated a growing share of their assets in emerging market securities, notably local currency bonds (JP Morgan, 2005).

In this new context, there is growing consensus that domestic debt has become equally, if not more, important to assess financial vulnerability in emerging economies than is external debt. Illustrative of this, the Group of Seven, one of the highest fora for cooperation in international monetary and financial affairs, has acknowledged the role of public domestic debt markets as a key contributor to growth and financial stability in emerging economies (G7, 2007).² Likewise, the BIS has endeavoured to draw implications from the development of these markets for global financial stability (BIS, 2007).

A nascent line of research has provided evidence on the determinants of the *development* of domestic bond markets. For instance, Burger and Warnock (2006) found that countries with stable inflation and strong creditor rights have larger domestic bond markets. Claessens, Klingebiel and Schmukler (2007) found that large economies with a wide investor base have larger domestic bond markets; that less flexible exchange rate regimes are associated with more foreign currency issuance and that inflation, the fiscal burden, the origin of the legal system and capital account openness also matter.

One aspect which has received less attention in the literature, however, is that domestic debt itself is a potential source of risks, particularly when it comes to its *composition*.³ Excessive reliance on short-term public domestic paper exposes borrowers to default risk, if debt cannot be rolled over, or to liquidity risk if assets are illiquid. The role of short-term public debt, namely the Tesobonos and the GKO, was identified as a major source of vulnerability as early as in the Mexican crisis of 1995 and the Russian crisis of 1998. In addition, denomination in foreign currencies of public domestic debt may give rise to balance sheet mismatches if the bulk of assets

² See the statement of the G7 Finance Ministers meeting in Essen on 9-10 February 2007 (G7, 2007): “We also met with Ministers of Finance from a number of key emerging market economies to discuss the role of local bond markets in fostering growth and financial stability. In this context developing local currency bond markets deserves higher priority to reduce emerging countries’ vulnerability to external shocks and financial crises and to promote growth.”

³ As the BIS put it, any financial innovation may involve new risks, and the swift development of domestic bond markets in emerging economies is “no exception” (BIS, 2007).

or revenues are in local currency. Last, indexation to an interest rate, a price index or a foreign currency, may render liabilities uncertain and prone to increase in bad times (IMF, 2003).

In this setting, fewer studies have tried to provide systematic evidence on the composition of public domestic debt in emerging economies and on the possible emergence of new risks, bar Jeanne and Guscina (2006), Cowan et al. (2006) and Panizza (2008). None of these studies, however, provide an empirical analysis of the determinants of risky domestic debt compositions. Along with Burger and Warnock (2006) and Claessens, Klingebiel and Schmukler (2007), closest to our paper is Hausmann and Panizza (2003) who examine financial vulnerabilities arising from the so-called “domestic original sin”, namely the inability of emerging economies to borrow domestically in local currency at long maturities and fixed interest rates.⁴ The empirical analysis therein is based, however, on a small sample of 21 country-observations.

The key contribution of our paper is therefore to explain why public domestic debt composition in emerging economies can be risky by analysing empirically the determinants of three major sources of risk separately, namely short maturities, foreign currency denomination and indexation. To this end, our paper relies on a new large dataset on the composition of public domestic government debt, which we carefully develop from national statistics for a broad set of 33 emerging market economies from the mid-1990s to 2006. The lack of high quality and internationally comparable data has been recognised as a key impediment to the understanding and development of domestic debt markets in emerging countries, leading to the launch of initiatives to improve data quality (BIS, 2007; G7, 2007; G8, 2007). Our large dataset helps address some of the limitations of data used in previous literature, and is thereby another contribution of the paper.

To anticipate on the paper’s main results, we find that sources of risky public domestic debt compositions vary greatly across emerging economies, although short-term maturities are the

⁴ This study finds that monetary credibility, as measured by inflation and the imposition of capital controls, helps explain “domestic original sin”.

most common source of risky debt. In addition, our data indicate that public domestic debt compositions have become overall safer in the last fifteen years, notably because maturities have lengthened. Our empirical results suggest that economic size, the breadth of the domestic investor base, inflation and fiscal soundness are all associated with the riskiness of public domestic debt composition, yet to an extent that varies considerably in terms of magnitude and significance across sources of risk. Only inflation impacts all types of risky debt, underscoring the overarching importance of monetary credibility to make public domestic debt compositions in emerging economies safer.

The remainder of the paper is set out as follows. Section 2 presents the new data and evidence on risky public domestic debt compositions in emerging economies. Section 3 reviews the empirical methodology. Section 4 presents the results. Section 5 concludes.

2 Domestic debt composition: new data and evidence

2.1 The new dataset

The lack of high quality and internationally comparable bond market data has been a key impediment to analyse mismatches and other vulnerabilities arising from the rapid development of domestic debt markets in emerging countries. In reviewing some of the existing data sources, Panizza (2008) recalls that about two-thirds of recent joint IMF-World Bank debt sustainability analyses discuss vulnerabilities linked to total – i.e. including domestic – public debt (see also IMF, 2003 and 2006). However, few of these exercises have data on the composition (maturity, currency, indexation terms) of debt, and most of the policy conclusions are based on vulnerabilities arising from external debt only (ibid.).

One of the main international sources of data on domestic bond markets worldwide traditionally used in both official reports and the literature (see e.g. Burger and Warnock, 2006, Claessens et al. 2007) is the data provided by individual central banks and published quarterly by

the BIS. Beyond the traditional split between external and domestic debt, these data provide little or no information on characteristics relevant to financial stability analysis, such as currency of issuance, maturity or indexation terms (BIS, 2007).⁵ These shortcomings inhibit comparisons across countries and tend to impede effective monitoring of potential mismatches and other vulnerabilities. Better data are therefore crucial to assess the risks associated with the rapid development of domestic debt in emerging economies.

To address some of the shortcomings of existing sources of data, we carefully develop a dataset on the composition of the stock of central government debt for 33 emerging economies on the basis of national sources. As can be seen from Table A in the annex, which reports the sources and definitions, extensive data collection work was needed, occasionally involving security-by-security checks.⁶ Additional data quality checks were carried out using the BIS's databases on domestic debt securities. Relative to existing datasets available in the literature, our data have three characteristics.

First, the cross-section dimension is relatively broad. We have data for 33 emerging economies from all emerging market regions. This is more than most existing datasets (e.g. Hausman and Panizza, 2003, have 21 emerging economies; against 27 in Burger and Warnock, 2006; 19 in Jeanne and Guscina, 2006; 22 in Cowan et al., 2006 and 12 in Claessens et al., 2007). In a very recent overview of the literature, Panizza (2008) presents data drawn from various sources for as many as 130 countries, including mature, emerging and developing economies. This is clearly more than our dataset, although our country dimension should be sufficient for our purpose, given that we are primarily interested in understanding financial vulnerabilities arising

⁵ In carrying out a survey of emerging market central banks, the BIS notes that comparatively few central banks regularly compute summary measures of these characteristics, although the underlying data are often publicly available.

⁶ Admittedly, our data - like those in most papers in the literature - do not include private bond issues. However, the resulting bias is unlikely to be large for most emerging economies, as debt security issuance by financial institutions and corporations has been traditionally limited in emerging markets, with the important exception of some of the emerging Asian economies.

from risky domestic debt composition in emerging economies, not in mature or in developing economies.

Second, the time series dimension is relatively long. Many previous studies (Hausman and Panizza, 2003; Borensztein et al., 2004; Eichengreen and Hausmann, 2005; Burger and Warnock, 2006) have data for a (occasionally small) cross-section of countries. We have data from 1994 to 2006. Admittedly, some papers (Jeanne and Guscina, 2006; Cowan et al. 2006) have datasets with an even longer time dimension that stretches to the 1980s. We do not see this as a major shortcoming of our data, however, as the development of modern, bonded, debt markets in emerging economies started in earnest in the 1990s, if not after the turn of the millennium (BIS, 2007).

Third, and perhaps most importantly, the data can be disaggregated to obtain a systematic view of the main sources of risky domestic debt compositions. Many of the previous studies (e.g. Burger and Warnock, 2006; Cowan et al., 2006; Claessens et al., 2007) have breakdowns between external vs. domestic debt or between local currency vs. foreign currency debt. Our data allow for a more detailed analysis of mismatches and vulnerabilities related to domestic debt by providing breakdowns by currency of issuance (foreign vs. domestic), maturity (short term vs. long term) and indexation terms (variable interest rate or price indexation vs. straight fixed interest rate). Our breakdowns are similar to those of Hausmann and Panizza (2003) and Jeanne and Guscina (2006), but for a longer time dimension and for a broader cross-section, respectively.

Specifically, we calculate the four following measures M of the riskiness of domestic debt composition:

$$M^i \equiv \frac{d^i}{D} \in [0,1], i = 1, 2, 3, 4$$

where D denotes total public domestic debt and d is one of the four following categories i of risky public domestic debt, namely ($i=1$) in foreign currency, ($i=2$) with a short maturity, ($i=3$) indexed

and ($i=4$) combining all risk categories. Clearly, for a given measure, the higher is M , the riskier is public domestic debt composition.

2.2 *Stylised facts*

Risky public domestic debt compositions in emerging economies are characterised by four main features. As can be seen from Table 1, which reports the average share of risky public domestic debt in total public domestic debt, sources of risk (foreign currency denomination, short maturities and indexation, all risks combined) are unevenly widespread across emerging economies. Between 1994 and 2006, short-term maturities were the most common source of risk (accounting for 24% of domestic debt), followed by indexation (with 20%) and – only last – foreign currency denomination (with 12%). This comes somewhat unexpected given that much of the literature’s attention has thus far focused on foreign currency debt as the main source of financial vulnerabilities in emerging economies (Eichengreen and Hausmann, 1999 and 2005; Panizza, 2008). These three sources of risk taken together, around half of public domestic debt in our 33 emerging economies could be considered as risky over 1994-2006. The averages hide marked differences across countries and time, as suggested by relatively large standard deviations (between 21% to 34%). Most of these differences arise from variation across (i.e. between) countries rather than from variation over time (i.e. within countries).

Table 1: Selected descriptive statistics on the sources of risky public domestic debt compositions in emerging economies (pooled 33 countries, 1994-2006; %)

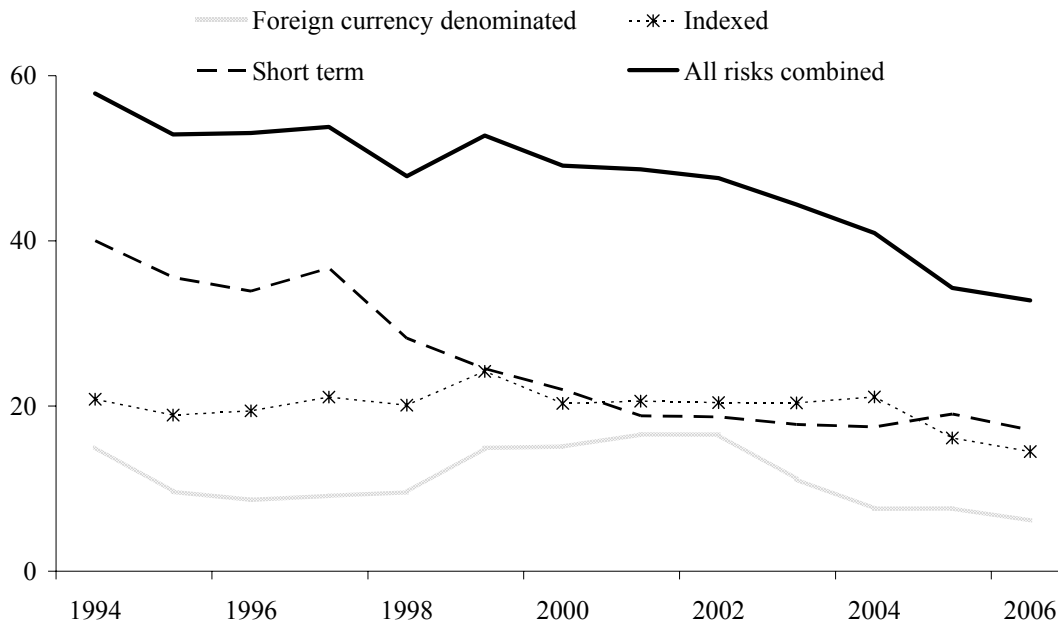
	FX denominated domestic debt / total domestic debt	Indexed domestic debt / total domestic debt	Short term domestic debt / total domestic debt	All risky debt sources combined / total domestic debt
	(1)	(2)	(3)	(4)
Average	11.8	20.0	23.9	47.4
St. dev. <i>overall</i>	25.6	25.7	21.4	34.1
<i>between</i>	27.4	23.7	16.0	31.6
<i>within</i>	7.5	9.8	13.5	13.9

Source: authors’ calculations.

Note: Given that a debt security can have different risk characteristics (e.g. being both short term and indexed to prices), the ratios reported in column (4) do not necessarily equal the sum of those reported in columns (1), (2) and (3).

Public domestic debt composition has become overall safer in the last fifteen years, albeit with marked nuances across sources of risk. Between 1994 and 2006, the share of risky public debt has declined from about 60% to around one-third of total public domestic debt (Figure 1).

Figure 1: Evolution since 1994 of the main sources of risk affecting public domestic debt composition in emerging economies



Source: authors' own calculations.

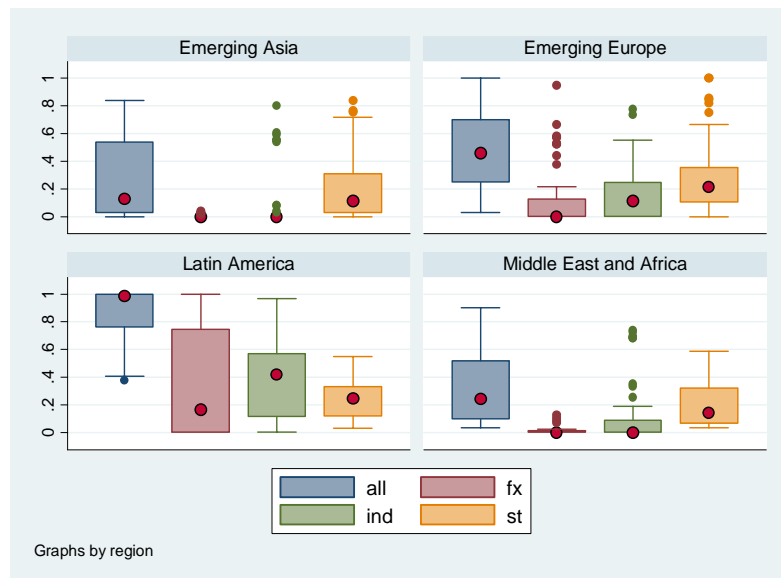
Note: Annual averages for the 33 emerging economies included in the dataset.

Public domestic debt has become safer primarily because its maturity has lengthened: the share of short-term debt to total public debt has decreased from about 40% to less than 20%. The share of indexed public debt has also declined somewhat (from 20% to 14%). The share of foreign currency public debt has been perhaps the most volatile, increasing from about 9% in 1997 to 16% in 2002, after the Argentinean and Turkish crises, before decreasing to 6% in 2006.

Public domestic debt composition also varies greatly in terms of sources of risk across regions and countries. For each of the emerging regions in our dataset, Figure 2 plots the median of our four risk measures (dots) together with the respective inter-quartile range (rectangles). Emerging Asia, together with the Middle-East and Africa, are the two emerging regions where

public domestic debt composition is safest. Both regions have almost no debt in foreign currency and only a small share of their total public domestic debt (8-12%) is indexed. Admittedly, about one-fifth has a short maturity, which is similar to the share in other regions. Public debt is riskiest in Latin America: one-third is in foreign currency, 40% indexed and one-quarter short-term. Differences are even stronger at the country level. For some countries (e.g. Brazil, Croatia, Mexico), public domestic debt is risky from virtually all sources. For other countries, some sources of risk are inexistent: for instance, South Korea has no foreign currency debt; Singapore and Thailand have no indexed debt; Israel has a high share of indexed debt, but a small share of foreign currency debt, etc.

Figure 2: Selected descriptive statistics on the sources of risky domestic debt compositions in emerging economies (country level, 1994-2006)



Source: authors' own calculations.

Note: The figure plots the median of our four risk measures (dots) together with the respective inter-quartile range (rectangles) for each of the emerging regions in our dataset; "fx" refers to foreign currency denominated debt, "ind" to indexed debt, "st" to short-term debt and "all" to all sources of risk combined.

3 Empirical methodology

3.1 *Theoretical determinants of public domestic debt composition*

Potential determinants of the composition of public domestic public debt in emerging economies are multifaceted. For our core specification, we draw from the literature on the development of local bond markets and ‘domestic original sin’, which typically include determinants such as the size of the economy, the breadth of the investor base and the soundness of macroeconomic policies both on the inflation and fiscal fronts.

To test the robustness of the results and extend them, we also consider other potential determinants, including: money supply growth, nonlinearities in inflation, the magnitude of the fiscal burden, the role of the banking sector, property right enforcement, foreign investor appetite, the exchange rate regime and capital account openness.

Size of the economy and breadth of the investor base

Claessens, Klingebiel and Schmukler (2007) found that large countries with broad domestic investor bases have larger local bond markets, while smaller economies rely more on foreign currency bonds. This suggests that scale effects exist in the development of local bond markets, for instance in terms of spreading fixed costs associated with the establishment of clearing and settlement systems, an appropriate legal framework or in terms of market liquidity.

A broader domestic investor base can also be expected to make domestic debt composition safer by contributing to support demand for domestic currency, unindexed, long-dated debt instruments. Pension system and capital market reforms are of paramount importance in this respect (IMF, 2002 and 2003).⁷ In the empirical estimations, the size of the economy is proxied with the natural logarithm of GDP. The breadth of the investor base is proxied with the ratio of gross private savings to GDP, taken from the IMF’s *World Economic Outlook* (WEO).

⁷ For instance, pension funds have an interest in debt securities carrying low default risk and denominated in domestic currency (Borensztein et al., 2004).

Inflation

Lower and less volatile inflation help deepen domestic debt markets (Burger and Warnock, 2006). But price stability can also change the composition of public debt and make it less risky. Hausmann and Panizza (2003) found indeed that monetary credibility, as measured by lower inflation and the imposition of capital controls are associated with lower ‘domestic original sin’ in emerging economies.⁸ Persistent creditor fears that debt might be inflated away can prevent governments from issuing long-term bonds durably, thereby pointing to a potential “credibility barrier”, however (Jeanne, 2003). In the empirical estimations, monetary credibility and inflation are proxied with the annual growth rate of the GDP deflator, also taken from the IMF’s *WEO*.

Soundness of public finances

It is especially debt maturity which can be affected by fiscal profligacy. Missale and Blanchard (1994) show that governments will tend to have a shorter debt maturity to enhance credibility when the debt burden is high, but not necessarily at low levels.⁹ In a similar vein, Drudi and Giordano (2000) develop a model where the relation between the level and maturity of debt depends on both inflation and default risk. The relation is negative at high levels of debt in particular, because the default risk premium becomes then too large for governments to issue long-term debt. In the empirical estimations, the level of the debt burden is proxied with the ratio of the central government fiscal balance to GDP, also taken from the IMF’s *WEO*.

3.2 *Core specification*

⁸ Exchange rate rigidity is also found to be positively correlated with domestic original sin, although the relationship is not robust to the inclusion of capital controls. Falcetti and Missale (2002) attribute the rise in the share of fixed rate bonds and loans in central government debt of twenty OECD countries from the mid-1980s to increased central bank independence, in turn reflecting growing investor confidence in long-run price stability.

⁹ In their theoretical set-up, the maximum debt maturity consistent with a credible pledge to price stability decreases with the level of debt.

The econometric analysis raises challenges relating to both our measures of risky openness domestic debt compositions and the nature of our dataset. First, given that our measures of risky domestic debt compositions are by construction bounded between zero and one, estimation has to resort to censored regression methods. This can be done by using the tobit model, which is well suited when the dependent variable takes values within fixed bounds, a solution retained in previous literature. Second, given the panel structure of our dataset, the possible existence of unobservable country effects has to be taken into account. Indeed, unobserved country heterogeneity would bias standard tobit estimations. To address these issues, we resort to random-effects tobit estimation, which is defined as the following combination of linear and probabilistic regression:

$$y_{i,t}^* = \beta x_{i,t} + v_i + \varepsilon_{i,t} \quad (1)$$

with:

$$y_{i,t} = \begin{cases} 1 & \text{if } y_{i,t}^* > 1 \\ y_{i,t}^* & \text{if } 0 \leq y_{i,t}^* \leq 1 \\ 0 & \text{if } y_{i,t}^* < 0 \end{cases}$$

where i and t are the country and time dimensions, respectively, $y_{i,t}^*$ the measure of domestic original sin defined in (1), $x_{i,t}$ a vector of explanatory variables and β a vector of parameters to be estimated. The disturbances are split into both unobserved country effects, noted v_i , which are i.i.d. $N(0, \sigma_v^2)$, and panel level effects, noted $\varepsilon_{i,t}$, which are i.i.d. $N(0, \sigma_\varepsilon^2)$ and independent of v_i . All regressions also include time dummies to control for e.g. global factors and regional dummies to capture fixed regional effects.

To gauge whether random-effects tobit estimation is required, it is useful to calculate the ρ -statistic, which measures the contribution of the variance of the disturbances due to country effects to the total variance of the disturbances:

$$\rho = \frac{\sigma_v^2}{\sigma_\varepsilon^2 + \sigma_v^2}$$

When ρ is close to zero, random-effect tobit estimation is not significantly different from a standard tobit one. Formal comparison between the two models can be achieved by running a likelihood-ratio test, where the null hypothesis is that the standard tobit is better suited than the random-effect tobit. Moreover, a likelihood-ratio test of the nullity of v_i , also comparing the tobit estimator and the panel estimator, as well as Wald tests on nullity of the estimated parameters can be calculated.

4 Results

4.1 Core results

Baseline estimates are presented in Table 2, which reports marginal effects. The marginal effects of the explanatory variables are estimated at their sample means. The marginal effects of dummy variables are estimated for a change in these variables from 0 to 1. For the sake of comparability between the various specifications, we strive to ensure that the number of observations remains the same, however, due to data availability some models include fewer observations. The ρ -statistic is significantly positive, confirming that standard tobit estimation – which does not take into account unobserved country effects – would be inappropriate.

Overall, our results suggest that economic size, the breadth of the domestic investor base, inflation and fiscal soundness are all associated with the riskiness of public domestic debt composition, yet to an extent that varies considerably in terms of magnitude and significance across sources of risk.

Public domestic debt composition is found to be risky in small economies whose domestic investor base is narrow. However, depending on the sources of risk, the magnitude of the impact of economic size and of the breadth of the domestic investor base differs markedly.

Economic size matters for all categories of risk but does not matter significantly for short-term public debt in total public domestic debt. This suggests that scale effects exist, e.g. in terms of spreading the fixed costs of setting clearing and settlement systems or in terms of market liquidity, but not necessarily when it comes to issuing more public domestic debt with longer maturities specifically. We also have evidence that the relationship is causal, with the Wu-Hausmann F -test and the Durbin-Wu-Hausman χ^2 test suggesting that economic size is exogenous in most specifications.¹⁰

Table 2: Core specification regression results

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.004 ** (1.97)	-0.007 ** (2.45)	0.004 (1.01)	-0.022 ** (2.41)
Domestic savings to GDP	-0.117 ** (2.16)	-0.007 (0.11)	-0.105 (1.28)	-0.086 (0.57)
Inflation	0.054 *** (3.68)	0.028 * (1.65)	0.070 *** (2.69)	0.243 *** (3.20)
Fiscal balance to GDP	-0.202 *** (2.70)	-0.058 (0.60)	-0.260 ** (2.16)	-0.392 * (1.80)
Constant	1.005 ** (2.48)	0.831 *** (3.36)	0.285 * (1.89)	0.757 *** (4.92)
Log likelihood	-197.65	-258.26	-224.28	-160.38
Wald test	112.19 ***	95.53 ***	163.55 ***	221.03 ***
σ_v^2	1.367 ***	0.897 ***	0.528 ***	0.318 ***
σ_c^2	0.582 ***	0.474 ***	0.329 ***	0.268 ***
ρ	0.846 ***	0.781 ***	0.720 ***	0.584 ***
Likelihood ratio test $\sigma_v^2 = 0$	315.23 ***	286.38 ***	215.08 ***	146.71 ***
Number of observations	426	426	426	426
Number of countries	33	33	33	33

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

Public domestic debt composition becomes also safer when the domestic investor base broadens, as proxied by an increase in the private savings-to-GDP ratio. Financial deepening underpinned by heftier private savings is therefore important to increase the demand for, and tilt domestic debt composition towards, safer debt security instruments. However, this effect varies again sizeably across sources of risk and is statistically significant only as regards the share of foreign currency debt. In this respect, according to our median point estimates, an increase in the

¹⁰ The exception is when the share of foreign currency debt is the dependant variable.

investor base by 1 percentage point is associated with a decrease in the share of foreign currency debt by 0.1 percentage point. The relationship is in this case also found to be causal according to the aforementioned test statistics.

Echoing previous literature on ‘domestic original sin’ and the development of local bond markets (Hausmann and Panizza, 2003; Burger and Warnock, 2006; Claessens et al. 2007), poor macroeconomic policies (monetary instability through high inflation and high fiscal deficits) are found to be associated with riskier domestic debt compositions. Only inflation impacts all types of risky debt, however. According to our median point estimates, a decrease in inflation by 1 percentage point is associated with a decrease in the share of foreign currency, of indexed and of short-term debt in total public domestic debt by about 0.05 percentage point each; when all sources of risky public domestic debt are combined together, the total decline is in the order of 0.2 percentage point. Progress towards price stability is therefore systematically important to alleviate creditor fears that domestic debt could be inflated away (as in Jeanne, 2003) and to change its composition towards local currency, long-term and unindexed instruments. The relationship is also causal in most specifications, except when the share of indexed debt in total domestic debt is the dependant variable, which is probably due to the fact that part of debt indexation is to inflation.

Sounder public finances are also almost always associated with safer public domestic debt compositions, barring that they have no impact on the share of indexed debt in total public domestic debt. According to our median point estimates, an improvement in the fiscal balance-to-GDP ratio by 1 percentage point is associated with a decline in the share of foreign currency debt and in the share of short-term debt in total public domestic debt by about 0.25 percentage point each; when all sources of risky domestic debt are combined together, the total decline is in the order of 0.4 percentage point. As aforementioned, fiscal profligacy might prompt governments to make their commitment to price stability more credible by issuing debt with shorter maturities (as

in Missale and Blanchard, 1994) or prevent them from issuing long-term debt as the debt premium becomes overly large (as in Drudi and Giordano, 2000). The relationship is causal in most specifications, except when the measure that combines all risks together is the dependant variable.

Overall, our results suggest that only inflation impacts all types of risky debt, underscoring the overarching importance of monetary credibility to make public domestic debt compositions in emerging economies safer. Moreover, the share of foreign currency and short term debt in total public domestic debt both decrease when the domestic investor base broadens, inflation declines and fiscal policy becomes sounder. This suggests that potential currency and maturity mismatches arising from risky public domestic debt compositions can mainly be alleviated through better policies. By contrast, the share of indexed debt specifically decreases in large countries and when inflation declines. This suggests that vulnerabilities arising from contingent interest payments can mainly be reduced by exploiting scale effects and through higher monetary credibility.

4.2 *Robustness checks*

To assess the robustness of our results, we first change the estimator and re-run regressions using a standard tobit estimator with country fixed effects (rather than random effects) and time effects. The results are not fundamentally altered.¹¹ We then take alternative definitions of the variables and start by replacing inflation with the growth of M2 (Table 3) and by a dummy that equals 1 when inflation exceeds an ad-hoc threshold of 10% to capture potential non-linearities associated with high inflation levels (Table 4).

¹¹ To save space, the results are not reported here but are available upon request from the authors.

Table 3: Robustness checks on inflation: Broad money growth

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	0.003 (1.20)	-0.008 *** (3.38)	-0.009 ** (2.48)	-0.027 *** (2.94)
Domestic savings to GDP	-0.121 * (1.80)	0.026 (0.53)	-0.154 ** (2.36)	-0.122 (0.80)
Broad money growth	0.023 * (1.65)	0.002 (0.46)	0.017 ** (2.28)	0.078 * (1.87)
Fiscal balance to GDP	-0.206 ** (2.05)	0.016 (0.22)	-0.320 *** (3.23)	-0.722 *** (3.39)
Constant	0.916 ** (2.49)	1.075 *** (4.74)	0.587 *** (4.63)	1.111 *** (8.88)
Log likelihood	-204.19	-255.78	-217.93	-170.39
Wald test	74.08 ***	98.30 ***	192.18 ***	243.55 ***
σ_v^2	1.156 ***	1.046 ***	0.602 ***	0.308 ***
σ_ε^2	0.582 ***	0.501 ***	0.325 ***	0.275 ***
ρ	0.797 ***	0.813 ***	0.773 ***	0.557 ***
Likelihood ratio test $\sigma_v^2 = 0$	290.55 ***	285.43 ***	218.27 ***	146.45 ***
Number of observations	390	390	390	390
Number of countries	33	33	33	33

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

Table 4: Robustness checks on inflation: Non-linearities in inflation levels

	Shares M^i of risky domestic debt in total domestic debt (broken down by source of risk)			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.003 * (1.66)	-0.001 (0.36)	0.003 (0.78)	-0.023 *** (2.56)
Domestic savings to GDP	-0.068 * (1.71)	0.024 (0.91)	-0.078 ** (1.94)	0.013 (0.09)
High inflation dummy [#]	0.010 ** (2.19)	0.004 (1.41)	0.010 (0.98)	0.063 *** (3.49)
Fiscal balance to GDP	-0.173 ** (2.52)	-0.010 (0.25)	-0.339 *** (2.87)	-0.555 *** (2.61)
Constant	0.237 (0.69)	0.080 (0.35)	0.568 *** (4.55)	0.922 *** (7.71)
Log likelihood	-215.32	-257.83	-229.41	-163.55
Wald test	116.38 ***	67.18 ***	169.21 ***	244.26 ***
σ_v^2	1.455 ***	1.473 ***	0.537 ***	0.340 ***
σ_ε^2	0.581 ***	0.496 ***	0.333 ***	0.268 ***
ρ	0.862 ***	0.898 ***	0.722 ***	0.617 ***
Likelihood ratio test $\sigma_v^2 = 0$	286.34 ***	299.33 ***	208.94 ***	161.37 ***
Number of observations	390	390	390	390
Number of countries	33	33	33	33

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

#) Equals 1 when inflation > 10%.

Again, the lack of monetary credibility proxied by an acceleration in money supply growth is still associated with riskier public debt compositions, although not when it comes to indexed debt. High inflation levels also increases the riskiness of public domestic debt composition, but only as regards debt in foreign currency and when all sources of risk are combined.

Next we replace the fiscal balance-to-GDP ratio with an index of fiscal autonomy which measures the burden imposed by the government on economic activity, as in Claessens et al. (2007).¹² Again, our main results remain fundamentally unchanged (Table 5). A higher tax burden on the economy is associated with riskier public domestic debt compositions of all kinds, bar short-term public debt.

Table 5: Robustness checks on fiscal balance: Fiscal burden

	Shares M^l of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.001 (0.98)	-0.009 *** (2.96)	0.005 (1.44)	-0.003 *** (3.65)
Domestic savings to GDP	-0.111 ** (2.06)	0.024 (0.39)	-0.107 * (1.61)	0.041 (0.25)
Inflation	0.077 *** (4.90)	0.049 ** (2.42)	0.080 *** (3.39)	0.245 *** (3.30)
Higher fiscal burden	0.059 ** (2.31)	0.148 *** (4.53)	0.037 (0.95)	0.198 ** (2.42)
Constant	0.002 (0.00)	-0.325 (0.83)	0.155 (0.65)	0.530 ** (2.54)
Log likelihood	-177.40	-234.79	-199.83	-142.45
Wald test	85.1 ***	70.89 ***	143.85 ***	180.59 ***
σ_v^2	1.442 ***	0.881 ***	0.592 ***	0.309 ***
σ_c^2	0.544 ***	0.461 ***	0.317 ***	0.258 ***
ρ	0.875 ***	0.784 ***	0.777 ***	0.588 ***
Likelihood ratio test $\sigma_v^2 = 0$	323.44 ***	291.57 ***	202.26 ***	137.06 ***
Number of observations	390	390	390	390
Number of countries	33	33	33	33

Notes: Absolute value of z statistics in parentheses
(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

We then try to sharpen our results on the role of the investor base by focusing more on local banks. Local banks are the main investors in emerging local bond markets, which is a major

¹² This index published by The Heritage Foundation comprises, among other variables, the overall amount of tax revenues levied by government.

difference relative to mature economies where the investor base is known to be more diverse.¹³ Due to their prominent role as investors, local banks in emerging economies might also have a bearing on domestic debt composition. One rationale for this lies in bank ownership, with state-owned banks being possibly urged by governments to buy certain types of debt instruments that the latter would otherwise not be able to sell in the market (La Porta et al., 2002; Hauner, 2008).¹⁴ Incentive distortions might provide another rationale: for instance, Hauner (2008) found that banking sectors in emerging economies that hold large amounts of government debt also tend to develop more slowly. As he puts it, banks become then too complacent (the so-called “lazy banks” hypothesis) and have little incentives to develop deposits, private credit and other traditional financial products and, in this respect, “the consequences of large public sector borrowing from the domestic banking sector are also a timely policy issue, given the ongoing debate on optimal debt structures”. We attempt to address these consequences by testing the impact of bank holdings of government bonds on the riskiness of domestic debt composition. To this end, we take from the Bank Regulation and Supervision Database (World Bank, 2007) a variable that accounts for the share of bank holdings in the total government bond market (Table 6). We also test the impact of banks ownership to reflect Hauner (2008)’s view that state owned banks could be required to hold government bonds (Table 7). Using the same database, we include a measure of bank ownership that we interact with the measure of banks holdings of government bonds.

The results reported in Table 6 suggest that economies where banks hold a large share of domestic bonds tend to have safer public domestic debt compositions in terms of most sources of risk. In particular, when interacting bank holdings with ownership (see Table 7), this effect seems

¹³ The share of local bonds held by banks in emerging economies is four times larger than in mature economies (40% against 11% in 2005, according to BIS, 2007).

¹⁴ More precisely, La Porta et al. (2002) find that more prevalent government ownership of banks tends to be associated with less efficient and less developed banking sectors. This argument is taken up by Hauner (2008) who argues that “the banks would not hold public debt because they are “rationally lazy,” but because they are coerced into it” (p. 2).

to be more due to state-owned banks than to privately-owned banks (they are not included here in the regression but their corresponding coefficient is insignificant). All in all, these results suggest that a growing role of local banks in the domestic investor base also help make public domestic debt composition safer.

Table 6: Robustness checks on the investor base: Bank holdings of government bonds

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.003 *** (2.61)	-0.006 (1.43)	0.005 (1.39)	0.002 (0.39)
Bank holdings of gov. bonds	-0.077 *** (3.21)	-0.088 *** (3.51)	-0.911 *** (12.13)	-0.711 *** (7.87)
Inflation	0.015 * (1.84)	0.021 * (1.87)	0.088 *** (3.30)	0.287 *** (4.23)
Fiscal balance to GDP	0.172 *** (3.20)	0.017 (0.34)	-0.379 *** (3.17)	-0.520 *** (3.36)
Constant	0.929 *** (3.18)	0.380 * (1.86)	0.518 *** (5.09)	0.772 *** (8.70)
Log likelihood	-181.75	-228.55	-174.32	-110.17
Wald test	62.19 ***	63.70 ***	279.35 ***	229.43 ***
σ_v^2	1.832 ***	1.379 ***	0.534 ***	0.389 ***
σ_ε^2	0.59 ***	0.483 ***	0.296 ***	0.228 ***
ρ	0.910 ***	0.891 ***	0.766 ***	0.743 ***
Likelihood ratio test $\sigma_v^2 = 0$	330.65 ***	309.35 ***	294.59 ***	315.26 ***
Number of observations	387	387	387	387
Number of countries	30	30	30	30

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

Table 7: Robustness checks on the investor base: Public banks holdings of government bonds

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	0.004 (0.78)	0.005 (1.43)	0.006 (1.39)	0.004 (0.57)
Public banks holdings of gov. bonds	-0.004 (1.09)	-0.002 ** (2.02)	-0.005 * (1.73)	-0.017 *** (3.06)
Inflation	0.014 * (1.66)	0.027 * (1.87)	0.049 ** (2.05)	0.228 *** (3.49)
Fiscal balance to GDP	-0.406 *** (4.11)	-0.072 (0.88)	-0.416 ** (2.32)	-0.852 *** (4.53)
Constant	-0.563 ** (2.15)	-0.164 (0.86)	0.374 *** (3.18)	0.737 *** (8.69)
Log likelihood	-97.67	-124.52	-86.27	-32.55
Wald test	54.96 ***	52.87 ***	155.65 ***	171.22 ***
σ_v^2	1.342 ***	1.212 ***	0.605 ***	0.34 ***
σ_ε^2	0.361 ***	0.377 ***	0.239 ***	0.169 ***
ρ	0.932 ***	0.911 ***	0.864 ***	0.801 ***
Likelihood ratio test $\sigma_v^2 = 0$	234.16 ***	221.39 ***	200.18 ***	258.43 ***
Number of observations	239	239	239	239
Number of countries	30	30	30	30

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

We next attempt to assess the impact of property right enforcement. As pointed out by Borensztein et al. (2004) and Burger and Warnock (2004), property rights enforcement is key to investors by contributing to inspire greater confidence in domestic financial markets. Allegedly, this would help in the development of domestic currency markets. We introduce a proxy for property right enforcement, which we take from the *International Country Risk Guide* database (Table 8). The results indicate that stronger property rights enforcement also tends to help reduce the riskiness of public domestic debt composition, albeit only with regard to indexed debt and when all sources of risk are combined.

Table 8: Extensions: Property rights enforcement

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.004 *	0.016 ***	0.004	-0.028 ***
	(1,65)	(4,54)	(1,14)	(2,87)
Domestic savings to GDP	-0.092 *	-0.035	-0.141 **	-0.007
	(1,67)	(0,44)	(1,98)	(0,04)
Inflation	0.013	0.003 **	0.072 ***	0.237 ***
	(0,73)	(2,12)	(2,85)	(3,31)
Fiscal balance to GDP	-0.141 *	-0.204 *	-0.216 **	-0.292
	(1,71)	(1,72)	(1,98)	(1,23)
Property rights	0.003	-0.122 ***	-0.014	-0.138 **
	(0,19)	(4,77)	(0,50)	(2,35)
Constant	0.946 **	2.173 ***	0.372 **	0.977 ***
	(2,13)	(7,19)	(2,16)	(5,91)
Log likelihood	-237.60	-235.62	-198.90	-141.40
Wald test	102.98 ***	98.27 ***	147.17 ***	258.80 ***
σ_v^2	1.287 ***	0.834 ***	0.574 ***	0.298 ***
σ_ε^2	0.557 ***	0.458 ***	0.315 ***	0.258 ***
ρ	0.842 ***	0.768 ***	0.768 ***	0.572 ***
Likelihood ratio test $\sigma_v^2 = 0$	177.53 ***	268.09 ***	208.86 ***	141.12 ***
Number of observations	390	390	390	390
Number of countries	33	33	33	33

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

Foreign investors, notably global investors, are reported to have shown increasingly growing interest in local currency bond markets of emerging economies in very recent years (Burger and Warnock, 2004). Data on foreign investor participation in local debt markets is often not readily available (BIS, 2007), however. We therefore use a standard proxy of foreign investor appetite, namely the spread between local money market rates and the US interest rate (see e.g. Kamin and von Kleist, 1999). Our results indicate that greater foreign investor appetite is associated with a reduction in most categories of risky public domestic debt (Table 9). This further underscores that widening the investor base to domestic and foreign investors alike contributes to make public domestic debt composition safer.

Table 9: Extensions: Foreign investor appetite

	Shares M^l of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.009 *** (3,97)	-0.008 *** (2,56)	0.002 (0,56)	-0.028 *** (3,14)
Domestic savings to GDP	-0.080 * (1,72)	0.033 (0,47)	-0.097 * (1,71)	-0.139 (0,89)
Inflation	0.073 *** (3,09)	0.070 ** (2,09)	0.097 *** (3,20)	0.231 ** (2,38)
Fiscal balance to GDP	-0.178 ** (2,44)	-0.077 (0,69)	-0.236 ** (2,40)	-0.407 * (1,72)
Foreign investor appetite	-0.035 * (1,82)	-0.052 * (1,71)	-0.023 ** (1,80)	0.001 (1,02)
Constant	1.188 *** (3,13)	1.027 *** (4,14)	0.358 ** (2,29)	0.888 *** (6,27)
Log likelihood	-196.58	-255.18	-216.57	-154.84
Wald test	83.61 ***	121.38 ***	170.18 ***	235.47 ***
σ_v^2	1.378 ***	0.874 ***	0.620 ***	0.301 ***
σ_ε^2	0.563 ***	0.478 ***	0.333 ***	0.267 ***
ρ	0.857 ***	0.770 ***	0.776 ***	0.559 ***
Likelihood ratio test $\sigma_v^2 = 0$	256.81 ***	246.24 ***	213.31 ***	143.43 ***
Number of observations	410	410	410	410
Number of countries	32	32	32	32

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

We then introduce a dummy to proxy the de facto exchange rate regime, which equals one when exchange rate movements vis-à-vis the US dollar exceed an ad-hoc cut-off of +/-5%, suggesting that the exchange rate then tends to be more flexible. We find that countries that have flexible exchange rate regimes also tend to have safer public domestic debt compositions, which are less tilted toward foreign currency and short-term debt (Table 10). This echoes evidence in Claessens et al. (2007) who found that countries with flexible exchange rates tend to have larger local currency bond markets, either because investors might be less fearful of sharp currency depreciations and large inflation spikes or because governments are less pressed to commit to a foreign anchor currency by issuing foreign currency bonds.

Table 10: Extensions: Exchange rate regime

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.009 *** (4,07)	-0.008 ** (2,64)	-0.005 (1,27)	-0.020 *** (2,60)
Domestic savings to GDP	-0.066 (1,32)	0.001 (0,02)	-0.168 ** (2,37)	-0.025 (0,18)
Inflation	0.045 *** (3,04)	0.031 * (1,75)	0.094 *** (3,37)	0.295 *** (4,07)
Fiscal balance to GDP	-0.154 ** (2,27)	-0.078 (0,80)	-0.297 *** (2,68)	-0.375 ** (1,98)
Exchange rate regime	-0.006 * (1,65)	-0.005 (0,87)	-0.013 * (1,71)	-0.025 * (1,72)
Constant	1.848 *** (5,46)	0.784 *** (3,68)	0.496 *** (4,10)	0.861 *** (7,75)
Log likelihood	-202.50 ***	-259.51 ***	-222.98 ***	-158.43 ***
Wald test	85.4 ***	95.74 ***	202.8 ***	243.72 ***
σ_v^2	1.389 ***	0.890 ***	0.562 ***	0.353 ***
σ_ε^2	0.563 ***	0.473 ***	0.331 ***	0.267 ***
ρ	0.859	0.780	0.742	0.636
Likelihood ratio test $\sigma_v^2 = 0$	305.87 ***	282.60 ***	212.55 ***	150.49 ***
Number of observations	410	410	410	410
Number of countries	32	32	32	32

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

Last, we consider the impact of financial openness. Hausmann and Panizza (2003) found that the imposition of capital controls helps lower domestic ‘original sin’, and tilt domestic debt composition towards safer, i.e. local currency, non-indexed, long-term, instruments. Such restrictions may force residents to hold long-term domestic currency denominated bonds by narrowing the range of alternative funding or investment opportunities. There might be opposite forces, however. For instance, the lifting of capital controls could also be expected to help reduce domestic debt riskiness, for instance, by contributing to a widening of the investor base to foreigners. To address the issue, we introduce a dummy for financial openness in the empirical specification, which we take from Fratzscher and Bussière (2004). Our results suggest that financial openness is associated with an increase in the riskiness of public domestic debt compositions (Table 11), in line with Hausmann and Panizza (2003).

Table 11 – Extensions: Capital account openness

	Shares M^i of risky domestic debt in total domestic debt			
	Foreign currency	Indexed	Short-term	All risks combined
Log(GDP)	-0.010 *** (5,17)	-0.007 ** (2,18)	-0.008 * (1,71)	-0.037 *** (2,96)
Domestic savings to GDP	-0.097 ** (2,25)	-0.018 (0,26)	0.101 (1,27)	-0.021 (0,09)
Inflation	0.029 *** (3,24)	0.035 * (1,73)	0.068 *** (2,66)	0.338 *** (3,63)
Fiscal balance to GDP	-0.011 (0,30)	0.008 (0,08)	-0.438 *** (2,86)	-1.336 *** (3,87)
Capital account openness	0.016 (0,01)	0.066 *** (2,67)	0.023 * (1,75)	0.028 (0,51)
Constant	3.130 (0,04)	0.184 (0,41)	-0.255 (1,30)	1.122 *** (5,41)
Log likelihood	-96.06 ***	-167.37 ***	-106.43 ***	-62.73 ***
Wald test	100.81 ***	78.68 ***	243.58 ***	277.5 ***
σ_v^2	2.189 ***	0.968 ***	0.606 ***	0.277 ***
σ_ε^2	0.379 ***	0.419 ***	0.257 ***	0.211 ***
ρ	0.971	0.842	0.848	0.632
Likelihood ratio test $\sigma_v^2 = 0$	247.43 ***	184.64 ***	178.84 ***	115.76 ***
Number of observations	410	410	410	410
Number of countries	32	32	32	32

Notes: Absolute value of z statistics in parentheses

(*) significant at 10%; (**) significant at 5%; (***) significant at 1%.

5 Conclusions

Our paper has endeavoured to explain why public domestic debt composition in emerging economies can be risky by analysing empirically the determinants of three major sources of risk, namely short maturities, foreign currency denomination and indexation. To that end, it has relied on a new large dataset on the composition of domestic government debt.

Looking at our evidence, we found that sources of risky public domestic debt compositions vary greatly across emerging economies. Short-term maturities are the most common source of risky debt, followed by indexation and – only last – foreign currency denomination, with sizeable differences among emerging economies. This comes somewhat unexpected given that much of the literature's attention has thus far focused on foreign currency debt as the main source of financial vulnerabilities in emerging economies. Domestic debt

compositions have become overall safer in the last fifteen years, albeit also with marked nuances across sources of risk, given e.g. that it is notably debt maturities that have lengthened. Our empirical results suggest that economic size, the breadth of the domestic investor base, inflation and fiscal soundness are all associated with the riskiness of public domestic debt composition, but again to an extent that varies considerably in terms of magnitude and significance across sources of risk. There is evidence that the relationships are causal in most cases. Overall, our results suggest that only inflation impacts all types of risky debt, underscoring the overarching importance of monetary credibility to make public domestic debt compositions in emerging economies safer. Moreover, the share of foreign currency and short term debt in total public domestic debt both decreases when the domestic investor base broadens, inflation declines and fiscal policy becomes sounder. The results therefore suggest that potential currency and maturity mismatches arising from risky public domestic debt compositions can mainly be alleviated through better policies. By contrast, the share of indexed debt decreases specifically in larger countries and when inflation declines. This suggests that vulnerabilities arising from contingent interest payments can mainly be reduced by exploiting scale effects and with higher monetary credibility.

The results are broadly robust to changes in the estimator, in the definitions of the variables and to additions of other potential determinants. In this respect, we find that the exchange rate regime, capital account openness, property right enforcement, foreign investor appetite and the role of local banking sectors also matter for some of the measures of risky public domestic debt.

From a policy perspective, monitoring risky public domestic debt compositions in emerging economies becomes increasingly relevant to global financial stability given the rapid development of local bond markets. Risk monitoring should increasingly focus on indicators of domestic rather than external debt sustainability. The set of indicators used to monitor financial

vulnerabilities in emerging economies on a regular basis might therefore also need to evolve. Measures of risk arising from public domestic debt composition might be one indicator to consider, in this new context.

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ANNEX - Table A – Sources and definition of the data on domestic debt composition in emerging economies

Country	Available data	Sample size	Source
Argentina	Debt securities issued in foreign currency; debt securities issued in domestic currency (of which; securities issued with a fixed coupon: bocones; préstamos garantizados)	1994-2002	Courtesy of the National Office of Public Credit (www.mecon.gov.ar)
Brazil	Issues with maturity above 1 year; short-term issues; issues with prefixed-rate (of which with a maturity above 1 year); issues indexed to the SELIC; issues indexed to inflation; FX-indexed issues; other issues	1999-2006	Treasury (www.stn.fazenda.gov.br)
Bulgaria	Short-term debt securities in Bulgarian leva with a fixed coupon; long and medium-term debt securities in Bulgarian leva with a fixed coupon; other long and medium-term debt securities (in euro); government securities issued for structural reform; euro-denominated government securities issued under § 10 of TFP of SBL/ 1999; Domestic government guarantee securities	1999-2004	Ministry of Finance (www.minfin.government.bg)
Chile	Debt securities denominated in Chilean peso, of which: long-term/ fixed rate (BCPs); indexed to Unidad de Fomento; exchange rate-indexed or in US dollar	1994-2006	Ministry of Finance (www.hacienda.gov.cl)
Colombia	TES (bonds) of which: fixed rate (tasa fija); fixed/inflation adjusted (UVR fija); floating/ inflation adjusted (IPC)	2001-2006	Ministry of Finance and Public Credit (www.minhacienda.gov.co)
Croatia	Short-term debt securities; PPI indexed debt securities; frozen FX deposits; bonds-series 04 D-8 (Croatian kuna); other medium & long-term bonds	1997-2003	Ministry of Finance (www.mfin.hr)
Czech Republic	Treasury bills; Treasury bonds; other financing sources	1994-2006	Ministry of Finance (www.mfcr.cz)
Egypt	Treasury bills; tradable bonds; FX-denominated issues	1994-2006	Central Bank of Egypt (www.cbe.org.eg)
Estonia	Short term debt securities; long-term debt securities	1999-2003	Ministry of Finance (www.fin.ee)
Hong Kong	Treasury bills; Treasury bonds	1994-2006	Hong Kong Monetary Authority (www.info.gov.hk/hkma)
Hungary	Debt securities, of which: Treasury bills, bonds (including fixed rate bonds, floating rate bonds)	1994-2006	Government Debt Management Agency (www.allampapir.hu)

India	Long-term debt securities (GOIs), of which with a floating interest rate; Treasury bills	1994-2004	National Stock Exchange of India (www.nse-india.com)
Indonesia	Domestic securities; of which tradable debt securities (variable rate; fixed rate)	1999-2005	Ministry of Finance (Courtesy of the Directorate General of Treasury)
Israel	Total tradable debt securities; CPI linked debt securities, US dollar linked debt securities, Non-linked floating coupon debt securities, Non-linked fixed coupon debt securities; Non-tradable debt (CPI-linked)	1999-2004	Ministry of Finance (Courtesy of the Debt Management Unit)
Korea	Treasury bonds; National housing bonds; Grain securities; FX stabilisation fund bonds	1994-2004	National Statistical Office (http://kosis.nso.go.kr)
Latvia	Treasury bills; Treasury medium-term bonds; Treasury long-term bonds	1997-2006	Financial resources department of the State Treasury (www.kase.gov.lv)
Lithuania	Treasury bills; saving notes; bonds and notes, of which: no. 61001 (floating rate)	1994-2006	Ministry of Finance (www.finmin.lt)
Lebanon	Treasury bills; Treasury bonds	1994-2006	Central Bank of Lebanon (www.bdl.gov.lb)
Malaysia	Treasury bills; Islamic bonds; bonds (fixed rates)	1994-2006	Central Bank of Malaysia (www.bnm.gov.my)
Mexico	Treasury bills (CETES), bonds (of which: fixed rate bonds (Bonos); floating rate bonds (Bondes); CPI-linked bonds (Udibonos))	1994-2006	Ministry of Finance and Public Credit (www.shcp.gob.mx)
Peru	Direct bonded debt of the central government, including bonos soberanos (tasa fija)	2002-2004	Ministry of Economy and Finance (www.mef.gob.pe)
Philippines	Government securities (incl. special issues); Treasury bills; FX-linked securities; fixed rate bonds (incl. 0-coupons)	1999-2006	Bureau of the Treasury (www.treasury.gov.ph)
Poland	Treasury bills; marketable bonds (of which: fixed rate bonds; floating rate bonds; inflation-indexed bonds)	1997-2005	Ministry of Finance (www.mofnet.gov.pl)

Russia	GKO's (Treasury bills); OFZ-PD (maturity above 1 year, constant coupon); OFZ-FD maturity above 1 year, fixed coupon); OFZ-AD (maturity above 1 year, net of variable coupon)	1994-2006	Ministry of Finance (www.minfin.ru)
Singapore	Treasury bills; Treasury bonds	1994-2006	Singapore Government Securities (www.sgs.gov.sg)
Slovakia	Treasury bills; Treasury bonds with a fixed rate; Treasury bonds with a floating rate	1995-2004	National Bank of Slovakia (www.nbs.sk)
Slovenia	Short-term debt; Bonded debt (of which: in Slovenian tolar, long-term & with a fixed interest rate; other)	1994-2004	Ministry of Finance (www.gov.si/mf)
South Africa	Treasury bills; Treasury bonds (of which: with a fixed interest rate)	1999-2006	South African Reserve Bank (www.reservebank.co.za)
Taiwan	Treasury bills; Treasury bonds	1994-2006	Central Bank of China (www.cbc.gov.tw)
Thailand	Treasury bills; Treasury bonds	1994-2006	Thai Bond Dealing Centre (www.thaibdc.or.th)
Turkey	Treasury bills; Treasury bonds in domestic currency (of which: with a fixed interest rate); Treasury bonds in foreign currency	1998-2004	Treasury (www.treasury.gov.tr)
Uruguay	Treasury bills (in US dollar, peso, indexed); Treasury bonds in US dollar; indexed Treasury bonds	1999-2006	Central Bank of Uruguay (www.bcu.gub.uy)
Venezuela	Treasury bills (Letras del Tesoro); bonds (Bonos DPN, of which bonds with a fixed rate)	1999-2006	Ministry of Finance (www.mf.gov.ve)