

Macroeconomic determinants of sovereign bond market development in African emerging economies

Macroeconomic determinants of sovereign bond

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Abstract

Purpose – Despite being a viable source of funds, African sovereign bond markets are relatively underexplored. The empirical literature fails to consider the impact of exclusively macroeconomic factors and the volatile contexts in which African markets operate. The purpose of this paper is to fill the vacuum by proposing a context-sensitive theoretical framework. The study targets, specifically, macroeconomic factors and assesses the extent to which they affect bond market development.

Design/methodology/approach – Using panel data on sovereign bond markets from 26 African economies, the study extends previous methodologies used in similar studies by accounting for downside risk in a generalized method of moments (GMM) framework and employing tighter robustness measures.

Findings – This study finds that inflation, domestic debt, external debt, GDP at PPP, fiscal balance and exports are important macroeconomic drivers of sovereign bond market development in African emerging economies.

Research limitations/implications – While GMM estimation is beneficial in the presence of endogeneity between the dependent variables that are instrumented with lagged independent variables, it guarantees consistency but, not unbiased estimations.

Practical implications – Market-oriented government funding with well-defined debt management strategies must be implemented to support the development of sovereign bond markets. External debt must be set at a sustainable level, and government should be dedicated to the confirmation of this. Furthermore, inflation rates must be kept low and stable.

Social implications – If policymakers are to take this study seriously, bond markets may begin to be viable sources of funds for African emerging economies.

Originality/value – This study introduces a methodology for measuring bond market development that considers the systemic volatility in emerging markets and proposes a theoretical framework for African emerging economies. In addition, the authors identify a new macroeconomic determinant of bond market development in the region.

Keywords Africa, Downside risk, Performance, Emerging economies, Sovereign bonds, Sovereign debt

Paper type Research paper

1. Introduction

The empirical literature on determinants of bond market development is sparse, and contains only a handful of publications over the past 15 years. The practice has been to combine two main lines of inquiry – institutional (including political) and macroeconomic factors – in single a study of developed and emerging economies. Most of the studies on emerging economies are centered around Asia and Latin America with only three on Sub-Saharan Africa (SSA): Eichengreen and Luengnaruemitchai (2004), Bae (2012) and Bhattacharyay (2013) analyze Asia; Eichengreen *et al.* (2008) examine Latin America; Eichengreen *et al.* (2006) study Latin America and East Asia; and Adelegan and



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Radzewicz-Bak (2009), Mu *et al.* (2013) and Essers *et al.* (2016) research SSA. The literature identifies a wide range of statistically significant determinants derived from studies on regions other than SSA. These are: economy size; institutional quality; exchange rate; interest rate variability; openness of the economy; rule of law; and inflation. The determinants for SSA are: economy size; level of development; sector size; fiscal balance; exports; inflation; domestic debt; institutional quality; legal origin; and interest rates (Adelegan and Radzewicz-Bak, 2009; Mu *et al.*, 2013; Essers *et al.*, 2016). There are marked differences and similarities among the determinants in the two sets of studies. First, institutional quality, legal origin, exports, economic size, interest rate and inflation are very important for both categories (Adelegan and Radzewicz-Bak, 2009; Mu *et al.*, 2013; Essers *et al.*, 2016). However, the level of development, fiscal balance and domestic debt are important for SSA, while exchange rate matters for the other category. It is common in these studies to select bond markets from SSA as a region regardless of the state of their functionality, thereby misrepresenting the essential features that characterize most active African bond markets. Furthermore, although macroeconomic variables dominate the list of determinants, there is no separate study to determine their impacts individually and collectively on African sovereign bond market development. Finally, there is an increasing tendency toward improving methodological robustness over time, the last two studies on SSA having taken steps to account for endogeneity. Nevertheless, neither study takes measures to neutralize potential volatility of the results in order to improve their quality.

This trend suggests that the literature is steadily heading in the desired direction, although the journey is incomplete for three reasons. First, the recent extension of empirical studies to cover SSA is applauded. However, this coverage excludes Northern Africa. Furthermore, sample selection does not exclude inactive bond markets. We have not only extended the coverage of Africa to capture the entire region, but also, we have selected only fully operating bond markets, so that the results represent the true state of functioning bond markets in the region. Second, the current practice of combining institutional, macroeconomic, structural and other variables in a single study makes it impossible to delineate the impacts of specific categories of determinants and their implications for policy and management practice. Therefore, by targeting only macroeconomic variables that can be intuitively traced to bond market development, we are able to test their relevance for Africa. Our results confirm five macroeconomic variables – gross domestic product at purchasing power parity (GDP at PPP), inflation, exports, fiscal balance and domestic debt – as bond market determinants and identify a new variable – external debt. Finally, this paper introduces the downside β as an appropriate measure to stabilize results of studies on the region and thereby improve the quality of their findings comparable to those from the developed economies.

We have, in a nutshell, introduced four novelties from previous studies: selected only dynamic bond markets in the entire Africa region, further divided into SSA and the weakest markets as distinct subgroups; focused only on macroeconomic variables; accounted for downside risks and identified a new macroeconomic determinant of bond market development for SSA in addition to confirming five others. It is our expectation that these contributions will collectively add considerably to the enrichment of the current literature.

The rest of the paper is structured as follows. The next section reviews the extant literature, followed by an account of the methodology employed in the study in Section 3. Section 4 presents the results, while Section 5 engages in discussion of these results, concluding with recommendations and implications in Section 6.

2. Literature review

The work of Eichengreen and Luengnaruemitchai (2004) sets the tone for a review of the empirical literature. Inspired by the 1997 Asian crisis and the dismal performance of Asian economies, the authors use panel data on a set of socio-economic and institutional factors for

empirical estimation from 41 developing and developed countries, with a focus on Asia, from the year 1990 to 2001. Measures of domestic sovereign bond market development are regressed against various explanatory variables using a generalized least squares estimator. Burger and Warnock (2006) use previous methodology to study 49 developing and developed countries and find that countries with sound inflation have larger sovereign bond markets particularly because of its effect on a country's need to borrow from abroad.

Claessens *et al.* (2007) use panel data to examine a combination of institutional and macroeconomic variables sourcing data from 36 countries over the period 1993–2000. The authors observe that macroeconomic fundamentals positively influence the size of sovereign bond markets. Further, foreign currency debt stock is more sensitive to these fundamentals than the stock of domestic currency debt. Eichengreen *et al.* (2008), in a similar study, employ panel data from developed and developing countries with a focus on Latin America, and find country size, trade openness and legal origin to be positive and significant. Furthermore, fiscal balance, interest rate spread, GDP per capita at purchasing power parity, quality of bureaucracy, volatility of exchange rate and banking sector concentration are all found to be negative and significant determinants of sovereign bond market development. Concurrently, they find that an open capital account, a positive investment profile, GDP at purchasing power parity, distance from the equator and exports are positive and significant for sovereign bonds. Overall, market size is established as a positive determinant, and the larger the market size, the better the bond market development trajectory. Capital controls, as suggested by Eichengreen and Luengnaruemitchai (2004) and Mu *et al.* (2013), discourage bond market development; thus, trade openness is a positive determinant.

Bhattacharyay (2013) extends Eichengreen *et al.*'s (2008) study to establish interest rate spreads as a key determinant of bond market development in China, and economy size as having a positive, significant relationship with sovereign bond market development. In agreement with Eichengreen and Luengnaruemitchai (2004) and Mu *et al.* (2013), Bhattacharyay (2013) observes also, that a decrease in nominal exchange rate volatility improves bond market development.

Bae (2012) examines which variables – capital controls, institutional or macroeconomic variables – best explain country variances in bond market development. They follow the methodology used in previous studies and employ cross country panel regressions to establish if contrasts in bond market development can be attributed to significant differences in these variables. The analysis extends from 1990–2009 for developed and developing countries. Comparable to Bhattacharyay (2013), Bae (2012) establishes that bigger, more concentrated banking sectors are conducive to bond market development; however, a concern about the study is the validity of data used.

Mu *et al.* (2013) concentrate on bond markets in SSA, developing a baseline econometric model in harmony with Claessens *et al.* (2007) and Eichengreen *et al.* (2008), and the original model presented by Eichengreen and Luengnaruemitchai (2004). Data for 36 countries across the years 1980–2010 are used. Mu *et al.* (2013) establish that government bond market capitalization is related to interest rate volatility, and is inversely related to fiscal balance, exchange rate volatility, current and capital account openness and higher interest rate spreads. As with Burger and Warnock (2006), Mu *et al.* (2013) identify interest rate volatility as a key determinant of bond market development.

Essers *et al.*'s (2016) study of SSA is among the first to account for the volatile and uncertain environment in which bond markets in African emerging economies operate by applying robustness and sensitivity tests, such as the generalized methods of moments (GMM), to an econometric model to analyze 15 SSA bond markets. In line with Burger and Warnock (2006), Essers *et al.* (2016) find high inflation to be negatively correlated with bond market development and echo the sentiments of Eichengreen and Luengnaruemitchai (2004) and Mu *et al.* (2013) of an inverse relationship between fiscal balance and the development of

bond markets. Also using GMM, Smaoui *et al.* (2017) examine 22 emerging and 20 developed countries between 1990 and 2013, and find that a combination of structural, financial and institutional factors have significant effects on bond markets. Khalid and Rajaguru's (2018) investigation of the impact of economic, social and institutional variables on the size of a country's bond market, use an extension of Claessens *et al.*'s (2007) methodology, over the years 1998–2007 across a sample of 47 countries. The study, in concurrence with Eichengreen and Luengaruemitchai (2004), Claessens *et al.* (2007) Eichengreen *et al.* (2008), Bae (2012) and Mu *et al.* (2013), finds that macroeconomic variables such as economy size and interest rate determine domestic bond market size in emerging economies. A synthesis of the reviewed literature appears in Table I.

It may be argued that the varying time frames, different analytical techniques and shifting study areas account for the diversity of findings. However, it is generally agreed that sovereign bonds are a viable means to access the much needed funds for economic development (te Velte, 2014). Many authors, including Maana *et al.* (2008), Mu *et al.* (2013) and Smaoui *et al.* (2017) observe, at the same time, that bond markets in Africa are at a nascent stage and, therefore, lack the means to contribute significantly to African development.

Domestic bond markets contribute to lessening uncertainties in the financial sector of emerging economies, besides addressing the burden of “original sin” by narrowing the mismatch between domestic and foreign currency debt held by a country, thus easing the ability to roll-over short-term debt (Maana *et al.*, 2008). They are also effective in linking capital savers with those in need of capital funds (IMF, 2013)[1]. Other merits of well-developed bond markets in Africa include their role in the establishment of the yield curve necessary for the appropriate pricing of securities (ICMA, 2013). However, studies show that investors in emerging market bonds prefer to hold the bonds for relatively brief periods (Mezui, 2012), in order to limit exposure to interest rate, credit and similar risks inherent in these markets. These practices may have contributed to the current development finance vacuum, and African countries have to find the means, other than bonds, of funding government deficits (te Velte, 2014).

There are other practices that deter bond market development in Africa. The markets are frequently subjected to appraisals, reviews and approval criteria similar to those used for developed economies (Burger *et al.*, 2012). This system is applied despite the marked differences between developed and emerging markets. African markets are less liquid and efficient, and the countries face civil unrest, corruption, military dictatorships, wars and deep persistent poverty (Andjelic *et al.*, 2010). They, typically, have incidences of high-level country risks and fluctuating foreign currency exchange rates (Eichengreen and Hausmann, 1999; te Velte, 2014). The application of standard bond market frameworks for developed economies to emerging economies is, therefore, a misfit.

Sizes of sovereign bond issuance have, however, improved; yield curves have extended from short to medium and long terms, and reforms have been devised for the clearing and settlement systems of many markets (te Velte, 2014). More diversity has been infused into the investor base including a decrease in the dominance of commercial banks and more participation of non-financial institutions. Foreign participation in sovereign bond markets has increased as well as secondary market liquidity; however, in comparison to advanced economies bond markets development in Africa remains fragile. Apart from Egypt and South Africa, African bond markets are relatively underdeveloped (Smaoui *et al.*, 2017).

Figure 1 displays the large disparity among local currency sovereign bond markets in Africa as of 2014. South Africa, Mauritius and Egypt are the most capitalized bond markets while Burkina Faso and Nigeria are the least capitalized.

When viewed over a nine-year period, there is a general upward growth trend of local currency sovereign bond markets in Africa. Egypt, Kenya, Mauritius and South Africa experienced sharp turns in 2013 with Mauritius' capitalization decreasing and those of Egypt and South Africa increasing. Figure 2 indicates that the capitalization of the entire

Author	Market investigated	Variables explored	Primary methodology used	Bond market development measurement	Key determinants found
Eichengreen and Luengaruemitchai (2004)	41 developing and developed Asian countries 1990–2001	Country size, institutions, exchange rates, banking sectors, GDP at PPP, interest rate, exports, legal origin, distance from equator, fiscal balance, investment profile and openness	Multivariate panel regression and GLS	Bond market capitalization as a share of GDP	Country size, institutions, exchange rates and banking sector size
Burger and Warnock (2006)	49 developing and developed countries As of end 2001	Rule of law, inflation, fiscal balance, GDP growth and creditor rights	Ordinary least squares (OLS) regression and cross section multivariate tests		Rule of law and low inflation
Claessens <i>et al.</i> (2007)	36 countries around the world 1993–2000	Exchange rate regimes, inflation, fiscal burden, capital account openness and legal origin	Panel regression and feasible generalized least square (FGLS)	Size of bonds outstanding in logarithms	Economy size
Adelegan and Radzewicz-Bak (2009)	23 SSA countries 1990–2008	GDP at PPP, exports, legal origin, investment profile, law and order, GDP per capita, corruption, bank credit, bureaucracy quality, interest rate volatility and spread, exchange rate volatility and budget balance	Multivariate Analysis	Bond market capitalization as a share of GDP	Country size, common-law, per capita GDP, bureaucratic quality, corruption, banking sector size, interest rate volatility and fiscal balance
Bae (2012)	China 1990–2009	GDP per capita, fiscal balance, exports, exchange rate volatility, domestic credit, lending interest rate, market capitalization of listed companies, common law, investment profile, law and order, bureaucratic quality, accounting standard and capital controls	Panel and multivariate regression		Fiscal balance
Bhattacharyay (2013)	China 1998–2008	Interest rate spread, economy and banking system size, exchange rate, development stage and trade openness	Multivariate OLS, Random effects (RE), Fixed effects (FE), GLS models, time series and panel regression		Economy size, economic development, economy openness, banking sector size and interest rates

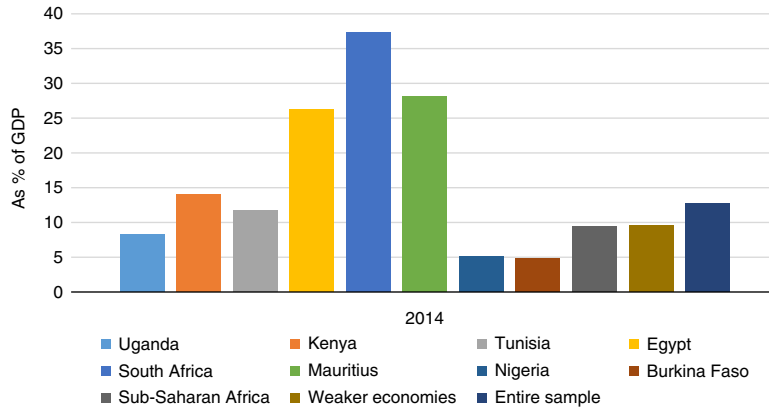
(continued)

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Table I.
Summary of bond market studies

Author	Market investigated	Variables explored	Primary methodology used	Bond market development measurement	Key determinants found
Mu <i>et al.</i> (2013)	SSA 1980–2010	Fiscal balance, interest rate, exchange rate, capital account openness, institutions, economy size and development	Pooled ordinary least squares (OLS), RE, FE and GMM		Institutions and interest rates
Essers <i>et al.</i> (2016)	SSA 2003–2012	Economy and banking sector size, economic development, trade openness, fiscal balance, inflation, capital account openness, institutional quality and legal origin	Panel data, PLS, RE, FE and GMM estimations		Fiscal balance, inflation, legal origin, democracy and strong institutions
Smaoui <i>et al.</i> (2017)	22 emerging and developed countries 1990–2013	Economy size, trade openness, legal origin, distance from equator, GDP per capita, institutional quality, banking system size, banking concentration, capital control, interest rate volatility and spread, exchange rate volatility and fiscal balance	Panel data regression, Prais–Winsten and GMM		Structural, financial and institutional factors
Khalid and Rajaguru (2018)	47 developed and emerging economies 1998–2007	Economy and banking system size, inflation, economic freedom, civil liberty and macroeconomic environment	Panel regression, FE and GMM		Economy size, banking sector development, monetary policy, openness, corruption, civil liberty and market access

Source: Researcher's compilation



Notes: Bond market comparisons, 2014 (percent of GDP) Sub-Saharan African countries in the sample include: Angola, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Cote d’Ivoire, Gabon, Ghana, Kenya, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Zambia and Senegal. Weaker economies comprise of: Algeria, Angola, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Cote d’Ivoire, Gabon, Ghana, Malawi, Morocco, Mozambique, Namibia, Nigeria, Rwanda, Tanzania, Uganda, Zambia and Senegal (the entire sample minus the five most economically strong countries in Africa being, Egypt, Kenya, Mauritius, Tunisia and South Africa). The entire sample consist of bond markets of: Algeria, Angola, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Cote d’Ivoire, Egypt, Gabon, Ghana, Kenya, Malawi, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Tunisia, Uganda, Zambia and Senegal

Source: African development bank (ADB) African Financial Sector Database

Figure 1.
Outstanding Local
Currency Government
Bonds (as % of GDP)
of selected countries
as of 2014

sample, over the nine years, steadily increased at a similar rate as the group described, in Section 4, as the “weaker- sample” and the “sub-Saharan sample,” respectively. Since 2009, the two samples have exhibited equal measures of capitalization.

3. Methodology

Many authors rely on the econometric framework of Eichengreen and Luengnaruemitchai (2004), yet, they ignore an earlier suggestion by Eichengreen (1998) that it is necessary to take into account the wider social context in macroeconomic analysis. This is relevant to African economies because the variance of returns as a measure of risk is appropriate only when the underlying return distribution is normal and symmetric (Estrada, 2007). However, Chinzara and Kambadza (2014) show that the underlying return distribution is not normal and asymmetric in most African economies, suggesting the inappropriate use of beta as a risk factor. Estrada (2007) proposes its replacement with an alternative framework based on the downside beta. This refined measure of risk employs the variance of returns to accommodate the abnormality and asymmetric distribution in African markets. Thus, this study alters, slightly, the standard Eichengreen and Luengnaruemitchai (2004) model to suit the African condition as the beta accommodates the volatility of macroeconomic measures. This model therefore replaces the standard β with the downside β_k^D as follows:

$$Y_{i,t} = \alpha + \delta(\mu_i + \mu_t) + \sum_{k=1}^K \beta_k^D X_{i,kt-1} + \sum_{l=1}^L \gamma_l Z_{i,lt} + \varepsilon_{i,t}, \quad (1)$$

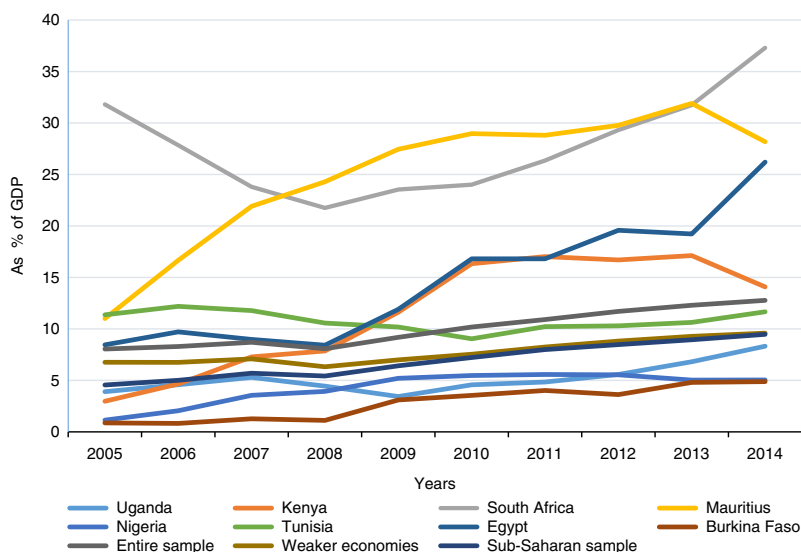


Figure 2.
Outstanding Local
Currency Government
Bonds (as % of GDP)
of selected countries

Note: Government bond market capitalization, 2005–2014 (percent of GDP)

Source: ADB African Financial Sector Database

where $Y_{i,t}$ is bond market capitalization as a share of GDP (Adelegan and Radzewicz-Bak, 2009; Essers *et al.*, 2016). A constant equal to the value of the dependent variable when the independent variable equals 0, is represented by α . The explanatory variable X_i is lagged by the addition of $t-1$ to its subscript and signifies time variant explanatory lagged variables that counterbalance the mismatched commencing dates of the dependent and certain explanatory variables, consequently increasing the size of the sample (Essers *et al.*, 2016). The subscript k denotes the number of explanatory variables. A common intercept throughout countries is assumed and asymptotically estimated for the nonlinear function of the parameter means of δ (Weisberg, 2001). Variables are normalized by γ with time invariant explanatory variables denoted by $Z_{i,t}$ (Eichengreen and Luengnaruemitchai, 2004). Country specific and time fixed effect (FE) acquires μ_i and μ_t , respectively and the error term is $\varepsilon_{i,t}$ (Essers *et al.*, 2016).

3.1 Variables

3.1.1 Dependent variables. The logarithm of sovereign bonds outstanding as a percentage of GDP is the dependent variable used in this study. The year-end outstanding domestic sovereign bond market capitalization taken as a share of GDP is calculated as the size of the domestic sovereign bond market (Mu *et al.*, 2013). This measure is used regardless of the residency of creditors. Essers *et al.* (2016) explain that in cases where debt settlements occur in foreign currency the settlement amount may be included in the dependent variable computation, only if their cash flows are of local currency. Data are obtained from the African Financial Markets Database (AFMD).

3.1.2 Explanatory variables. **3.1.2.1 Domestic debt.** Domestic debt (DomesticXb) provided to the private sector (as a percentage of GDP) is taken as a proxy for banking sector size (Mu *et al.*, 2013). A greater ratio suggests a larger banking sector and, consequently, a smaller sovereign debt market (Adelegan and Radzewicz-Bak, 2009). Banking sector size matters, particularly, to economies that have issued large quantities of

debt to the investment public (Anyanwu *et al.*, 2017). A large presence of banks may spur greater bank lending while deterring the use of bond financing. This is the case when perceived from the argument that banks and bonds rival each other (Adelegan and Radzewicz-Bak, 2009; Mu *et al.*, 2013). Data are sourced from AFMD.

3.1.2.2 Economy size. This study employs the log GDP at purchasing power parity (GDPPPPXb) as a proxy for economy size (Essers *et al.*, 2016). Larger economies may offer greater diversification benefits to investors than smaller ones (Hausmann and Panizza, 2003). Bond market development may be increased, and price volatility decreased by the availability of potential buyers that tend to be present in larger economies (Eichengreen and Luengnaruemitchai, 2004). Smaller economies tend to be unable to reach the scale efficiencies needed to attain deep and liquid markets, and funds raised from relatively small economies may be too small to draw interest from foreign investors and multinational companies (Eichengreen and Luengnaruemitchai, 2004). Additionally, fixed issuance costs are likely to be high in smaller economies than their larger counterparts. Risks and costs related to lending can be reduced in larger economies thus fostering an environment for governments to attain finance through bonds. Simultaneously, larger economies may require financing in addition to banks, which may be met through bonds. Overall, investors may view risks in smaller economies as higher than in larger ones (Eichengreen and Luengnaruemitchai, 2004). Data are taken from the IMF database.

3.1.2.3 Exchange rate. Following Eichengreen and Luengnaruemitchai (2004), Adelegan and Radzewicz-Bak (2009), Bhattacharyay (2013) and Mu *et al.* (2013), this study uses exchange rate variability (ExchangeXb) to compute the exchange variable. It is measured as the standard deviation of the change in the logarithm of the nominal exchange rate (Mu *et al.*, 2013). Fixed, or relatively stable exchange rates may signal to investors that there is a lower risk of sovereign bond market defaults, thus encouraging bond market development (Goldstein, 1998; Mu *et al.*, 2013). However, if not sufficiently considered, stable exchange rates may steer investors to underrate the risk of bank lending causing competition which may obstruct the development of sovereign bond markets (Goldstein, 1998). Data are sourced from AFMD.

3.1.2.4 Exports. Exports (ExportXb), in this study, is a proxy for trade openness and is a standard measure of an economy's connection with the rest of the world (Eichengreen and Luengnaruemitchai, 2004; Gelos *et al.*, 2011). The ratio of total exports of goods and services as a share of GDP captures trade openness (Eichengreen and Luengnaruemitchai, 2004). An open capital account is likely to expose economies to market discipline thus increasing attention to bonds by domestic investors (Essers *et al.*, 2016). Capital controls, for instance, may be a motivation for governments and corporations to seek funding from local markets, more specifically, domestic bond markets rather than external sources (Mu *et al.*, 2013). A more open economy may encourage bond market development as established interests may be unable to dictate policies that quell contending sources of funds in cases when an economy opens its sovereign bond markets to international competition (Rajan and Zingales, 2003). Contrarily, economies that are less integrated with external economies have more incentive to develop domestic bond markets in order to meet their financing needs (Adelegan and Radzewicz-Bak, 2009). Data are from the IMF database.

3.1.2.5 External debt. External debt (ExternalXb) is defined as outstanding payments to non-residents of a country repayable in the form of services, goods or currency (World Bank, 2018). It is an essential source of finance that is employed primarily as an addition to domestic sources of funds to support developmental needs (Siddique *et al.*, 2016). External debt levels that are unsustainable pose a negative impression to investors that a country is unable to handle its debt management well, an indication of a high risk of default. Such countries have less-developed bond markets. Data are taken from AFMD.

3.1.2.6 Fiscal balance. A three-year moving average of historical budget balances is the measure of fiscal balance (FiscalXb) used. The difference between fiscal revenues and expenditures determines fiscal balance (Smaoui *et al.*, 2017). The empirical literature has used the previous year's budget balance as a share of GDP, and public debt as a percentage of GDP to assess fiscal policy; however, the three-year moving average is favoured here because it is less susceptible to subjugation by fleeting influences (Eichengreen and Luengnaruemitchai, 2004). Larger fiscal deficits are positively related to larger government bond markets particularly in low inflation economies. When public expenditure outstrips public revenue, a finance gap is triggered that needs to be addressed typically, through the issuance of sovereign bonds. Thus, countries with relatively poor fiscal performance have the tendency to have bigger sovereign bond markets. Data are obtained from the World Development Indicators (WDI) database.

3.1.2.7 GDP per capita. The natural logarithm of GDP per capita (GDPXb) is used as a measure of the degree of economic development. Data are in constant 2005 US dollars. GDP per capita captures aspects of underdevelopment that are not fully captured by other explanatory variables (Mu *et al.*, 2013). La Porta and Shleifer (2008) consider GDP per capita as the most robust predictor of the size of the informal economy and is an expression of underdevelopment. According to Mu *et al.* (2013), less-developed countries are often characterized by poor transparency, weak creditor rights and generally volatile investment environments not deemed attractive to bond market investors. Economies with higher levels of development may promote bond markets as larger financing is likely to be required for investment projects. Data are obtained from the WDI database.

3.1.2.8 Central government debt. Central government debt (CentralXb), according to the WB (2019), comprises the all-inclusive stock of direct government fixed-term contractual duties due to distinct parties at a specific time computed as a percentage of total GDP (WB, 2019). This includes foreign and domestic liabilities such as money and currency deposits and securities, with the exception of bonds, shares and loans (WB, 2019). A surge in central government debt increases aggregate demand, thus raising interest rates, both real and nominal (Thumrongvit *et al.*, 2013). High and/or volatile interest rates may lessen risk averse investors' appeal for bonds. On the other hand, high interest rates, arising from high central government debt, provide relatively higher returns. Data are attained from the WDI database.

3.1.2.9 Inflation. Inflation, according to Burger and Warnock (2006), is a vital determinant of bond market development because of its effect on a country's need to borrow from abroad and the possibility of the "original sin" phenomenon occurring. In this study, inflation (InflationXb) is considered as the inflation rate based on the consumer price index. Burger and Warnock (2006) and Claessens *et al.* (2007) find that poor credibility of monetary policy due to volatile inflation rates are an important obstacle to the development of sovereign bond markets. High and/or volatile inflation rates may cause investors to be apprehensive about investing in sovereign bonds. This occurs as investors who fear that their claims may be lost to inflation invest very short term rather than in the longer-term bonds which support bond market development. Influential banks may fix interest rates at levels that entice investors as an avenue for financing. Banks, however, also operate as dealers and market makers thereby increasing liquidity and promoting well-functioning bond markets (Anyanwu *et al.*, 2017). Data are sourced from the IMF database.

3.2 Endogeneity

It is suspected that endogeneity occurs among some of the variables in this study as has been the case in previous studies (Burger and Warnock, 2006; Mu *et al.*, 2013). Bond market capitalization and fiscal deficit are likely to interact as many governments in Africa are

limited in their ability to borrow; consequently, the extent of fiscal deficit may be influenced by accessibility to debt finance. Furthermore, it is plausible that an interaction between bond market development and imminent inflation occurs. According to Eichengreen and Hausmann (1999), well-developed sovereign bond markets are likely to occur, in part, when political electorates are opposed to inflationary policies. Thus, a formal test for heteroscedasticity was undertaken using the Breusch–Pagan test and rejected the null of homoscedasticity. Unlike some panel data estimation techniques such as the [2] FE and random effects (RE) estimations, the GMM estimation allows for heteroscedasticity of unknown form. The GMM is a method of estimating a probability distribution’s parameters. It does so by inspecting viable values of distribution parameters that may result in the best fitting moments of the sample obtained from the distribution. The GMM curbs endogeneity and reduces multicollinearity complications (Lee and Yu, 2014). It is for this reason that we select it as the estimation technique for this study.

4. Results

4.1 GMM estimations

Table II presents the results of the estimation for sovereign bonds under GMM. There are likely to be large differences among the various countries in the study; because of this, the sample is divided into three subgroups. The first group comprises the entire sample of African countries with actively functioning bond markets; the second, excludes the five economies with the most capitalized sovereign bond markets, being Egypt, Kenya, Mauritius, Tunisia and South Africa (the weakest sample). They are excluded because their high capitalization of government bonds may distort results in one direction; thus, they are identified to elucidate clear patterns among the variables that may not be apparent in the rest of the sample. The third category includes only SSA countries. The isolation of the total sample into categories gives a clearer picture of the differentiated influence, if any, of each variable in the three subgroups.

The Sargan test for the GMM estimation establishes whether overriding assumptions in instrumental variable estimations hold (Sargan, 1958). The p -values of each of the three samples are smaller than the critical significance level; therefore, the null hypothesis that the overriding assumptions hold, is rejected meaning that the models do not suffer from over-identification.

	GMM		
	(1)	(2)	(3)
InflationXb	-1.367*** (0.226)	-0.873 (1.488)	-0.736*** (0.531)
CentralXb	0.423 (0.415)	0.274 (1.177)	-0.231 (0.367)
GDPXb	-0.755 (1.734)	2.747 (8.652)	-2.965* (1.581)
ExternalXb	0.172 (0.180)	1.769 (1.475)	0.569** (0.248)
ExportsXb	0.710*** (0.231)	-0.647*** (0.453)	0.806* (0.480)
DomesticXb	0.437* (0.253)	-2.587 (1.364)	0.930** (0.469)
GDPPPPXb	-12.650** (5.916)	21.244** (8.117)	-11.999*** (9.499)
FiscalXb	0.026 (0.312)	-1.253** (0.608)	-0.337 (0.542)
ExchangeXb	-0.035 (0.043)	-0.200 (0.185)	0.013 (0.039)
Observations	214	169	178
Sargan–Hansen test	< 0.0001	< 0.0001	< 0.0001
Breusch–Pagan test	< 0.0001	< 0.0001	< 0.0001

Notes: (1) Full sample GMM estimation; (2) estimation excludes strongest five macroeconomic countries; (3) estimations of Sub-Saharan Africa. All explanatory variables are lagged one year. Country level clustered standard errors are reported in brackets. Significance indicated as * $p < 10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

Table II.
Empirical results

Inflation, under the GMM estimation, is negative across all three samples with significance below 0.001 for the entire sample and 0.20 for the SSA sample. Central government debt is not significant across any sample and the association is positive in the first two categories but negative in the SSA sample. Conversely, GDP at PPP, the measure of the size of an economy, has a relatively strong, negative relation at 5 percent significance with the dependent variable in the entire sample; however, it is positively associated with bond market development in the weakest sample. Like the entire sample, the SSA sample estimate is negative but, insignificant. External debt in both the entire sample and the weakest sample are positively related to the dependent variable but lack statistical significance. The SSA sample, however, reflects a positive and significant association at 5 percent. Exports, at a significance level of 1 percent, is positively related to the dependent variable in the entire sample. Significance of the estimate is low in the SSA sample while the weakest sample exhibits a negative link that is only significant at 20 percent.

Domestic debt reveals positive relationships with the full and the SSA samples and is highly significant in the latter. The weakest sample shows a negative estimate that lacks significance. GDP per capita has negative relationship with the entire and SSA sample, the latter being significant only at 20 percent. The weakest sample has a positive but insignificant relationship with the dependent variable. Regarding fiscal balance, the variable has a negative and significant relationship with the dependent variable only in the weakest sample; it is positively related to the entire sample and negatively related to the SSA sample, neither of them being significant. The exchange rate estimates are relatively small. The entire sample and the weakest sample display negative estimates, whereas the estimate for the SSA sample is positive. The variable is insignificant in all three samples.

4.2 Sensitivity and robustness

The study evaluates robustness of the results and sensitivity to variations in the sample by means of the GMM, with three endogenous variables and the composite risk variable. An additional measure to ensure the sensitivity and robustness of results is taken by dividing the sample into the three subgroups described in Section 4. The outcome of this investigation is not exhibited here to save space and for brevity; however, it suggests a reasonably high level of likeness across the various estimations, reinforcing the robustness of the results displayed in Table II.

5. Discussion

The significant negative estimation of GDP at PPP in the entire sample rebuffs scale effects in sovereign bond market growth in accordance with Claessens *et al.* (2007), Bhattacharyay (2013) and Khalid and Rajaguru (2018). Similar results occur with the SSA sample but, only at a significance of 20 percent. The negative relationship indicates a country's inability to attract sizable potential investors. Large numbers of investors facilitate the flow of information; thus, when capital volumes are relatively low, investors find bond markets unattractive. Such economies frequently experience price volatility which further deters investors of bond markets (Eichengreen and Luengnaruemitchai, 2004). The positive and significant estimate of the weakest sample may be due to improved efficiency in the allocation and mobilization of financial resources brought about by financial development generally. This may have arisen from increases in the size of the economy that filtered from the real sector to financial markets including bond markets (Berensmann *et al.*, 2015). Table III presents a comparison of findings of SSA bond market studies and the various subgroups of the current study.

The weakest sample presents significant and positive estimates which support the findings of Berensmann *et al.* (2015) that a positive relationship may exist between economic development, measured as GDP per capita and the size of sovereign bond markets.

Region of study	Adelegan and Radzewicz-Bak (2009)	Mu <i>et al.</i> (2013)	Essers <i>et al.</i> (2016)	Current study Africa; weakest African countries; SSA
<i>Determinants</i>				
Inflation	NE	NE	(-)*	S1: (-)*** S2: (-)* S3: (-)*
Central government debt	NE	NE	NE	S1: (+) S2: (+) S3: (-)
GDP at PPP (Economy size)	NE	(+)***	NE	S1: (-)** S2: (+)*** S3: (-)
External debt	NE	NE	NE	S1: (+) S2: (+) S3: (+)**
Exports (Trade openness)	(-) **	(-)***	NE	S1: (+)*** S2: (-) S3: (+)*
Domestic Debt (Banking Sector size)	NE	(+)**	NE	S1: (+)* S2: (-) S3: (+)***
GDP per capita	NE	(+)***	NE	S1: (-) S2: (+) S3: (-)*
Fiscal balance	(-)**	(-)	(-)	S1: (+) S2: (-)** S3: (-)
Exchange rate	(-)*	NE	NE	S1: (-) S2: (-) S3: (+)

Table III.
Results of studies on bond markets in Sub-Saharan Africa (SSA) and Africa and the sub-groups of the current study

Notes: S1 is the Sample 1 (entire sample of 26 economies); S2 is the Sample 2 (weakest economies comprise a sample without the most capitalized bond markets: Egypt, Kenya, Mauritius, Tunisia, South Africa); S3 is the Sample 3 (SSA economies). Signs (+) and (-) designate positive and negative association respectively. An "NE" indicates that variables are not examined in those studies. Significance indicated as * $p < 10$, ** $p < 0.05$, *** $p < 0.01$

Additionally, and in corroboration with Berensmann *et al.* (2015), the relative size of sovereign markets is least in low-income economies and biggest in upper-income economies. The negative estimate in the entire and SSA samples concur with Mu *et al.* (2013) and may indicate that more developed economies rely less on their bond markets for funding as their economies facilitate more options for government funding.

The negative and significant estimate of fiscal balance in the weakest sample implies that as fiscal balance improves, the impetus for sovereign bond financing decreases. This occurs, as funds required by governments are more available and the need to seek additional funds from bond markets decreases. The importance of fiscal balance to bond market capitalization lies in a sound fiscal policy.

There is wide, documented consensus that elections closely influence macroeconomic variables such as inflation, fiscal balance and real exchange rate (Kaeding, 2013). Quite often, expansionary policies are adopted during election years causing uncertainty for businesses and investors (Uppal, 2011). It is likely that, in some of the samples, fiscal balances increased due to politicians providing more government initiatives causing them to be perceived as more capable and thus enticing additional ballots (Uppal, 2011). Voters in

fragile socio-economic and political environments have imperfect information about politicians, which may lead to misguided decisions as voters act on false information (Bohn, 2013). This is likely to translate into a widening of the fiscal deficit in the periods immediately prior to an election in most of the African countries in the sample. An example of this occurred in Egypt where, during the presidency of Hosni Mubarak, a persistent pattern of sharp declines in total reserves was observed six months prior to elections, and exchange rate devaluations were experienced shortly afterwards (Blaydes, 2010).

Initiatives such as the Heavily Indebted Poor Countries Initiative contributed greatly to Africa's lowest debt levels in many years (Blommestein and Horman, 2007; Ncube and Brixiova, 2015). Only the SSA sample shows significant estimates for external debt. This is unexpected theoretically; however, African countries are observed to be constantly demanding heavy investment for social and physical infrastructure to meet their development needs.

The negative relationships between central government debt and bond market capitalization in the SSA sample, although insignificant, may be due to the accumulation of debt by respective governments. According to Mbate (2013), concerns regarding policy measures that may be taken by governments to curtail the debt are likely to be the primary sources of uncertainty. Mbate (2013) also supports the explanation that a considerable stock of debt facilitates an ambiance of uncertainty in an economy. These results may be owed to high tax evasion and low tax bases and rates prevalent in African countries, which diminishes government's ability to finance fiscal deficits. As a result, public debt is sought after, usually, prior to increased inflation and imminent increases in financial market uncertainty. The consequent inflation is detrimental to sovereign bond market development but, policies that encourage issuance of sovereign bonds to the public offer a fiscal deficit-financing route that is neither inflationary nor destructive to uncertainty in a market (Ishaq and Mohsin, 2015). Bond market capitalization in the sampled countries is however, not typically high enough to reap the fiscal financing benefits.

The literature has acknowledged low inflation as an imperative bond market development prerequisite, and outcomes of the regressions confirm this as significant in the entire sample and to a lesser extent, the SSA sample (Sibanda and Dubihlela, 2013). Some benefits of high inflation exist, such as its ability to decrease the value of real debt outstanding; however, in the context of this study, the negative effects it has on sovereign bond market development deem high inflation inappropriate (Ishaq and Mohsin, 2015). This is consistent with Sunder-Plassmann (2013), who find that higher rates of inflation are usually related to higher inflationary volatilities thus increasing the propensity for African governments to inflate outstanding debt. Perhaps, a lack of governance is responsible for certain sovereign bond markets in the sampled countries to have only modest capitalization despite relatively low inflation rates. Senegal, for instance, has experienced a relatively steady inflation over the last decade; however, the country's bond market capitalization is among the lowest in the sample. Research suggests that longer-term investment, which is best for the demand for bond market financing, is likely to be discouraged in economies with high inflation and large fiscal deficits as these variables misrepresent economic behavior toward speculative securities (Mihaljek *et al.*, 2002). The insignificance of the inflation variable in the weakest sample reflects the under-development of the financial markets in those countries.

Most of the sampled countries employ a floating exchange rate as opposed to a fixed or pegged regime. The fixed exchange rates are likely to spur bond investment by foreign investors thus supporting development of bond markets; however, the growth of domestic intermediation may be hampered by subsequent foreign competition and any underestimation of exchange rate risks that may occur (Mu *et al.*, 2013). Volatility of exchange rate is found to be negative and significant with bond market development in comparable studies. Results of the current study are mixed and lack significance across all

samples, suggesting that other factors such as exchange rate misalignments may be present. It is probable that exchange rates are internalized by investors and hedged against exchange rate risk causing movements of rates to translate into small real quantities in African economies (Eichengreen and Hausmann, 1999; Mu *et al.*, 2013).

It is likely also that, although not statistically significant, exchange rate has had a bearing on the development of bond markets in African economies. Reliable reports state that bond markets in some countries have suffered due to volatility in exchange rates, for example, in Ghana, South Africa and Zambia. Relative to other emerging economies, the exchange rates in several African economies during the period of this study displayed volatility and the countries experienced sharp drops in currency (AfDB/OECD/UNDP, 2016).

The extent of a country's trade openness (measured by exports) is relevant to the development of bond markets; however, the outcomes of the variables are ambiguous. Capital controls, for instance, may be a motivation for governments and corporations seeking funding from sovereign bond markets rather than external sources (Mu *et al.*, 2013). The relationship between sovereign bond market capitalization and exports is strong and positive for the entire sample, and the SSA sample to a lesser effect, in accordance with the neoclassical hypothesis of McKinnon and Shaw (1973). The varying results of trade openness and sovereign bond markets among the three samples may signify the risks of trade openness in economies that are not economically stable. Additionally, the diverse results may be owed to the legal and regulatory structure (Law *et al.*, 2018). The authors suggest that rewards of trade openness can only be reaped in countries with legal and regulatory environments that ensure astute accounting procedures, protection of property rights and enforcement of contracts. The weakest sample displays a negative and insignificant estimate that may suggest a dominance of banks in the supply of funds. Risky behavior by banks may occur under more open capital accounts, and spark boom-bust cycles in countries with imperfect capital markets (Eichengreen *et al.*, 2018). Furthermore, borrowers may be persuaded by agency difficulties to employ bank loans to purchase risky assets during surges in lending resulting in banking crisis and recessions. Aksoy (2018) claim that trade openness in economies with agency problems and weak institutions may ignite short run crises.

Results for the weak sample support the school of thought that private sector credit (DomesticXb) is subject to a crowding out effect when government debt is issued excessively, particularly in countries with shallow financial markets and low national savings (Mbate, 2013). Similar results are found by Essers *et al.* (2016). These findings are consistent with Turner (2003) who asserts a complementary relationship between bond markets and banks. This, however, contradicts the finding of Adelegan and Radzewicz-Bak (2009) and Mu *et al.* (2013) in their examination of bond markets in SSA. The findings in the entire sample and the SSA sample suggest that private sector credit and bond markets operate to complement each other. The divergent findings between this study, Adelegan and Radzewicz-Bak (2009) and Mu *et al.* (2013) may be due to the downside risk framework used in the present study.

6. Conclusion and implications

This study assesses the extent to which macroeconomic factors that characterize African emerging economies affect bond market development. Furthermore, it is argued that, quite often, the continent's bond markets are questionably subjected to similar appraisal frameworks as their developed economy counterparts. This distinction is important for the health of African bond markets and the overall state of the continent because well-functioning bond markets provide crucial funding for governments to borrow at reasonable costs and spur economic growth. To date, the literature has made limited progress in exploring the African region, but this study offers a more focused analysis of three distinctive categories of active bond markets across the entire African continent.

While the study does not propose an overriding solution to supersede existing bond market models, it does expose the crucial importance of context when evaluating bond markets in African emerging economies. As a result of using the more appropriate downside risk framework in a GMM system, this study firmly suggests that inflation, domestic debt, exports, GDP at PPP, fiscal balance and external debt, a new variable, are important drivers of sovereign bond market development in African emerging economies.

African emerging economies are not a homogenous unit which is why they have been classified into three categories in this study (Table II). For the weakest economies, that is, the category excluding the five largest bond markets, GDP at PPP and fiscal balance are critical determinants. For the entire sample that includes the Sub-Saharan and North African regions, inflation, exports and GDP at PPP are the most important. Regarding the SSA category the most influential determinants are external debt and domestic debt. Central government debt, exchange rate and GDP per capita are insignificant for all three samples. For the entire sample, high inflation could be leading to high export spending, and subsequently low bond market size. Regarding the weakest economies, high fiscal deficit could be the ultimate consequence of smaller bond market size. Finally, in the case of the SSA sample, increasing costs of financing domestic debt, leading to high inflation could, in turn, increase external debts by borrowing at high interest rates and low maturity. Knowledge about these detailed findings is useful in enabling articulation of customized policy and management practices that foster bond market development at country levels.

Comparison of our SSA results with those of the three previous studies on SSA further reveals the value of our study in three ways (Table III). First, none of the studies have taken central government debt and external debt into account; yet, our study finds the latter to be a significant determinant. Second, our study finds domestic debt to be an important driver of bond market development in congruence with the only previous finding by Mu *et al.* (2013). Third, this study as well as Essers *et al.*'s (2016) are the only that take account of inflation and find that variable to be of weak significance for the SSA sample, although it is significant for the entire Africa sample. Thus, this study is the first, to our knowledge, to identify external debt as an important determinant of bond market development in SSA. Furthermore, it confirms domestic debt as important driver as well as inflation as a rather weak determinant.

6.1 Policy implications and scope for further research

A number of policy implications arise from this study. First, it is vital that inflation rates in all African emerging economies are kept low and stable because high inflation could be a threat, especially to smaller economies which are more susceptible to trade openness, creating fiscal imbalances that forestall bond market development. Second, a well-defined debt management strategy must complement market-oriented government funding. Third, the relationship between external debt and domestic debt must be set at a sustainable level, while government is dedicated to its implementation. Fourth, we observe several findings from previous studies which contradict the findings of the present study. Mu *et al.* (2013), conclude that GDP at PPP, export and GDP per capita are significant variables in contrast to our findings. Furthermore, Adelegan and Radzewicz-Bak (2009), find exports, fiscal balance and exchange rate to be important determinants in contrast to our results. We believe that these contradictions have arisen largely not only from the lack of uniformity in the selection of proxy indicators, but also from the methodological variations employed in these studies not matching the extra steps we have taken in the present study. Therefore, further, more careful studies will be necessary to establish the validity of the contrasting results. Finally, most studies of bond market development rely on only one or two dependent variables, thus limiting the scope of investigation. It will, therefore, be valuable to pursue further studies that employ additional dependent variables such as liquidity as a proxy for bond market development, since larger more developed bond markets tend to be more liquid than smaller bond markets.

Notes

1. A domestic sovereign bond is a debt security issued by a national government in the government's domestic currency.
2. The fixed effects (FE) estimator analyses the causes of variations within each country and removes all time invariant unobserved heterogeneity among countries. Efficiency of estimates may be decreased in this method (Essers *et al.*, 2016). Several studies on bond market determinants rely only on the fixed effects model to consider disparities across countries (Khalid and Rajaguru, 2018). However, such an approach may assume complete disassociation of fixed effects and repressors. A random effects (RE) estimation enables one to estimate the effects of time-invariant variables.

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