# Local currency bond market development in Sub-Saharan Africa: A stock-taking exercise and analysis of key drivers

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# Local currency bond market development in Sub-Saharan Africa: A stock-taking exercise and analysis of key drivers

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**Abstract**
This paper studies the current state and drivers of government local currency bond market (LCBM) development in Sub-Saharan Africa. We argue that well-developed government LCBMs could reduce countries' exposure to external shocks; help overcome 'original sin'; facilitate domestic savings mobilisation; and may have important financial, macroeconomic and institutional spill-overs. With detailed information collected from various sources the paper first shows that quite a few African countries have made significant progress in developing LCBMs. Increasingly, African governments issue fixed-rate local currency bonds with tenors of ten years and more on a regular basis. However, we also find that LCBMs in Africa often have low liquidity, feature very few corporate securities and generally have relatively narrow investor bases dominated by commercial banks. The second part of the study presents an econometric analysis of the drivers of African government LCBMs based on a new high-quality panel dataset compiled by the OECD. Our results indicate that LCBM capitalisation is correlated negatively with governments' fiscal balance and inflation, and positively with common law legal origins, institutional quality and strong democratic political systems.

**Keywords:** public debt; local currency bonds; Sub-Saharan Africa

**JEL codes:** H63; O16; O55

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# 1. Introduction

Concerns about financial stability associated with the external financing of developing countries have led to a renewed interest in the development of their domestic capital markets. Most notably, in November 2011 the G20 endorsed an action plan to support the development of local currency bond markets (LCBMs) in emerging markets and other developing economies and called upon international organisations to cooperate in data collection and analytical work on LCBMs.[1] This resulted in a joint 'diagnostic framework' (IMF, World Bank, EBRD and OECD 2013), a toolkit designed to help country authorities analyse the state of their LCBMs and identify reform priorities.

This paper focuses on government LCBMs in Sub-Saharan Africa more specifically, long time a blind spot in bond market research; mostly due to its relative underdevelopment and a lack of reliable, comparable data. Only very recently a number of studies have analysed African LCBMs (Blommestein and Horman 2007; Adelegan and Radzewicz-Bak 2009; Mu et al. 2013).

At least four important reasons can be distinguished for the further development of liquid LCBMs in Sub-Saharan Africa. First, the global financial crisis and its spill-overs have demonstrated that developing economies, in Africa and elsewhere, remain vulnerable to external shocks, including sudden stops in private capital flows (Essers 2013). Moreover, developing countries may face a more limited availability of official, concessional finance in the (near) future (Dabla-Norris et al. 2015; Dang et al. 2013). This would especially affect aid-dependent African countries. Well-developed LCBMs, with a broad local investor base, would reduce countries' exposure to external finance shocks, acting as a 'spare tyre' that stabilises the domestic economy (Anderson et al. 2011; Turner 2012).

Second, developing economies have traditionally not been able to borrow in their local currency from abroad or even domestically (except with ultra-short maturities), a phenomenon known as 'original sin' (Eichengreen and Hausmann 1999; see Khan 2005 on Africa). Original sin often leads to severe currency mismatches, with destabilising effects in case of real exchange rate pressure (Goldstein and Turner 2004; Eichengreen et al. 2005). LCBM development has the potential to reduce original sin by changing debt denomination from predominantly foreign to local currencies; by lengthening maturities; and by attracting non-resident investors to buy longer-term local currency bonds (Essers and Cassimon 2012).

Third, Sub-Saharan Africa is in urgent need of additional funds for growth-enhancing investment, notably in infrastructure (Foster and Briceño-Garmendia 2010; OECD 2012). Part of the funding needs could be fulfilled using government and corporate infrastructure project bonds (Mbeng Mezui and Hundal 2013). More generally, LCBMs could help mobilising Africa's domestic savings by improving financial intermediation, discouraging capital flight and even encouraging capital to return; much of Africa's private wealth has traditionally been held abroad, making the region a net capital exporter to the rest of the world (Collier et al. 2001; Ndikumana and Boyce 2011).

Fourth, the process of government LCBM development in particular has positive spill-over effects. These include boosting broader financial market development, as government bonds fulfil the role of 'safe asset' in the domestic economy and of pricing benchmark; encouraging sounder macroeconomic and monetary policy, as governments are forced to put

their house in order and central banks use government securities in their open-market transactions; and furthering institutional quality, as LCBMs require a strong legal framework and may contribute to building governments' domestic accountability (World Bank and IMF 2001; Kumhof and Tanner 2005; Abbas and Christensen 2010; IMF et al. 2013; Mu et al. 2013; Laeven 2014).

LCBMs are no panacea however. Especially in their initial stages of development, government LCBMs could potentially even crowd out private sector credit (Christensen 2005; Mbate 2013). Large holdings of government bonds by domestic banks may reduce their efficiency and shrink their private sector loan portfolios (Emran and Farazi 2009; Hauner 2009; Ismihan and Ozkan 2012). It has also been noted that debt service costs and refinancing/interest rate risks on local currency bonds are higher when compared with non-market funding such as concessional bilateral and multilateral loans (Beaugrand et al. 2002; Christensen 2005; Hanson 2007). The optimal public debt structure is one that balances important trade-offs: local vs. hard currency, domestic vs. external creditors, short vs. long maturities, and nominal vs. price-indexed debt (Blommestein 2005; Panizza 2008, 2010). As in advanced and emerging economies, African government LCBM development should ultimately be part of a broader, risk-based public debt management strategy (Blommestein 2005; Blommestein and Santiso 2007).

The contribution of this paper to the existing literature on government LCBMs in Sub-Saharan Africa is threefold. First, bringing together cross-country information that was hand-collected from various sources, we present a detailed account of the current state of African government LCBMs. This large cross-country overview features several LCBM indicators that are absent from previous work (e.g., Bua et al. 2014), including bond tenors, common bond coupon types and bond auction frequency. We find that several African governments now issue fixed-rate local currency bonds with tenors of ten years and more on a regular basis, but also uncover that African LCBMs are generally marked by low secondary market liquidity, narrow investor bases dominated by commercial banks, and few corporate securities.

Second, we introduce a new high-quality panel dataset, compiled by the OECD (2013), that covers central government debt in 15 selected Sub-Saharan African countries over the period 2003-2012. This dataset was sourced directly from African debt management offices through circulation of a standardised questionnaire, unlike in other papers that tend to mix primary and secondary data (e.g., Mu et al. 2013; Bua et al. 2014), hence allowing us to construct a fully comparable and consistent measure of government LCBM capitalisation, i.e., local currency marketable central government debt as a percentage of GDP. Our set of sample countries is small but more diverse than the group of African low-income countries on which Bua et al. (2014) present detailed debt structure data, which makes for interesting between-country comparisons.

Third, the current paper is the first to conduct an econometric analysis of the drivers of government LCBM capitalisation in Africa based on this alternative OECD dataset and complements and extends earlier work. For example, we include in our analysis explanatory variables such as inflation, democracy and other government debt stock, which have been ignored in comparable studies on Africa (Adelegan and Radzewicz-Bak 2009; Mu et al. 2013), and perform a battery of additional robustness tests. Our key findings are that, on

average, government LCBM capitalisation is larger in African countries with lower fiscal balances, lower inflation, common law legal origins, higher institutional quality and stronger democratic political systems. Controlling for unobserved country-specific heterogeneity and persistence in LCBM development, we find above all that a worsening fiscal balance and declining inflation are associated with increases in government LCBM capitalisation.

## 2. Taking stock: Sub-Saharan Africa's government LCBMs in perspective

### *2.1. Domestic vs. external public debt*

To place government LCBMs in a broader perspective, it is useful to first distinguish between domestic and external public debt. Panizza (2008) identifies three possible ways to make this distinction: based on the currency of the debt; based on creditor residency; or based on the place of issuance and legislation governing the debt contract. The second definition of domestic and external public debt is analytically most correct, but difficult to apply in practice with respect to bonded debt, since it requires periodic surveys to identify the ultimate bond holders. That is why, typically, the third method, and in some instances the first method, are used as more feasible alternative taxonomies (see e.g., IMF and IDA 2013).

Figure 1 shows the historical evolution of (unweighted) average domestic and external public debt as a percentage of GDP, for the whole of Sub-Saharan Africa and separately for countries that have benefitted from the Heavily Indebted Poor Country (HIPC) initiative (since 1996) and its successor, the Multilateral Debt Relief Initiative (MDRI), and non-HIPCs (see Essers and Cassimon 2012). It is clear that, largely due to external debt relief under HIPC and MDRI, total public debt ratios have come down dramatically since 2000 and domestic public debt now constitutes an important part, around 40%, of African public debt stocks. On average, the build-up of domestic public debt by African non-HIPCs was larger than by HIPCs. But also HIPCs tapped domestic markets, allegedly since they were limited in their non-concessional external borrowing as part of IMF programmes (Arnone and Presbitero 2010).

Importantly, not all domestic public debt reported in Figure 1 consists of (longer-tenor) government bonds denominated in local currency. According to the definitions applied by international organisations that collect data on domestic public debt, it may include a whole range of financial liabilities, including (but not limited to) securities such as bonds, notes, bills and commercial paper; currency and deposits; insurance technical reserves; financial derivatives; and other accounts payable, such as trade credits and central bank advances (see BIS, Commonwealth Secretariat, ECB, Eurostat, IMF, OECD, Paris Club, UNCTAD, and World Bank 2013). This in turn means that the above-mentioned benefits of government LCBMs do not automatically materialise in countries with large domestic public debt, and that narrower measures are needed to gain further insights into domestic public debt's potential and vulnerabilities.

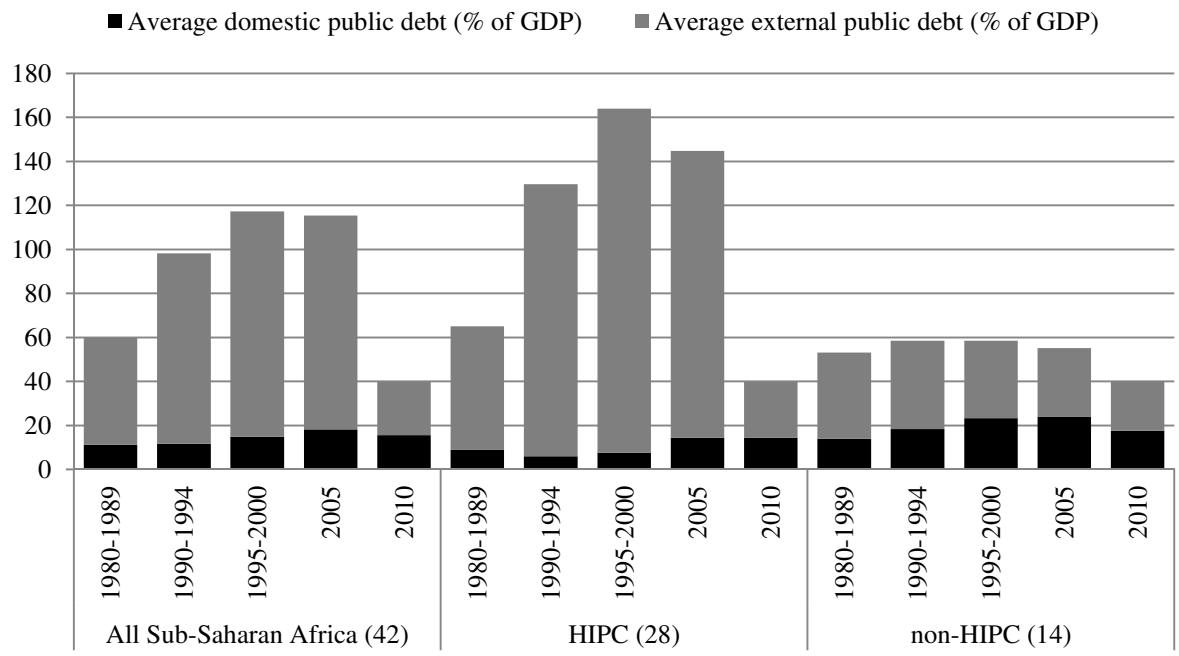


**Figure 1. Evolution of average domestic and external public debt (as % of GDP) in Sub-Saharan Africa, 1980-2010**

Notes: historical averages are from Christensen (2005); 2005/2010 figures from IMF Country Reports. Data are for most countries limited to central government debt, but sometimes include state and local governments and/or public company debt. Domestic-external debt classification is, in most cases, based on place of issuance. Comoros, Equatorial Guinea, Eritrea, Djibouti, Mauritania, Somalia and South Sudan are excluded for data availability reasons.

Ideally, one would decompose overall domestic public debt figures, not only by type of instrument, but also by currency, maturity and creditor type. Such detailed information is, however, not systematically available for a larger sample of African countries; although some useful information exists (see Presbitero 2012). For a sample of African HIPCs, Arnone and Presbitero (2010) show that between 1994 and 2003 the growing domestic public debt stock was strongly biased towards short-term instruments (mainly treasury bills), suggesting that external public debt's currency mismatches were initially replaced by domestic public debt's maturity mismatches (Christensen 2005). Using 1996-2011 data on 15 low-income countries (of which ten are Sub-Saharan African), Bua et al. (2014) find that central bank advances are still an important category of domestic public debt (especially in HIPCs), although the share of longer-term marketable securities such as bonds has grown over time.

## *2.2. Current state of government LCBMs*

In the remainder of the paper we focus on one particular subcategory of domestic public debt, i.e., local currency marketable central government debt (or government LCBMs in short), irrespective of the residency of creditors or place of issuance.[2] Table 1 presents information on a number of fairly detailed quantitative and qualitative government LCBM indicators for selected Sub-Saharan African countries, to which we have added as an appendage one column on corporate LCBM capitalisation. These cross-sectional data represent the most up-to-date

cross-checked information we were able to collect from various sources, primarily OECD (2013), Mu et al. (2013), the African Development Bank's AFMI website, Standard Chartered Bank's Local Market Compendium 2014 and Ecobank's Middle Africa Market Update. To our knowledge, these detailed indicators are not available in panel data format (apart from LCBM capitalisation figures, see below). Table 1, although uneven in terms of data coverage, gives some idea of the various stages of government LCBM development countries in the region have attained.[3]

South Africa's government LCBM is by far the largest and most developed in Sub-Saharan Africa. In relative terms (as a percentage of GDP), its outstanding central government marketable debt is only surpassed by tiny Mauritius and Eritrea (a country that only issues treasury bills). Other relatively large government LCBMs are those of Kenya, Ghana, Ethiopia, Malawi and Nigeria.[4] Also Zambia, Uganda, Namibia and Tanzania had central government marketable debt stocks in excess of 10% of GDP in 2012.

Note that quite a few African governments are now able to issue domestic longer-term bonds in local currency. In addition to South Africa, also Kenya, Namibia and Nigeria have successfully issued bonds with original maturities of 20 years or more; Botswana, Mauritius, Angola, Lesotho, Swaziland and a number of former HIPCs (Tanzania, Uganda, Zambia, Ethiopia and Mozambique) have issued bonds with tenors of at least ten years. Many of these governments have concrete plans to issue local currency debt with even longer maturities, thereby reducing original sin in Sub-Saharan Africa (Essers and Cassimon 2012).

Another notable feature is that most government bonds have fixed-rate coupons. But there are exceptions, such as Angola, where issues also include bonds denominated in and indexed to foreign currency as well as inflation-indexed local currency bonds (OECD 2013). About two thirds of the African countries listed in Table 1 publish an official bond auction calendar and hold government bond auctions at least quarterly; several among them hold such auctions even monthly. Half of the counties have primary dealer systems in place.

In spite of these developments, which have resulted in an expansion of African LCBMs, important policy challenges remain. Liquidity in most African LCBMs remains shallow, concentrated in government debt instruments of a handful of countries (particularly South Africa and Nigeria). Corporate LCBMs are at an early stage of development and even more illiquid than government LCBMs.[5] Only in South Africa there is currently a vibrant corporate LCBM segment. Ojah and Pillay (2009) show that firms using South Africa's LCBM are typically larger, longer-established, more profitable and less opaque than firms that borrow privately from bank and non-bank debt providers. Other African corporate LCBMs are starting to grow, but from a very low base (Mu et al. 2013). Activity is driven by relatively few issuers, mostly parastatals and commercial banks.

## Table 1. Government LCBM indicators for selected Sub-Saharan African countries

| | Central government LCBMs | | | | | | | | | | Corporate LCBMs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | **Capitalisation of marketable debt, % of GDP (year)** | **Full bond tenor span** | **Common bond tenors** | **Common bond coupon types** | **Published bond auction calendar / auction frequency** | **Primary dealer system** | **Main resident investors** | **Foreign investors** | **Restrictions on foreign investment** | **Bid-ask spread on secondary market (year)** | **Capitalisation, % of GDP (year)** |
| Angola | 7.8 (2012) | 1Y-12Y | 1Y-6Y | pre-determined / fixed; indexed; foreign currency | Yes / weekly | No | mainly commercial banks; also institutional investors (pension funds and insurance companies), central bank, and mining and oil companies | negligible | Yes, strict exchange controls | no active secondary market | no corporate bond market |
| Botswana | 3.7 (2010) | 2Y-15Y | existing bond issues tapped at auction | fixed; floating | No / de facto half-yearly | Yes | mainly institutional investors (insurance companies and pension funds); also commercial banks and central bank | negligible | Yes, only up to 20% of bonds issued | 20bps (2013) | 3.1 (2010) |
| Burundi | 2.2 (2008) | 2Y-5Y | N/A | N/A | No / ad hoc | No | mainly local commercial banks (65% in 2011); also institutional investors | negligible | No | very illiquid secondary market | no corporate bond market |
| Eritrea | 45.5 (2010) | only bills | none | none | No / none | No | N/A | N/A | N/A | no secondary market | no corporate bond market |
| Ethiopia | 20.6 (2009) | 5Y-10Y | N/A | fixed; floating; foreign currency | No / ad hoc | No | commercial banks and institutional and retail investors | none | Yes; infrastructure bonds only available to Ethiopian nationals and diaspora | no active secondary market | 7.2 (2010) |
| Ghana | 23.7 (2010) | 1Y-7Y | 1Y-7Y | fixed | No / de facto weekly | Yes | mainly commercial banks (35% in 2013); also national pension fund, retail investors, insurance companies, firms | considerable (>30% in 2013) | Yes, only allowed in bonds with tenors ≥3Y | 50bps (2013) | <0.1 (2010) |
| Kenya | 24.7 (2012) | 1Y-30Y | 2Y-20Y | fixed | Yes / monthly | No | mainly local commercial banks (50% in 2013); also institutional investors (incl. mutual/pension funds and insurance companies) (30%) | limited (<1% in 2013) | No | 50bps (2013) | 0.7 (2010) |
| Lesotho | 5.0 (2010) | 3Y-10Y | N/A | fixed | Yes / two-monthly | No | mainly commercial banks (90% in 2012); also institutional investors | negligible | No | very illiquid secondary market | no corporate bond market |
| Madagascar | 6.6 (2012) | only bills | none | fixed | No / none | No | mainly commercial banks (80% in 2012) | negligible | No | very illiquid secondary market | no corporate bond market |
| Malawi | 19.1 (2012) | 2Y-5Y | N/A | fixed | No / ad hoc | No | mainly central bank (75% in 2012); also commercial banks (15%), pension funds | negligible | Yes, only up to 10% of any class of security | very illiquid secondary market | N/A |
| Mauritius | 40.5 (2012) | 3Y-15Y | 3Y-5Y | fixed; floating; indexed | Yes / monthly | Yes | diversified: institutional investors (incl. pension funds and insurance companies) (55% in 2013); commercial banks (40%); also central bank, retail investors | limited (<1% in 2013) | No | 50-100bps (2013) | 0.16 (2006) |

**Table 1. (*Continued*)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mozambique | 4.5 (2012) | 3Y-10Y | 3Y-5Y | fixed; floating | Yes / at unequal intervals | Yes | mainly commercial banks (65% in 2013); also central bank, insurance companies, investment management companies | negligible | Yes, exchange controls and foreign investment only allowed in specific bond issues | very illiquid secondary market | few corporate bonds |
| Namibia | 11.1 (2010) | 2Y-22Y | N/A | fixed | Yes / two-weekly | No | mainly pension funds and insurance companies | N/A | No | illiquid secondary market | 6.2 (2010) |
| Nigeria | 15.2 (2012) | 2Y-20Y | 3Y-20Y | fixed; floating | Yes / monthly | Yes | mainly local commercial banks (55% in 2012) and institutional investors (incl. pension funds and insurance companies) (20%), also central bank | considerable (20% in 2012) | No | 8-12bps for ≤3Y); 3-6bps for >3Y (2013) | 3.8 (2010) |
| Rwanda | 8.8 (2010) | 2Y-5Y | N/A | fixed | Yes / quarterly | No | mainly commercial banks, pension funds and insurance companies; also retail investors | limited | No | very illiquid secondary market | <0.1 (2010) |
| Sierra Leone | 7.5 (2012) | 1Y (and 5Y non-traded) | 1Y | fixed | Yes / monthly | Yes | mainly commercial banks (75% in 2013); also central bank, institutional and retail investors | N/A | No | very illiquid secondary market | no corporate bond market |
| South Africa | 34.9 (2012) | 1Y-35Y (> for indexed) | 2Y-10Y for fixed; 7Y-30Y for indexed | fixed; indexed | Yes / weekly | Yes | mainly institutional investors (incl. pension funds and insurance companies) (45% in 2013); also commercial banks (15%), central bank, retail investors, mutual funds and other | considerable (35-40% in 2013) | No | 2-4bps for fixed; 3-5bps for indexed (2013) | 20.0 (2010) |
| Swaziland | 6.4 (2010) | 2Y-10Y | N/A | fixed; floating | Yes / at unequal intervals | Yes | mainly commercial banks (70% in 2013); also non-bank financial institutions (20%), central bank and others | limited | No | very illiquid secondary market | 0.7 (2010) |
| Tanzania | 10.4 (2012) | 2Y-15Y | 2Y-10Y | fixed | Yes / two-weekly | Yes | mainly commercial banks (55% in 2013); also institutional investors (incl. pension funds and insurance companies) (40%), central bank | N/A | Yes, only nationals and EAC foreigners can invest in bonds | 50bps (2013) | 0.3 (2010) |
| Uganda | 13.0 (2012) | 2Y-15Y | 2Y-3Y | fixed | Yes / monthly | Yes | mainly commercial banks (50% in 2013); also institutional investors (incl. national social security fund and insurance companies), central bank | considerable (10-20% in 2013) | No | 50bps (2013) | 0.4 (2010) |
| Zambia | 13.6 (2012) | 2Y-15Y | 2Y-5Y | fixed | Yes / quarterly | No | mainly commercial banks (35-50% in 2013); also institutional investors (incl. pension funds and insurance companies) (>30%), central bank (15%) | limited (5% in 2012) | No | 100bps (2013) | 0.6 (2010) |

Notes: Data are from OECD (2013), Mu et al. (2013), AFMI website (africanbondmarkets.org; last consulted: 16 October 2014), Standard Chartered Bank's Local Market Compendium 2014, Ecobank's Middle Africa Market Update (various issues) and country-specific documents. 'Indexed' = bond coupon indexed to domestic inflation rate. 'Floating' = bond coupon linked to domestic or international reference interest rate. 'N/A' = not available.

Local banks continue to be the dominant investor class in African government LCBMs. According to Table 1 domestic commercial banks often hold 50% or more of outstanding government securities, especially in countries with the least developed LCBMs (Lesotho, Sierra Leone, Swaziland and Burundi). In some cases this situation reflects regulatory or supervisory requirements for banks to hold government debt in portfolio, but it may also mirror other forms of financial repression (Blommestein and Horman 2007). The dominance of local commercial banks matters for several reasons. First, a sound banking system is thought to be a key precondition for LCBM development (Ozkan et al. 2010; IMF et al. 2013). Second, in the event of a domestic banking crisis, local banks' bond holdings become overnight government debt (Panizza 2010). Third, with banks as the dominant investor class government LCBMs will no longer act as a 'spare tyre' when countries are facing a banking stress-induced credit crunch (Eichengreen 2008). Fourth, excessive holdings of local currency government debt by local banks increase the likelihood of crowding out private sector credit. This last point is of particular relevance in the African context, where private companies rely primarily on bank lending, partly due to the underdevelopment of corporate LCBMs (Christensen 2005). Therefore, an encouraging evolution in a number of African LCBMs is the growing role of local non-bank, institutional investors. For example, South African pension funds are now the largest group of resident investors in government bonds. Local pension funds and/or insurance companies are also major bond holders in Botswana, Mauritius, Namibia and Tanzania, while they account for non-negligible shares in Kenya, Nigeria, Uganda, Zambia and others. As these institutional investors seek to match long-term assets with long-term liabilities (Adelegan and Radzewicz-Bak 2009), their expansion has gone hand-in-hand with the lengthening of government bond maturities.

Another dimension covered (although very unevenly) by Table 1 is the presence of foreign investors in government LCBMs and the existence of restrictions thereon. We observe a diverse pattern. For example, in Ethiopia foreigners are banned completely from investing in infrastructure bonds. Both Angola and Mozambique operate strict exchange controls, whereas Botswana and Malawi apply quotas to foreign investment in certain government bond issues. Tanzania has only very recently opened up its LCBMs to residents of the East African Community (EAC). De facto, only South Africa, Ghana, Nigeria and Uganda have markets with a considerable foreign presence. Foreign bond investment in emerging government LCBMs has both pros and cons. On the one hand, foreign investor participation expands the investor base, increasing liquidity and demand for longer-maturity bonds (IMF et al. 2013). Also, it may put extra pressure on improving financial intermediation and market infrastructure, thereby strengthening market functioning (World Bank and IMF 2001; Peiris 2010). On the other hand, greater reliance on foreign investors increases the vulnerability of host countries to international shocks, especially of countries with weaker fundamentals (Ebeke and Lu 2014).

# 3. Drivers of government LCBMs in Sub-Saharan Africa

## *3.1. Related literature*

The question of what drives domestic public debt, and government LCBM development more particularly, in emerging markets and other developing countries has been the subject of a relatively new, but growing literature. Some authors study the determinants of the domestic share of total public debt or domestic public debt's composition (Guscina 2008; Mehl and Reynaud 2010; Forslund et al. 2011), whereas others focus more narrowly on original sin (Hausmann and Panizza 2003; Mehl and Reynaud 2005) or emerging market LCBMs (Burger and Warnock 2006; Eichengreen and Luengnaruemitchai 2006; Claessens et al. 2007; Eichengreen et al. 2008; Bae 2012; Bhattacharyay 2013). The current paper is most related to two recent papers that look at Sub-Saharan Africa in particular.[6] Both Adelegan and Radzewicz-Bak (2009) and Mu et al. (2013) use IMF and World Bank data to analyse the drivers of African government bond market capitalisation. They find that the capitalisation of such markets is affected by variables such as overall economic development, country area size, the fiscal balance, interest rate spreads, exchange rate and interest rate volatility, banking sector size, trade and capital account openness, common law legal origins and institutional quality. Some of these variables also seem to correlate with corporate bond markets.

## *3.2. Empirical strategy and data description*

### 3.2.1. Model specification

We estimate a series of panel data models which, in their most general form, can be written as follows:

$$Y_{i,t} = \alpha + \beta X_{i,t-1} + \delta\mu_i + \gamma\pi_t + \varepsilon_{i,t}\,; \qquad (1)$$

where $Y_{i,t}$ is the dependent variable, i.e., government LCBM capitalisation for country i in year t; $X_{i,t-1}$ is a vector of one-year lagged[7] time-varying and time-invariant explanatory variables derived from the literature and described in more detail below; $\mu_i$ are country-specific effects; $\pi_t$ is a common global factor; and $\varepsilon_{i,t}$ is a well-behaved error term.

In our search for drivers of government LCBMs, we will use and compare a variety of panel data estimation techniques and model specifications. For our baseline estimations we rely on (i) pooled ordinary least squares (POLS) estimation, assuming a common intercept across countries ($\delta = 0$ in Equation (1)) and (ii) the fixed effects (FE) ('within') estimator, which allows for country-specific effects that are correlated with other regressors. In the robustness section we also discuss the results of (iii) feasible generalised least squares (FGLS) and (iv) the random effects (RE) estimator. Due to limited within-country variation in our sample (see below) and relatively small sample size, some of the traditional diagnostic tests we present may not provide definitive answers to questions of model choice. Moreover, given

the dominance of between-country variation, it makes sense to consider other estimators in parallel with FE (which eliminates all time-invariant heterogeneity between countries).

In separate regressions we will explicitly control for persistence in LCBM capitalisation, in view of the possibility that government LCBM development is a process of gradual adjustment. We do so by adding a lag of the dependent variable, $Y_{i,t-1}$, to Equation (1) and estimating the autoregressive relation by means of the 'system' generalised method of moments (GMM) estimator, which uses internal instrumental variables to overcome dynamic panel bias.

### 3.2.2. Sample, data sources and descriptive statistics

As the source for our dependent variable we use the fourth edition of the OECD's African Central Government Debt Statistical Yearbook (OECD 2013), henceforth the 'African Yearbook', which has a number of advantages over the datasets used by related papers covering Sub-Saharan Africa. First of all, the African Yearbook sources all its data on debt stocks directly from African debt management offices (or similar national agencies) participating in the OECD Project on African Public Debt Management and Bond Markets (see Blommestein and Ibarlucea Flores 2011), whereas other papers tend to mix primary and secondary (usually IMF and World Bank) data (e.g., Mu et al. 2013; Bua et al. 2014). Data collection is accomplished through a standardised questionnaire, circulated since 2010, that follows the methodology of the Statistical Yearbook on Central Government Debt for OECD countries, which contributes to the cross-country comparability of debt stock data.

Second, the African Yearbook explicitly covers only *central government* debt (excluding the debt of state and local governments, social security funds and other state guarantees, which tend to be more heterogeneous across countries) and classifies this debt according to *currency* and whether or not it concerns *marketable* instruments.[8] This allows us to construct a measure of government LCBM capitalisation, i.e., year-end outstanding local currency marketable central government debt as a percentage of GDP (*lc_mdebt_gdp*), which proxies well the kind of debt stock that protects governments against currency mismatches and generates positive spill-overs (see above). Other datasets classify government (marketable) debt based on creditor residency (Bua et al. 2014) or the place of issuance (Mu et al. 2013) and do not seem to explicitly take into account currency denomination.

The fourth edition of the African Yearbook covers 17 countries over the span of ten years, from 2003 to 2012: Angola, Cameroon, Gabon, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Sierra Leone, South Africa, Tanzania, Uganda, Zambia (all Sub-Saharan Africa), and Morocco and Tunisia. Limiting ourselves to the 15 Sub-Saharan African countries only, leaves us with government LCBM capitalisation figures for an almost balanced panel sample of 137 observations. Because of the limited coverage of countries, we cannot claim that our results will be fully representative of government LCBMs in Sub-Saharan Africa. Nevertheless, we believe this small but diverse set of African low-income, lower-middle-income and upper-middle-income countries makes for interesting comparisons.

Figure A.1 in Appendix evaluates our dependent variable against figures from Mu et al. (2013), which in principle should be similar, except for the fact that the latter do not

exclude domestically issued *foreign currency* marketable debt. It shows that the data generally correspond well, although not always. Closer inspection reveals large (hard-to-explain) breaks in Mu et al.'s (2013) government debt series for some countries, including Uganda and Sierra Leone, unlike in the African Yearbook data. Our analysis of an alternative dataset therefore constitutes a useful check of Mu et al.'s (2013) findings.

Figure A.2 in Appendix plots the evolution of government LCBM capitalisation in our sample. There seems to be no clear common trend over the 2003-2012 period. In Mauritius, for example, market capitalisation steadily declined from 2003 to 2008 and remained stable thereafter, whereas in South Africa it increased rapidly after reaching a trough in 2009. The expansion of South Africa's government LCBM in recent years is also apparent from Figure A.3 in Appendix, which plots the size of the four largest government LCBMs in absolute (nominal) US$ terms. Other notable expansions are those of Nigeria, over the whole of the 2003-2012 period, and of Angola in 2008.[9] Figure A.4 in Appendix shows government LCBMs' share of total central government debt. Again we observe large country variations and very different trajectories. In South Africa and Mauritius LCBMs constituted more than 80% of total government debt over the full sample period; whereas in Nigeria the share of LCBMs increased from just over 20% in 2003-2004 to 80% and beyond in 2006-2012, due to a huge debt relief package agreed on with Nigeria's Paris Club creditors in October 2005. Similarly, the large increase in the range of LCBM shares of total government debt for other sample countries from 2006 onwards seems to have gone together with HIPC and MDRI debt relief. We will examine in greater detail the effect of debt relief on government LCBM capitalisation in the robustness section.

The independent variables in our analysis were assembled from different databases and selected in line with the literature and maximum data availability for our specific sample. Table A.1 in Appendix lists all baseline variables, their labels, definitions and sources and gives the descriptive statistics. Below we discuss the rationale for incorporating them in our models as potential determinants of government LCBM capitalisation.

***Country size***

Larger-sized economies have scale advantages in developing deep and liquid LCBMs as the greater availability of potential buyers and sellers reduces price volatility and encourages investment, or because of important fixed market infrastructure costs (Eichengreen and Luengnaruemitchai 2006; Claessens et al. 2007). Also, LCBMs of larger economies are said to more easily attract foreign investors due to the greater diversification benefits they offer (Hausmann and Panizza 2003). On the other hand, smaller countries may need to rely more heavily on domestic public funding, lacking the creditworthiness to borrow sizeable amounts from abroad (Mu et al. 2013). We use log GDP at purchasing power parity (PPP) as our preferred measure of economic size (*ln_gdp_ppp*). We complement it with a geographic measure of size, log surface area in squared kilometres (*ln_area*).

***Economic development***

Financial development, in its various aspects, is often thought to co-evolve with broader economic development (see e.g., Calderon and Liu 2003; Levine 2005). Financial intermediation makes capital formation and investment possible by bringing together savers and borrowers. But as an economy grows, the demand for financial services and instruments is also expected to increase. We take log GDP per capita (PPP) as a broad proxy for the developmental stage of the economy (*ln_gdppc_ppp*). To the extent that GDP per capita is correlated with better governance and policies, stronger creditor rights and a more favourable investment climate, it may also capture some aspects of institutional quality not fully covered by the more explicit measures we consider (see below).

***Trade openness***

The expected relationship of government LCBM development with trade openness is ambiguous. On the one hand, Rajan and Zingales (2003) argue that in countries that are more open to trade, incumbent interest groups are less able to insist on policies that protect their advantage in relationship-based financing and suppress competing sources of finance, such as securities markets. On the other hand, however, for given financing needs, less integrated countries may be more incentivised to develop domestic bond markets (Mu et al. 2013). We measure trade openness as the ratio of total exports of goods and services to GDP (*x_gdp*).

***Banking sector size***

Bank- and (bond) market-based finance can be either substitutes or complements (see e.g., Levine 2002; Song and Thakor 2010). To the extent that banks already cater directly to the government there may be no immediate need to set up deep government LCBMs. But, at the same time, local banks often serve as primary dealers and market makers (Eichengreen et al. 2008). In most African countries banks are also important government bond investors themselves (see above). We follow previous studies and the broader literature on bank financing in taking as a proxy for banking sector size domestic credit provided to the private sector (as a percentage of GDP) (*domcred_gdp*).

***Fiscal balance***

Another potentially important driver is the fiscal balance, i.e., government revenue minus government expenditure. Ceteris paribus, countries running negative fiscal balances (deficits) have greater need for issuing government bonds than those with positive fiscal balances (surpluses). That said, the fiscal balance may well be endogenous to government LCBM development. Especially in Africa, many governments face constraints in their ability to borrow so that the size of fiscal deficits may be in part driven by the availability of bond financing (Mu et al. 2013). Besides, large and sustained negative fiscal balances could perhaps undermine the trust of potential LCBM investors. To smoothen out transient factors we use a three-year moving average of the general government fiscal balance, defined as the

difference between revenue and total expenditure including the net acquisition of non-financial assets by the government (and expressed as a percentage of GDP) (*av_fiscbal_gdp*).

***Inflation***

A lack of monetary policy credibility, as evident from high and/or volatile inflation rates, has been empirically established as a key impediment to developing government LCBMs (see e.g., Burger and Warnock 2006; Claessens et al. 2007). If creditors, domestic or foreign, fear that their claims may be inflated away by the government, this will prevent the latter from issuing longer-term local currency bonds (that are not indexed to domestic prices or foreign currency), unless they resort to financial repression of course (Forslund et al. 2011). Alternatively, in countries with high inflation, governments may not need to issue large debts as they derive revenues from the 'inflation tax'. However, inflation may be endogenous too. Eichengreen and Hausmann (1999), for example, propose that better-developed LCBMs may create a political constituency opposed to inflationary policies and other forms of debt dilution. In support of this assertion, Rose (2014) finds that the existence of a longer-term government LCBM significantly lowers inflation, although only so in inflation-targeting countries. We consider here the inflation rate based on the consumer price index (*infl_cp*).

***Capital account openness***

The effect of capital account openness on LCBM development is again theoretically ambivalent. Just as trade openness, an open capital account can expose countries to market discipline, which would make domestic investors more interested in bonds (Claessens et al., 2007); it is also a necessary trait to attract foreign investors. Conversely, governments may use capital controls to prevent domestic capital from leaving the country and create a captive investor base (Forslund et al. 2011). We employ a time-varying index of de jure capital account openness developed by Chinn and Ito (2006) (*kaopen*). Higher values of the index signify less capital controls and thus a more open capital account.

***Legal origins***

La Porta et al. (1998) argue that in countries whose legal rules originate in the British common law tradition investors tend to be much better protected than in countries where the legal system is based on civil law, in particular French civil law. These legal origins may be especially important for LCBMs (Claessens et al. 2007). We use a dummy variable indicating whether the country in question has common law legal origins or not (*comlaw*). In our Sub-Saharan African sample, nine out of 15 are common law countries (Kenya, Malawi, Namibia, Nigeria, Sierra Leone, South Africa, Tanzania, Uganda and Zambia); the other six all have a French civil law tradition.

***Other government debt***

Some factors we have considered so far may be correlated with both LCBMs and other marketable and non-marketable government debt stocks; but there could also be substitution effects between different kinds of debt for given financing needs. Moreover, with the exception of South Africa, Mauritius, Namibia and Angola, all countries in our sample have enjoyed substantial debt relief or at least debt restructuring in recent years, mostly as part of the HIPC initiative and MDRI. Since HIPC granted debt relief on non-marketable debt owed to foreign multilateral, bilateral and commercial creditors, while at the same time 'forcing' countries to use their domestic debt markets (Arnone and Presbitero 2010), we would again expect a negative relation between government LCBMs and the rest of the government debt stock. To ensure consistency with our dependent variable, we use as other government debt stock the *complement* of LCBM capitalisation, i.e., all central government debt apart from local currency marketable debt as a percentage of GDP, taken from the OECD's African Yearbook (*othdebt_gdp*). This broad measure thus includes all foreign and local currency non-marketable government debt (i.e., multilateral, bilateral and commercial loans, but also central bank advances) as well as foreign currency marketable government debt (i.e., foreign currency securities, irrespective of whether they were issued domestically or in international markets).

***Institutional quality***

Many institutional arrangements beyond those captured by dichotomous time-invariant legal origins could possibly have an effect on the functioning and development of government LCBMs, including contract and property rights enforcement, the impartiality of the legal system, strength of the regulatory framework and corruption (Mu et al. 2013). Since we have no priors on the relative importance of different institutional dimensions we construct a composite index from four indicators of the International Country Risk Guide (ICRG) (*comprisk_icrg*): investment profile, law and order, bureaucracy, and corruption. Higher values of the composite index indicate better overall institutional quality.[10]

***Democracy***

It is often argued that the strength of democratic political systems has a distinct impact on the choice of government policies. By extension, there may also be an impact on the pace and scope of financial sector development, including progress in LCBM development. Haber et al. (2007) claim that the openness and competitiveness of a country's political system tend to be reflected in the openness and competitiveness of its financial system. Moreover, constraints on the power of democratic governments are said to increase political stability and enhance the credibility of commitments towards investors/creditors (North and Weingast 1989). We follow Claessens et al. (2007) in using as an explanatory variable the institutionalised democracy index of the Polity IV database (*democ*) (see Marshall et al. 2013). This index scores countries on the competitiveness of political participation, the openness and

competitiveness of executive recruitment, and constraints on the chief executive; with higher scores meaning stronger democratic institutions.

From the descriptive statistics in Table A.1 in Appendix it is clear that the lion share of variation arises from differences between countries rather than from within-country changes over time, except for independent variables inflation and other government debt; an issue to which we will come back in the following sections. Panels (a)-(k) of Figure A.5 in Appendix plot our measure of government LCBM capitalisation against the proposed explanatory variables. These scatter plots suggest a positive relation of government LCBM capitalisation with economic development, trade openness, private sector domestic credit, capital account openness, common law legal origins, institutional quality and the strength of democracy; and a negative relation with country surface area, past fiscal balances, inflation and other government debt. Some of these relations however hinge on the inclusion of South Africa and/or Mauritius, which are outliers in a number of dimensions.

To control for common global conditions ($\pi_t$ in Equation (1)) we also include in our estimations the annual average of the Chicago Board Options Exchange (CBOE) Volatility Index or VIX, a general measure of global investor sentiment calculated from stock index option prices (*vix*) (with higher values indicating higher global risk aversion).[11]

## *3.3. Results and discussion*

### 3.3.1. Baseline estimation results

Table 2 presents the estimation results for different specifications of Equation (1), estimated by POLS and FE. Because of our limited sample, it is hard to find variables that are robustly correlated with the capitalisation of African government LCBMs. However, there seem to be a number of macroeconomic and institutional variables which do show significant effects and/or consistent signs throughout.

POLS estimates, which capture jointly between- and within-country variation and ignore country-specific effects, show that having better past fiscal balances is negatively correlated with LCBM capitalisation, probably because of the lesser need for governments to issue bonds. This result is in line with previous studies, for Africa and other regions. As expected, past inflation is found to exert a negative (but economically small) effect on capitalisation. Countries with a common law tradition have government LCBMs that are significantly larger than countries with legal origins rooted in French civil law, a result that is again conform with the literature. POLS models further suggest that the banking sector (the size of which is proxied by private sector credit) and government LCBMs are complements (in three out of four specifications), and indicate positive partial correlations of trade openness, overall institutional quality and the strength of democracy with LCBM capitalisation. The negative coefficient of other central government debt is not economically meaningful. Smaller-sized countries have on average relatively larger government LCBMs, but this seems to be due to the inclusion in our sample of Mauritius (which is absent from the model in column (3)). We do not discern any clear effects of GDP, GDP per capita, capital account openness or the VIX.

The picture that emerges from the FE estimates in Table 2, concentrating on within-country variation, is rather different. Worsening fiscal balances and declining inflation are still associated with increases in government LCBM capitalisation and also the positive correlation with institutional quality is preserved. Contrary to POLS, however, the FE estimator seems to point at substitution effects between banks and bonds. Furthermore, none of the other coefficients is significantly different from zero.[12] Breusch-Pagan LM tests lead to a clear rejection of the null hypothesis of no country-specific effects, whereas Hausman-type overidentification tests strongly reject the null that such country effects are uncorrelated with the other regressors, for all four model specifications. This seems to imply that the FE estimator is preferred over POLS and RE. However, diagnostic tests such as the Hausman test may perform poorly in small samples and when within-country time variation of variables is limited, which very much applies to our panel (see above). Similarly, FE's sole focus on within-country differences may not be appropriate to assess whether certain slowly-changing variables, such as institutional quality or the strength of democracy, drive government LCBM development. It thus seems imperative to also study and compare the results of other estimators, like simple POLS.

## Table 2. Baseline results - POLS/FE estimations

| | POLS | | | | FE | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | 0.134 | -0.016 | 0.147 | 0.988 | 13.731 | 13.648 | -5.576 | 15.105 |
| | [0.955] | [0.856] | [0.962] | [1.098] | [20.449] | [18.665] | [12.097] | [20.417] |
| *ln_area* | -3.609*** | -3.532*** | -1.090 | -3.163*** | | | | |
| | [0.683] | [0.626] | [1.560] | [0.755] | | | | |
| *L.ln_gdppc_ppp* | -1.507 | -1.459 | -1.863 | 1.111 | -20.352 | -19.533 | 9.523 | -23.210 |
| | [2.279] | [2.372] | [1.847] | [2.802] | [31.130] | [30.286] | [17.436] | [31.578] |
| *L.x_gdp* | 0.309*** | 0.304*** | 0.201** | 0.214* | -0.002 | -0.040 | -0.037 | -0.006 |
| | [0.084] | [0.083] | [0.073] | [0.110] | [0.056] | [0.092] | [0.072] | [0.052] |
| *L.domcred_gdp* | 0.169*** | 0.163*** | 0.128** | 0.070 | -0.098* | -0.103* | -0.091+ | -0.089+ |
| | [0.043] | [0.048] | [0.046] | [0.068] | [0.050] | [0.055] | [0.060] | [0.051] |
| *L.av_fiscbal_gdp* | -0.520*** | -0.618** | -0.287* | -0.516*** | -0.187* | -0.235** | -0.156+ | -0.205* |
| | [0.149] | [0.217] | [0.143] | [0.158] | [0.097] | [0.104] | [0.095] | [0.101] |
| *L.infl_cp* | -0.123** | -0.109** | -0.073** | -0.111+ | -0.101* | -0.108* | -0.054+ | -0.107* |
| | [0.055] | [0.047] | [0.029] | [0.067] | [0.055] | [0.054] | [0.032] | [0.058] |
| *L.kaopen* | 0.646 | 0.564 | -0.231 | 0.568 | -1.188 | -1.293 | -0.589 | -1.600 |
| | [0.698] | [0.635] | [0.831] | [0.634] | [1.470] | [1.516] | [1.220] | [1.654] |
| *comlaw* | 7.250*** | 6.971*** | 9.335*** | 6.350*** | | | | |
| | [1.841] | [1.845] | [1.928] | [1.759] | | | | |
| *othdebt_gdp* | | -0.030+ | | | | -0.005 | | |
| | | [0.018] | | | | [0.016] | | |
| *L.comprisk_icrg* | | | 4.510+ | | | | 2.859+ | |
| | | | [2.923] | | | | [2.048] | |
| *L.democ* | | | | 1.026** | | | | 0.594 |
| | | | | [0.461] | | | | [0.473] |
| *vix* | -0.071 | -0.052 | -0.046 | -0.079 | 0.024 | 0.044 | 0.015 | 0.027 |
| | [0.077] | [0.087] | [0.077] | [0.073] | [0.054] | [0.052] | [0.059] | [0.053] |
| constant | 54.728*** | 54.590** | 17.629 | 27.823 | 124.479 | 121.678 | -39.941 | 138.090 |
| | [17.920] | [18.528] | [23.918] | [22.665] | [164.158] | [165.076] | [87.518] | [166.109] |
| Observations | 137 | 124 | 127 | 137 | 137 | 124 | 127 | 137 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.850 | 0.858 | 0.761 | 0.871 | 0.208 | 0.231 | 0.177 | 0.227 |
| Intra-class correlation ρ | | | | | 0.992 | 0.992 | 0.973 | 0.993 |
| Hausman *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *othdebt_gdp* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

### 3.3.2. General robustness tests and additional government LCBM correlates [13]

There are many ways in which we can test our baseline findings for robustness. First, we re-estimate the models of Table 2 with FGLS, an estimator that can better handle heteroskedastic error structures and panel-specific autocorrelation than POLS; and with RE, which is more efficient than FE but assumes country-specific effects are distributed randomly across countries and independently from other explanatory variables. Table A.2 in Appendix shows that FGLS and RE estimations confirm the negative correlation of fiscal balances and inflation with LCBM capitalisation and the positive coefficients of common law legal origins, institutional quality and democracy that we found using POLS and/or FE. Other effects we identified in POLS models, such as those of trade openness and banking sector size, seem not particularly robust.

Second, we exclude, in turn, South Africa and Mauritius from our sample, which can be considered outliers in terms of absolute/relative government LCBM sizes and in a number of other dimensions (see Figures A.2-A.5). Apart from Mauritius' influence on the negative area size effect, none of our findings seems to be entirely driven by any of these two countries. If anything, the exclusion of Mauritius boosts the economic significance of the common law dummy (since Mauritius has French legal origins and still relatively large LCBMs). Excluding both countries reduces the significance of the fiscal balance coefficient, but leaves other results intact.

Third, we have tried alternative measures for some of our key variables. Replacing consumer price-based inflation with a GDP deflator-based measure somewhat reduces the economic significance of the inflation coefficient but produces otherwise almost identical results. Capping consumer price inflation at 25%, which effectively eliminates three data points with extreme inflation from our sample (i.e., Angola in 2002, 2003 and 2004), the economic and statistical significance of the negative inflation effect on government LCBM capitalisation increases, rather than decreases. Also, replacing our preferred three-year moving average fiscal balance measure with a simple one-year lag yields very similar results.

Fourth, we have further investigated the role of institutional quality, substituting our ICRG composite measure by a similarly constructed index based on the World Bank's Worldwide Governance Indicators (WGI) dimensions of regulatory quality, the rule of law, government effectiveness and control of corruption (Kaufmann et al. 2010). Government LCBM capitalisation is again positively correlated with better institutions. This positive correlation is highly significant in POLS models, but not when employing FE (probably due to the even more limited time variation in this institutional quality index). Inserting the different ICRG scores separately rather than as part of a composite index, shows it is not straightforward to pinpoint the positive effect of overall institutional quality to one particular dimension. The strongest results are for the investment profile and bureaucratic quality, the coefficients of which are statistically significant in POLS specifications.

Fifth, we have replaced our broad institutionalised democracy index with one of its components, executive constraints, which more narrowly measures the extent of institutionalised restraints on the decision-making powers of a country's chief executives, be it individuals or collective bodies. In line with our baseline results, this variable is found to be positively and highly significantly correlated with LCBM capitalisation using POLS, but not in the case of FE.

Sixth, in Table A.3 in Appendix we augment our baseline model specification (column (1) of Table 2) with three additional explanatory variables suggested by Mu et al. (2013) and constructed from the IMF's International Financial Statistics (IFS). Bank lending spreads (*spread*), defined as the (annually averaged) difference between the interest rate charged by banks on loans to prime private sector customers and the LIBOR, bear a significantly negative coefficient in the FE model. This may point to lower bank competition and/or efficiency hampering LCBM development (as banks are important participants in government LCBMs). The inclusion of the bank lending spread renders the inflation coefficient insignificant, which can be explained by high collinearity between spreads and inflation in our sample. Interest rate variability (*intvol*), which we calculate as the yearly standard deviation of monthly treasury bill rates (or money market rates, if treasury bill rates are unavailable; cf. Adelegan

and Radzewicz-Bak 2009), seems also negatively correlated with government LCBM capitalisation, although not significantly so in the FE model. Volatile interest rates increase uncertainty for both investors and issuers, or may just reflect illiquid money and bond markets (Mu et al. 2013). We have also added a common indicator of exchange rate variability, i.e., the yearly standard deviation of first differences in log nominal monthly exchange rates against the US dollar (which proxies unanticipated deviations from a constant trend) (*xrtvol*). The effect of exchange rate variability on LCBMs is a priori ambiguous (Mu et al. 2013). On the one hand, less volatile exchange rates may encourage investor demand for local currency bonds, especially from foreign investors. On the other hand, relatively stable exchange rates may lead governments (as well as foreigner investors) to underestimate the risk of foreign currency borrowing (lending) and thereby reduce incentives to develop domestic financial intermediation (Eichengreen and Luengnaruemitchai 2006). Table A.3 indicates that the exchange rate variability coefficient is very imprecisely estimated in both POLS and FE models. The estimated effects of key variables like the fiscal balance and inflation remain however virtually unchanged.[14]

Seventh, we have looked more closely at the role of debt relief in government LCBM development. Arnone and Presbitero (2010) present some evidence suggestive of increased domestic public debt accumulation after countries' graduation from their HIPC decision point, whereas Merotto et al. (2014) find that the recent (mostly moderate) return to borrowing by African governments having enjoyed debt relief has been driven predominantly by new *external* borrowing (in foreign currency). Figure A.6 in Appendix shows the evolution of the non-marketable debt stock that has been the subject of debt relief under the HIPC initiative (i.e., outstanding loans owed to multilateral, bilateral and commercial creditors) as well as our measure of government LCBM capitalisation for the five countries that reached their HIPC completion point during the 2003-2012 sample period: Madagascar (2004), Zambia (2005), Cameroon (2006), Malawi (2006) and Sierra Leone (2006).[15] To facilitate comparison, we have plotted the evolution of debt stocks in a five-year window centred around each of these HIPCs' respective completion points. From panel (a) of Figure A.6 one can evidently see the direct effect of HIPC debt relief on non-marketable debt stocks in the completion point and/or subsequent years. However, in panel (b) we do not discern a very clear impact on LCBMs. Only in Malawi and Zambia there seems to have been an increase in government LCBM capitalisation following completion point. Tables 2 and A.2 already showed the lack of a strong link between LCBMs and other government debt stocks. In Table A.4 in Appendix we introduce a set of HIPC completion point dummies (*hipc_cp*). The POLS and FE results suggest that there is no immediate response of LCBM capitalisation to HIPC debt relief, although we do find a (small) positive coefficient for the *two-year lagged* HIPC completion point dummy. This could possibly indicate a delayed effect of HIPC debt relief on LCBMs, or reflect the fact that often (part of) actual debt stock relief takes place some time after the official completion point. Similar results are obtained if we incorporate into these dummy variables Nigeria's 2005 Paris Club deal (which entailed substantial relief outside HIPC). The positive debt relief effect disappears completely when including instead dummies for *all* post-HIPC completion point years or for the year 2006 (when all HIPCs in our sample received MDRI relief). We acknowledge that more research is needed to fully disentangle the links between debt relief and government LCBMs.[16]

Lastly, we further test the substitutability between government LCBMs and alternative sources of finance. From the OECD-DAC's Official Development Assistance (ODA) database we have constructed the three-year moving average of past net aid inflows as a percentage of GDP (i.e., aid grants plus net concessional loans, excluding debt relief) (*av_oda_gdp*). Table A.4 shows that the aid variable's coefficient takes a negative sign and is highly significant in POLS but not in FE estimations (since aid inflows differ mostly *between* countries). The negative fiscal balance effect on government LCBM capitalisation seems only marginally affected by the inclusion of the aid variable. To more explicitly take into account different forms of market access, we have also replaced our broad other government debt stock variable, in turn, by two of its subcomponents (again sourced from the African Yearbook and scaled to GDP): foreign currency marketable debt (which includes the international bonds some countries have issued) (*fc_mdebt_gdp*) and foreign currency non-marketable loans from commercial creditors (typically syndicated international bank loans) (*fc_com_nmdebt_gdp*). Using the second subcomponent however further reduces our sample. Table A.4 indicates a significant substitution effect between government LCBM capitalisation and both debt stock subcomponents in POLS estimations; it also suggests a *positive* correlation between LCBMs and the stock of commercial creditor loans when employing FE. This apparent complementarity between LCBMs and commercial creditor loans may seem counterintuitive but perhaps reflects that (local currency) marketable and (foreign currency) non-marketable debt constitute substantially different asset classes for investors and/or are used for different purposes by debtor governments. Interestingly, the fiscal balance coefficient again hardly changes and remains significant.[17]

### 3.3.3. Dynamic panel estimations

So far we have not allowed for the likely possibility that government LCBM capitalisation is a cumulative process. LCBM development in one period is expected to be an important determinant of the state of the LCBM in the next period; most obviously because LCBM capitalisation is a stock variable (with longer-maturity bond issues staying on governments' books for several years), but perhaps also due to the typically gradual nature of adaptations to the existing market infrastructure, or the persistence of a good/bad reputation in repaying bonds. The most straightforward way to introduce these dynamics into our model is by adding a one-year lag of the dependent variable, $Y_{i,t-1,}$ to Equation (1). For such an autoregressive model, however, POLS, FGLS, RE and standard FE estimators are known to be biased and inconsistent (especially in short-term panels as ours), because of the correlation of the lagged dependent variable with the error term (Nickell 1981).

The difference and system GMM estimators developed and popularised by Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) tackle the dynamic panel bias; in addition, they can be used to control for the endogeneity of other regressors too.[18] The idea behind difference GMM is to apply a first-difference transformation to the dynamic model and then to instrument the first-differenced lagged dependent variable, and other potentially non-exogenous regressors, with suitable lags of the untransformed (level) explanatory variables. One problem with the difference GMM estimator is that it may produce large finite sample bias and very imprecise estimates, in

particular when the process under study is highly persistent (in which case lagged levels of variables are only weak instruments for first differences); when time series are short; and/or when the variance of fixed effects is large relative to the variance of idiosyncratic errors.[19] In these instances, Blundell and Bond (1998) suggest using the more efficient system GMM estimator, which complements the first-differenced equation instrumented by lagged levels with the original level equation instrumented by lagged differences. The validity of the additional moment conditions of system GMM rests on the assumption that deviations of the dependent variable from its long-run conditional mean are not systematically related to the fixed effects. This implies that the subjects studied (here: countries) should not be too far from their steady states at the beginning of the sample period (Roodman 2009).

**Table 3. Dynamic panel results - system GMM estimations**

| | System GMM | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1a)** | **(1b)** | **(1c)** | **(1d)** | **(2a)** | **(2b)** | **(2c)** | **(2d)** |
| *L.lc_mdebt_gdp* | 0.787*** | 0.728*** | 0.916*** | 0.700*** | 0.783*** | 0.727*** | 0.901*** | 0.726*** |
| | [0.140] | [0.149] | [0.236] | [0.115] | [0.131] | [0.114] | [0.238] | [0.084] |
| *ln_gdp_ppp* | 0.307 | 0.294 | 0.197 | 0.248 | 0.523+ | 0.241 | 0.222 | 0.562 |
| | [0.385] | [0.320] | [0.373] | [0.288] | [0.314] | [1.268] | [0.368] | [0.458] |
| *ln_area* | -0.468 | -0.744 | -0.173 | -0.868* | -0.407 | -0.145 | -0.216 | -0.683* |
| | [0.490] | [0.623] | [0.841] | [0.427] | [0.443] | [2.097] | [0.779] | [0.324] |
| *ln_gdppc_ppp* | -0.225 | 0.325 | -1.554** | -0.191 | 0.102 | 2.671 | -1.449+ | 0.155 |
| | [0.767] | [1.509] | [0.722] | [1.039] | [0.877] | [6.954] | [1.055] | [1.181] |
| *x_gdp* | 0.101* | 0.088 | 0.086* | 0.131*** | 0.086+ | 0.013 | 0.085* | 0.106** |
| | [0.049] | [0.132] | [0.045] | [0.041] | [0.051] | [0.194] | [0.044] | [0.043] |
| *domcred_gdp* | 0.014 | 0.019 | 0.022 | 0.026 | -0.004 | -0.028 | 0.021 | 0.001 |
| | [0.025] | [0.029] | [0.035] | [0.022] | [0.023] | [0.100] | [0.025] | [0.031] |
| *av_fiscbal_gdp* | -0.421*** | -0.417 | -0.034 | | -0.409** | -0.318 | -0.040 | |
| | [0.139] | [0.636] | [0.128] | | [0.144] | [0.329] | [0.127] | |
| *infl_cp* | -0.213*** | -0.089 | -0.149* | -0.144*** | -0.214*** | -0.066+ | -0.153* | -0.147*** |
| | [0.044] | [0.077] | [0.073] | [0.046] | [0.045] | [0.039] | [0.077] | [0.045] |
| *kaopen* | 0.054 | 0.056 | 0.071 | 0.038 | 0.045 | 0.178 | 0.072 | 0.011 |
| | [0.181] | [0.255] | [0.193] | [0.151] | [0.150] | [0.431] | [0.162] | [0.133] |
| *comlaw* | 1.846 | 2.075 | 0.990 | 2.623** | 1.692+ | 1.848*** | 1.074 | 2.158** |
| | [1.397] | [2.301] | [1.733] | [1.097] | [1.217] | [0.568] | [1.562] | [0.856] |
| *vix* | -0.003 | -0.018 | 0.035 | -0.099 | -0.005 | -0.028 | 0.031 | -0.092 |
| | [0.042] | [0.102] | [0.064] | [0.085] | [0.042] | [0.054] | [0.066] | [0.078] |
| *democ* | | | | | 0.228 | 0.396 | 0.037 | 0.292+ |
| | | | | | [0.178] | [0.719] | [0.276] | [0.175] |
| *fiscbal_gdp* | | | | -0.425* | | | | -0.379* |
| | | | | [0.223] | | | | [0.198] |
| constant | 6.310 | 5.886 | 10.782 | 12.263* | 2.362 | -17.141 | 10.616+ | 6.103 |
| | [7.657] | [13.289] | [9.852] | [6.110] | [7.435] | [67.422] | [6.458] | [7.826] |
| Observations | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |
| # instruments | 14 | 15 | 14 | 14 | 15 | 16 | 15 | 15 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.331 | 0.000 | 0.000 |
| AR(1) *p*-value | 0.018 | 0.061 | 0.017 | 0.020 | 0.014 | 0.008 | 0.020 | 0.008 |
| AR(2) *p*-value | 0.536 | 0.496 | 0.560 | 0.561 | 0.531 | 0.436 | 0.559 | 0.480 |
| Hansen *p*-value | 0.635 | 0.593 | 0.477 | 0.756 | 0.705 | 0.630 | 0.472 | 0.881 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. Windmeijer-corrected standard errors are reported in brackets. Number of observations refers to number of data points in the untransformed (level) equation. Number of instrument lags is limited to one and instrument matrix is collapsed. Columns (a): only *av_fiscbal_gdp* predetermined; columns (b): *av_fiscbal_gdp* and *infl_cp* predetermined; columns (c): *av_fiscbal_gdp* endogenous; columns (d): *fiscbal_gdp* endogenous. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

Table 3 presents the results of two-step system GMM estimations of the autoregressive LCBM capitalisation model, with small sample statistics and the Windmeijer (2005) correction for standard errors. Importantly, Roodman (2009) points out that GMM estimations with too many instruments tend to 'overfit' the endogenous variables and weaken the power of Hansen tests for instrument validity. To keep the total instrument count below (or at least close to) the number of cross-sectional units we limit the number of instrument lags to just one; 'collapse' the instrument matrix; and estimate only the model specifications for which we have data on all 15 sample countries (i.e., the specifications in columns (1) and (4) of Table 2).[20] Whereas our primary motivation for employing GMM estimation techniques here is to be able to include lagged government LCBM capitalisation as an extra explanatory variable, we have also attempted to account for the potential endogeneity of some of our baseline regressors using GMM's internal instruments. Good external instruments would arguably be better-suited to establish causality but are very difficult to find in practice. Following Mu et al. (2013) and our prior economic intuitions (spelled out in the discussion of baseline variables) we choose to instrument, above all, the fiscal balance and, in second instance, also inflation. Table 3 makes different endogeneity assumptions: in columns (a) the fiscal balance variable is modelled as a predetermined variable, whereas the other independent variables are considered strictly exogenous; in columns (b) both the fiscal balance and inflation are assumed predetermined; in columns (c) the fiscal balance is modelled to be endogenous; and in columns (d) we replace the original three-year moving average fiscal balance by an endogenised single-year measure.[21]

Table 3 clearly shows the high degree of persistence in government LCBMs, with the autoregressive parameter on the lagged dependent variable (*L.lc_mdebt_gdp*) estimated as being between 0.7 and 0.9. Similar as in the static FE models, it is difficult to robustly identify effects for most explanatory variables. The coefficients for time-invariant legal origins and our slowly changing democracy variable always take the expected positive sign, but are estimated with relatively large standard errors. However, in line with our previous results, we find a significantly negative impact of inflation on LCBM development in seven out of eight system GMM estimations. The fiscal balance coefficient is also consistently negative, but becomes very small and statistically insignificant once modelled as endogenous. Interestingly, when the three-year moving average fiscal balance is substituted by an endogenised single-year measure, with inherently more within-country variation, we again find a significantly negative impact on LCBMs. This illustrates that one needs to be realistic about the extent to which GMM estimators can be used to firmly establish causality in our sample, because of relatively small sample size (GMM being a large-N estimator) and limited time variation in most variables.

Looking at the diagnostic tests at the bottom of Table 3, Arellano-Bond AR(2) tests reassure us that there is no second-order autocorrelation in differenced residuals and therefore no first-order correlation in the level residuals. The Hansen test of overidentifying restrictions furthermore suggests that the null of joint validity of our instruments is never rejected. For robustness, in Table A.5 in Appendix we re-estimate the specifications of Table 3 using the difference GMM estimator, which is less efficient than system GMM but also makes fewer assumptions (see above).[22] The results are overall very similar; controlling for persistence in LCBM capitalisation, the fiscal balance and inflation stand out as the most robust correlates.

Moreover, applying system GMM to the alternative specifications we have considered before, i.e., models including (one by one) bank lending spreads, interest or exchange rate variability, HIPC completion point dummies, aid inflows, foreign currency marketable debt, or commercial creditor loans, we fail to find any statistically significant correlation with government LCBMs beyond the negative effects of the fiscal balance, inflation and, perhaps, aid inflows (significant at the 10% level).

## 4. Conclusion

This paper has studied the current state and drivers of government LCBMs in Sub-Saharan Africa, a region whose progress in developing such markets has not received much systematic attention in the literature thus far. We have argued that well-developed government LCBMs could reduce countries' exposure to external shocks; help overcome 'original sin'; facilitate domestic savings mobilisation; and may have important financial, macroeconomic and institutional spill-over effects. With detailed information collected from various sources, the paper has first shown that quite a few African countries have made significant progress in developing government LCBMs. Increasingly, African governments issue fixed-rate local currency bonds with tenors of ten years and more on a regular basis. Moreover, the non-bank, local institutional investor base has continued to grow. But we have also demonstrated that LCBMs in Africa often have low liquidity, feature very few corporate securities and generally still have relatively narrow investor bases dominated by commercial banks.

In the second part of our study we have presented an econometric analysis of the drivers of African government LCBMs based on a new high-quality panel dataset of central government debt in 15 African countries, which was sourced directly from these countries' debt management offices and compiled by the OECD. Our estimations indicate that, on average, government LCBM capitalisation is larger in African countries with lower fiscal balances, lower inflation, common law legal origins, higher institutional quality and stronger democratic political systems. Controlling for unobserved country-specific heterogeneity and persistence in LCBM development, we find above all that a worsening fiscal balance and declining inflation are associated with increases in government LCBM capitalisation. These key results are robust to the use of different estimators, the exclusion of outliers, alternative measures for our key variables and the inclusion of additional potential correlates of government LCBMs. There are some indications that LCBM capitalisation may also be linked to lower bank lending spreads, lower interest rate variability, past debt relief and alternative financing sources, including aid, although such links were seemingly not robust across estimators and require further research.

Our main findings generally correspond well with those of the broader domestic public debt and bond market literature and of Adelegan and Radzewicz-Bak (2009) and Mu et al. (2013) on Africa, in particular on the importance of the fiscal balance, legal origins and institutions. Some of the differences in results between the current paper and Mu et al. (2013), for example the lack of significance of exchange rate variability and trade or capital account openness as drivers of government LCBMs in our estimations, may be due to subtle differences in the way LCBM capitalisation is defined and our use of primary rather than

secondary IMF and World Bank data; differences in the set of regressors we include; and our explicit accounting for LCBM persistence in GMM specifications; as well as to differences in sample countries and the time period considered. We acknowledge that relatively small sample size and limited within-country variation are drawbacks to our econometric analysis. Larger country samples and longer time series will be needed to increase the representativeness of our results for Sub-Saharan Africa and to achieve better identification of any causal relations.

Moreover, the econometric work in this paper has narrowly focused on government LCBM *capitalisation*, ignoring other dimensions of LCBM development. From our more detailed, multi-source cross-sectional overview it is apparent that African government LCBMs differ in many other aspects too, including liquidity and the length of tenors of bonds typically issued. Panel data analysis of variables such as secondary market turnover, bid-ask spreads, average maturity and yields of local currency government bonds would surely complement the current paper and enrich our understanding of Sub-Sahara African LCBMs. To our knowledge, however, such data are currently not (publicly) available (in a comparable format) for a wider range of countries in the region.

## Notes

[1] See publicdebtnet.org/export/sites/PDM/public/MoreAboutUs/G8/G20_LCBM_3_4_Nov_2011_Cannes.pdf.

[2] We do not know, however, of any issuance of local currency securities in international markets by African governments, so that all local currency marketable central government debt can be assumed to have been issued domestically.

[3] All countries in Table 1 are non-CFA (Communauté Financière Africaine); for overviews of the regionally organised LCBMs of CEMAC (Economic and Monetary Community of Central Africa) and WAEMU (West African Economic and Monetary Union) countries we refer to Beaugrand et al. (2002), Sy (2010) and Diouf and Boutin-Dufresne (2012).

[4] See, e.g., Mboweni (2006), Asogwa and Ezema (2005) and Mbewa et al. (2007) on the early history of the relatively large and developed LCBMs in South Africa, Nigeria and Kenya, respectively.

[5] Similar observations are made by Didier and Schmukler (2014) in their study of the LCBMs of emerging economies in Asia, Latin America and Eastern Europe.

[6] Andrianaivo and Yartey (2010) also study the determinants of African financial market development but focus on banking systems and stock markets rather than bond markets.

[7] The reasons for using lagged variables here are twofold. First, our dependent variable extends to the year 2012, whereas some explanatory variables were only available up to 2011 at the time of writing. Second, the use of lagged regressors also diminishes endogeneity concerns.

[8] 'Local currency' debt is defined in the African Yearbook as debt denominated in, or indexed to, local currency. This may include debt for which settlements occur in foreign currency, provided that the cash flows are not indexed to foreign currency (i.e., economic exposure needs to be to the local currency). 'Marketable' debt refers to instruments (securities) that can be bought and sold in the secondary market. The African Yearbook further subdivides non-marketable debt into loans from multilateral, bilateral and commercial creditors and a residual category (which may include central bank advances) (see OECD 2013).

[9] In April 2014 Nigeria revised its GDP base year, resulting in a 89% increase in its 2013 GDP estimate. In this paper we use the old nominal GDP series to scale our LCBM measure, which is arguably how market participants perceived the Nigerian economy prior to the rebasing.

[10] Note that Mauritius is not rated on these ICRG dimensions by the PRS Group.

[11] We choose not to include time fixed effects (year dummies) to account for global trends as this leads to 'overfitted' models with few degrees of freedom, due to our small sample size. Very similar results are obtained if we replace the VIX with other (yearly averaged) global variables, such as the Bank of America-Merrill Lynch US high yield spread (of below-investment grade US corporate bonds over US Treasuries) or the US Effective Federal Funds rate, or when including a linear time trend instead.

[12] Since country area size and legal origins are time-invariant variables they are dropped in the FE estimations.

[13] To save space, not all the estimations mentioned in this section are reported. All results are, however, available from the authors upon request.

[14] We deviate from Mu et al. (2013) in calculating annual interest rate and exchange rate variability, rather than over ten-year periods, We do so because of our limited sample period and in order to bring in more within-country variation.

[15] All HIPCs in our sample passed their decision points before 2003. Uganda reached its (enhanced) HIPC completion point in 2000, and Mozambique and Tanzania both in 2001.

[16] Ideally, one would attempt to account for the concessionality of the debt stock involved in debt relief operations and for whether the relief consists of outright debt forgiveness or concessional rescheduling by using Net Present Value (NPV) estimates of debt relief. Such NPV measures have been constructed by Depetris Chauvin and Kraay (2005) and used, for example, in Presbitero (2009) and Johansson (2010). To our knowledge, however, the annual NPV debt relief measures of Depetris Chauvin and Kraay (2005) have not been updated beyond 2003, which prevents us from including them in our econometric analysis.

[17] We find qualitatively similar results when replacing the commercial creditor loan variable from the African Yearbook with a measure of international claims by BIS-reporting banks on the public sector of our sample countries, obtained from the BIS Consolidated Banking Statistics.

[18] Whereas GMM estimators were originally developed for microeconomic panel data research with many cross-sectional units (large N) and short time series (small T), they are now also commonly used in macroeconomic research. Of the above-mentioned studies related to the current paper, both Mu et al. (2013) and Mehl and Reynaud (2005) report system GMM estimations. Only Mehl and Reynaud (2005), who analyse domestic original sin, include a lagged dependent variable in one of their models. Mu et al. (2013) use GMM techniques primarily to attempt to control for the potential endogeneity of some of the regressors in their models but do not seem to account explicitly for persistence in LCBM capitalisation with an autoregressive factor.

[19] In the extreme case of the process being a random walk, where the autoregressive parameter equals one and the series has a unit root, there will be no correlation at all between the first-differenced series ('white noise') and lagged levels of the series. This implies that the difference GMM estimator does not identify the autoregressive parameter and will not provide any information on this parameter (Bond et al. 2005).

[20] Models with a higher instrument count, relative to cross-sectional units, lead to very inefficient estimates and unreliable diagnostic test statistics.

[21] We have experimented with system GMM regressions where, in addition to the fiscal balance and inflation, also banking sector size and/or capital account openness are considered predetermined. These regressions yield qualitatively similar but typically less precise estimates than those reported in Table 3, most probably due to problems of weak instruments and over-instrumentation. There is only so much endogeneity we can try to control for in our relatively small sample.

[22] Usually difference-in-Hansen tests are used to check whether the additional moment conditions of system GMM compared to difference GMM (related to the differenced instruments in the level equation) are fulfilled. However, because the difference GMM estimations we present are only just identified, no such tests could be conducted.

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# Appendices

## Table A.1. Labels, definitions, sources and descriptive statistics of baseline variables

| Variable | Label | Definition | Source | Period | Obs. | Mean | Min | Max | Std. Dev. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dependent** | | | | | | | | | overall | between | within |
| Local currency bond market (LCBM) capitalisation | *lc_mdebt_gdp* | Year-end outstanding local currency marketable central government debt (in % of GDP) | OECD 2013 African Central Government Debt Statistical Yearbook (4th edition) | 2003-12 | 137 | 15.423 | 1.066 | 58.662 | 11.894 | 11.997 | 2.798 |
| **Independent** | | | | | | | | | | | |
| Total GDP | *ln_gdp_ppp* | Natural logarithm of GDP at purchasing power parity (PPP) (in international dollar billions) | IMF World Economic Outlook (WEO) | 2002-11 | 150 | 3.413 | 1.201 | 6.324 | 1.208 | 1.223 | 0.230 |
| Area size | *ln_area* | Natural logarithm of surface area (in squared kilometres) | World Bank African Development Indicators (ADI) | 2003-12 | 150 | 12.753 | 7.621 | 14.036 | 1.599 | 1.649 | 0 |
| GDP per capita | *ln_gdppc_ppp* | Natural logarithm of GDP per capita at PPP (in international dollars) | WEO | 2002-11 | 150 | 7.698 | 6.278 | 9.651 | 1.015 | 1.033 | 0.166 |
| Trade openness | *x_gdp* | Total exports of goods and services (in % of GDP) | ADI | 2002-11 | 150 | 35.523 | 8.648 | 86.018 | 16.516 | 16.401 | 4.478 |
| Domestic credit | *domcred_gdp* | Domestic credit to the private sector (in % of GDP) | ADI | 2002-11 | 150 | 28.553 | 2.181 | 167.536 | 36.540 | 37.130 | 6.311 |
| Fiscal balance | *av_fiscbal_gdp* | 3-year moving average of the general government fiscal balance, i.e., revenue minus total expenditure including the net acquisition of non-financial assets (in % of GDP) | WEO | 2002-11 | 150 | -0.896 | -9.581 | 13.507 | 4.493 | 3.422 | 3.031 |
| Inflation | *infl_cp* | Year-on-year change in annually averaged consumer price index (CPI) (in %) | WEO | 2002-11 | 150 | 10.095 | -3.659 | 108.893 | 12.443 | 7.804 | 9.880 |
| Capital account openness | *kaopen* | Chinn-Ito coding of restrictions on cross-border financial transactions based on IMF Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) | Chinn-Ito KAOPEN database | 2002-11 | 150 | -0.281 | -1.864 | 2.439 | 1.488 | 1.515 | 0.237 |
| Legal origins | *comlaw* | Dummy which equals 1 for countries with a British common law heritage and 0 otherwise | Andrei Shleifer's personal website: http://scholar.harvard.edu/shleifer | 2003-12 | 150 | 0.600 | 0 | 1 | 0.492 | 0.507 | 0 |
| Other government debt | *othdebt_gdp* | Complement of *lc_mdebt_gdp*: year-end outstanding (foreign and local currency) non-marketable and foreign currency marketable central government debt (in % of GDP) | OECD 2013 African Central Government Debt Statistical Yearbook (4th edition) | 2003-12 | 124 | 30.843 | 0 | 139.192 | 32.245 | 19.133 | 26.116 |
| Institutional quality ICRG | *comprisk_icrg* | Unweigthed sum of normalised (0-to-1) scores on four ICRG political risk dimensions: 'investment profile', 'law and order', 'bureaucratic quality' and 'corruption' | Political Risk Services (PRS) Group International Country Risk Guide (ICRG) | 2002-11 | 140 | 1.887 | 1.003 | 2.646 | 0.321 | 0.314 | 0.103 |
| Democracy | *democ* | Polity IV institutionalised democracy index combining scores on 'competitiveness of political participation, 'openness and competitiveness of executive recruitment' and 'constraints on chief executive' | University of Maryland Polity IV Project database | 2002-11 | 150 | 4.853 | 0 | 10 | 2.973 | 2.947 | 0.823 |
| VIX | *vix* | Yearly averaged Chicago Board of Options Exchange (CBOE) Volatility Index measuring the implied volatility of S&P 500 index options | Federal Reserve Bank of St. Louis Federal Reserve Economic Data (FRED) | 2003-12 | 150 | 20.934 | 12.810 | 32.690 | 6.707 | 0 | 6.707 |

## Table A.2. Robustness - FGLS/RE estimations

| | FGLS | | | | RE | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | -0.793+ | -0.631 | -1.124** | -0.617 | -0.409 | -0.101 | -0.903 | -0.330 |
| | [0.540] | [0.527] | [0.573] | [0.683] | [1.665] | [2.177] | [1.187] | [1.349] |
| *ln_area* | -3.938*** | -4.043*** | 1.713+ | -3.206*** | -4.171** | -4.379* | 3.645** | -3.569** |
| | [0.546] | [0.542] | [1.064] | [0.594] | [2.034] | [2.321] | [1.860] | [1.739] |
| *L.ln_gdppc_ppp* | 1.117 | 1.689 | -1.050 | 3.923*** | 0.037 | 0.827 | 1.918 | 0.524 |
| | [1.330] | [1.386] | [0.892] | [1.381] | [3.109] | [4.085] | [2.171] | [2.671] |
| *L.x_gdp* | 0.089** | 0.088** | 0.038 | 0.038 | 0.110 | 0.060 | -0.031 | 0.098 |
| | [0.041] | [0.043] | [0.039] | [0.039] | [0.102] | [0.131] | [0.066] | [0.102] |
| *L.domcred_gdp* | 0.139*** | 0.129*** | 0.107*** | 0.043+ | 0.053 | -0.001 | -0.037 | 0.027 |
| | [0.030] | [0.030] | [0.032] | [0.032] | [0.046] | [0.053] | [0.051] | [0.055] |
| *L.av_fiscbal_gdp* | -0.166** | -0.198*** | -0.150** | -0.115* | -0.233** | -0.286** | -0.153+ | -0.253** |
| | [0.073] | [0.076] | [0.065] | [0.064] | [0.112] | [0.136] | [0.095] | [0.119] |
| *L.infl_cp* | -0.035+ | -0.043+ | -0.038+ | -0.029 | -0.079** | -0.083*** | -0.060*** | -0.080** |
| | [0.027] | [0.029] | [0.025] | [0.026] | [0.033] | [0.031] | [0.019] | [0.036] |
| *L.kaopen* | 0.006 | -0.035 | -1.225*** | -0.171 | -0.012 | -0.416 | -0.761 | -0.195 |
| | [0.350] | [0.339] | [0.404] | [0.303] | [1.112] | [1.261] | [1.049] | [1.138] |
| *comlaw* | 7.031*** | 7.060*** | 10.265*** | 7.288*** | 8.608** | 9.103** | 13.996*** | 7.405** |
| | [1.139] | [1.097] | [1.236] | [1.130] | [3.497] | [4.203] | [3.578] | [2.943] |
| *othdebt_gdp* | | 0.014 | | | | -0.005 | | |
| | | [0.011] | | | | [0.020] | | |
| *L.comprisk_icrg* | | | 3.364** | | | | 2.816+ | |
| | | | [1.407] | | | | [2.170] | |
| *L.democ* | | | | 1.208*** | | | | 0.875* |
| | | | | [0.174] | | | | [0.480] |
| *vix* | -0.032 | -0.010 | -0.030 | -0.060** | -0.036 | -0.001 | 0.007 | -0.039 |
| | [0.033] | [0.034] | [0.030] | [0.030] | [0.065] | [0.063] | [0.064] | [0.065] |
| constant | 50.113*** | 46.124*** | -14.248 | 17.905+ | 60.086+ | 58.179 | -58.807* | 46.118+ |
| | [11.600] | [11.950] | [16.437] | [12.996] | [39.615] | [52.181] | [34.220] | [32.384] |
| Observations | 137 | 124 | 127 | 137 | 137 | 124 | 127 | 137 |
| Overall $\chi^2$ *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$ | | | | | 0.682 | 0.559 | 0.514 | 0.745 |
| Intra-class correlation ρ | | | | | 0.738 | 0.833 | 0.887 | 0.712 |
| Breusch-Pagan *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *othdebt_gdp* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

## Table A.3. Robustness - POLS/FE estimations including bank lending spreads, interest rate variability and exchange rate variability

| | POLS | | | FE | | |
|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(1)** | **(2)** | **(3)** |
| *L.ln_gdp_ppp* | 0.147 | -0.065 | 0.156 | 29.144 | 20.133 | 13.998 |
| | [0.967] | [0.714] | [0.946] | [23.786] | [26.004] | [20.792] |
| *ln_area* | -3.611*** | -3.397*** | -3.630*** | | | |
| | [0.681] | [0.551] | [0.660] | | | |
| *L.ln_gdppc_ppp* | -1.508 | -0.078 | -1.501 | -44.475 | -29.048 | -20.829 |
| | [2.462] | [2.505] | [2.290] | [36.504] | [38.808] | [31.676] |
| *L.x_gdp* | 0.308*** | 0.309** | 0.309*** | -0.010 | -0.013 | -0.002 |
| | [0.090] | [0.125] | [0.084] | [0.060] | [0.055] | [0.057] |
| *L.domcred_gdp* | 0.168*** | 0.140** | 0.168*** | -0.077* | -0.094+ | -0.095* |
| | [0.045] | [0.046] | [0.043] | [0.041] | [0.055] | [0.050] |
| *L.av_fiscbal_gdp* | -0.529*** | -0.638*** | -0.522*** | -0.306** | -0.202+ | -0.186* |
| | [0.152] | [0.184] | [0.147] | [0.126] | [0.145] | [0.098] |
| *L.infl_cp* | -0.117 | -0.157* | -0.123** | -0.049 | -0.129+ | -0.101* |
| | [0.105] | [0.074] | [0.055] | [0.053] | [0.076] | [0.055] |
| *L.kaopen* | 0.637 | 0.572 | 0.633 | -0.672 | -0.990 | -1.181 |
| | [0.699] | [0.710] | [0.693] | [1.269] | [1.516] | [1.479] |
| *comlaw* | 7.155*** | 7.866*** | 7.265*** | | | |
| | [1.994] | [2.329] | [1.805] | | | |
| *L.spread* | -0.009 | | | -0.116** | | |
| | [0.089] | | | [0.052] | | |
| *intvol* | | -0.382* | | | -0.036 | |
| | | [0.179] | | | [0.152] | |
| *xrtvol* | | | 3.931 | | | -6.145 |
| | | | [24.458] | | | [10.964] |
| *vix* | -0.073 | -0.049 | -0.072 | 0.042 | 0.019 | 0.026 |
| | [0.075] | [0.078] | [0.079] | [0.055] | [0.057] | [0.054] |
| constant | 54.986** | 42.836** | 54.830*** | 254.518 | 169.095 | 127.151 |
| | [19.039] | [15.746] | [17.751] | [193.434] | [201.507] | [167.082] |
| Observations | 134 | 124 | 137 | 134 | 124 | 137 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.847 | 0.848 | 0.850 | 0.257 | 0.208 | 0.209 |
| Intra-class correlation ρ | | | | 0.998 | 0.995 | 0.992 |
| Hausman *p*-value | | | | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *intvol*, *xrtvol* and *vix*. Standard errors, clustered at the country level, are reported in brackets. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

## Table A.4. Robustness - POLS/FE estimations including HIPC completion point dummies and alternative sources of finance

| | POLS | | | | FE | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(1)** | **(2)** | **(3)** | **(4)** |
| *L.ln_gdp_ppp* | 0.194 | -2.258*** | -0.164 | -0.347 | 12.706 | 12.511 | 32.498+ | -4.266 |
| | [0.945] | [0.589] | [0.640] | [0.751] | [20.483] | [19.732] | [22.019] | [11.343] |
| *ln_area* | -3.599*** | -3.800*** | -3.174*** | -3.010*** | | | | |
| | [0.671] | [0.355] | [0.594] | [0.587] | | | | |
| *L.ln_gdppc_ppp* | -1.230 | -7.512*** | -0.265 | -0.862 | -18.633 | -19.176 | -47.040+ | 11.071 |
| | [2.282] | [1.869] | [2.014] | [2.492] | [31.357] | [30.367] | [32.929] | [17.220] |
| *L.x_gdp* | 0.305*** | 0.350*** | 0.302** | 0.269*** | 0.002 | 0.003 | -0.056 | -0.118+ |
| | [0.084] | [0.055] | [0.115] | [0.062] | [0.055] | [0.060] | [0.077] | [0.087] |
| *L.domcred_gdp* | 0.164*** | 0.233*** | 0.177*** | 0.160*** | -0.100* | -0.094* | -0.073+ | -0.109* |
| | [0.043] | [0.032] | [0.039] | [0.047] | [0.051] | [0.048] | [0.044] | [0.058] |
| *L.av_fiscbal_gdp* | -0.562*** | -0.711*** | -0.641*** | -0.409** | -0.214* | -0.205* | -0.221+ | -0.181* |
| | [0.144] | [0.134] | [0.186] | [0.141] | [0.104] | [0.096] | [0.131] | [0.088] |
| *L.infl_cp* | -0.125** | -0.120*** | -0.122* | -0.030 | -0.101* | -0.100* | -0.103* | -0.088*** |
| | [0.055] | [0.034] | [0.062] | [0.028] | [0.056] | [0.054] | [0.056] | [0.027] |
| *L.kaopen* | 0.651 | -0.139 | 0.609 | 0.130 | -1.065 | -1.267 | -0.163 | -0.361 |
| | [0.701] | [0.317] | [0.701] | [0.578] | [1.495] | [1.557] | [1.087] | [1.015] |
| *comlaw* | 7.273*** | 8.315*** | 8.006*** | 7.831*** | | | | |
| | [1.891] | [0.977] | [2.168] | [1.784] | | | | |
| *hipc_cp* | -2.307 | | | | -0.944 | | | |
| | [1.770] | | | | [1.150] | | | |
| *L.hipc_cp* | -0.146 | | | | 0.104 | | | |
| | [1.304] | | | | [0.722] | | | |
| *L2.hipc_cp* | 2.851** | | | | 1.054 | | | |
| | [1.031] | | | | [0.817] | | | |
| *L.av_oda_gdp* | | -0.820*** | | | | -0.079 | | |
| | | [0.155] | | | | [0.147] | | |
| *fc_mdebt_gdp* | | | -1.195** | | | | -1.349 | |
| | | | [0.459] | | | | [1.689] | |
| *fc_com_nmdebt_gdp* | | | | -0.244* | | | | 0.170** |
| | | | | [0.123] | | | | [0.070] |
| *vix* | -0.091 | 0.026 | -0.066 | -0.057 | 0.015 | 0.026 | -0.009 | 0.058 |
| | [0.080] | [0.074] | [0.079] | [0.098] | [0.053] | [0.055] | [0.048] | [0.065] |
| constant | 52.896** | 111.513*** | 40.380** | 43.770** | 115.07 | 120.105 | 264.051+ | -48.368 |
| | [17.786] | [15.070] | [14.218] | [19.214] | [165.746] | [161.194] | [172.486] | [90.073] |
| Observations | 137 | 137 | 124 | 114 | 137 | 137 | 124 | 114 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $R^2$/$R^2$-within (for FE) | 0.854 | 0.901 | 0.861 | 0.821 | 0.217 | 0.210 | 0.264 | 0.290 |
| Intra-class correlation ρ | | | | | 0.991 | 0.991 | 0.998 | 0.976 |
| Hausman *p*-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. All independent variables are one-year lagged, except for *ln_area*, *comlaw*, *fc_mdebt_gdp*, *fc_com_nmdebt_gdp* and *vix*; *hipc_cp* is included together with its one- and two-year lags. Standard errors, clustered at the country level, are reported in brackets. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

## Table A.5. Dynamic panel results - difference GMM estimations

| | Difference GMM | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **(1a)** | **(1b)** | **(1c)** | **(1d)** | **(2a)** | **(2b)** | **(2c)** | **(2d)** |
| *L.lc_mdebt_gdp* | 0.804*** | 0.866*** | 0.809*** | 0.798*** | 0.798*** | 0.862*** | 0.820*** | 0.770*** |
| | [0.179] | [0.220] | [0.204] | [0.158] | [0.181] | [0.224] | [0.207] | [0.155] |
| *ln_gdp_ppp* | -1.237 | -5.190 | 8.474 | 5.662 | -0.749 | -4.797 | 7.594 | 8.304 |
| | [22.897] | [26.159] | [18.205] | [11.563] | [23.150] | [26.465] | [18.842] | [10.955] |
| *ln_area* | | | | | | | | |
| *ln_gdppc_ppp* | 2.379 | 9.188 | -10.889 | -6.246 | 1.565 | 8.531 | -9.410 | -10.695 |
| | [31.460] | [37.524] | [24.771] | [16.653] | [31.921] | [38.063] | [25.631] | [15.498] |
| *x_gdp* | 0.115 | 0.125 | 0.046 | 0.142 | 0.115 | 0.125 | 0.045 | 0.135 |
| | [0.129] | [0.155] | [0.106] | [0.153] | [0.129] | [0.155] | [0.108] | [0.152] |
| *domcred_gdp* | -0.038 | -0.043 | -0.041 | -0.060 | -0.038 | -0.042 | -0.042 | -0.055 |
| | [0.071] | [0.080] | [0.068] | [0.064] | [0.071] | [0.080] | [0.069] | [0.063] |
| *av_fiscbal_gdp* | -0.429+ | -0.471+ | -0.035 | | -0.427+ | -0.470+ | -0.037 | |
| | [0.265] | [0.297] | [0.132] | | [0.266] | [0.298] | [0.129] | |
| *infl_cp* | -0.210*** | -0.127 | -0.166** | -0.135+ | -0.210*** | -0.128 | -0.166** | -0.138* |
| | [0.065] | [0.112] | [0.074] | [0.079] | [0.065] | [0.113] | [0.075] | [0.074] |
| *kaopen* | 0.518 | 0.391 | 0.655 | -0.607 | 0.519 | 0.393 | 0.654 | -0.480 |
| | [0.761] | [0.804] | [0.820] | [0.948] | [0.769] | [0.812] | [0.821] | [0.963] |
| *comlaw* | | | | | | | | |
| *vix* | 0.018 | 0.001 | -0.001 | -0.062 | 0.017 | 0.001 | -0.001 | -0.058 |
| | [0.072] | [0.064] | [0.077] | [0.083] | [0.073] | [0.064] | [0.078] | [0.079] |
| *democ* | | | | | 0.103 | 0.077 | -0.193 | 0.530 |
| | | | | | [0.452] | [0.480] | [0.309] | [0.714] |
| *fiscbal_gdp* | | | | -0.335 | | | | -0.302 |
| | | | | [0.252] | | | | [0.240] |
| constant | | | | | | | | |
| Observations | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 |
| # instruments | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 |
| Overall F *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(1) *p*-value | 0.021 | 0.047 | 0.016 | 0.015 | 0.022 | 0.050 | 0.017 | 0.011 |
| AR(2) *p*-value | 0.520 | 0.505 | 0.454 | 0.374 | 0.520 | 0.504 | 0.447 | 0.358 |
| Hansen *p*-value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Notes: Dependent variable is *lc_mdebt_gdp*, year-end outstanding local currency marketable central government debt (% of GDP). Sample countries, years and independent variables as defined in the text and Appendix Table A.1. Windmeijer-corrected standard errors are reported in brackets. Number of observations refers to number of data points in the transformed (first-differenced) equation. Number of instrument lags is limited to one and instrument matrix is collapsed. Columns (a): only *av_fiscbal_gdp* predetermined; columns (b): *av_fiscbal_gdp* and *infl_cp* predetermined; columns (c): *av_fiscbal_gdp* endogenous; columns (d): *fiscbal_gdp* endogenous. 'N/A' means statistic could not be calculated because specification is just identified. ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; +$p<0.20$.

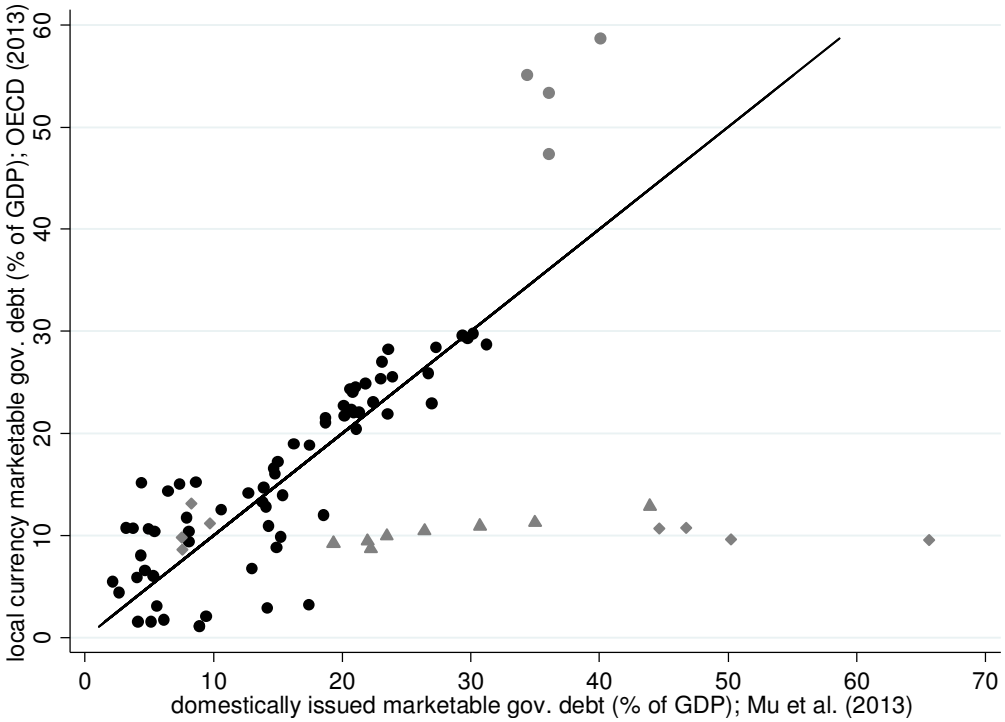


**Figure A.1. Comparison of dependent variable of current paper with that of Mu et al. (2013)**

Notes: Straight line is 45° line. Data points for Mauritius are grey dots, for Sierra Leone grey triangles, and for Uganda grey diamonds.

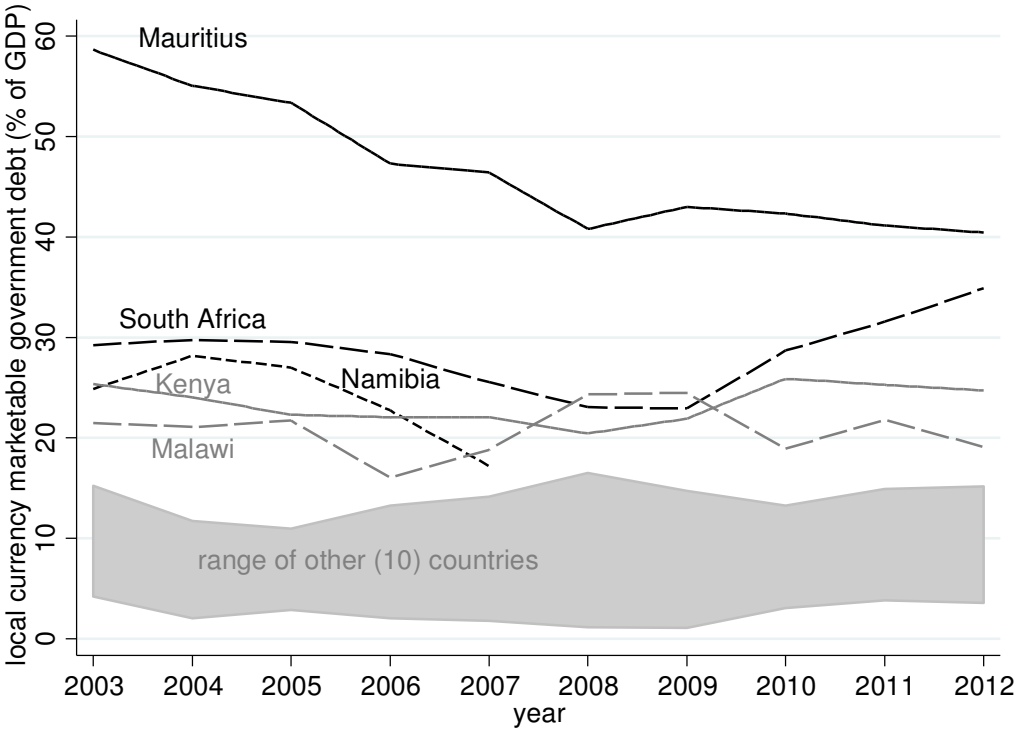


**Figure A.2. Evolution of government LCBMs (as % of GDP) for sample countries, 2003-2012**

Notes: For presentation purposes, only five largest LCBMs (relative to GDP) are shown separately. Range represents the minimum and maximum values of LCBM capitalisation for other ten sample countries: i.e., in descending order of relative LCBM size over 2003-2012, Zambia, Nigeria, Tanzania, Uganda, Sierra Leone, Angola, Madagascar, Mozambique, Cameroon and Gabon.

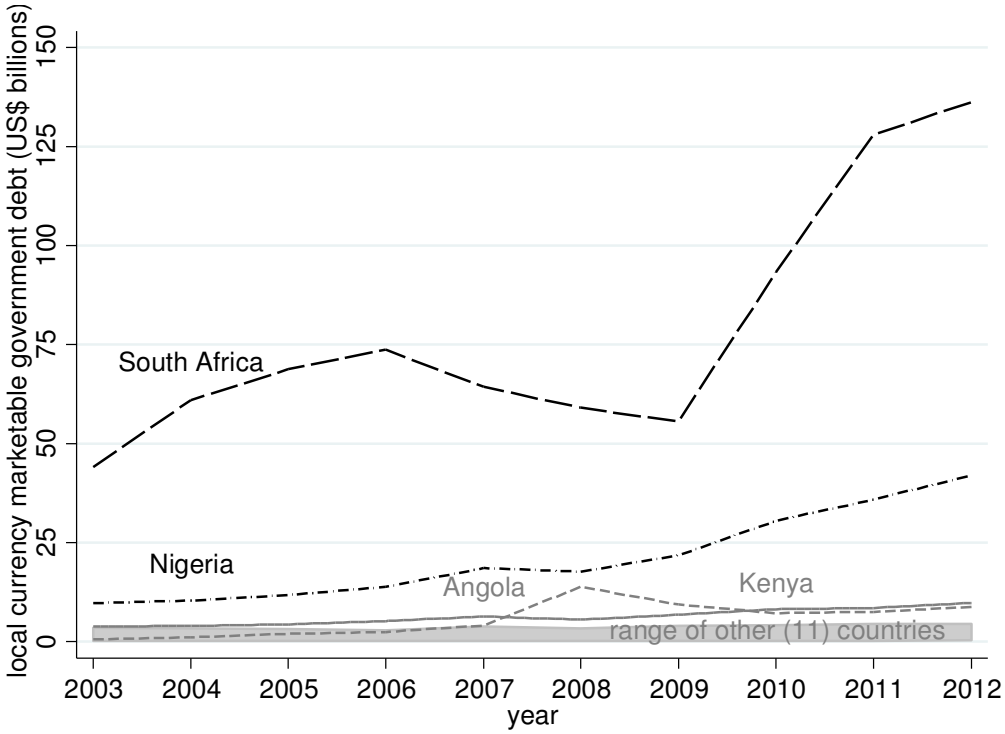


**Figure A.3. Evolution of government LCBMs (in nominal US$ billions) for sample countries, 2003-2012**

Notes: For presentation purposes, only four largest LCBMs (in absolute US$ terms) are shown separately. Range represents the minimum and maximum values of LCBM size for other eleven sample countries: i.e., in descending order of absolute LCBM size over 2003-2012, Mauritius, Tanzania, Zambia, Namibia, Uganda, Malawi, Cameroon, Madagascar, Mozambique, Sierra Leone and Gabon.

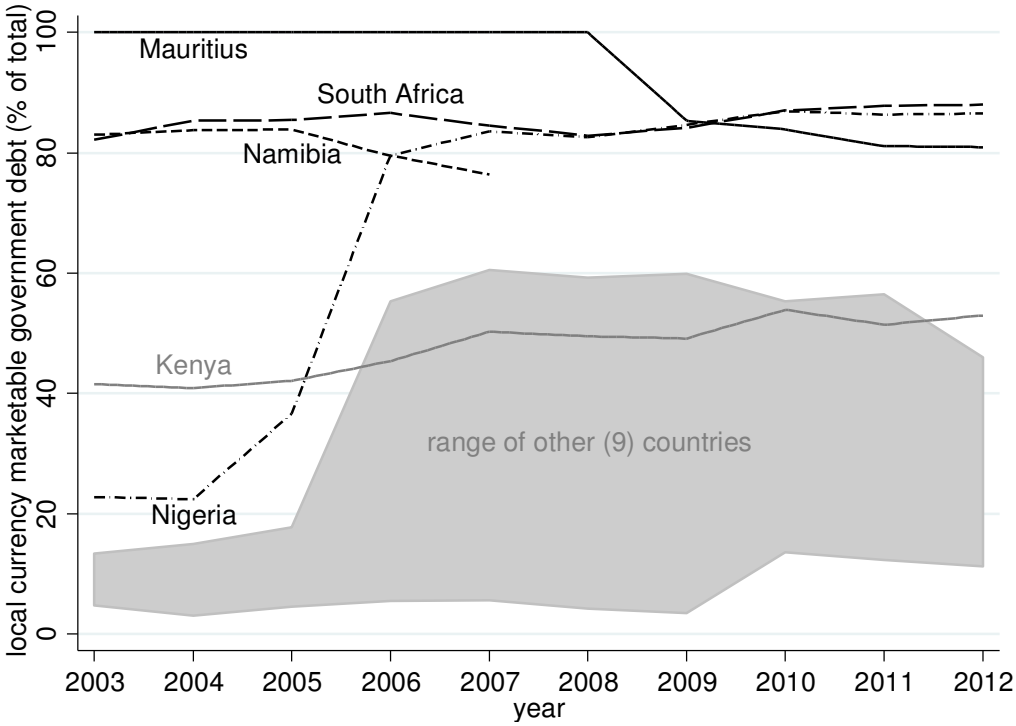


**Figure A.4. Evolution of government LCBMs (as % of total central government debt) for sample countries, 2003-2012**

Notes: For presentation purposes, only five largest LCBM shares of total central government debt are shown separately. Range represents the minimum and maximum values of LCBM shares of total debt for other nine sample countries: i.e., in descending order of LCBM shares over 2003-2012, Zambia, Malawi, Uganda, Angola, Madagascar, Sierra Leone, Cameroon, Mozambique and Gabon. Total central government debt is not available for Tanzania.

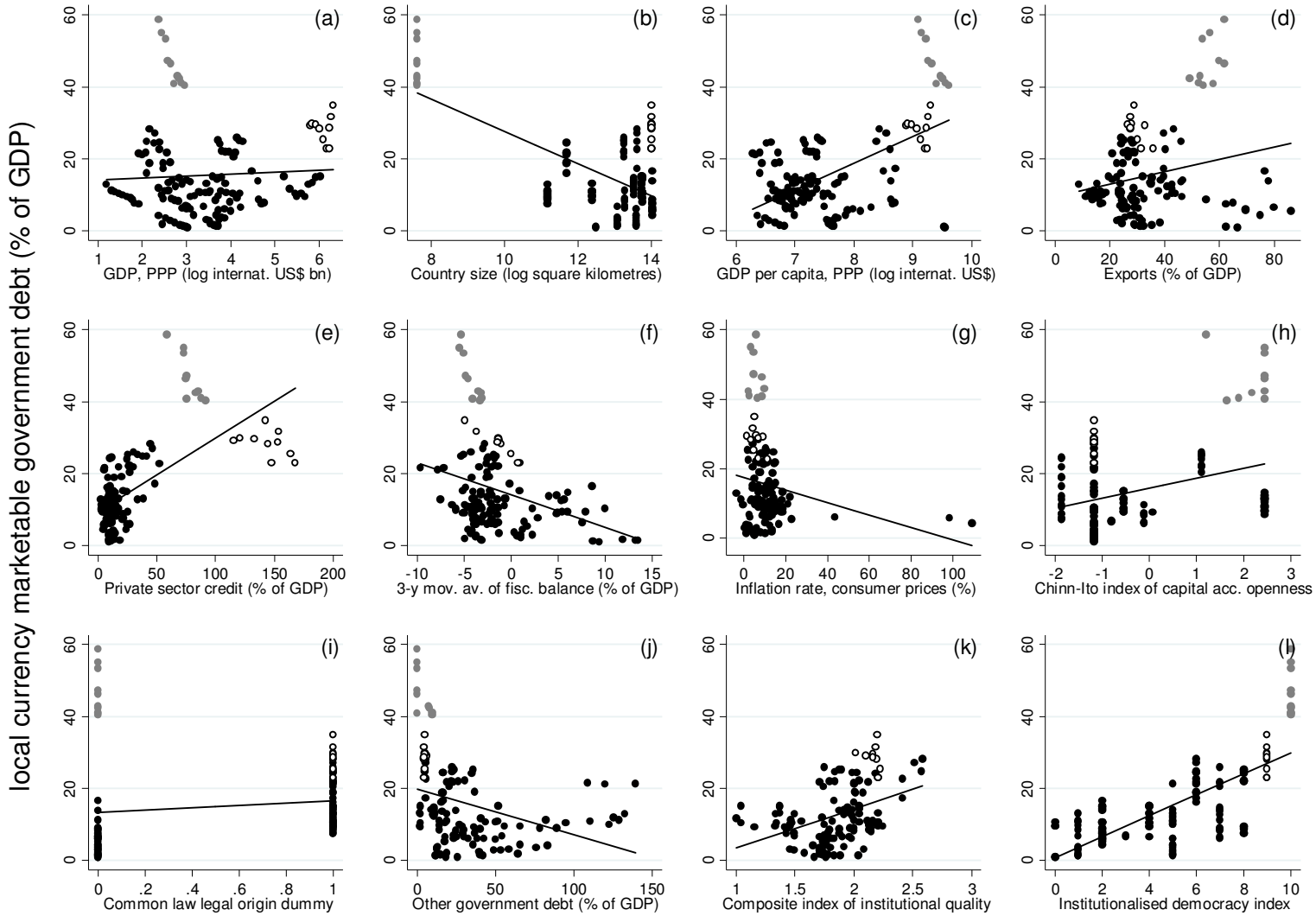


**Figure A.5. Bivariate scatter plots: government LCBM capitalisation vs. baseline explanatory variables**

Notes: Sample countries, years and variables as defined in the text and Appendix Table A.1. All explanatory variables are one-year lagged, except for country size, common law dummy and other government debt. Lines represent best linear fit. Data points for South Africa are white dots, and for Mauritius grey dots.

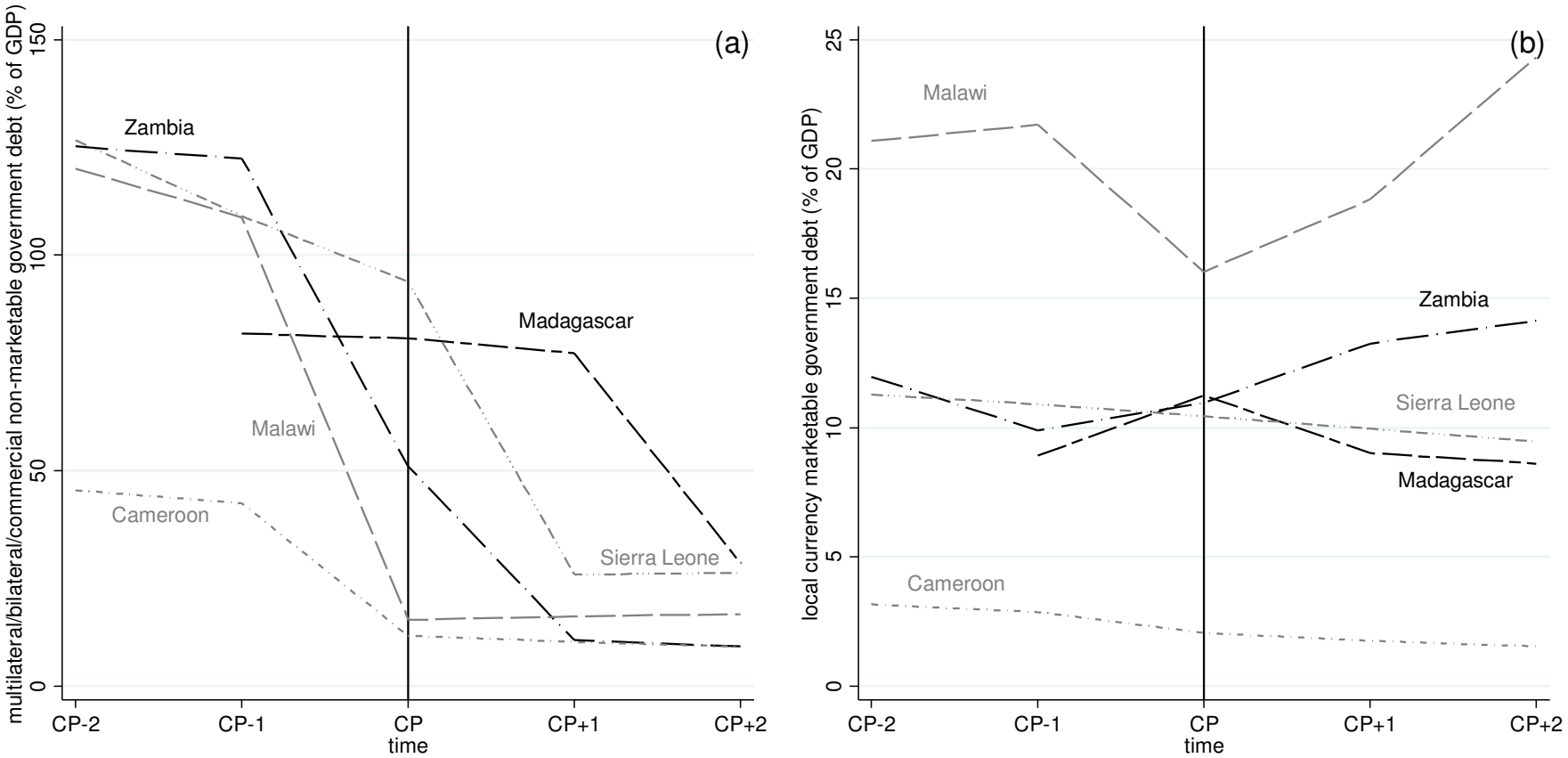


**Figure A.6. Evolution of non-marketable government debt and government LCBMs (as % of GDP) for HIPC completion point sample countries**

Notes: For presentation purposes, non-marketable government debt stock and LCBM capitalisation are only shown for five sample countries that reached HIPC completion point during 2003-2012: Madagascar (2004), Zambia (2005), Cameroon (2006), Malawi (2006) and Sierra Leone (2006). To facilitate comparison, evolution of HIPCs' debt stocks is shown in a five-year window centred around respective completion points.