INFRASTRUCTURE FINANCING AND BOND MARKETS DEVELOPMENT IN SUB-SAHARAN AFRICA

By

Paul Shepherd Mukoki

Supervisors:

Professor. O. Kodongo and Professor K. Ojah

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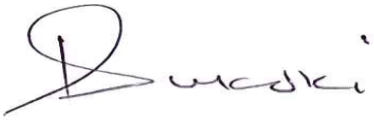
DECLARATION

I, Paul Shepherd Mukoki, declare that this thesis is the result of my own work. I am submitting it to fulfil the requirements for the degree of Doctor of Philosophy at the University of Witwatersrand, Johannesburg. To my knowledge, this thesis contains no material previously published or written by any other person, for any degree or examination in this or any other university, except where due reference is made in the text of the thesis. All errors are my own.

Signed:  ..... Date: 02 November 2022

Paul Shepherd Mukoki

Johannesburg, South Africa

DEDICATION

Bless the LORD, O my soul; And all that is within me, bless His holy name! [Psalms 103:1]

To all my esteemed clan members, my father and late mother, my wife, children and siblings (alive and late).

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"*Wisdom is like a baobab tree; no one individual can embrace it.*"

-African Proverb-

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ABSTRACT

This thesis explores how domestic public debt (bond) markets can be developed into viable mechanisms for closing the infrastructure funding gap existing in the sub-Saharan Africa (SSA) region. The infrastructure deficit in the SSA region is colossal and an impediment to its economic growth. To narrow the large deficits, Africa needs to bridge its infrastructure financing gap, estimated at US$62 billion annually until 2025. On the other hand, domestic public debt markets are seen as a potential funding source for filling this huge financing gap, but they are not considered well-developed.

We first examined the relationship between bond markets development and the infrastructure gap in Sub-Saharan Africa. We employed the panel threshold regression (PTR) model on 40 countries covering 2003-2018 and documented a non-linear (single-triple) relationship between public debt market development and the infrastructure gap. We established that many of the fledgling government and corporate bond markets play a complementary role in the financing of infrastructure; and interestingly, with corporate public debt markets eliciting a greater reduction in the infrastructure financing gap than government public debt markets.

We then used a cross-country survey approach on 8 SSA countries and nonparametric inferential statistics to investigate, first, the state of the public bond markets in SSA and, second, the ways by which their liquidity can be improved so that infrastructure investment can be enabled. The major conclusions from these survey results are: First, government yield curves do not provide a reliable benchmark for corporate bonds. Second, the government bond markets, which are expected to offer foundational mechanisms for establishing robust and effective yield curves, have remained underdeveloped. Commercial banks remain the predominant investors in government bond markets, followed by nonbank financial institutions, and a few foreign investors, in that order. Third, except for South Africa, only 38% of the corporate bond markets in SSA are moderately developed; the rest are either developing (25%) or nascent (25%). Fourth, pension funds in many SSA countries have somewhat reformed to engage in infrastructure financing, though within statutory limits. Fifth, liquidity in government bond and corporate bond markets is relatively low in many countries, which in turn, limits infrastructure financing. Finally, we found that sophisticated financial instruments could facilitate infrastructure financing by deepening and fostering liquidity in domestic public debt markets. These instruments include infrastructure project bonds, diaspora bonds, green bonds, and

securitised debt assets. An important part of this initiative involves increasing the sale of state-owned enterprise bonds and municipal bonds backed by guarantees from the government.

The overall results show that the public debt markets in many of the surveyed SSA countries are underdeveloped and cannot significantly plug the infrastructure financing gap in the region unless substantial capital (especially public debt) markets growth and/or development are embarked upon.

Keywords: Public debt markets, infrastructure deficit/gap, market liquidity, threshold regression, sub-Saharan Africa, pension funds, yield curve.

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation/Acronym	Expansion
ACBF	The African Capacity Building Foundation
ACCA	Association Of Certified Chartered Accountants
ACM	African Capital Markets
ACSA	Airport Company South Africa
ADB	Asian Development bank
ADF	Augmented-Dickey-Fuller test
AfDB	African Development Bank
AFMI	African Financial Markets Initiative
AIDI	Africa Infrastructure Development Index
AUC	Africa Union Commission
AUM	Assets under management
BDC	Botswana Development Corporation
bps	Basis points
CPA	Certified Public Accountants
CSD	Centralized Security Depository
DB	Defined-benefit pension system
DBSA	Development Bank of South Africa
DC	Defined-contribution pension system
DFI	Development Finance Institutions
DvP	Delivery versus Payment
EAC	East African Community
EAP	East Asia Pacific
ECA	Europe and Central Asia
EMH	Efficient Market Hypothesis
EMs	Emerging markets
Eskom	South Africa power utility company
FABI	Fleming Aggregate Bond Index
FD	Financial Development
FDI	Foreign direct investment
FEM	Fixed Effect Model
FER	fixed effects regression
FSD	Financial Sector Deepening
GB	Gigabyte

Abbreviation/Acronym	Expansion
GDP	Gross domestic product
GFC	Global Financial Crisis
GFCF	Gross Fixed Capital Formation
GMM	Generalized method of moment
GW	Gigawatt
HDI	Human Development Index
ICA	Infrastructure Consortium for Africa
ICT	Information And Communication Technology
IDC	Industrial Development Corporation of South Africa
IFG	Infrastructure Financing Gap
IMF	International Monetary Fund
IOPS	International Organisation of Pension Supervisors
IOSCO	International Organization of Securities Commissions
JIBAR	Johannesburg Interbank Average Rate Index
L1	Likert scale 1
L2	Likert scale 2
L3	Likert scale 3
L4	Likert scale 4
L5	Likert scale 5
L6	Likert scale 6
L7	Likert scale 7
LAC	Latin America and the Caribbean
LCB	Local currency bond
LCBM	Local currency bond market
LCY	Local currency
LICs	Lower-Income-Countries
LMCs	Low-To-Middle-Income Countries
LPT	Liquidity Preference Theory
MDG	Millennium Development Goals
MEFMI	Macroeconomic and Financial Management Institute of Eastern and Southern Africa
NDBs	National Development Banks

Abbreviation/Acronym	Expansion
NEPAD	New Partnership for Africa's Development
NPRA	Nigeria Pensions Regulatory Authority
NR	Not Reformed
NVR	Not very reformed
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OEQ	Open-ended questions
OTC	Over-the-counter
PAYG	Pay-as-you-go
PBMD	Public Bond Market Development
PCA	Principal Components Analysis
PF	Pension Fund
PFA	Pension Fund Administrator
PMG	Pooled mean group
PPI	Private Participation in Infrastructure
PPP	Public-Private Partnerships
PTR	Panel Threshold Regression
QSR	Qualitative Solutions and Research International
RF	Reformed
SA	South Africa
SANRAL	South African Roads Agency
SAVCA	Southern Africa Venture Capital and Private Equity Association
SDG	Strategic Development Goals
SPSS	Statistical Package for Social Scientists
SPV	Special Purpose Vehicle
SSA	Sub-Saharan Africa
SWFs	Sovereign Wealth Funds
SWNR	Somewhat not reformed
SWR	Somewhat reformed
T-Bill	Treasury Bill
T-Bond	Treasury Bond

Abbreviation/Acronym	Expansion
Transnet	South Africa Railways company
TWh	Terawatt-hour
UMCs	Upper-Middle-Income countries
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
US$	United States Dollar
USD	United States Dollar
VR	Very reformed
WEF	World Economic Forum
WHT	Withholding tax
WSS	Water Supply and Sanitation

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CHAPTER 1: INTRODUCTION

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1.1 Background and Context of the Study

Expenditure on infrastructure and an increment in the access to infrastructure are cited in the literature as facilitators of economic activity and enablers of economic growth and development (ACBF, 2016; Bertelsmann-Scott, Markowitz & Parshotam, 2016; Kodongo & Ojah, 2016). However, despite the importance of infrastructure as demonstrated empirically in the infrastructure-economic growth nexus studies (ACBF, 2016; Aschauer, 1989; Calderón & Servén, 2010a; Donou-Adonsou, Lim & Mathey, 2016; Esfahani & Ramírez, 2003; Fedderke & Garlick, 2008; Gramlich, 1994; Röller & Waverman, 2001), access to infrastructure in many SSA countries remains a challenge. Scholars such as Foster and Briceño-Garmendia (2010), Gutman, Sy and Chattopadhyay (2015); Ncube (2013) and Yepes, Pierce and Foster (2008) have observed that SSA's infrastructure development lags behind their peers in the developing world.

The rate of access, for example, to electricity in SSA low-income countries is 16 percent compared to 41 percent in other developing regions of similar income levels (Foster & Briceño-Garmendia, 2010). The access to road networks in SSA is constrained by a low density of paved roads, which stands at 31 km per 1,000 km compared to 134 km per 1,000 km in other low-income countries in the developing world. As of 2012, the internet penetration rate was 6 percent compared to 40 percent elsewhere in the developing regions (AUC, 2014b; Collier & Cust, 2015; Ondiege, Moyo & Verdier-Chouchane, 2013). The infrastructure shortage is worsened by the pillage and dilapidated state of public assets caused by political instability and conflicts prevalent in several SSA countries, such as the Democratic Republic of Congo, Somalia, South Sudan, etc. (Collier & Cust, 2015). Such limited access to infrastructure provision perpetuates poverty and inequality with the resultant adverse impact on productivity and economic growth in the SSA region (ACBF, 2016; Kodongo & Ojah, 2016).

Also worrisome to some policymakers and investors is the high cost of SSA's infrastructure services attributable to infrastructure shortage (AfDB, 2010). According to Calderon (2009), SSA prices for infrastructure are approximately 3 to 11 times higher than in peer developing countries, such as Indonesia, Thailand, Malaysia, Chile, Peru, etc. For instance, the average cost of electricity in SSA is US$0.24 per kWh compared to US$0.03 per kWh in other developing regions (i.e., 800 percent higher). The highest tariffs are on water and internet access, which are

approximately 1,100 percent greater than in other peer-developing regions. The high infrastructure tariffs make infrastructure services unaffordable and inaccessible to the poor and raise the cost of doing business in Africa (Ondiege et al., 2013; World Bank, 2016). Consequently, the infrastructure deficit and associated high cost of infrastructure services are believed to impede the continent's economic growth by as much as 2 percent of GDP; and as much as they also hinder the achievement of the Millennium Development Goals (MDGs)[1] (AUC, 2014b; Collier & Cust, 2015; OECD, 2012; Ondiege et al., 2013).

Driven by the African Union's resolve to provide adequate infrastructure that supports the continent's accelerated growth by 2063, the African Union Commission (AUC), in conjunction with the African Development Bank (AfDB), World Bank, the New Partnership for African Development (NEPAD) and the Development Bank of South Africa (DBSA) established an institution known as the "Programme for Infrastructure Development in Africa" (PIDA) (AUC, 2010; Mezui & Hundal, 2013). Its essence of being is to coordinate efforts to bridge SSA's wide infrastructure gap, amongst several other responsibilities (ACBF, 2016; AUC, 2010). PIDA has therefore assessed the infrastructure needs for the continent in the critical sectors of Energy, Transportation and Information Communications and Technology (ICT) and estimated the continent's demand for infrastructure by 2040. These demands include: firstly, power demand is estimated to increase 5 times from 590 Terawatts per hour (TWh) in 2010 to 3,100 TWh in 2040. To meet this demand in 2040, additional infrastructure will be required to increase power generation capacity from 125 gigawatts (GW) in 2010 to approximately 700 GW. Secondly, the current traffic volumes, which are less than 300 million tonnes, are earmarked to increase by as much as 6 times to over two billion tonnes by 2040. The investment in transportation is thus expected to include the construction of 37,300 kilometres of modern highways and 30,200 kilometres of new railways (ACBF, 2016). Lastly, data traffic volumes will increase 20-fold to

[1] Millennium Development Goals (MDGs) are the United Nations (UN) goals set to address extreme poverty and hunger, inequality, diseases, lack of adequate shelter, access to primary education, gender inequality and environmental sustainability. All economic developing regions have set targets to meet towards addressing these key developmental goals. The UN's 2015 MDGs Report reveals that although SSA has had many successes, it however still lags behind many developing regions in terms of meeting a number of the MDGs (United Nations, 2015). After their 2015 deadline, the MDGs were succeeded by the "Sustainable Development Goals" (SDGs) which were adopted in New York in 2015 (Costanza, Fioramonti & Kubiszewski, 2016).

6,000 gigabytes (GB) per second by 2040 from an approximate current of 300 GB per second (ACBF, 2016; AUC, 2010; Mezui & Hundal, 2013; Ncube, 2013).

To address this huge infrastructure gap, scholars and development finance experts estimate that the SSA region needs to spend approximately US$130- 170 billion per annum for infrastructure investment up to 2025 (AfDB, 2018a; ICA, 2017; Juvonen, Kumar, Ayed & Marin, 2019)[2]. This estimated expenditure was about 10% of SSA's gross domestic product (GDP) as of 2016[3] . Of this estimated average of US$ 108-170 billion per annum required, the region is able to only raise about US$62 billion from its traditional sources (AfDB, 2018a; ICA, 2017). The traditional sources are: government budget appropriations, official development assistance (ODA) from both the Organisation for Economic Co-operation and Development (OECD) and non-OECD countries such as China, India, Kuwait and others, multilateral development banks (MDBs) and the private sector (Cassel, de Candia & Liberatore, 2010; Foster & Briceño-Garmendia, 2010; ICA, 2018; Kodongo, 2013; Ncube, 2013; Sy, 2015b). All of this leaves Africa faced with an infrastructure financing gap of between US$ 68 billion and US$108 billion per annum (AfDB, 2018a).

Funding from these traditional sources has been declining over the past few decades, thereby presenting a major challenge to raising sufficient infrastructure finance (Brautigam, 2010; Gutman et al., 2015; Hagerman, 2012; Mu, Phelps & Stotsky, 2013). For example, although the public sector, through taxation and user charges, provides about 65-66 percent of infrastructure finance in SSA countries (ICA, 2014; Mengistu, 2013), their spending as a percentage of GDP is low. According to Habitat (2011), African governments spend about 10-12 percent of GDP on infrastructure capital expenditure. Spending is much less in fragile, politically unstable and conflict-ridden states (e.g. Chad, Cameroon, Somalia, Kenya, Zimbabwe, Côte d'Ivoire, Guinea, Mauritania, and Madagascar) which allocate an average of 5-8 percent of GDP towards capital expenditure. The allocation is thus far less than what is required to meet the continent's infrastructure needs, which is estimated at 15 percent of SSA GDP (ACBF, 2016; Estache &

[2] The above estimates differ from those presented by the World Bank in its previous publications (Foster & Briceño-Garmendia, 2010), which estimated annual financing needs and a funding gap of US$ 93 billion and US$ 31 billion, respectively. The African Development Bank and the Infrastructure Consortium for Africa (2017) highlight that the new estimates, which are broken down by sector are for Africa to achieve universal (80-100 per cent) access to electricity, water and sanitation, roads and other transport sectors from their current levels.

[3] SSA's GDP in 2016 was US$1.542 Trillion according to the data on the World Bank's website: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=ZG (Accessed 16 June 2021).

Garsous, 2012; Foster & Briceño-Garmendia, 2010; Gutman et al., 2015; Mayaki, 2012; Sy, 2015a).

Literature shows that international distributed funds by governments and donors, mainly from OECD countries, through ODA, who were responsible for contributing about 8 percent of infrastructure finance in SSA countries, have also been retreating from providing the much needed financial support (Bräutigam, 2011; Cassel et al., 2010; Estache, Serebrisky & Wren-Lewis, 2015; Mengistu, 2013; OECD, 2012). This is mainly because many western donor countries face substantial fiscal challenges, especially in the aftermath of the 2008/2009 global financial crisis (Jerome, 2008; Masetti, Mihr, Lanzeni, AG, & Hoffmann, 2013). For instance, in 2013, bilateral aid to SSA dropped by 4 percent to US$ 26.2 billion (United Nations, 2014).

Lately, the involvement of China, India and some Arabian countries in infrastructure investment in SSA, who are filling the gap left by donors from OECD countries, has been quite evident (ACBF, 2016; Mengistu, 2013; Mezui & Hundal, 2013; OECD, 2012; Wentworth & Makokera, 2015). However, there has been a noticeable drop in China's contribution towards Africa's infrastructure development; in 2014, it dropped from US$13.4 billion in 2013 to US$3.1 billion, which jeopardises the sustainability of a funding source (ICA, 2014). This follows China's economic slowdown in the past few years.

Evidence from the World Bank's Private Participation Infrastructure database reveals that while private investment in infrastructure assets is booming in other emerging markets, the SSA region is struggling to attract significant private investment in infrastructure. For example, in 2015, only 6 SSA countries (i.e., South Africa, Nigeria, Zambia, Rwanda, Senegal and Uganda) received about US$6.3 billion in private investment (World Bank, 2015). This amount is less than 1 percent of GDP and significantly lower than those of Latin America and the Caribbean (LAC) and the East Asia Pacific (EAP) regions, which received US$ 35.2 billion and US$ 13.5 billion, respectively, during the same period (World Bank, 2015). It is worth noting that South Africa gets the bulk of the private sector investment, followed by Nigeria. Of the US$6.3 billion received in 2015, South Africa received 63 percent of the share (US$3.97 billion), while Nigeria received the next biggest tranche of 14 percent (US$ 0.88 billion). This shows that only a few countries in the SSA region are able to attract private sector towards infrastructure investments.

Researchers believe that one of the major impediments to the participation of the private sector in infrastructure development/investment in the SSA region is the lack of availability of long-term finance (ACBF, 2016; Wentworth & Makokera, 2015). Infrastructure projects, by their nature, require large capital funding and have long gestation periods and low-risk profiles (Croce & Gatti, 2014; Croce & Yermo, 2013). A trend that is emerging globally is that institutional

investors (pension funds, insurance companies, mutual funds, etc.), who manage large pools of savings, are increasingly being attracted to infrastructure assets because of their low-risk profile and stable returns. Institutional investors globally were, in 2014, estimated to hold between US$ 80 trillion and US$ 100 trillion of assets under their management, of which a relatively small fraction is allocated to infrastructure assets (Genberg, 2016). According to Petratos (2015), institutional investors (mainly pension funds) account for more than US$ 37 trillion in infrastructure assets globally.

In comparison, African pension funds have about US$ 380 billion (approximately 61 percent of GDP) in assets under management (Sy, 2016). About 85 percent of these assets are in South Africa, followed by Nigeria with 6 percent. However, according to Preqin (2016), since 2007, Africa has raised only about US$ 4.6 billion from institutional investors for infrastructure development. This shows relatively low participation of institutional investors in infrastructure investment in the African region relative to the rest of the world.

Yet scholars and policymakers (e.g., ACBF, 2016; Collier & Cust, 2015; Mezui & Hundal, 2013; OECD, 2012; Sy, 2016; Wentworth, 2013) expect the private sector, particularly domestic institutional investors, to contribute a substantial share towards filling the existing huge infrastructure funding gap. Researchers are optimistic that the region has the potential to attract long-term finance and stimulate the participation of the private sector (particularly the institutional investors) in infrastructure financing, provided it is committed to building efficient domestic public debt markets (Berensmann, Dafe, Lindenberg & Volz, 2015b; Brixiova, Mutambatsere, Ambert & Etienne, 2011; Kodongo, 2013; Mezui, 2012; Mezui & Hundal, 2013); and provide enabling environment for public-private partnerships (PPPs) to develop and thrive (ACBF, 2016; Ondiege et al., 2013). Well-developed public debt markets (or "bond markets")[4] play a critical role in matching overall savings with long-term investment opportunities (Luüs, 2014). They offer an alternative source of debt finance to both government and the private sector, who seek long-tenor finance.

[4] In this study, the terms "public debt markets" and "bond markets" are used interchangeably. We also further clarify an important matter of definition that may cause confusion – i.e., the use of the terms "public debt market or bond market", relative to "government/sovereign public debt market or government/sovereign bond market" and "corporate public debt market or corporate bond market" when used interchangeably can be confusing. The term "public" in this context refers to "publicly tradable/traded financial securities", it is not a reference to the "public sector", which is traditionally represented by government units. To avoid confusion, going forward, we will stick to use of the terms "bond market or local currency bond market (LCBM)" to mean the overall domestic public debt market, and "government/sovereign/Treasury bond market" and "corporate bond market" to mean markets for issuance of bonds by public sector agents and issuance of bonds by private sector agents, respectively.

Scholars and policymakers have raised great concern about the state of under-development and inefficiency of public debt markets in several Sub-Saharan countries, which, except for South Africa, are cited as major impediments to raising long-term finance for infrastructure (Adelegan & Radzewicz-Bak, 2009; Berensmann et al., 2015b; Masetti, Mihr, Lanzeni & Hoffmann, 2013; Mezui, 2012). Yet, despite South Africa having a well-developed bond market and a sizeable base of institutional investors (pension and insurance market), it has not fully explored the use of project finance or project or revenue bonds for infrastructure financing; these are mechanisms that are extensively used in Europe, the United States and some emerging markets such as Chile, Mexico, etc. (Mezui & Hundal, 2013)[5].

Beck, Maimbo, Faye and Triki (2011) observe that the small size, low liquidity of capital (tradable) markets compared to the banking sector in the SSA region and low levels of domestic savings in the region (Aryeetey & Udry, 2000; Berensmann, Dafe & Volz, 2015c; UNECA & AUC, 2014) limit the ability of infrastructure developers to use equity and bond instruments to finance infrastructure. These features make the capital markets limit the use of non-bank capital (from pension and insurance funds), thus, compelling infrastructure developers to continue relying on bank loans for project finance. Scholars (e.g., Croce & Gatti, 2014; Ng & Tao, 2016) believe that while bank loans are likely to continue to play a dominant role in funding infrastructure in Africa, the new Basel III rules will likely make banks limit the tenor of loans and availability of adequate credit. These new rules force banks to maintain liquid and high-quality assets in their books. This has the effect of restricting the growth of project finance loans. Whilst these developments have compelled financial markets in developed and emerging

[5] It is important to note, however, that the development of bond markets may not necessarily translate to a commensurate growth (or rate of growth as implied by the cited literature and/or our subsequent findings) in the financing of infrastructure, for several reasons. First, as already pointed out, there are fears of a possible debt crisis in the SSA region following recent excessive utilization of external commercial debt (Coulibaly, Gandhi & Senbet, 2019) such that additional debt issuances, even in the domestic markets, may accentuate debt sustainability concerns. Second, infrastructure financing may not be the most important priority area for governments: for example, where a government is facing domestic food vulnerabilities (see e.g., Nechifor et al., 2021), it might make sense to utilize the larger debt markets to expand food production capacity before, say, financing railway infrastructure expansion. Third, the legendary weak governance in the SSA region (see e.g., Muhanji & Ojah, 2016) may distort resource allocation efficiency; thus, although governments may increase debt issuances in response to larger domestic currency bond markets, the finances so raised may not all be allocated to infrastructure development, but to alternative (perhaps more urgent) priorities, or suffer misallocation and/or leakages. Finally, scholars (e.g., Collier & Cust, 2015; Irving, 2016) have observed that the investment gap in infrastructure is not only a result of shortage of capital. It is also rather on the lack of well-prepared, investment-ready bankable projects.

markets to develop innovative strategies that mitigate the possible retreat of banks from project finance and attract risk-averse institutional investors to finance infrastructure through the use of debt securitization[6] of project loans (Bjerre, 2002; Buchanan, 2017; Carbo-Valverde et al., 2015; Gorton & Souleles, 2007; Lemmon, Liu, Mao & Nini, 2014), there is limited evidence which shows the extent to which securitization strategies have been embraced in Sub-Saharan Africa's bond markets and/or the impact they are having in bridging the infrastructure finance gap.

1.2 The Research Problem

The quality and stock of infrastructure in the SSA region are inadequate, in poor condition, and lag behind all other regions in the developing world. To cover the infrastructure deficit, the region requires spending about US$ 130-170 billion annually until 2025, and the annual funding gap will be between US$ 68 and US$108 billion (AfDB, 2018a). This colossal funding gap has to be filled from other sources. Scholars and policymakers suggest that the region could tap into long-term savings held by the private sector (particularly pension and insurance funds), provided efficient and viable public debt markets are in existence to facilitate the requisite special kind of intermediation (Berensmann et al., 2015b; Brixiova et al., 2011; Kodongo, 2013; Mezui, 2012; Mezui & Hundal, 2013).

There is no scientific evidence on the potential of SSA domestic bond markets to finance infrastructure. Several previous studies have looked at bond markets development in the SSA region (Adelegan & Radzewicz-Bak, 2009; Berensmann et al., 2015c; Donou-Adonsou et al., 2016; Kapingura & Makhetha-Kosi, 2014; Maana, Owino & Mutai, 2008; Manroth & Irving, 2009; Mezui, 2012; Mezui & Hundal, 2013; Mu et al., 2013) without linking it to infrastructure financing. A majority of the studies focused mainly on the factors that cause the markets to remain underdeveloped and inefficient. These studies highlight that small size, lack of secondary market activity, absence of stable macroeconomic policies, weak regulatory framework, low sovereign credit ratings, shortage of innovative financial instruments, and low levels of domestic savings are some factors that impede the bond market development.

[6] Securitisation is defined by OECD (2015a) as a form of structured finance which involves the bundling of various types of contractual debts (usually loans) for the purpose of pooling risky contracts and selling them in less risky forms to investors. Securitisation also allows banks to transform long-term infrastructure loans into cash, thus increasing lending capacity which is able to provide further lending to infrastructure projects (Carbo-Valverde, Degryse & Rodríguez-Fernández, 2015; Nassr & Wehinger, 2015).

However, little is known empirically about the level of development of African bond markets in their current state. Also not clear in the literature is the extent to which domestic bond markets are able to meet the existing infrastructure funding gap in the SSA region, and the level of bond markets development at which the markets can "meaningfully" fund infrastructure development. Additionally, the literature has not adequately explored possible innovative ways the SSA countries could adopt to make bond markets more liquid and serve as a sustainable source of funds for bridging the infrastructure finance gap. This study is an attempt to fill these knowledge gaps.

1.3 Research Questions

This study seeks to answer the following questions:

1.3.1 What is the relationship between infrastructure gap/deficit and bond markets development in SSA?

1.3.2 What is the current state of development of domestic bond markets in the SSA region?

1.3.3 What possible ways can SSA countries use to make their bond markets more liquid and able to sustainably bridge the region's huge infrastructure gap?

In sum, the overarching research question of this work is framed as follows: What factors cause the domestic bond markets to remain an untapped funding mechanism in financing infrastructure development in the SSA region?

1.4 The Research Objectives

To further guide this study systematically, certain objectives are apparent, following the research questions. Specifically, the study's objectives are:

1.4.1 To establish the relationship between the infrastructure gap/deficit and bond markets development in the SSA region.

1.4.2 To assess the state of development of bond markets in the SSA region.

1.4.3 To explore possible ways that SSA countries can use to make their bond markets liquid and able to sustainably bridge the region's huge infrastructure gap.

1.5 Purpose Statement

The purpose of this study is to explore how domestic bond markets can be developed into viable mechanisms for closing the infrastructure funding gap existing in the SSA region.

1.6 Significance and Findings of the Study

This study is relevant to the economic development of the SSA region because it addresses the issues of the funding gap for infrastructure projects. Infrastructure stock and quality are important for the economic growth and development of the SSA region. Insufficient infrastructure can derail the SSA region's quest to meet the UN's Strategic Development Goals[7] (SDGs) and Africa's Agenda 2063 developmental goals[8]. Our research aims to highlight and address the concerns surrounding the factors that cause bond markets to remain an untapped funding platform in financing infrastructure development in the SSA region. It looks at the shortcomings of traditional infrastructure finance sources. In other words, it means that there is a gap in the literature about how bond markets' financing can be used as a model to close the existing infrastructure financing gap in SSA.

Secondly, the study makes an empirical contribution by examining the relationship between infrastructure deficit/gap and the domestic debt markets using a panel threshold regression model (PTR) proposed by Hansen (1999). To our knowledge, this is the first study to empirically investigate the functional form of the relationship between debt markets development and the infrastructure financing gap in SSA. To this end, the study makes a novel contribution by showing the estimate threshold capitalisation of both governments' public debt markets and public corporate debt markets required in various income-group countries (i.e., lower-income (LICs), lower-middle-income (LIC) and upper-middle income countries (UMCs)) in order to bridge the infrastructure deficit.

[7] The MDGs have been renamed "Sustainable Development Goals" (SDGs) after their 2015 deadline (Costanza et al., 2016). SDG 9 specifically promotes infrastructure investment and innovation as crucial levers for sustainable economic growth and development.

[8] Africa's Agenda 2063 developmental goals are elaborated by the Africa Union Commission in its document entitled "Agenda 2063: The Africa we want" (AUC, 2014a). It outlines the seven aspirations African countries intend to make a reality by 2063. The declaration was adopted and launched at the 50th Africa Union Heads of State Meeting held in Addis Ababa on 03 September 2013.

Thirdly, our results indicate that more work needs to be done to develop SSA bond markets if they are to be used as a viable model to close the existing infrastructure financing gap in SSA. Specifically, to close the current colossal infrastructure gap, our threshold analysis shows that the current average size of sovereign public debt markets needs to double more than its current size. In contrast, the corporate public debt markets should increase their current size by more than six-fold.

Fourthly, our study is unique because it uses cross-sectional survey data from a wide range of key public bond market players/participants. It uses a structured questionnaire to investigate the state of bond markets development and how liquidity can be improved for enabling infrastructure financing. The respondents are from eight key SSA countries. These countries were selected because they have active capital markets and hence enabled a greater chance of accessing data from bond market participants.

Lastly, our study provides policymakers in SSA countries (governments, developmental financiers, and non-governmental organisations) with support and guidance to design policies that promote the mobilisation of capital from the private sector via bond markets, to finance infrastructure.

1.7 Organisation of the Thesis

The thesis consists of five chapters organised as follows:

Chapter 1 is the introductory chapter, which has laid out the general outlook and background of the study, outlining the research problem and questions, significance and findings.

Chapter 2 investigates *the role of domestic bond markets in closing the infrastructure deficit in Sub-Saharan Africa.* We employ the panel threshold regression (PTR) model on data from 40 countries covering 2003-2018 to document a nonlinear (single-triple threshold) relationship between public debt markets development and the infrastructure financing gap. The findings show that these fledgling government and corporate public debt markets play a complementary role in infrastructure financing; interestingly, corporate public debt markets elicit a greater reduction in the infrastructure financing gap than government public debt markets.

Chapter 3 empirically examines *the state of public bond markets development* in eight SSA countries using survey data and nonparametric inference statistics. Our findings indicate that in most countries, except in SA, the government yield curves are ineffective in providing a reliable benchmark for corporate bond pricing. This reflects that government debt markets are developing

at a relatively slow pace due to their lack of depth (i.e. liquidity in secondary markets) and breadth (i.e. variety of tenors). As a result, the development of corporate bond markets remains uneven. For example, the corporate bond market in South Africa is relatively developed, with 39.1% of existing marketable debt outstanding as of 2013 well-developed. According to 2013 data, Botswana, Mauritius, and Nigeria have moderately developed public corporate debt markets, with 16%, 17% and 18% of total outstanding local currency debt, respectively, whereas Ghana and Kenya are still developing. At 1% and 3% of overall debt outstanding, Rwanda's and Tanzania's corporate bond markets are in their infancy. We also found that pension funds in many SSA countries have moderately reformed to engage in infrastructure financing, albeit within statutory limits. However, we note that pension funds are prevented from participating in corporate bond markets and infrastructure funding by a number of factors, including a lack of long-term financial instruments, a shortage of bankable projects, stringent regulations, and managers and trustees lacking the necessary skills and knowledge for participating effectively in these markets.

Chapter 4 explores *the possible ways of improving liquidity in domestic public debt markets in SSA to enable infrastructure financing*. We surveyed 8 Sub-Saharan Africa (SSA) countries to analyse the state of public debt markets liquidity. In turn, we propose possible ways of improving the liquidity of these national sovereign and corporate bond markets going forward. We found that liquidity in government and corporate bond markets is relatively low in many countries, which limits infrastructure financing. For fostering market liquidity in SSA public debt markets, the study showed that offering long-term maturity government bonds, broadening the investor base, making available a range of instruments, and promoting primary dealers' activities are the top four factors deemed highly important. Furthermore, Botswana, Kenya, and Tanzania need to reform their tax systems to enhance debt market liquidity, especially withholding tax. Finally, we found that introducing more creatively and/or nuanced financial instruments, such as infrastructure project bonds, diaspora bonds, green bonds, and securitised debt assets, will deepen local currency bond markets and equip them to finance infrastructure.

Chapter 5 finally concludes this thesis and offer policy recommendation for possible useful reforms.

CHAPTER 2: CLOSING THE INFRASTRUCTURE DEFICIT IN SUB-SAHARAN AFRICA: IS THERE A ROLE FOR DOMESTIC BOND MARKETS?

2.1 Introduction

Recent studies suggest that African countries have substantial infrastructure deficits, which are regarded as a binding constraint on their economic growth (Calderon, Cantu & Chuhan-Pole, 2018; Kodongo & Ojah, 2016). To narrow or close the large deficits and potentially attain the transformative growth potential that fuller infrastructure provisioning promises, the African region needs to bridge its infrastructure financing gap, estimated at US$ 62 billion annually until 2025 (AfDB, 2018a; Juvonen et al., 2019).[9] Traditionally, African countries have tended to finance infrastructure development through budgetary allocations (funded by domestic tax revenues) and official development assistance. However, many countries in the region have not been able to operate at optimal tax capacity due to several reasons, including structural constraints, large informal sectors, weak labour force data, and dominance of nonmonetary sectors such as subsistence agriculture (see e.g., Glenday, Bharali & Wang, 2019). Similarly, official development flows have been dwindling lately due largely to international credit constraints arising from a volatile global economy and dynamics in the global geopolitical landscape (Gutman et al., 2015; Mu et al., 2013; Olaniyan, 2002).

Consequently, African countries are encouraged to explore alternative ways to raise long-term capital to bridge their infrastructure financing gap (Collier & Cust, 2015; Kodongo, 2013; Mu et al., 2013)[10]. One of the key alternative approaches being advocated for both developed and developing countries is mobilising private financing through public debt markets (Hyun, Park & Tian, 2019; Regan, 2017). Therefore, it has become common practice globally for governments and infrastructure developers with constrained internal financing capacity to turn to capital

[9] Infrastructure financing deficit is defined as "the difference between the infrastructure investment needs and the total amount of financial commitments by all financiers of infrastructure development" (African Economic Outlook (2018). In this paper, we use the terms "infrastructure gap" and "infrastructure financing deficit" interchangeably; they are, arguably, representing two sides of the same coin (Gatti, 2013; Kodongo & Ojah, 2016).

[10] Other factors besides the state of financial markets also have an impact on the accumulated infrastructure shortages in SSA. These include the fact that there are few bankable projects that are attractive to infrastructure investors (Collier & Cust, 2015), poor institutional governance in both public and private sector, unsound procurement techniques, and inefficient public spending (Calderon et al., 2018; Gutman et al., 2015).

market borrowing (GIZ, 2017; Oji, 2015). For example, between 2007 and 2017, about a dozen countries in Sub-Saharan Africa (e.g., Kenya, Nigeria, and Ghana) issued sovereign bonds, raising commercial debt in excess of US$ 35 billion for infrastructure projects; however, due to apparent domestic debt market capacity constraints, most of these issues have been floated in the international (Eurobond) debt market. Additionally, because of the relatively well-developed bond market in South Africa, state-owned enterprises (SOEs) such as Eskom (Power Utility), Transnet (Railways), and Sanral (Roads) have in recent years successfully raised bridging capital by floating project (or infrastructure) bonds (Juvonen et al., 2019; Mezui, 2013; Raubenheimer, 2019).

The use of the debt market is not confined to governments and public enterprises. The African Development Bank, which has raised more than US$1 billion since 2010 by issuing green bonds[11] in foreign capital markets, is calling for the enhancement of the capacity of African bond markets to issue local currency green bonds to attract private infrastructure capital from the growing institutional investor segment with a mandate to spend a portion of their resources in environmental or climate-friendly infrastructure projects (AfDB, 2016; Humphrey, 2018). Since 2012, twenty green bond issuances have been floated in Africa, accumulating a total of US$2.78 billion, suggesting a great potential to expand this public bond market segment to bridge the infrastructure finance gap (AfDB, 2016; Caminha, 2020). To ease the utilization of this market, Financial Sector Deepening (FSD) Africa, in partnership with Climate Bonds Initiative, has launched an Africa Green Bonds Toolkit to guide African capital markets on the mechanics of issuing green bonds in line with international standards (Caminha, 2020).

Given these developments, it is no wonder that studies have pointed to the essential role that domestic public debt markets could play in mobilizing resources from diverse savers (Collier & Cust, 2015; Kodongo, 2013; Mu et al., 2013). Yet, except for South Africa, public debt markets in Sub-Saharan Africa (SSA) are largely in their infancy and are, therefore, shallow and illiquid (Essers, Blommestein, Cassimon & Ibarlucea Flores, 2015; Machokoto, Areneke & Ibrahim, 2020). To illustrate, Mu et al. (2013) have shown that the region's government and corporate debt market capitalization amounted to only 14.8 and 1.8 percent of GDP, respectively. This is very low compared to other developing regions, such as Asia, where a single nation – Malaysia

[11] Green bonds are emerging innovative private financial instruments that are potential source of climate finance in developing countries (Banga, 2019; Mathews & Kidney, 2012). According to Ehlers and Packer (2017, p. 1), "green bonds are fixed income securities which finance investments with environmental or climate-related benefits." The green bonds can be packaged in the form of corporate bonds, project bonds or asset-backed security (ABS) bonds, and used to finance climate-resilient projects through the capital market.

– has domestic public debt market capitalization of 57.3 per cent and 57 per cent of GDP for government and corporate bond markets, respectively. Whereas some national markets in Africa have shown good promise, they are invariably thinly traded and dominated by public sector issuances. For example, the gross amount of bonds issued between 2013 and 2018 in Morocco averaged 67 billion Moroccan Dirham (US$ 7.5 billion, approximately) per year, with Treasury bills making up almost 75% of the total debt issued on the financial market (Raubenheimer, 2019).

As such, it is interesting to address the question of whether the region's public debt markets are well-equipped to mobilize a sufficient amount and type of capital to meet the considerable infrastructure need: infrastructure projects often require lumpy capital characterised by long gestation and payback periods, as well as have high exposure to economic, political and financial risks (Ba, Gasmi & Um, 2017; Mustafa, 2015). Thus, this study seeks to address the question of whether Africa's domestic public debt markets can play an effective role in plugging the region's infrastructure financing gap. Specifically, we seek, first, to establish the nature of the relationship between the levels of development of Africa's public debt markets and the infrastructure financing gap; and, second, to ascertain the (threshold) level of development of Africa's public debt markets that can mobilize sufficient capital to effectively attenuate the region's legendary infrastructure financing gap.

These questions must be understood against the backdrop of the many studies that have given a prominent role to well-functioning domestic debt markets in the participation of the private sector in provisioning long-term financing for infrastructure investment (e.g., Ba & Gasmi, 2011; Hyun et al. (2019). In the case of Sub-Saharan Africa, some recent studies (e.g., Calderon et al., 2018; Foster & Briceño-Garmendia, 2010) have argued that although the private sector's contribution towards infrastructure financing is low (at about US$ 9.4 billion or 1.5% of GDP), if effectively harnessed, private finance – by way of public debt markets – could help close about 40% of the SSA's infrastructure financing gap – an equivalent of about 2% of GDP.

In the literature, whilst most studies have examined the link between financial development (FD)/public bond market development[12] and economic growth (e.g., Fink, Haiss & Hristoforova, 2003; Fink, Haiss, Kirchner & Moser, 2006; Islam, 2014; Kapingura & Makhetha-Kosi, 2014; Muharam, Ghozali & Arfinto, 2018; Pradhan et al., 2015; Pradhan, Arvin, Bennett, Nair & Hall,

[12] In this study the terms 'financial development (FD)' and 'public bond market development (PBMD)' are used interchangeably.

2016a; Thumrongvit, Kim & Pyun, 2013), and between infrastructure and economic growth (see, ACBF, 2016; Calderón & Servén, 2014; Canning & Pedroni, 2008; Chakamera & Alagidede, 2018; Estache & Garsous, 2012; Fedderke & Garlick, 2008; Kodongo & Ojah, 2016; Zhang & Ji, 2018), the impact of public bond market development on the infrastructure deficit (financing gap, has not received much attention[13]. In other words, while both FD and infrastructure spending impact economic growth and vice-versa, little is known about the role FD plays on IFG. Specifically, it remains unclear whether a higher level of FD is associated with the infrastructure development and financing gap in SSA. Since both public bond market development (PBMD) and infrastructure spending are linked to economic growth, we hypothesise that PBMD is linked to the IFG.

Suppose that our conjecture is not refuted. In this case, the need to understand the precise level of development of the public debt markets that would have a meaningful effect on financing the infrastructure gap in the region becomes critical. We argue that if the capacities of local public debt markets are bolstered, they will facilitate the extension of local currency (LCY) debt under competitive terms, which is crucial in fostering private-sector participation in infrastructure financing (Ba et al., 2017).[14] Thus, we initially use a linear function to test for the existence of a relationship between debt markets development and infrastructure financing gap and then employ a panel threshold regression model (PTR)[15], proposed by Hansen (1999), to ascertain the exact nature of the relationship if one exists. To our knowledge, this is the first study to empirically investigate the functional form of the relationship between debt markets development and the infrastructure financing gap in SSA. The key objective here is to assist SSA governments by providing data-guided, and hopefully more productive, infrastructure

[13] The research gap in this area could be due to a lack of reliable and adequate data on infrastructure financing. For example, although the World Bank's Africa Infrastructure Country Diagnosis (AICD) examined infrastructure financing gaps in 24 SSA countries in the early 2000s (see, Foster & Briceño-Garmendia, 2009), its report has not been updated to date. Later data from Oxford Economics and Global Infrastructure Hub (2017) and (Metcalfe & Valerie, 2019) cover only a few countries. For this reason, in our study, we use an alternative metric - the infrastructure gap/deficit - as a proxy for the infrastructure financing gap.

[14] Local currency debt is important in the mobilization of resources for infrastructure investment because proceeds from utilization of the financed asset (e.g., user charges on a toll road) is denominated in the same currency as the currency of liabilities (e.g., interest and principal on debt), making planning less complicated by eliminating currency risk for the borrower.

[15] We chose the PTR method because of its appropriateness to capture the network effects of infrastructure in estimating nonlinearity (Candelon, Colletaz & Hurlin, 2013; Ojah, Muhanji & Kodongo, 2022; Zhang & Ji, 2018).

investment strategies and/or policies. Our panel dataset includes 40 SSA countries for the period 2003 – 2018.

The main findings of the chapter are as follows. First, the provisioning of government and/or corporate public debt finance reduces the infrastructure financing gap (i.e., a statistically significant negative association). Specifically, the results show that an increase of 10% in the size of government bond markets reduces the infrastructure financing gap by between 0.16% and 0.54 % of GDP, while the same change in the size of *corporate* bond markets has a larger effect on the infrastructure financing gap, reducing it by 0.36% to 1.10%. This significant finding can be interpreted in light of the fact that the private sector contributes not only financial capital but also managerial expertise to infrastructure projects that deliver low-cost and better-quality of infrastructure services. (Ba et al., 2017; Gassner, Popov & Pushak, 2009; Marin, 2009).

Our second major finding is that the relationships between both government public debt markets and corporate public debt markets and the infrastructure financing gap are nonlinear and largely indicate single to triple threshold values. The single threshold for public debt markets for SSA's overall infrastructure gap is 80.71% of GDP (against the current mean endowment of only 35.6% of GDP). In comparison, the double threshold capitalisation for corporate debt markets is 75.99% and 91.61% of GDP (against an observed mean of 15% of GDP). This means that debt market sizes should grow from the current average levels to these threshold levels for the SSA economies to experience substantial reductions in infrastructure deficits.

The remainder of this chapter is organised as follows. Section 2.2 presents the stylized facts and discusses further the need for active public debt markets in Sub-Saharan Africa; Section 2.3 presents the data, model specification and econometric method deployed for data analysis; Section 2.4 discusses empirical results, and Section 2.5 concludes.

2.2 Stylized Facts and the Need for Active Public Debt Markets in Sub-Saharan Africa

According to Calderon et al. (2018), the SSA region has huge infrastructure development gaps relative to other regions at the same level of economic development;[16] they estimate that closing these infrastructure development gaps will increase the region's per capita growth by 1.2

[16] For instance, the rate of access to electricity in SSA low-income countries is 16%, the density of paved roads stands at 31 km per 1,000 km, and internet penetration rate is 6% relative to 41%, 31 km per 1,000 km, and 40% respectively in other developing regions with similar income levels.

percentage points per annum, with the largest growth benefits accruing from reducing the infrastructure gaps in the electricity and road sectors. Undoubtedly, to provide adequate and sustainable quality infrastructure require large capital resources. Researchers and policymakers (AUC, 2014b; Bond, 2016; Gutman et al., 2015) cite funding constraints as the major obstacle impeding most SSA countries from providing adequate and quality infrastructure to meet the demands of increasing economic activity, rapid upward trends in youth demographics, and increasing incidences of urbanisation and climate change-based demands[17].

To sustain economic growth, SSA needs to close its infrastructure endowment gap (e.g., ACBF, 2016; Ba et al., 2017), which requires countries to accelerate investments in infrastructure (Ba et al., 2017). Metcalfe and Valerie (2019) estimate that for SSA to meet its infrastructure needs, the region requires approximately US$ 177.7 billion (10% of GDP[18]) annually until 2040. Of this amount, only US$ 132.3 billion (8% of GDP) per annum can be raised from traditional sources (e.g., public sector, donors, and private sector), given existing capacity. This leaves a financing gap of about US$45.5 billion (or 2% of GDP) per annum. Given the limited resources of the public sector, the huge financing gap requires that the region employs innovative strategies to attract supplementary private investment (from publicly accessible markets) to bridge the gap (Calderon et al., 2018; Kodongo & Ojah, 2016).

Therefore, in the light of evidence indicating that inadequate fiscal resources are a binding constraint to infrastructure financing, we take the view that governments in SSA must, among other interventions, encourage increased private sector participation in infrastructure financing through, for instance, the Public-Private Partnerships (PPPs)[19] procurement arrangements, which are now widely embraced by many governments around the world to reduce fiscal burdens and enhance risk-sharing (Babatunde & Perera, 2017; Li, Abraham & Cai, 2017). For example, ADB (2017) and Hyun, Park and Tian (2017) show that PPPs, in conjunction with LCY bond markets,

[17] According to Ojah et al. (2022), Sub-Saharan Africa's unique infrastructure challenges arise from the fact that 16 of its nations are landlocked (the most among all developing regions). Many of them encounter severe infrastructure bottlenecks (road, railway, airways) – which, for instance, raise transportation costs and/or hinder international trade and economic growth, compared to coastal countries.

[18] GDP for SSA in 2018 = US$1.699 trillion (World Bank database).

[19] Public-private partnerships (PPPs) are described by the World Bank and PPIAF (2014) as arrangements between public and private sectors in order to provide specific services that, though are a government responsibility, can receive support from the private sector. In other word, such arrangements can reduce fiscal budget commitments in projects by allowing the private sector to bring in financial resources, expertise and efficiency.

are used widely in Malaysia, China, Japan, and other countries, as an alternative source for infrastructure financing. PPPs are generally regarded as proficient in mobilising private finance, especially from the perspective of long-term institutional investors (e.g., pension funds, insurance companies, etc.) and channelling them into infrastructure investments[20]; in that way, they help to address the infrastructure investment gap (Berrone et al., 2018; Gerbert, 2013).

However, also notable is the fact that in some under-developed domestic debt markets in low-to-middle-income countries (LMCs), markets are driven by the dominance of government bonds, particularly where the financing of infrastructure is heavily dependent on government resources. While well-developed government bond markets provide conducive conditions for developing corporate bond markets, the dominance of the public debt market by government issuances may diminish the effective participation of the private sector in financing infrastructure projects. For example, Hyun, Park and Tian (2018) empirically examine the determinants of PPPs in infrastructure provisioning in twelve Asian LMCs over the period 1995 to 2015 and find a negative association between bond markets development and PPP investment. They attribute this finding to the crowding-out effect on corporate debt by the more dominant government bond market.

Often, countries finance infrastructure projects via the Eurobond markets whilst generating revenue in domestic currency. These countries are constantly exposed to the exchange rate and interest rate volatility risk (Ba et al., 2017; Turner, 2002). Therefore, well-developed local currency debt markets ("bond markets")[21] not only play a critical role in matching overall savings with long-term investment opportunities (Luüs, 2014) but also offers an alternative source of debt finance to both the public and private sectors. Furthermore, researchers (e.g., Barth et al., 2004; Cassimon, Essers & Verbeke, 2016) argue that by developing local currency debt markets, emerging economies reduce dependency on foreign funds and thereby reduce their vulnerability to international financial shocks that may inhibit cross-border capital flows. For these reasons, Sub-Saharan African countries are encouraged to accelerate the development of their public debt markets so that these markets could play the much-needed vital role in infrastructure financing,

[20] According to Engel, Fischer and Galetovic (2014), the spread and growth of PPPs around the globe is closely linked to the development of project finance (a financial technique which is based on lending against cash flow of the project that is economically self-contained). Project Finance arrangements are usually highly leveraged. Whilst banks tend to finance highly risky construction phase of projects, bond finance commonly substitutes for bank lending during the operations phase which is less risky.

[21] In this study, the terms "debt markets" and "bond markets" are used interchangeably.

among other capital projects funding (Berensmann, Dafe, Lindenberg & Volz, 2015a; Essers et al., 2015; Mezui & Hundal, 2013).

2.3 Data and Methodology

2.3.1 Data and model specification

We use annual data of four infrastructure types, namely electricity, water and sanitation, transport, and information and communication technology (ICT), all of whose financing reflect some level of private sector participation, as documented in World Bank's Private Participation in Infrastructure (PPI) database for the period 2003–2018 (i.e., 16 years) for 40 SSA countries. The length of the study period and the countries selected are determined by the availability of data for the relevant variables of the study. The list of countries sampled for the study is presented in Table A-2.1 of the Appendix. The table also shows the income groups in which the countries were classified based on the 2009 World Bank Analytical Classifications.

We start by specifying the following empirical model:

$$infgap\_index_{it} = \beta_0 + \beta_1 debt_{it} + \beta_2 infinv\_index_{it} + \beta_3 gdpcpg_{it} + \beta_4' X_{it} + \varepsilon_{it} \quad (1)$$

where Infrastructure deficit/gap (the dependent variable) is represented by $infgap$. We rely on the Africa Infrastructure Development Index (AIDI) developed by the African Development Bank (AfDB, 2013; Kodongo & Ojah, 2016) to calculate the infrastructure gap as a proxy for the infrastructure deficit[22]. The AIDI contains four sub-indices of infrastructure – transport, electricity, information and communications technology (ICT), and water and sanitation

[22] Economic growth theory, and the associated empirical literature suggest infrastructure spending has a positive effect on long-term economic growth (Estache & Garsous, 2012; Estache, Speciale & Veredas, 2005; Kodongo & Ojah, 2016; Liberini, 2006; Mbulawa, 2017). For example, in a study of a panel of 45 SSA countries over the period 2000-2011, Kodongo and Ojah (2016) find that a 1% spending on infrastructure and incremental access to infrastructure influence economic growth by 0.127%. They also find that spending on infrastructure is more important for the region's less developed economies than for its relatively more developed economies, which uncommonly have an infrastructure stock that is close to zero. These studies also paradoxically point out that the current SSA infrastructure deficits play a role in hindering SSA's economic growth (Calderon et al., 2018; Estache et al., 2005). In other words, inadequate infrastructure results in low productivity. Consequently, the infrastructure deficit is, in one way or another, reflect the existence and/or extent of infrastructure financing gap (IFG). Thus, we similarly conclude that the presence of IFG is hindering SSA's economic development and argue that by addressing infrastructure deficit, the IFG is concurrently addressed. Therefore, the infrastructure gap can be a suitable proxy for IFG.

(WSS)[23]. AIDI is used to estimate the infrastructure deficit/gap for both Aggregate/Overall Infrastructure deficit index ($infgap\_index$), and sub-indices of infrastructure types, namely: transport infrastructure deficit ($tran\_gap$), electricity infrastructure deficit ($elec\_gap$), information and communications technology (ICT) infrastructure deficit (ict_gap) and water and sanitation (WSS) infrastructure deficit wss_gap), which, individually and interchangeably, serve as the dependent variables in our baseline regression.

We estimate the infrastructure gap/deficit as the difference between the optimal and the actual infrastructure endowment (Liberini, 2006). We, therefore, consider the existing infrastructure indices to represent the 'actual infrastructure endowment' at time t. Since, according to AfDB (2013), the composite index for each component is normalised to take the values of between 0 and 100 over the indicated period, we assume that the 'optimal infrastructure endowment' of each country is 100. Therefore, 100 minus the actual infrastructure endowment is our estimate of the infrastructure gap country i at time, t.[24] The use of an infrastructure index as a proxy for infrastructure investment is not new in infrastructure studies. For example, Sahoo, Dash and Nataraj (2010) use an infrastructure index as a composite indicator for infrastructure investment and development. Similarly, Calderón and Servén (2010b) used the indicators of quantity and quality of infrastructure and a dataset of 97 countries over 1960-2005 to examine the financing trends of infrastructure investment in Latin America.

The explanatory variable of interest, debt market size, is represented by *Debt* in Equation (1) and measured as the market value of outstanding domestic listed government debt securities ($Govt\_debt$) and outstanding domestic listed corporate debt securities ($Corp_{debt}$) both scaled

[23] More importantly, the four sub-indices are disaggregated into nine indicators which measures the dimensions of infrastructure (quantity and quality). According to the AfDB (2013), the nine indicators of infrastructure development aggregated into AIDI are:–total paved roads (km per 10,000 inhabitants), total road network in kilometers (per square km of exploitable land area), electricity generation (kilowatt per hour (kWh) per inhabitant), total Phone Subscription (per 100 inhabitants), number of Internet Users (per 100 inhabitants), fixed (wired) Broadband Internet Subscribers (per 100 inhabitants), International Internet Bandwidth (Mbps), improved water source (percentage of population with access) and improved sanitation facilities (percentage of population with access) – derived through principal component analysis (PCA). In other words, the infrastructure development index is a composite index of four infrastructure types – Transport, Electricity, Information communication and technology (ICT) and Water and Sanitation. Composite indices for each infrastructure type was also developed from the indicators of infrastructure development applicable to type. For example, a composite index of ICT was derived from the following five indicators – telephone subscriptions, internet subscriptions, number of internet users, fixed broadband users and international internet bandwidth (AfDB, 2013; Pradhan, Arvin, Nair, Bennett & Bahmani, 2017)

[24] Thus the infrastructure gap/deficit for each year is computed as: $Infragap_{it} = AIDI_t^* - AIDI_{it}$, where $AIDI_t^*$ is the optimal index at time t.

by GDP. The two indicators of bond market development are covered by Beck, Demirgüç-Kunt and Levine (2000) in their financial database and have been used by Čihák, Demirgüç-Kunt, Feyen and Levine (2012) in benchmarking financial systems in 205 countries, and they have been used in many recent studies to measure debt market depth or size (e.g., Burger, Warnock & Warnock, 2015; Fabella & Madhur, 2003; Pradhan et al., 2016a). Theoretically, we expect the coefficient of domestic debt variables to be negatively correlated with the aggregate infrastructure gap variable ($ingap$) and to different infrastructure type variables ($tran\_gap$),($elec\_gap$), (ict_gap) and (wss_gap).

Next, $infinv\_index$ represents the PPP infrastructure variables, namely the transport ($tran\_Inv$) , electricity ($elec\_Inv$), ICT (ict_Inv) , and water and sanitation(wss_inv), all scaled by GDP. These variables represent some level of existing private sector investment in key infrastructure sectors as documented in the World Bank's Private Participation in Infrastructure (PPI). In the empirical analysis, we work with infrastructure investments as a single variable through an aggregate/overall infrastructure index ($infinv\_index$) constructed using Principal Components Analysis (PCA). Because the infrastructure variables are highly correlated (see correlation matrix of the variables in Table A-2.2 of the Appendix), they are introduced in the model alternately. It is postulated that the infrastructure gap and PPP investment variables are negatively related because higher investment in infrastructure should reduce the infrastructure financing gap (Calderon et al., 2018).

We control for economic growth using the annual growth rate in GDP per capita ($gdpcpg$). Economic output growth may generate additional demand for supportive infrastructure to sustain the growth momentum (Fedderke & Bogetić, 2009; Kumo, 2012; Lee, Levendis & Gutierrez, 2012), thus expanding the infrastructure gap[25]. Alternatively, an expansion in economic output (positive GDP growth) may create additional resources to invest in infrastructure, thus reducing the infrastructure gap. Thus, depending on the relative strength of each of these two opposing effects, the coefficient sign might be negative or positive; the two effects may also cancel out each other, in which case the coefficient of GDP growth might be zero.

Equation (1) also includes a vector of other controls (X), which includes corporate governance, exchange rate, foreign direct investment, public sector gross fixed capital formation (GFCF), stock market capitalisation and interest rates. The quality of governance is one of the key

[25] The possibility of a reverse causality is acknowledged, and this will be corrected by introducing a lagged GDP per capita in the model.

determinants of private sector participation in infrastructure investments (Ba et al., 2017; Um, Gasmi & Ba, 2010). The governance index variable (gov_index) is a synthetic indicator of good governance, constructed from government efficiency, control of corruption, regulatory quality and political stability, all obtained from the Worldwide Governance Indicators database (Kaufmann, Kraay & Mastruzzi, 2011). Each governance indicator ranges from -2.5 to 2.5, with higher scores denoting higher perceptions of effective governance (Kaufmann et al., 2011).

Literature suggests that good governance attracts infrastructure finance and facilitates the growth of debt markets (Acemoglu, Johnson & Robinson, 2005; Banerjee, Oetzel & Ranganathan, 2006; Misati & Nyamongo, 2011; Regan, 2017). In other words, private investors and financial markets often respond positively where corruption risk is low and regulatory frameworks offer more robust investor protection and a stable political environment. These indicators are therefore expected to correlate negatively with the infrastructure gap/deficit.

According to Schwartz, Ruiz-Nuñez and Chelsky (2014), exchange rate ($exch\_rate$) volatility could affect the cost of imported infrastructure construction or operations input. For example, in a study to examine the determinants of private sector investments in energy infrastructure projects in 37 developing countries, using a 1990-2007 dataset, Um et al. (2010) found that currency risk negatively impacts energy infrastructure projects. Similarly, Frimpong and Marbuah (2010) find that depreciation of the real exchange rate increases the cost of imported capital goods and could, as a result, negatively influence the level of private-sector investment in import-dependent infrastructure sectors. Consistent with empirical literature, we expect foreign currency exchange risk to have a negative effect on the infrastructure deficit.

Foreign direct investment (FDI) scaled by GDP (fdi_gdp) is included as a control variable in this study in order to capture the flow of foreign capital into the economy, which does inject not only additional capital into infrastructure investments, but also complements domestic investment by enhancing domestic capital accumulation and ushering in technological progress, new knowledge and ideas that enhance productivity in a host country, and in turn, help to reduce the country's infrastructure gap (Anaman, 2018; Ndikumana & Verick, 2008; Tsaurai & Ndou, 2019). We predict that the relation between FDI and the infrastructure gap is negative.

Domestic investment is one of the key drivers of economic growth (Azolibe, Okonkwo & Adigwe, 2020; Meyer & Sanusi, 2019). The Keynesian theory postulates that new and additional investment is likely to increase aggregate demand in the economy (Faulkner, Loewald & Makrelov, 2013; Tobin, 1965). The economic growth stimulated by domestic investment can, in turn, increase the demand for infrastructure services, thereby widening the infrastructure deficit. We use the change of GFCF (public sector) to GDP (GDP ($gfcfp$) to control the effect of public

sector investment on infrastructure development. We therefore expect the change of gross fixed capital formation to have a negative correlation with infrastructure deficit.

We incorporate stock market capitalisation as per cent of GDP ($smkt\_cap$) into the equation to capture the role of financial intermediation in promoting infrastructure financing. Stock markets, as financial intermediaries, can play both substitution and a complementary role alongside public bond markets in providing long-term finance to infrastructure projects (Brealey, Cooper & Habib, 1996; Gatti, 2013). Therefore, the influence of the stock market capitalisation variable on infrastructure deficit can either be positive or negative.

The macroeconomic environment is important for the development of infrastructure; hence in this study, we use real interest rate ($rintrate$) as a measure of macroeconomic stability. High levels of real interest rates discourage infrastructure investments by increasing the cost of funds and affecting their availability (Schwartz et al., 2014). We, therefore, expect real interest to have a positive impact on the infrastructure deficit.

Lastly, we control for the human development index (HDI) as a proxy for human capital development. Human capital development fosters the availability of skilled and highly productive labour that contributes to the efficient and/or effective delivery of infrastructure projects (ACBF, 2016; Han & Lee, 2020; Tsaurai & Ndou, 2019). The HDI (hdi) is a component of three indices, namely the average and expected year of schooling index, life expectancy index and national income index. Table 2.1 contains a summary description, notations, and source of the deployed data (variables).

Table 2.1: Data description, notation, and source

Variables	Notation	Data source
Dependent variables		
Overall infrastructure index	$Overall\_index$	*Authors' calculations using data from African Development Bank's Africa Infrastructure Development Index (AIDI) Database*
Aggregate/overall infrastructure gap index	$infgap\_index$	
Infrastructure gap in the transport sector	$tran\_gap$	
Infrastructure index gap for the electricity sector	$elec\_gap$	
Infrastructure index gap for the information and communications technology (ICT) sector	ict_gap	
Infrastructure index gap for water and sanitation sector	wss_gap	
Independent variables		
Government public debt market capitalisation–GDP ratio	gov_debt	*African Development Bank*
Corporate public debt market capitalisation-GDP ratio	$corp\_debt$	*World Bank, Financial Development Indicators (FDI), and Authors calculations using data from Datastream, World Federation of Exchanges (WFE), African Security Exchanges Association (ASEA).*
Public-Private Partnerships (PPP) investment in Aggregate/overall infrastructure	$infinv\_index$	*Authors' calculations using data from World Bank's Private Participation in Infrastructure (PPI) Database*
PPP investment in transport sector-GDP ratio	$tran\_inv$	*World Bank's PPI Database*
PPP investment in the electricity sector-GDP ratio	$elec\_inv$	*World Bank's PPI Database*
PPP investment in ICT sector-GDP ratio	ict_inv	*World Bank's PPI Database*
PPP investment in water and sanitation (WSS) sector- GDP ratio	wss_inv	
Annual growth rate of GDP per capita	$gdpcp$	*World Bank, World Development Indicator (WDI) Database*
Control variables		
Stock market capitalisation–GDP ratio	$smkt\_cap$	*World Bank, Financial Development Indicators (FDI), and Authors calculations using data from Datastream, World Federation of Exchanges (WFE), African Security Exchanges Association (ASEA).*
Human development index	hdi	*World Bank, WDI Database*
Exchange rate	$exch\_rate$	*The Global Economy.com*
Real interest rate (per cent)	$rint\_rate$	*International Monetary Fund, International Financial Statistics and data files using World Bank data on the GDP deflator.*
Change in Gross capital formation-GDP ratio	$\Delta gfcfp$	*World Bank, WDI Database*
Foreign direct investment-GDP ratio	fdi_gdp	*World Bank, WDI Database*
Governance indicators	gov_index	*World Bank, Worldwide Governance Indicators (WGI) produced by Daniel Kaufmann (Natural Resource Governance Institute and Brookings Institution) and Aart Kraay (World Bank Development Research Group)*

Equation (1) assumes a linear relationship between the two key variables. However, we argue that low levels of debt markets development may not have a meaningful impact on the high infrastructure deficits observed in the SSA region and that larger debt markets may be necessary to enable a cumulation of such meaningful effects. Specifically, we believe that there is a

requisite minimum cumulation of infrastructure investment (or endowment) reflected by a threshold level of debt markets development at which domestic debt financing begins to have an effect on the infrastructure deficit (and thus the financing gap). To estimate the threshold effect, we employ the panel threshold regression model developed by Hansen (1999):

$$infgap\_index_{it} = \mu + \beta_1 debt_{it}(\psi_{it} \leq \gamma_1) + \beta_2 debt_{it}(\gamma_1 < \psi_{it} \leq \gamma_2) + \beta_3 debt_{it}(\gamma_2 < \psi_{it} \leq \gamma_3) + \ldots + \beta_n debt_{it}(\gamma_n < \psi_{it}) + \delta infrainv\_index_{it} + \theta gdpcpg_{it} + \lambda' X_{it} + \varepsilon_{it} \quad (2)$$

where ψ is the threshold variable, defined as the level of infrastructure financing gap; $\gamma_1, \gamma_2, \ldots \gamma_n$ are the values of the threshold variable, and $\beta's$ are estimated coefficients of the threshold variables; δ, θ, and λ are other coefficients to be estimated; μ and ε are the cross-sectional fixed effects to deal with unobserved country-level heterogeneity, and noise terms, respectively.

We first estimate a single threshold model and test the significance of the single threshold. The null hypothesis of no threshold effect is tested against the alternative hypothesis of a single threshold. We subsequently test for the null hypothesis of a single threshold against the alternatives of two thresholds and three thresholds, and so on, as we seek to determine the number of thresholds in the model.

2.3.2 Descriptive statistics

Table 2.2 shows the summary statistics of the variables used in this study.

Table 2.2: Summary statistics

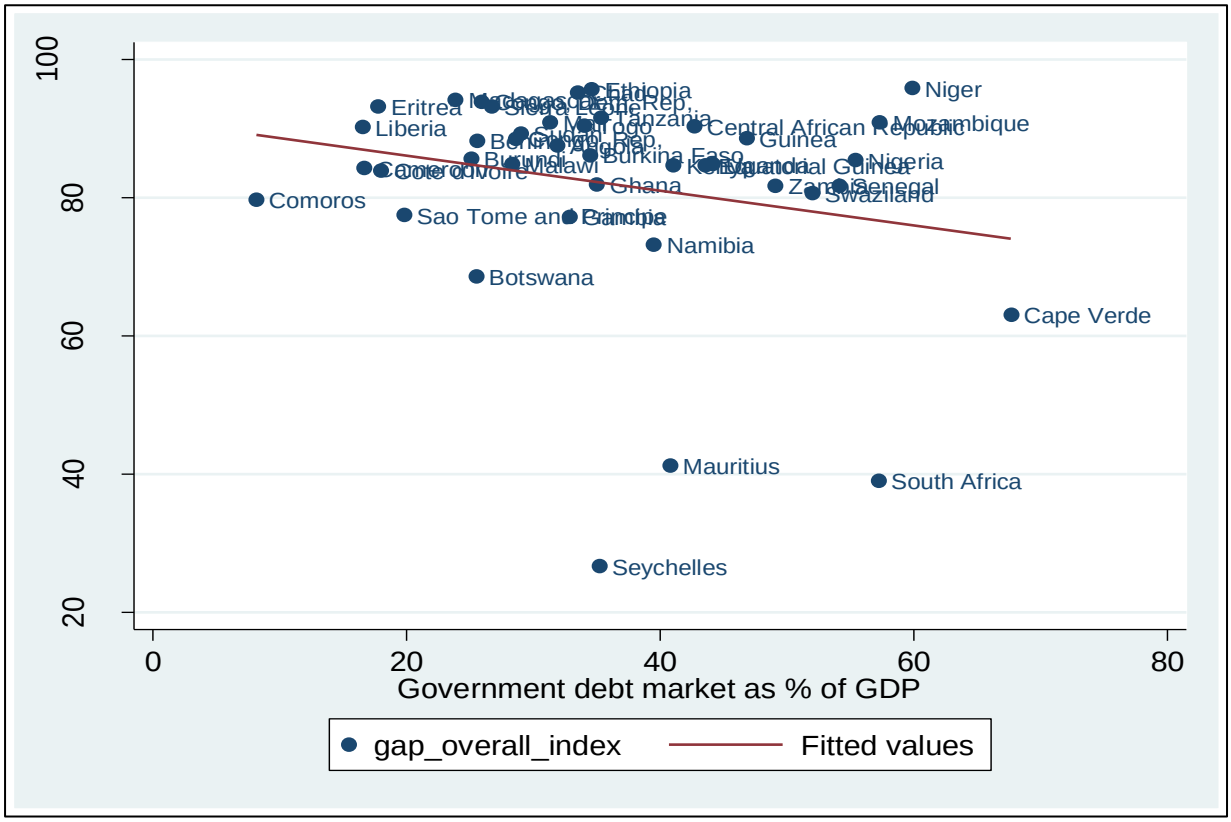
Variable	Mean	Standard deviation	Minimum	Maximum	Observations
Income groups	1.625	0.828	1	4	N = 640
$Overall\_index$	17.863	15.944	0.369	94.324	N = 640
$infgap\_index$	82.137	15.944	5.676	99.631	N = 640
$elec\_inv$	5.658	14.373	0.001	88.430	N = 640
$elec\_gap$	92.887	15.043	17.624	100	N = 640
wss_inv	1.921	3.185	0.015	19.155	N = 640
wss_gap	47.304	20.104	0.212	99.109	N = 640
$tran\_inv$	0.983	2.457	0.00009	14.906	N = 640
$tran\_gap$	90.594	10.251	46.691	99.446	N = 640
ict_inv	2.856	7.274	0.0002	70.985	N = 640
ict_gap	95.263	8.773	36.556	100	N = 640
$gdpcp$	2.004	4.584	-36.557	32.169	N = 640
gov_debt	35.634	17.442	4.1	98.487	N = 640
$corp\_debt$	15.055	10.642	0.738	62.599	N = 640
$smkt\_cap$	10.280	36.044	0.724	328.361	N = 640
hdi	0.484	0.107	0.263	0.797	N = 640
$exch\_rate$	652.283	1260.562	0 .867	9088.32	N = 640
$rint\_rate$	6.157	9.083	-34.210	52.437	N = 640
$\Delta gfcfp$	0.204	4.091	-40.015	31.981	N = 640
fdi_gdp	4.983	9.321	-6.369	103.337	N = 640
gov_index	-1.45e-10	0.984	-1.778	2.688	N = 640
$infinv\_index$	9.75e-11	0.909	-0.470	4.486	N = 640

Source: Authors' assembled data.

The sample size in this balanced panel dataset is 640. The table shows that existing infrastructure investment in SSA countries is relatively low, with transport being the least, with an average investment of 0.98% of GDP, followed by water, ICT, and electricity with mean values of 1.92%, 2.86% and 5.66% of GDP, respectively. This is not surprising since the involvement of the private sector in infrastructure in SSA is still minimal. For example, between 2014 and 2018, SSA received an average of US$4.3 billion annually in private infrastructure investment commitment, compared to an annual average of US$34 billion, US$28 billion and US$17 billion for Latin America and the Caribbean (LAC), East Asia Pacific (EAP) and Europe and Central Asia (ECA) regions respectively (World Bank, 2014, 2018). This implies that SSA's share of overall PPI investment commitments is, on average, around 5% per annum compared to 41%, 34% and 20% for LAC, EAP and ECA, respectively.

The SSA government debt market size (mean value of 35.63% of GDP) is high relative to the corporate debt market size (15.06% of GDP). The relationship between debt market capitalisation (market size), which is the targeted independent variable, and the infrastructure gap is explored further in the scatter plots in Figures 2.1 and 2.2. Figure 1 plots the 16-year averages (2003-2018) of SSA countries' infrastructure gap as a percent of GDP (y-axis) against domestic government debt markets as a percent of GDP (x-axis). The figure shows that Niger, Mozambique, Nigeria, Senegal, Swaziland (now Eswatini), and Guinea have relatively high infrastructure gaps and high government debt markets. Countries like Cape Verde, Nigeria, Mozambique, and South Africa have some of the highest government debt market sizes in the region. Comoros, Liberia and Cameroon have the least government debt market sizes. On the infrastructure gap, the leading countries with relatively high values include Nigeria, Ethiopia, Chad, and Madagascar. There are a number of factors which can contribute to such a pattern, including larger economies, and population size, among others. Relatively large economies need effectively higher infrastructure endowments. However, the bulk of the countries' infrastructure gaps are high, whilst government debt market sizes are low.

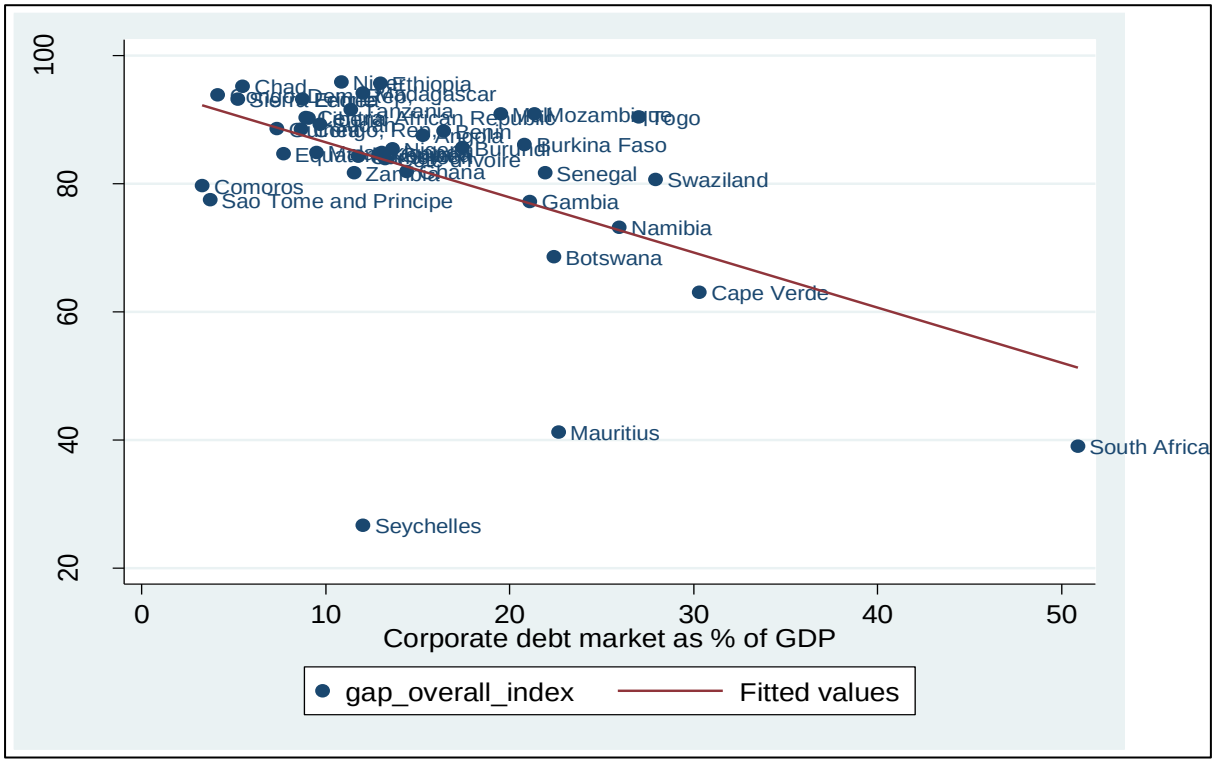
Figure 2.1: Infrastructure deficit/gap and domestic government debt market in SSA



Source: EViews output using African Development Bank Group dataset

Similar to Figure 2.1, Figure 2.2 shows that lower-middle to upper-middle income countries (LMCs and UMCs)[26] such as Eswatini, Namibia, Botswana, Senegal, and Togo have relatively high infrastructure gaps and high corporate debt markets. Countries with low corporate debt markets are Comoros, Sao Tome, Congo democratic republic, and Sierra Leone. On average corporate debt markets seem to be relatively low compared to government debt. Thus, SSA countries should adjust their policies and attract more corporate debt issuance so as to possibly lower the cost of capital for domestic enterprises and government.

Figure 2.2: Infrastructure gap and corporate debt market as a share of GDP in SSA



Source: EViews output using African Development Bank Group dataset

2.3.3 Preliminary tests

Before running our main empirical tests, we perform some preliminary tests on the data. First, we test for cross-sectional dependence in the variables. Cross-sectional dependence is where units in the same cross-section are highly correlated. This usually happens due to the effect of

[26] In this study, the classification of countries by income groups is based on the 2009 World Bank Analytical Classifications.

some unobserved common factors which affect each of the units. The presence of cross-sectional dependence in a panel can create estimation problems if it is not accounted for. By way of mitigation, the unit root tests and the regression estimation methods should be adjusted to account for the cross-sectional dependence (Martínez-Zarzoso & Bengochea-Morancho, 2004). Table A-2.2 in the Appendix shows the null hypothesis of no cross-sectional dependence is rejected for all variables except trade balance. Thus, we adjust for cross-sectional dependence in our tests.

Next, we test for unit root in our panel dataset. Given the presence of cross-sectional dependence reported in Table A-2.3, we thus deploy unit root tests of Im, Pesaran's and Shin W-statistic, ADF - Fisher Chi-square and PP - Fisher Chi-square. These unit root tests assume cross-sectional independence but allow for heterogeneity in the form of individual deterministic effects and heterogeneous serial correlation structure of the error terms (Gengenbach, Palm & Urbain, 2009). Table 2.3 shows the unit-root test outcomes with variables in the first difference. The null hypothesis is of a unit root (non-stationary). The results show that all the variables are stationary after differencing once.

Table 2.3: Unit root test

Variable		Im, Pesaran's and Shin W-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square
$infgap\_index$	*Statistic*	*-4.37(0.000)*	*142.17(0.000)*	*221.71(0.0000)*
$elec\_gap$	*Statistic*	*-8.18 (0.000)*	*226.89(0.000)*	*478.53(0.000)*
$tran\_gap$	*Statistic*	*-12.03(0.000)*	*231.45(0.000)*	*425.39(0.000)*
wss_gap	*Statistic*	*-0.83(0.000)*	*94.92(0.000)*	*245.46(0.000)*
ict_gap	*Statistic*	*3.75(0.000)*	*38.20(0.000)*	*90.16(0.000)*
$elec\_inv$	*Statistic*	*-10.39(0.000)*	*257.59(0.000)*	*755.24(0.000)*
wss_inv	*Statistic*	*-13.22(0.000)*	*322.95(0.000)*	*552.24(0.000)*
ict_inv	*Statistic*	*-16.75(0.000)*	*404.83(0.000)*	*755.24(0.000)*
$tran\_inv$	*Statistic*	*-12.34(0.000)*	*302.45(0.000)*	*526.04(0.000)*
gov_debt	*Statistic*	*-6.32(0.000)*	*168.71(0.000)*	*331.41(0.000)*
$corp\_debt$	*Statistic*	*-5.37(0.000)*	*147.80(0.000)*	*346.57(0.000)*
$gdpcp$	*Statistic*	*-13.05(0.000)*	*318.91(0.000)*	*507.90(0.000)*
fdi_gdp	*Statistic*	*-9.91(0.000)*	*246.61(0.000)*	*952.05(0.000)*
gov_index	*Statistic*	*-18.25(0.000)*	*438.97(0.000)*	*755.25(0.000)*
$infinv\_index$	*Statistic*	*-22.77(0.000)*	*538.31(0.000)*	*1111.88(0.000)*
$\Delta gfcfp$	*Statistic*	*-4.247(0.000)*	*107.2315(0.000)*	*195.749(0.000)*
$smkt\_cap$	*Statistic*	*-3.646(0.000)*	*55.34(0.000)*	*82.146(0.000)*
$exch\_rate$	*Statistic*	*-6.87(0.000)*	*179.05(0.000)*	*353.77(0.000)*
hdi	*Statistic*	*-6.32(0.000)*	*168.71(0.000)*	*331.41(0.000)*

Source: Author's assembled data

Notes:

The unit root tests are based on variables in the first difference.

Numbers in parentheses are p-values

Generally, fixed effects and random effect model estimators assume that countries or units in the panel dataset do not exhibit cross-sectional dependence. As observed by Pesaran and Smith (1995), conventional estimation methods such as the fixed effects, the random effects, and the GMM, assume non-cross-sectional dependence as they are designed to also correct for fixed-effect heterogeneity issue that occurs in the case of large N and small T panels. When we have cross-sectional dependence fixed effects, the random effects and the GMM estimators are inconsistent estimation techniques, as they do not take endogeneity caused by heterogeneity into consideration. To ensure consistent results, the pooled mean group (PMG) estimator developed by Pesaran, Shin and Smith (1999), which is more efficient due to the valid long-run restrictions, can be considered. Another advantage of the PMG is that it is robust to outliers and lag orders. Moreover, the PMG estimator requires long-run coefficients across cross-sections to be similar. In light of the guidance from the diagnostic tests above, we use the PMG technique in exploring the linear relationship between the infrastructure gap and the debt market variables.

2.4 Empirical Results

2.4.1 Pooled mean group regression analysis of government bond markets development

Tables 2.4 and 2.5 present the results of the five pooled mean group (PMG) linear regression models of infrastructure gap against government debt markets and corporate debt markets and control variables. In Table 2.4, under column 2, where we regress the overall infrastructure gap ($infgap\_index$) on the government debt market(gov_debt), control variables and a constant, the results show that government debt market development is negatively and statistically significantly related to the overall infrastructure gap. This result means that more developed government debt markets can facilitate the channelling of funds to infrastructure projects and help to reduce the overall infrastructure gap. Columns 2 through 6 have the dependent variable being the various infrastructure gaps and also control for corporate governance (gov_index), the annual growth rate of gross domestic product per capita ($gdpcpg$), the exchange rate ($exch\_rate$), foreign direct investment (fdi_gdp), gross fixed capital formation of the public sector ($gfcfp$), stock market capitalisation ($smkt\_cap$) and real investment interest rates ($rint\_rate$). Several of these control variables are expressed as a per cent of Gross Domestic Product (GDP). In addition to the listed control variables above, the models also control for the current PPP infrastructure investment in the respective models.

Table 2.4: Pooled mean group regression output for Government debt markets

1		Model 1	Model 2	Model 3	Model 4	Model 5
2	Variable	Overall Infrastructure Gap	Transport Gap	Electricity Gap	ICT Gap	WSS Gap
3	Constant	8.425 (2.404)	9.363 (2.295)	5.270 (2.450)	1.894 (2.535)	1.279 (3.494)
4	gov_debt	-0.018 (-2.283)	-0.016 (-2.944)	-0.054 (-3.039)	-0.042 (-1.560)	-0.041 (-3.351)
5	$infinv\_index$	1.915 (1.751)				
6	$tran\_inv$		-0.212 (-1.799)			
7	$elec\_inv$			-0.099 (-2.138)		
8	ict_inv				0.181 (3.950)	
9	wss_inv					0.118 (0.469)
10	gov_index	-0.115 (-0.168)	0.327 (1.045)	-0.971 (-1.737)	-0.353 (-0.359)	1.289 (2.198)
11	$gdpcp$	-0.002 (-0.051)	-0.040 (-2.569)	0.044 (1.592)	-0.005 (-0.104)	0.006 (0.212)
12	$exch\_rate$	0.001 (3.755)	0.0003 (2.254)	0.001 (2.917)	0.002 (4.575)	-0.002 (-5.309)
13	fdi_gdp	-0.004 (-0.978)	-0.008 (-0.890)	0.008 (0.466)	0.001 (0.051)	-0.017 (-0.998)
14	$\Delta gfcfp$	-0,074 (-2.061)	-0,012 (-2.840)	-0,017 (-1.933)	-0,0135 (-3.281)	-0,031 (-1.861)
15	$smkt\_cap$	-0.014 (-1.202)	0.026 (4.868)	-0.013 (-1.381)	0.003 (0.184)	-0.002 (-0.208)
16	$rint\_rate$	-0.020 (-0.831)	-0.005 (-0.437)	-0.036 (-1.883)	0.007 (0.204)	-0.015 (-0.736)
17	R squared	0.536	0.554	0.473	0.488	0.491
18	Durbin-Watson stat	1.984	2.055	1.972	1.414	1.094
19	Akaike info criterion	5.47	3.91	5.053	6.21	5.18
20	Schwarz criterion	5.92	4.37	5.506	6.66	5.63
21	Hannan-Quinn criterion.	5.64	4.09	5.229	6.39	5.36

Notes:

The dependent variables are the infrastructure gaps of overall/aggregate infrastructure, transport, electricity, information, and communications technology (ICT) and water and sanitation infrastructure types.

Numbers in parentheses are t-statistics.

In all the models, we observe that the coefficient for government debt markets is negative and statistically significant when using different infrastructure gap variables. We, therefore, conclude that there is a robust negative association between the infrastructure gap and the size of the government debt markets, suggesting that the government debt market plays a vital role in reducing the infrastructure gap. Specifically, the coefficients for government debt markets range

from -0.016 (-2.944) for transport to -0.054 (-3.039) for electricity, implying an improvement in the development of government debt markets by, say, 10% would elicit a reduction in the average transport infrastructure gap by 0.16 to 0.54 % of GDP.

In models 2 and 3, we observe that a negative and statistical relationship between current PPP investment levels is associated with a reduction of the respective infrastructure gap. Specifically, in model 2, a 10% increase in current transport investment is associated with a 2.12% decline in the transport infrastructure gap. In model 3, a 10 % increase in current electricity investment is associated with a 0.99% reduction in the electricity infrastructure gap. These results are consistent with expectations (Calderon et al., 2018).

In models 1 and 4, we have a contrary relationship where an increase in the current PPP investment level appears to be associated with the widening of the ICT infrastructure gaps (coefficient =1.915 (1.75)) and the ICT investment (0.181). This finding means more infrastructure investment is associated with a higher infrastructure gap. This relationship might be due to a demand-driven type of investment where an additional investment of one infrastructure type should be accompanied by more investment in another infrastructure type, generating a complimentary type of investment which, if not done, may raise the infrastructure gap (Agénor, 2010; Rinaldi, Peerenboom & Kelly, 2001). According to Rinaldi et al. (2001), most infrastructure sectors are highly connected/networked and mutually dependent: for example, the addition of a new water supply facility or transportation infrastructure (e.g., railway system) may, in turn, requires new and better energy infrastructure to support the initial infrastructure addition.

A good example is the introduction of a Gautrain Rapid Rail Link[27] in South Africa, which was an addition to transport infrastructure but required sufficient and reliable electricity supply to operate efficiently and sustainably (Xaba & Yusuff, 2018). The derived demand for complementary infrastructure may deepen the infrastructure gap if an appropriate injection of additional capital is not immediately available to meet the new demand. Another example is that a boom in mobile telephone technology can create a higher demand for complementary ICT infrastructure, such as faster Internet connectivity, and increased fixed broadband, more efficient

[27] The Gautrain Rapid Rail Link is an urban passenger railway transit system implemented in South Africa in 2010 to connect the Gauteng Province's economic nodes of Johannesburg and Pretoria metropolis and the Oliver Tambo International Airport.

international Internet bandwidth, and secure servers; and so forth (ECA, 2019; Pradhan et al., 2017; Pradhan, Arvin & Hall, 2016b).

We also observe, in Model 2, a statistically negative relationship between the transport infrastructure gap and GDP growth rate per capita. That is, a 10% increase in GDP per capita growth would elicit a 0.40% reduction in the transportation infrastructure gap. This result can be explained by the fact that the growth in GDP per capita allows governments to mobilise resources from taxes and domestic savings to channel into transport infrastructure to facilitate population mobility and market access.

Except for the water infrastructure gap, the exchange rate has a positive and statistically significant relationship with all forms of infrastructure gaps. This finding is consistent with the literature (see, Frimpong & Marbuah, 2010; Schwartz et al., 2014; Um et al., 2010), which suggests that exchange rate volatility could reduce the size of private-sector spending in import-dependent infrastructure sectors, contributing to a rise in the infrastructure gap. Change in public sector GFCF has a negative and statistically significant relationship with gaps in all infrastructure types. This result implies that all infrastructure sectors benefit more from public sector investment in infrastructure (e.g., through fiscal budget appropriation). This finding is consistent with the literature, which shows that African governments are still the major financiers of African infrastructure (Foster and Briceño-Garmendia (2010). Concerning the model's goodness of fit, the R-squared, Durbin-Watson statistic, and the many information criteria all largely suggest a good fit.

2.4.2 Pooled mean group regression analysis of corporate bond markets development

We now shift to corporate debt markets. Table 2.5 shows that, like government debt, corporate debt has a negative and statistically significant relationship with the infrastructure gap, as shown in row 4 of Table 2.5. In general, a 10% increase in corporate debt market size is associated with a 0.36% to 1.10% decline in the infrastructure gap. The magnitude of this relationship is stronger in models 1 (overall infrastructure gap) and 4 (ICT infrastructure gap), where a 10% increase in corporate debt is associated with a 0.88% and 1.1% decrease in infrastructure gap, respectively. Our findings are consistent with the relevant literature, which encourages policymakers to mobilise private financing from public debt markets as a way of bridging the infrastructure financing gap (e.g., Collier & Cust, 2015; Hyun et al., 2019; Regan, 2017).

Comparing Tables 2.4 and 2.5, we observe that corporate debt is more effective in reducing the overall infrastructure gap, transport infrastructure gap, ICT infrastructure gap and water

infrastructure gap compared to government debt. This result can be explained in many ways. Firstly, the private sector brings into PPP arrangements, financial resources, managerial expertise and efficiency to the infrastructure projects (Ba et al., 2017; Hyun et al., 2019). It is assumed that the resulting private sector managerial expertise and technical and operational efficiency add to improved efficiency of spending and productivity; reduced corruption and red tape; and sound procurement practices and revenue collection, among others, which result in the delivery of low-cost and better quality of infrastructure services (Calderon et al., 2018). Secondly, PPP infrastructure projects are also perceived to be efficient in controlling cost and time overruns relative to government-funded projects (Deep, Kim & Lee, 2019). For example, in a study of the outcome of large public construction projects in the United Kingdom between 1982 and 2001, MacDonald (2002) found that traditional public projects had cost overruns of 24%-66% and time overruns of 4%-39% during construction. In contrast, PPP projects were more effective in both. In the survey, the author found that 78 % of PPP projects were within the budget parameter, compared to 27% of government-funded projects.

Finally, this result lends support to the notion that corporate bond markets may be successfully tapped only by corporates/special purpose vehicles with sufficiently good credit ratings, implying that those entities comply with full listing procedures or adhere to generally accepted accounting practices and therefore are committed to delivering a viable risk/return profile of investment (Endo, 2000; Johnson, Muhoza, Osano, Senyagwa & Kartha, 2017; Tyson, 2018). In other words, the high creditworthiness of the bond issuer is associated with the sustainable profitability of the issuer's business operation (Endo, 2000).

Interestingly, models 3 in Tables 2.4 and 2.5 show that the government debt market is more efficient in reducing the electricity infrastructure gap than the corporate debt market. Specifically, a 10% increase in government debt is associated with a 0.54% decline in the electricity infrastructure gap, compared to a 0.42% decline when using corporate debt. This finding is unsurprising if we consider that governments and state-owned enterprises (SOEs) are the largest investors in SSA's energy sector, contributing around 81% (Foster & Briceño-Garmendia, 2010).

Table 2.5: Pooled mean group regression output for Corporate debt markets

1		Model 1	Model 2	Model 3	Model 4	Model 5
2	*Variable*	*Infrastructure Gap (Index)*	*Transport Gap*	*Electricity Gap*	*ICT Gap*	*WSS Gap*
3	*Constant*	*8.795 (2.821)*	*91.530 (2.654)*	*5.288 (2.863)*	*1.395 (2.872)*	*0.245 (3.281)*
4	$corp\_debt$	*-0.088 (-3.121)*	*-0.036 (-2.041)*	*-0.042 (-3.529)*	*-0.110 (-2.790)*	*-0.046 (-1.901)*
5	$infinv\_index$	*2.233 (2.076)*				
6	$tran\_inv$		*-0.210 (-1.793)*			
7	$elec\_inv$			*-0.126 (-2.690)*		
8	ict_inv				*0.182 (4.001)*	
9	wss_inv					*0.137 (0.539)*
10	gov_index	*-0.368 (-0.539)*	*0.386 (1.233)*	*-0.906 (-1.623)*	*-0.581 (-0.590)*	*1.282 (2.159)*
11	$gdpcp$	*-0.0004 (-0.013)*	*-0.040 (-2.552)*	*0.046 (1.643)*	*-0.007 (-0.151)*	*0.009 (0.334)*
12	$exch\_rate$	*0.001 (3.797)*	*0.0004 (2.352)*	*0.0009 (3.242)*	*0.002 (4.475)*	*-0.001 (-5.014)*
13	fdi_gdp	*-0.007 (-0.358)*	*-0.007 (-0.736)*	*0.014 (0.861)*	*-0.005 (-0.179)*	*-0.012 (-0.707)*
14	$\Delta gfcfp$	*-0.002 (-3.705)*	*-0.040 (-2.214)*	*-0.244 (-2.117)*	*-0.105 (-1.875)*	*-0.206 (-2.309)*
15	$smkt\_cap$	*-0.012 (-1.018)*	*0.026 (4.721)*	*-0.016 (-1.685)*	*0.007 (0.399)*	*-0.004 (-0.403)*
16	$rint\_rate$	*-0.019 (-0.828)*	*-0.005 (-0.473)*	*-0.039 (-2.018)*	*0.009 (0.261)*	*-0.017 (-0.835)*
17	*R squared*	*0.534*	*0.540*	*0.679*	*0.486*	*0.429*
18	*Durbin-Watson stat*	*2.14*	*2.55*	*1.853*	*1591*	*1.089*
19	*Akaike info criterion*	*5.45*	*3.91*	*5.05*	*6.20*	*5.19*
20	*Schwarz criterion*	*5.90*	*4.36*	*5.50*	*6.65*	*5.65*
21	*Hannan-Quinn criterion.*	*5.63*	*4.08*	*5.22*	*6.38*	*5.37*

Notes: The dependent variables are the infrastructure gaps of overall/aggregate infrastructure, transport, electricity, information, and communications technology (ICT) and water and sanitation infrastructure types.

Numbers in parentheses are t-statistics.

Source: Authors' assembled data

Consistent with Table 2.4, we also observe a mix of positive and negative statistically significant relationships between the infrastructure gap and the respective current infrastructure investment. The same can also be seen for corporate governance, exchange rate and gross fixed capital formation. Again, the model fitness test shows fairly well-fitted models.

2.4.3 Nonlinear analysis of bond markets development

We now attempt to ascertain the true nature of the relationship between the infrastructure gap and government debt and corporate debt markets, respectively. In particular, we investigate possible nonlinearity in these relationships. Table 2.6 shows the results of the threshold regression analysis. The infrastructure variables, the dependent variables for the respective models, are depicted in the first row. Each infrastructure type has two threshold models, one each for government debt and corporate debt, presented side in row 2. Row 3 shows each model's threshold value(s), while rows 4-7 report the beta coefficients for the respective threshold regimes. Rows 8-19 show the coefficients of the controls, and rows 20-27 report some diagnostic statistics. In our tests, only the debt market variable is considered regime dependent. Debt market development is the only explanatory variable whose elasticity is hypothesized to change as the level of the infrastructure gap varies. Therefore, since we have already extensively discussed the effect of the other variables on the infrastructure gap in the previous section, we focus our discussion, in this section, only on the implications of the debt markets.

Table 2.6: Threshold regression results for 40 countries (full sample)

		Infrastructure Gap (Index)		Transport Gap		Electricity Gap		ICT Gap		*WSS Gap*	
2	***Debt market***	***Government***	***Corp-orate***	***Government***	***Corp-orate***	***Government***	***Corp-orate***	***Government***	***Corp-orate***	***Government***	***Corp-orate***
3	***Est. threshold value (share of GDP)***	*80.71*	*75.99, 91.61*	*97.97*	*93.44*	*90.58, 96.19*	*90.44*	*97.23*	*91.28, 97.96, 99.98*	*30.65, 53.18, 65.45*	*25.21, 45.38, 63.59*
4	***Beta for regime #1***	*-0.436 (-1.158)*	*-1.207 (-1.014)*	*-0.529 (-0.706)*	*-1.538 (-0.547)*	*0.224 (0.953)*	*-1.038 (-2.554)*	*-1.895 (-5.458)*	*-1.119 (-3.333)*	*0.085 (0.404)*	*-0.512 (-2.177)*
5	***Beta for regime #2***	*-0.560 (-4.845)*	*-1.379 (-1.042)*	*-1.058 (-3.330)*	*-2.112 (-5.552)*	*-0.744 (-2.235)*	*-1.958 (-6.867)*	*-0.577 (-4.715)*	*-1.700 (-4.032)*	*-0.408 (-3.362)*	*-0.849 (-3.464)*
6	***Beta for regime #3***		*-3.161 (-7.317)*			*-0.750 (-5.669)*			*-2.486 (-2.308)*	*-0.335 (-2.441)*	*-1.206 (-4.369)*
7	***Beta for regime #4***								*-1.632 (-1.777)*	*-0.302 (-2.398)*	*-1.079 (-3.117)*
8	$infinv\_index$	*0.489 (0.382)*	*-0.005 (-0.004)*								
9	$tran\_inv$			*1.296 (2.891)*	*1.675 (3.370)*						
10	$elec\_inv$					*0.387 (4.577)*	*0.118 (1.178)*				
11	ict_inv							*0.589 (3.779)*	*0.975 (5.536)*		
12	wss_inv									*0.365 (1.453)*	*1.097 (4.247)*
13	gov_index	*-7.047 (-5.253)*	*-12.361 (-8.978)*	*-8.249 (-6.473)*	*-16.177 (-11.41)*	*-5.829 (-4.435)*	*-16.56 (-11.359)*	*-7.060 (-5.693)*	*-18.638 (-12.53)*	*-6.125 (-7.299)*	*0.436 (5.045)*
14	$gdpcp$	*0.989 (4.102)*	*0.667 (6.817)*	*0.873 (3.611)*	*0.899 (3.338)*	*1.057 (4.315)*	*1.052 (3.711)*	*0.881 (3.571)*	*1.212 (4.283)*	*0.769 (4.862)*	*0.697 (4.083)*
15	$exch\_rate$	*0.002 (2.223)*	*0.006 (4.435)*	*0.004 (3.930)*	*0.007 (6.926)*	*0.001 (1.564)*	*0.006 (6.286)*	*0.002 (2.609)*	*0.007 (7.247)*	*0.002 (2.814)*	*0.176 (1.977)*
16	fdi_gdp	*0.357 (2.972)*	*0.845 (6.786)*	*0.387 (3.195)*	*0.698 (5.155)*	*0.387 (3.078)*	*0.843 (5.891)*	*0.429 (3.498)*	*0.849 (5.946)*	*0.210 (2.608)*	*-0.041 (-1.36)*
17	$\Delta gfcfp$	*1.004 (-2.96)*	*3.77 (-2.04)*	*0.77 (-1.93)*	*3.66 (-2.82)*	*1.51 (-2.33)*	*3.86 (-2.75)*	*1.86 (-3,07)*	*4.76 (-2,39)*	*0.67 (-1.76)*	*-1.56 (-2.21)*
18	$smkt\_cap$	*-0.119 (-3.636)*	*-0.209 (-5.296)*	*-0.002 (-0.077)*	*-0.109 (-2.749)*	*-0.169 (-4.983)*	*-0.243 (-5.081)*	*-0.046 (-1.378)*	*-0.214 (-4.835)*	*-0.022 (-0.997)*	*-0.041 (-1.36)*
19	$rint\_rate$	*0.796 (6.565)*	*0.817 (6.627)*	*0.902 (7.386)*	*0.938 (6.974)*	*0.954 (7.695)*	*1.135 (8.148)*	*0.842 (6.672)*	*0.928 (6.538)*	*0.486 (5.975)*	*-10.556 (-12.21)*
20	***Number of countries***	*40*	*40*	*40*	*40*	*40*	*40*	*40*	*40*	*40*	*40*

		Infrastructure Gap (Index)		Transport Gap		Electricity Gap		ICT Gap		*WSS Gap*	
21	***R-squared***	*0.621*	*0.531*	*0.470*	*0.443*	*0.425*	*0.361*	*0.376*	*0.582*	*0.307*	*0.651*
22	***Durbin-Watson statistic***	*2.239*	*2.370*	*0.237*	*1.983*	*0.335*	*2.365*	*2.283*	*1.851*	*1.592*	*2.069*
23	***Akaike info criterion***	*9.48*	*9.718*	*9.49*	*9.856*	*9.53*	*9.79*	*9.52*	*9.79*	*8.64*	*8.789*
24	***Schwarz criterion***	*9.67*	*10.043*	*9.69*	*10.181*	*9.80*	*9.98*	*9.72*	*10.13*	*8.98*	*9.114*
25	***Hannan-Quinn criterion.***	*9.55*	*9.844*	*9.57*	*9.983*	*9.64*	*9.86*	*9.60*	*9.92*	*8.77*	*8.915*

Source: EViews using the 40 countries panel data from 2003-2018. In the table, we have the coefficient and the t-statistics in parentheses

Beginning with government debt markets under the overall infrastructure gap, for the entire sample of 40 countries, we find a single threshold value of 80.71% (government debt as a proportion of GDP). A single threshold value implies that we have two regimes, first, when the government debt as a per cent of GDP is below 80.71%, and the second, when the government debt as a per cent of GDP exceeds 80.7%. The two regime betas are in rows 4 and 5. The beta for the first regime, -0.436, is not significant given the t-statistics of -1.158, which is below the acceptable rule of thumb[28]. The slope of the second regime, -0.560, is significant given the t-statistic value of -4.845. Thus, when the size of government debt exceeds 80.71% of GDP, we have a negative and significant relationship between the overall infrastructure gap and the government debt. This relationship is not available when the government debt is below the 80.71 value as a per cent of GDP value. This points to a nonlinear relationship between the overall infrastructure gap and government debt. This finding implies that for a significant reduction of the overall infrastructure gap, SSA countries should more than double the size of their government debt market from the current mean of 35.634 (Table 2.2) to no less than 80.71% of GDP.

Judging by the betas of the corporate debt model under the overall infrastructure gap, we can see that more corporate debt than government debt is required to reduce the overall infrastructure gap significantly. The corporate debt model has two threshold values (75.99, 91.61), thus creating three regimes. We can observe that the third regime is the only one that produces a statistically significant relationship. This result means that to reduce the overall infrastructure gap significantly, the corporate debt market as a per cent of GDP should grow by more than six times from the current average of 15.055 (Table 2.2) to a value of 91.61 or higher. This finding implies that, due to the current low level of corporate bond sector development, a substantial critical mass needs to be developed beyond the threshold value of about 91.66 % of GDP to realise a reduction in the infrastructure gap.

To get the infrastructure and debt market size relationships for the sub-categories, Table 2.6 also shows the threshold model for transport, electricity, ICT, and water infrastructure. Starting with the transport infrastructure gap, columns 4 and 5 show single threshold values of 97.97 and 93.44 as a percent of GDP for government debt and corporate debt, respectively. Thus, we have two regimes for both government debt and corporate debt, with only the second one being statistically significant (t-values of -3.330 and -5.552) for the beta coefficients. These results imply that

[28]The rule of thumb is that a coefficient should have t-statistic value of at least 2 for the coefficient to be statistically significant.

government and corporate debt markets need to grow to at least the threshold levels to impact the infrastructure gaps.

Similar results are obtained for electricity, water, sanitation, and ICT, each showing that substantial impacts on the infrastructure financing gap are possible with larger debt markets relative to GDP. Nonetheless, corporate debt markets appear to start exerting substantial influence on ICT at relatively low levels of development, while for water and sanitation infrastructure, both corporate and government debt report significant effects at lower levels of development. A possible interpretation of both findings is that water and sanitation and ICT infrastructure tend to have high social returns to formerly excluded segments of society (Hagerman, 2012), the former in terms of health benefits and the latter in the form of financial inclusion, both of which quickly improve their quality of life. Thus, small increments in funding would incentivize their development and yield substantial improvements in their provision.

2.4.4 Some robustness checks

We run several tests to check the robustness of our findings. First, we re-estimate the models in Table 2.6 with different compositions of sampled countries in the first instance, excluding South Africa. In the second case, we group countries by income level. The purpose of excluding South Africa is that, as seen in Figures 2.1 and 2.2, the country is an outlier having more developed capital markets and substantially above-zero infrastructure endowment. For this reason, one may argue that it has the capability to bias our results. Figures 2.1 and 2.2 also show that richer countries in the region (e.g., Mauritius and Seychelles) have relatively lower infrastructure deficits than their lower-income counterparts. For these reasons, it is interesting to establish whether our baseline results hold across income levels.

Table 2.7: Threshold regression model summaries

Dependent variable	*Debt market*	*Full sample*	*Without SA*	*Low income*	*Lower and Upper middle-income*
Overall Infrastructure gap	*Government*	*80.71*	*73.61*	*-*	*63.39*
	Beta for regime #1	*-0.436 (-1.158)*	*0.298 (0.984)*		*-0.206 (-0.866)*
	Beta for regime #2	*-0.560 (-4.845)*	*-0.69 (-5.381)*		*-0.465 (-3.299)*
	Beta for regime #3				
	Beta for regime #4				
	Corporate	*75.99, 91.61*	*75.99, 89.79*	*82.93, 92.39*	*63.39, 79.55, 86.29*
	Beta for regime #1	*-1.207 (-1.0140)*	*-1.011 (-2.604)*	*-1.127 (-1.675)*	*0.190 (0.649)*
	Beta for regime #2	*-1.379 (-1.042)*	*-1.614 (-4.658)*	*-1.787(-4.185)*	*-0.637 (-1.784)*
	Beta for regime #3	*-3.161 (-7.317)*	*-1.592 (-3.714)*	*-3.221(-5.504)*	*0.499 (0.675)*
	Beta for regime #4		*-2.349 (2.422)*		*-3.299 (-2.597)*
Transport gap	*Government*	*97.97*	*82.71, 98.01*	*97.21, 98.09*	*73.59, 91.47, 97.36*
	Beta for regime #1	*-0.529 (-0.706)*	*0.258 (0.973)*	*-0.737 (-4.338)*	*0.077 (0.320)*
	Beta for regime #2	*-1.058 (-3.330)*	*-0.564(-4.494)*	*-0.71 6(-3.011)*	*-0.489 (-2.068)*
	Beta for regime #3		*-1.185 (-3.905)*	*-0.844 (-2.583)*	*-0.853 (-3.442)*
	Beta for regime #4				*0.396 (1.441)*
	Corporate	*93.44*	*82.71, 93.48, 98.01*	*94.45, 98.27*	*90.76*
	Beta for regime #1	*-1.538 (-0.547)*	*-1.087 (-2.739)*	*0.046 (0.328)*	*-0.779 (2.950)*
	Beta for regime #2	*-2.112 (-5.552)*	*-1.532 (-3.933)*	*-0.037 (-0.511)*	*-1.513 (-3.529)*
	Beta for regime #3		*-1.062 (-2.412)*	*-1.846 (-1.895)*	
	Beta for regime #4		*-3.681(-3.950))*		
Electricity gap	*Government*	*90.58, 96.19*	*90.69*	*97.09, 98.81*	*65.64, 93.12, 95.54*
	Beta for regime #1	*0.224 (0.953)*	*0.191(0.777)*	*-0.201 (-3.581)*	*-0.313 (-0.638)*
	Beta for regime #2	*-0.744 (-2.235)*	*-0.698 (-5.673)*	*-0.004 (-0.108)*	*0.189 (0.813)*
	Beta for regime #3	*-0.750 (-5.669)*		*0.023 (0.916)*	*-0.619 (1.920)*
	Beta for regime #4				*-0.744 (-3.320)*
	Corporate	*90.44*	*93.13, 98.70*	*96.85, 99.59*	*90.76*
	Beta for regime #1	*-1.038 (-2.554)*	*-0.585 (-1.538)*	*0.043 (0.852)*	*-0.779 (-2.950)*
	Beta for regime #2	*-1.958 (-6.867)*	*-1.616 (-4.280)*	*0.031 (0.317)*	*-1.513(3.529)*
	Beta for regime #3		*-1.812 (-2.573)*	*-0.395 (-2.300)*	
	Beta for regime #4				

Cont.

Dependent variable	*Debt market*	*Full sample*	*Without SA*	*Low income*	*Lower and Upper middle-income*
ICT gap	*Government*	*97.23*	*98.77*	*94.82, 98.06*	*83.68, 93.09, 99.99*
	Beta for regime #1	*-1.895 (-5.458)*	*-1.656 (-5.285)*	*-0.366 (-1.706)*	*-1.879 (-1.556)*
	Beta for regime #2	*-0.577 (-4.715)*	*-0.502 (-3.899)*	*0.019 (0.273)*	*-1.781(-3.239)*
	Beta for regime #3			*0.004 (0.068)*	*-1.009 (-3.429)*
	Beta for regime #4				*-0.589 (-2.620)*
	Corporate	*91.28, 97.96, 99.98*	*91.25, 99.98*	*91.52, 96.99*	*83.68, 99.92*
	Beta for regime #1	*-1.119 (-3.333)*	*-1.129 (-3.069)*	*-0.283 (-4.222)*	*-1.372 (-2.562)*
	Beta for regime #2	*-1.700 (-4.032)*	*-1.905 (-4.755)*	*-0.238 (-1.829)*	*0.305 (0.622)*
	Beta for regime #3	*-2.486 (-2.308)*	*-2.202 (-3.067)*	*0.105 (0.482)*	*-1.563 (-4.242)*
	Beta for regime #4	*-1.632 (-1.777)*			
WSS gap	*Government*	*30.65, 53.18, 65.45*	*30.65, 53.18*	*39.97, 52.24*	*22.40, 39.19*
	Beta for regime #1	*0.085(0.404)*	*0.032 (0.138)*	*-0.673 (-0.914)*	*-0.074(-0.465)*
	Beta for regime #2	*-0.408 (-3.362)*	*-0.403 (-3.228)*	*-0.003 (-0.022)*	*-0.431(-2.324)*
	Beta for regime #3	*-0.335 (-2.441)*	*-0.312 (-3.269)*	*-0.330 (-2.573)*	*-0.322 (-3.715)*
	Beta for regime #4	*-0.302 (-2.398)*			
	Corporate	*25.21, 45.38, 63.59*	*31.47, 51.44, 65.74*	*42.70, 51.32, 69.06*	*12.07, 32.18, 43.84*
	Beta for regime #1	*-0.512 (-2.177)*	*0.398 (1.313)*	*-1.753 (-3.312)*	*-0.377(-1.164)*
	Beta for regime #2	*-0.849 (-3.464)*	*-0.924 (-3.774)*	*-0.204 (-1.533)*	*-0.447(-1.798)*
	Beta for regime #3	*-1.206 (-4.369)*	*-0.415 (-1.369)*	*-0.831(-3.062)*	*-0.351(-1.624)*
	Beta for regime #4	*-1.079 (-3.117)*	*-1.318 (-3.531)*	*1.007 (0.828)*	*-1.614 (-8.194)*
Number of countries		*40*	*39*	*23*	*17*

Notes:

This table reports the threshold regression model outputs for various SSA country groupings.

The numbers in bold and italics are the threshold values of debt markets as a per cent of GDP.

The numbers in parentheses are t-statistics.

Table 2.7 above shows the summary of the robustness test results. Except for the overall infrastructure gap under LICs-government debt, which produces no threshold values, the tests yield threshold values for all models, which are generally consistent with the results in Table 2.6. We also have relatively high threshold values under all the models, with consistently low threshold values reported for the water infrastructure gap. Our results are, therefore, robust to the composition of countries in the sample. We estimate the models using fixed effects regression (FER) in our second robustness test. Tables A-2.4 and A-2.5 in the Appendix report the results of the linear model estimated through the FER procedure. . Although the magnitudes of the regression coefficients are expectedly different, both the PMG and FEM show a negative and significant relationship between the infrastructure gap and government (Table A-2.4) and corporate (Table A-2.5) debt markets.

In the third set of robustness checks, we measure the infrastructure financing gap (IFG) as the dependent variable.[29] Using IFG as the dependent variable, we run PMG linear regression and non-linear regression tests. The results, reported in Table A-2.6, Table A-2.7 and Table A-2.8 in the Appendix, are qualitatively similar to those using our construct of infrastructure gap, reported in Table 2.4, Table 2.5 and Table 2.6, respectively. The results indicate that increasing the size of debt markets in the region will help lower the infrastructure financing gap. In this regard, we can infer that the infrastructure gap developed in this paper is a good proxy for the infrastructure financing gap. Therefore, our results speak to the much-discussed infrastructure financing gap in Sub-Saharan Africa.

2.5 Conclusion

As the main purpose of this study is to explore how bond markets can be developed into viable mechanisms for closing the infrastructure funding gap existing in the SSA region, in this chapter, we use panel data of 40 SSA countries from 2003 to 2018 to empirically examine the relationship between public debt markets development and the infrastructure financing gap, with the main aim of establishing the potential of debt markets to reduce Africa's infrastructure financing gap. Firstly, we find that the relationship between the infrastructure financing gap and debt markets development in our sample of SSA countries is negative. Secondly, we find a nonlinear

[29] We use the IFG data, which was prepared by World Bank's Africa Infrastructure Country Diagnostic (AICD) in conjunction with several researchers (e.g., Briceño-Garmendia, Smits & Foster, 2008; Dominguez-Torres & Foster, 2011; Domínguez & Foster, 2011; Ranganathan & Foster, 2011a, 2011b; Ranganathan & Foster, 2011c) to test the robustness of our regression results. We did not use this data in our study because such data is available for 24 SSA countries and only for a limited period. Also, subsequent related data produced by Oxford Economics and Global Infrastructure Hub (2017) and Metcalfe and Valerie (2019) covered 7 and 12 countries, respectively.

relationship between the infrastructure financing gap and local currency public debt markets development. Thirdly, our threshold analysis shows that the current average size of sovereign public debt markets needs to double. In contrast, the corporate public debt markets should increase more than six-fold for SSA to realise a significant pace of reduction in its legendary colossal infrastructure financing gap.

Indeed, the empirical results strongly confirm that the public debt markets in many SSA countries are underdeveloped and cannot significantly plug the infrastructure financing gap in the region unless substantial capital (especially public debt) markets growth and/or development is embarked upon. A valuable and clear policy implication emanating from our findings is that attention should be paid to designing policies and strategies that boost the level of government and corporate bond markets to facilitate the mobilization and channelling of substantial debt funds towards infrastructure investment. Such policy initiatives would reduce the current excessive reliance on tax revenues and official development assistance, the supplies of which are declining.

CHAPTER 3- PUBLIC DEBT (BOND) MARKETS DEVELOPMENT IN SUB-SAHARAN AFRICA: EVIDENCE FROM A SURVEY

3.1 Introduction

Estimates published by the African Development Bank in its 2018 African Economic Outlook indicate that Africa needs about US$ 130-170 billion per year[30] for infrastructure investment up to 2025 and that the annual funding gap will be between US$ 68 billion and US$108 billion (AfDB, 2018a). The above estimates differ from those presented by the World Bank in its previous publications (Foster & Briceño-Garmendia, 2010), which estimated annual financing needs and a funding gap of US$ 93 billion and US$ 31 billion, respectively. The new estimates present a major financing challenge to Sub-Saharan Africa as the amounts required exceed what might be provided through the traditional sources of government budgets, development partner assistance (donors), and the low-scale involvement of the private sector[31]. Thus, it is reasonable to expect that the private sector would play a central role in sealing a substantial portion of the infrastructure financing gap (e.g., ACBF, 2016; Collier & Cust, 2015; Mezui & Hundal, 2013; Sy, 2016; Wentworth, 2013).

According to Juvonen et al. (2019), to bridge the continent's annual US$ 108 billion[32] infrastructure gap, only about 0.1% and 12%, respectively, of the assets of global and African institutional investors are required. By 2017, African Pension funds held about US$ 676 billion (approximately 61% of GDP) in assets under management. However, according to Preqin (2016),

[30] This is approximately 4.6 % of Africa's Gross Domestic Product (GDP) each year (Juvonen et al., 2019). The African Development Bank and the Infrastructure Consortium for Africa (2017) highlight that the new estimates, which are broken down by sector are for Africa to achieve universal (80-100 per cent) access to electricity, water and sanitation, roads and other transport sectors from their current levels.

[31] According to Infrastructure Consortium for Africa (ICA)'s Infrastructure Financing Trends in Africa Report (ICA, 2017), contributions to financing Africa's infrastructure over the period 2013 to 2017 averaged approximately US$ 30.2 billion (38%), US$44.5 billion (56%) and US$4.8 (6%) from government budgets, development partners (both bilateral and multilateral partners) and the private sector, respectively.

[32] Juvonen et al. (2019) opine that the USD 75 billion that is currently spent annually is inadequate. An estimated infrastructure funding gap of approximately USD 67.6-107.5 billion (average USD 94 billion a year over 2017-2027) persists, which is expected to expand over the medium term primarily due to increased demand, restricted domestic revenues, and global economic headwinds, especially the slowdown in China and the decrease in earnings associated with the decrease in prices of several key commodities (e.g. oil, metals, etc.).

from 2007, Africa had raised only about US$ 4.6 billion from institutional investors for infrastructure development, a paltry 0.68% of the assets under management in 2017, indicating a low appetite of institutional investors for infrastructure assets.

One of the major impediments to the participation of the private sector in infrastructure development/investment in the SSA region is believed to be the asset-liability mismatches that result from the low availability of long-term finance (ACBF, 2016; Wentworth & Makokera, 2015). Infrastructure projects, by their nature, are often massive and require lumpy capital, which is characterized by long gestation and payback periods. To address the asset-liability mismatch, researchers have argued that developing domestic bond markets in SSA is fundamental to bridging the financing gap (Kodongo, 2013; Mezui, 2012; Mu et al., 2013).

The demonstrated need to develop bond markets in the Sub-Saharan African region to facilitate the mobilization of long-term finance for infrastructure investment, among many potential benefits,[33] motivates the need to understand the state of bond markets development in the region. Our study is the first serious attempt to respond to this need. First, in the literature, the few related studies have attempted mainly to proffer reasons for the *perceived* underdevelopment of bond markets in SSA relative to those in other developing regions. Second, many previous studies typically employ secondary data, which are often incomplete. For example, Mu, et al. (2013) use time-series data, while Essers et al. (2015) apply a panel dataset compiled by OECD (2013) that covers government debt securities; Dafe, Essers and Volz (2018) use a panel dataset of local currency sovereign bond markets; to their credit, however, their study supplements the secondary data with case studies of Ghana, Kenya and Nigeria.

Our study is novel because it uses cross-sectional survey data from a wide range of key bond market players/participants[34] using a structured questionnaire. The respondents are from 8 key

[33] Mu et al. (2013, pp. 121-122) proffer three additional arguments on why bond markets are necessary in Africa. First, the development of bond markets can improve the intermediation of savings. Second, promoting bond market development can improve the structure of the African financial system, currently dominated by banks. Third, deeper bond markets will enable central banks to conduct monetary policy more effectively.

[34] 'Bond market players' comprises the key participants in the bond/debt market who are identified in the literature (see Chami, Fullenkamp & Sharma, 2010; Wyman, 2015) as borrowers or debt contract issuers, lenders or investors/financiers, financial intermediaries/ or liquidity providers (e.g. primary and secondary dealers), Market enablers (securities markets organizers and regulators) and information providers (e.g. credit rating agencies). For example, amongst the debt issuers are the infrastructure providers (e.g. central government, municipalities, state-owned enterprises, and private companies, etc.), whilst financiers comprise banking institutions, pension funds, insurance companies, asset management companies, etc. Among market enablers are the securities market authorities and regulators, whilst financial intermediaries comprise the agents of issuers and investors (e.g. primary dealers, investment banks, etc.).

SSA countries[35]. First, utilizing the cross-sectional survey approach allows us to collect extensive and valuable first-hand information by tapping into the knowledge of bond market experts in the region, who have in-depth insights into the current state of bond markets. Second, the survey considers expert opinions, perceptions, and attitudes about the state of bond markets at a specific point in time. Third, the cross-sectional survey data allow us to make cross-country comparisons (Connelly, 2016; Liu, 2008) using nonparametric tests such as Chi-square (χ^2), Kruskal Wallis, Mann-Whitney and Wilcoxon-Whitney.

Our key findings of this paper are as follows. About 75% of SSA countries in the sample use securities exchanges as the primary trading platform for their government securities. Although all 8 sampled countries use the auction system to different proportions, Botswana and Mauritius use the system as their primary trading system. The financial instruments popularly used in all the countries as the pricing reference in corporate bond markets are the 3- to 10-year Treasury bonds for pricing longer tenors and the 91-day and 182-day Treasury bills for short tenors. However, respondents perceive the government bond-based yield curve as ineffective in providing a reliable benchmark for pricing corporate issues. The main reason is that local currency bond markets (LCBMs) don't regularly issue government debt instruments with a wide range of maturities that can be used as a reference point for pricing other non-government debt instruments. Besides, in LCBMs that expand benchmark instruments, issuance is not regular. Most LCBMs are making an effort to lengthen the yield curve. The Johannesburg Interbank Average Rate (JIBAR) index is also highly preferred as benchmarking instrument in South Africa, while Botswana also uses the Fleming Aggregate Bond Index (FABI). Commercial banks are the most prominent investors in government debt securities, followed by Insurance Companies and Pension Funds.

Most SSA countries do not restrict foreign investors from participating in domestic government bond markets. We find that the development of corporate bond markets is still uneven. South

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Banks include: commercial, investment, development, regional development and multilateral banks with offices in the 8 selected SSA countries.

[35] The 8 countries were purposively selected because they have reasonably well-developed bond markets and are ranked amongst the top 10 in the AfDB's 2014 African Fundamental Bond Index (AFBI) Annual Country Rankings and Scores (AFMI, 2014). Furthermore, according to the latest Africa Competitiveness Report (WEF, 2017), the eight selected countries have relatively developed infrastructure. For example, Mauritius's infrastructure is ranked 41 on the Global Competitiveness Index 2016-2017 and is on the top list amongst the SSA countries, followed by South Africa, with a global ranking of 64 out of 138 countries. These sample countries were therefore conceived to have data available to assess the state of development of bond markets and capability to raise funding for infrastructure through their debt markets.

Africa's corporate bond market is well-developed, while Nigeria's and Mauritius' corporate bond markets are close behind. The corporate bond markets in Rwanda and Tanzania are still in their infancy. The reasons for the slow development of corporate bond markets in these economies include the ineffectiveness of the government bond-based yield curves to provide a reliable reference for pricing corporate bonds, mainly arising from underdeveloped government bond markets; the existence of a narrow base of listed and credit-rated issuers; couple with also a narrow base of institutional investors, among others.

Our findings also indicate that the reforms in the pension sector are moderate, and the asset allocation remains strongly biased towards government debt securities (Treasuries) because restrictions in investing in corporate bonds and other asset classes still exist in many countries. For example, in Kenya, the limits are 20% in corporate bonds which may include infrastructure bonds. In Nigeria, the pension funds' investment limit in corporate bonds is 40%, while up to 25% and 10% can be allocated to infrastructure bonds and infrastructure funds, which is a significant improvement from 2.5% and 0%, respectively, before the enactment of the Pensions Reform Act of 2014. In Ghana, pension funds can allocate up to 35% to corporate debt securities (including infrastructure bonds), up from 30% prescribed in the previous guidelines under the National Pensions Act of 2008.

On the other hand, Mauritius does not have legislative restrictions on pension funds allocation to corporate debt instruments. In contrast, in South Africa, pension funds can allocate up to 75% of AUM to corporate debt instruments provided a South African bank guarantees the debt against its balance sheet. These developments make it possible for bond markets in these countries to finance the corporate sector, including infrastructure projects through innovative debt instruments such as infrastructure or project bonds, asset-backed securities, mortgage-backed securities, and green bonds, among others. Similarly, we attribute the gradual growth of corporate bond markets in Ghana, Kenya and Nigeria to the slackening of restrictions that forbade pension funds from holding corporate debt securities (bonds).

Furthermore, pension funds face a number of barriers in their quest to participate in infrastructure financing using LCBMs–such as a narrow issuer base with limited listings, limited credit ratings, lack of long-term financial instruments, and a limited pipeline of bankable projects, among others. However, we also find that raising the limits to allow pension funds to invest in listed equity and unlisted equity provides more diversification opportunities for pension funds to invest directly in equity infrastructure via listed companies, for example, utilities, energy or transport companies, or indirectly via infrastructure funds.

The remainder of the chapter is structured as follows. Section 2 presents background literature. Section 3 discusses the research methodology and description of the survey data. Section 4 presents and discusses the survey findings. Section 5 closes the paper with conclusion and policy recommendations.

3.2 Background and Literature Review

This chapter investigates the state of bond markets development in SSA. This section reviews the empirical literature on the features or characteristics of well-developed public debt (bond) markets and examines the empirical evidence on the state of bond market development in the SSA region. First, we start with the empirical literature on well-developed public bond market characteristics.

3.2.1 Empirical evidence on key features of well-developed local currency bond markets

According to Thumrongvit et al. (2013:530), the bond market plays a critical role in the efficient functioning of capital markets by channelling savings to make funds available to long-term borrowers. Thus, one of their primary purposes is to play a channelling role by linking issuers having long-term financial needs with investors willing to place funds in long-term, interest-bearing securities[36]. For this reason, the development of bond markets is widely encouraged (Laeven, 2014). This is because local bond markets play a central role for governments in financing large fiscal deficits using funds from domestic markets, thus averting governments' appetite for foreign borrowing, which comes with exchange rate risk exposure; and facilitating sterilization of large capital inflows (Mu et al., 2013; Panizza, 2008a; Panizza & Presbitero, 2013; Park, Shin & Tian, 2021).

Abbas and Christensen (2007) further note that well-developed debt markets allow central banks to indirectly use government securities to influence monetary policy operations and collateralized lending in interbank markets. This effectively will enable banks to manage liquidity independently without frequent interventions from Central Banks. Consequently, this obviates the need for Central Banks to rely on interest rates, credit ceilings, and changes in reserve requirements to control monetary policy implementation directly.

[36] Long-term projects tend to require huge capital outlays, tend to be risky, and take time to yield returns (Beeferman & Wain, 2016; Deutsche Bank, 2017). These characteristic make investors reluctant to finance them but the risk-sharing and risk-shedding features of bonds make investors more willing to take on the risk than banks (IFC, 2013).

Laeven (2014) argues that local bond markets should foster financial deepening alongside the development of banking markets, thus enhancing the efficiency of capital allocation in the economy. Laeven (2014) further posits that finances obtained via bond markets are relatively cheaper than bank loans; hence, capital markets provide healthy competition in the financial systems. Fabella and Madhur (2003) concur that the corporate bond market stimulates competition in the banking sector as yields on government Treasuries (bonds) are the pricing benchmarks for long-term private debt issued by banks or companies.

Park et al. (2021) posit that developing the local currency bond markets (LCBMs) will enhance financial institutions' stability and improve their ability to manage risks, interest rates, and credit risk. Panizza (2008b) and Dafe et al. (2018) add that long-term debt issued in domestic currency is much safer from a borrower's perspective because of reduced currency mismatch than foreign debt issued in the short term.

According to Felman et al. (2014), bond markets serve as a "spare tyre" in the event of financial system failures. De la Torre, Gozzi and Schmukler (2008) explain the bond market phenomenon serving as a "spare tyre". The authors argue that in the event of a financial crisis happening, e.g. the recent Global Financial Crisis (GFC) of 2008, banking industries ("main tyre") if they collapse, the bond markets ("spare tyre") can sustain financing need, as they continue to provide funding in the market. Additionally, the long-term bonds denominated in local currency would help to reduce systemic risk as most bond contracts are not callable (Berensmann et al., 2015a; IMF & World Bank Group, 2016; Park et al., 2021).

Several characteristics or features of well-developed and well-functioning public debt securities (bonds) markets are widely discussed in the literature. They include:

Stable macroeconomic environment. Fabella and Madhur (2003), Bhattacharyay (2013), and Le, Nguyen and Nguyen (2015) suggest that a stable and predictable macroeconomic environment is essential for the development of a robust bond market. Stable interest rates and low inflation are key ingredients of such an environment. In addition, a stable economic environment encourages firms to make long-term investment decisions and develop an appetite for long-term financing in the process.

The government securities markets and the yield curves. The government bond markets are essential for providing a firm foundation for corporate bond market development (Batten & Szilagyi, 2007; Fabella & Madhur, 2003; Ojah & Kodongo, 2015). One recommended strategy to develop nascent bond markets in emerging economies is to actively develop the benchmark yield curve based on regular and structured (systematic) issuances of sovereign bonds – usually emanating from a debt management programme (Batten & Szilagyi, 2007; Tendulkar &

Hancock, 2014). To implement this strategy effectively, these researchers recommend that bond market authorities pre-announce the bond auction calendar for the benchmark bonds to enhance market transparency. Policymakers can also consider issuing quasi-sovereign bonds to build the yield curve[37]. Furthermore, for more mature corporate bond markets, authorities should consider lengthening the maturities of the yield curve from, e.g., beyond the standard 3-, 5-, 10- years to beyond 20 years and above (Dafe et al., 2018; Soumaré, Kanga, Tyson & Raga, 2021). For example, Gabauer, Subramaniam and Gupta (2022) report that several countries in the Asia Pacific region (.e.g. Hong Kong, Japan, Korea, Malaysia, etc.) have facilitated the development of the government benchmark yield curve through the issuance of a wide variety of instruments with varying maturities – ranging from as short as a week to as long as 30 years for these different instruments.

Widening the investor base. In emerging markets (EMs), banks are often the largest investors in government bond markets because of the requirement to keep statutory reserves[38] (Park, 2017; Sophastienphong, Mu & Saporito, 2008). Emerging markets are rapidly building stable and diversified investor bases, which ensures varied and constant demand, and includes institutional investors, nonfinancial corporations, retail investors, and foreign investors, among others, to create a stable market for non-government securities (Braun & Briones, 2006a, 2006b; Fabella & Madhur, 2003; Impavido, Musalem & Tressel, 2003). For example, Braun and Briones (2006a) find that the demand for institutional funds, such as pension and insurance funds, positively correlates with the bond market size. Higher level of protection in capital markets, active investor education, reducing the minimum amounts required to invest in Treasury bills/bonds, and promoting user-friendly digital technologies, among others, are some of the measures to promote retail participation in LCBs (ADB, 2019; Adetiloye, Babajide & Ugwu, 2015; Kamba, 2015; Ndung'u, 2018; Tyson, 2015)[39]. A narrow investor base is detrimental to

[37] For example, Bolokwe and Sedimo (2020) note that despite consistently running budget surpluses, the Botswana government still issues sovereign debt securities to foster a liquid benchmark yield curve, which facilitates price discovery in the corporate debt market.

[38] However, literature also notes that the reserve and capital adequacy requirements (e.g. on commercial banks, pension funds, insurance companies, etc.) might deter trading in instruments that are not issued regularly and limit trading in the secondary markets (World Bank & IMF, 2001).

[39] For example, Kenya introduced an M-Akiba retail bond, which is accessible through a mobile phone platform, whist Tanzania reduced the minimum amounts required to invest in Treasury bills and bonds from Tanzanian Shilling (TZS) 1,000,000 (US$500) for both to TZS100,000 (US$50) and TZS50,000 (US$25) respectively (Kamba, 2015).

building a stable and reliable yield curve and liquid secondary markets, as most investors buy and hold Treasury securities (Panizza, 2008b; Sophastienphong et al., 2008).

Pension funds barriers. Several studies (e.g., Barnor, 2018; Juvonen et al., 2019; Maurer, 2017; Oberholzer, Markowitz, Pautz, Barnor & Grobbelaar, 2018) observe that the barriers that prevent pension funds (PFs) from investing in assets such as private sector debt securities, and infrastructure project bonds include the relatively low liquidity in secondary markets, low credit rating of corporate issuers[40], policy and regulatory restrictions on specific investments, limited knowledge and expertise among fund managers, administrators and trustees in assessing investment portfolio risks and returns profiles of asset classes different from government securities. Infrastructure assets are ideal investments for pension funds as they tend to match their long-term liabilities, provide inflation-protected yields, and have a lower correlation with other financial assets (Bitsch, Buchner & Kaserer, 2010; DiStefano, 2010; Inderst, 2016, 2017; Szado, 2013; Wurstbauer & Schäfers, 2015). In countries with less well-developed equity markets, pension funds have tended to invest more in government bonds (World Bank & IMF, 2001).

Foreign investors. Peiris (2010) and Felman et al. (2014) advocate attracting greater participation of foreign investors in the domestic bond markets in order to widen the investor base and improve liquidity. Felman et al. (2014) suggest that the active trading induced by foreign investors can lead to better price discovery in the market, thus reinforcing the utility of the bond market as the 'spare tyre'. To attract non-resident investors, researchers recommend policymakers address any regulatory impediments, capital control, taxation and macroeconomic and political risk issues that could limit debt markets deepening (Luengnaruemitchai & Ong, 2005; Mohanty, 2002).

Issuers of corporate bonds. Infrastructure utility companies (which include power generation and distribution, telecommunication, transportation (road, railways, airlines, airport companies, port facilities, etc.)), water and sanitation supply– most of which are state-owned enterprises - housing finance corporations, development finance institutions (DF1) are among the most

[40] Juvonen et al. (2019) find that institutional investors consider the country's credit rating before investing in African debt markets; and often require rating of at least BBB- on Standard & Poor's and Fitch ratings, and Baa3 on Moody's, which are investment grades. Incidentally, only less than 20 countries in SSA are rated by at least one global credit rating agency, which technically means that many SSA countries bond markets may not attract such institutional investors. Of this number, only three meet the investment grade, i.e. Botswana, Mauritius, Namibia and South Africa. Maurer (2017) observes that Ghana, Kenya, Nigeria, Uganda and Zambia are rated below the investment grade.

regular issuers of non-government bonds in most emerging markets because they enjoy highest credit ratings (Endo, 2000; Mezui, 2013). For example, in the South African bond market, state-owned firms, such as Eskom (Power Utility), Transnet (Railways), South African Roads Agency (SANRAL), Airport Company South Africa (ACSA), are frequent issuers of quasi-sovereign bonds (Mezui, 2013; Raubenheimer, 2019) that promote the development of a liquid benchmark yield curve.

Trading, clearing and settlement systems. Adequate, efficient and robust platforms for issuing and trading government securities and clearing, settlement and depository infrastructure must be in place for government and non-government bond instruments (Faure, 2013). Trading of government and non-government bonds is commonly over-the-counter (OTC)[41], electronic trading platforms, and stock exchanges (Hashimoto et al., 2021). In addition, auctions are a standard method of issuing Treasury bills and bonds by most governments. Robust clearing and settlement systems include a centralized security depository (CSD), the book-entry system, and a shorter settlement cycle to reduce counter-part insolvency or default risk (Harwood, 2000).

3.2.2 Empirical evidence on the state of bond market development in SSA

Empirical literature shows that except for South Africa, a large proportion of public debt (bond) markets in SSA are mainly underdeveloped and are, therefore, shallow and illiquid (Berensmann et al., 2015a; Berensmann et al., 2015c; Dafe et al., 2018; Essers et al., 2015; Machokoto et al., 2020). To illustrate, Mu et al. (2013) have shown that the region's government and corporate bond market capitalization amounted to only 14.8% and 1.8% of GDP, respectively. The debt markets capitalization is very low compared to other developing regions such as Asia, where Malaysia, for example, has domestic public debt market capitalization of 57.3% and 57% of GDP for government and corporate bond markets, respectively.

Berensmann et al. (2015a) note that South Africa and Mauritius are the largest LCBMs in SSA, as measured by the market capitalisation of LCMBs to GDP as of 2013. In 2013, the local currency TBs outstanding in these two countries exceeded 30% of GDP. Other countries with relatively large government LCBMs were Cabo Verde, Ghana and Kenya, with each TBs above 10% of GDP.

[41] OTC, also known as 'negotiated trading' is more suitable to trade non-government bonds than on automated exchanges (IMF, 2013).

Mu et al. (2013) and Dafe et al. (2018) observe a low proportion of corporate bonds in SSA relative to all bonds and that sovereign bonds dominate investors' long-term diversified portfolios. However, Andrianaivo and Yartey (2010) have noted a rise in issuing corporate debts in seven SSA countries, namely Botswana, Ghana, Kenya, Mauritius, Nigeria, Tanzania, and Zambia. According to Essers, Blommestein, Cassimon and Flores (2016), the volume of corporate debt outstanding in these markets was about 2% of GDP in 2013.

The AFMI (2016)[42] found that Botswana, Ghana, Kenya, Nigeria, and Tanzania face challenges in building stable and reliable yield curves. The author cites a range of challenges, which includes: a lack of issuers as well as investors (most investors buy and hold securities), the limited and illiquid secondary markets, market fragmentation (either small bond issues or infrequent issues), few intermediaries and lack of transparency (e.g., no platforms to guide on daily prices/yields). Further, Essers et al. (2015) find that secondary market illiquidity and a small investor base characterize African LCBMs, which commercial banks dominate.

The Kenyan government's securities yield curve stretches to 30 years with five benchmark points along the curve (2-5-10-15 and 20 years). The issuance strategy is to have a ratio of 75% bonds versus 25% Treasury bills (Soumaré et al., 2021), again for financing long-term developmental projects, for example, infrastructure, housing, etcetera. According to the National Bank of Rwanda (2020), the Rwandan government yield curve stretches to 20 years with seven benchmark points of 364 days, 3-,5-,7-10-15 and 20 years along the curve. As a result, 85% of the benchmark instruments consist of Treasury bonds of different maturities. The government's desire to attract long-term finance for infrastructure projects drives the maturity structures of financial instruments (Irving, 2016). Similarly, the Tanzanian government's issuance strategy is to auction Treasury bonds to fund budgetary deficits regularly, and long-term matured obligations[43].

Commercial banks, followed by pension funds and insurance companies, dominate the bond market sector in SSA (Abbas & Christensen, 2007; Essers et al., 2016; Essers et al., 2015).

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[42] The African Financial Markets Initiative (AFMI) developed the "African Yield Curves Guidebook", which provides basic information on countries' attempts to gradually generate and publish their yield curves.

[43] However, contrary to this finding, Lotto and Mmari (2018) show that, in 2017, the amount of funds raised through issuance of Treasury bills exceeded that received through Treasury bonds. That is, respectively, TZS 4 312.1 billion and TZS1 916.1 billion of Treasury bills and Treasury bonds were raised. This is a 69% T-bills and 31% T-bonds ratio. The authors further observe that the borrowed funds may be channeled towards financing of budget deficits, the payment of principal and mature debt obligations, the growth of financial markets and the financing of other government operations. This nature of spending may not necessarily lead to economic growth.

Specifically, Essers et al. (2016) noted that commercial banks, holding more than 70% of outstanding government debt, dominate the least developed domestic bond markets (e.g., Eswatini, Lesotho, Malawi, Sierra Leone, and others).

Furthermore, Raubenheimer (2019) noted maturity gaps in most bond markets. For example, in Botswana, the government is focused on a small number of tenors, limiting the ability to price other debt securities of the yield curve.

Juvonen et al. (2019) note that the AUM of domestic institutional investors (PFs, insurance companies, sovereign wealth funds (SWFs)) in Africa are growing from US$1.2 trillion in 2017 to US$1.8 trillion by 2020. Among these assets are PF's AUM in 12 African countries, estimated to be around US$679 billion and US$800 billion in 2017 (Maurer, 2017; PwC, 2015). Notably, there is enormous pressure on African PFs to invest their capital productively, for example, in domestic and cross-border infrastructure investments, corporate bonds, private equities, and others (Mutero, 2011; Sy, 2017). African pension funds historically invest heavily in domestic debt (Juvonen et al., 2019; Maurer, 2017)[44].

Sy (2017) and Maurer (2017) find that many African countries have restrictive regulations around asset allocations, such as cross-border investments, infrastructure assets, corporate bonds, and private equities/non-listed stocks. Barnor (2018) also expressed similar sentiments after noting that most pension funds in Botswana, Kenya, Nigeria and South Africa invest heavily in specific assets (e.g. government bonds, equity and Treasury bills). That choice is informed by what investment managers understand. Tyson (2018) find that after the 2017 pension reforms, both private and public pension funds contributed 60% of the investment to build the Kigamboni Bridge.

In a study of 21 SSA LCBMs, Essers et al. (2015) found that foreign investor participation was primarily very low in several countries – for example, in two local currency bond markets (Ethiopia and Eritrea), foreign investors do not exist. Secondly, the participation of foreign investors was negligible in seven LCBMs (i.e., foreign investors held less than 1% of marketable debt securities in 2013). On the other hand, in five LCBMs, foreign investors held slightly above 1% of the marketable debt in 2013, and whilst in four LCBMs (i.e., Ghana, Nigeria, South Africa

[44] Africa Investor (2014) note that authorities have restricted pension and insurance companies to investing mostly in government bonds. Maurer (2017) noted that except for SA PFs, most African PFs are heavily invested in short-term (3-months) domestic debt markets.

and Uganda), the participation of non-residents was considerable, with foreigners holding between 20-40% of the local currency debt.

Oberholzer et al. (2018) observe a shortage of publicly-listed infrastructure securities in many SSA countries, a significant restriction that prevents pension funds and other institutional investors from investing in infrastructure projects. Secondly, there is a limitation on the number of investable infrastructure projects. The lack of well-prepared, bankable projects limits investment opportunities for pension funds (Irving, 2016; Manroth & Irving, 2009). ACBF (2016) found that pension funds and other institutional investors have an appetite for Public-Private Partnership (PPP) projects that they believe are capable of issuing debt instruments

Most economies in SSA (e.g. Ghana, Kenya, Mauritius, Nigeria, and others) have adopted the electronic book-entry clearing system, and payments are on a fully automated Delivery versus Payment (DvP) basis.

3.3 Research Methodology and Description of the Survey-dataset

This chapter explores the state of bond markets development in SSA. We conducted this study using a survey instrument on 304 respondents from Botswana, Ghana, Kenya, Mauritius, Nigeria, Rwanda, South Africa (SA), and Tanzania. These countries were selected because they have active capital markets; hence, we had a greater chance of accessing data from the bond market participants (Agyemang-Badu et al., 2021; Dafe et al., 2018). Secondly, as of 2010, approximately 81% of the SSA LCBM capitalisation is concentrated in these eight countries (Essers et al., 2016). Finally, these countries are representative of the low-income, lower-middle-income and upper-middle-income groups as classified by the World Bank (Berensmann et al., 2015c).

Figure 3.1 displays the profiles of the 304 respondents whose opinions were captured in the survey. These countries have active capital markets, which means we will have a better chance of obtaining data from bond market participants

Figure 3.1: Profile of survey participants

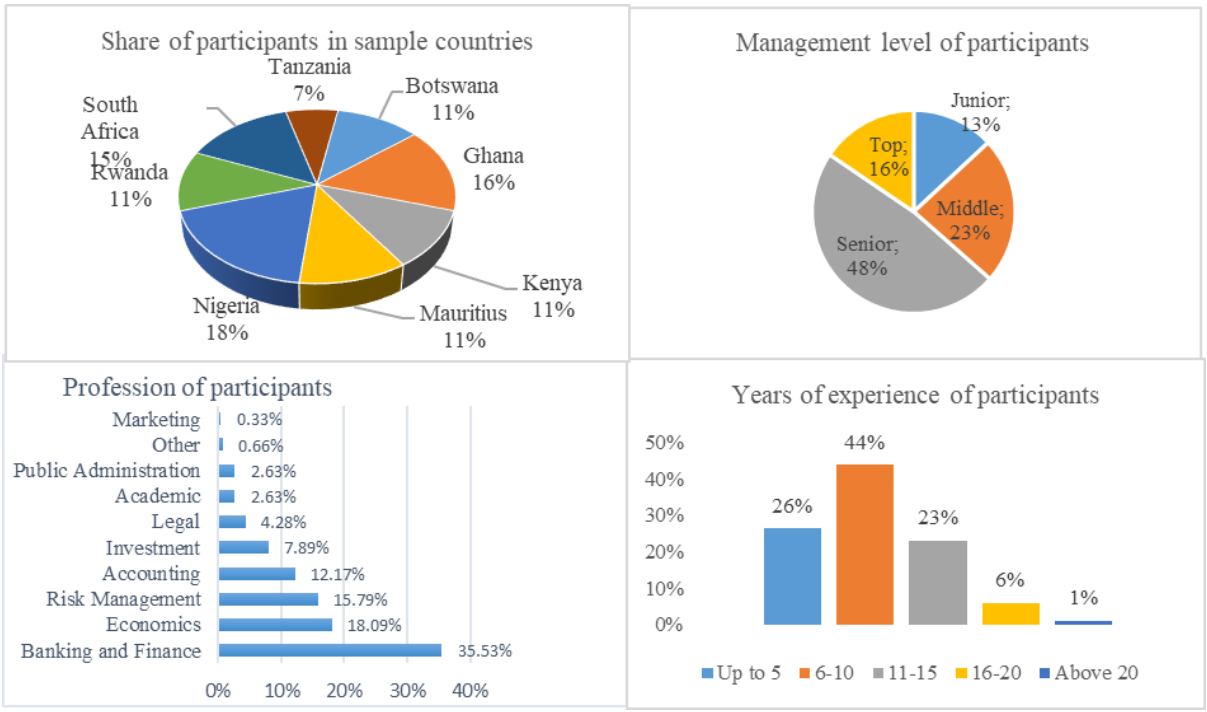


Figure 3.1 shows that the study engaged professionals in various areas, with banking and finance, investments, risk management, and economics constituting over 70% of the sampled respondents. All respondents are on multiple levels of management; the bulk (74%) had over 6 years of work experience and, therefore, would have good knowledge of the economics and microstructure of financial markets. Almost 50% of the respondents were from Nigeria, South Africa, and Ghana, but the rest of the countries were also well represented.

The largest share of respondents was from financial institutions, which constituted 75.7% of the sample size, followed by 10.2% from public institutions, which included security issuers, investors, intermediaries, and debt market participants. In particular, the survey covered 24 business types, with commercial banks (28.3%), insurance (13.2%), and central banks (11.5%) constituting the majority of participating organizations.

The questionnaire, attached as Appendix A-5.1[45], was developed based on existing literature. The questionnaire consists of questions using a seven (7)-point Likert scale, such as strongly disagree (L1) to strongly agree (L7), dichotomous questions requiring a choice of either a "Yes" or "No", and open-ended questions (OEQs). The OEQs were used to enrich the dataset. This

[45] Please note that the questions for this chapter are Q1-19 on the Survey Questionnaire.

survey was preceded by a pilot study as widely recommended in the literature (e.g. Creswell, 2013; Hassan, Schattner & Mazza, 2006).

We use tables, figures, and graphs to present survey findings and qualitative content analysis in NVivo QSR to analyse and interpret data from open-ended questions. The debt market literature themes guided inductive coding using NVivo (Braun & Clarke, 2006; Christensen et al., 2016; Singer & Couper, 2017; Züll, 2016).

We also conduct some statistical difference tests to establish relationships within groups in tables. Specifically, we employ the t-test for independent samples; the Mann-Whitney U test to compare differences between two independent groups when the dependent variable is either ordinal or continuous; and the Kruskal-Wallis H test to test the independence of more than two groups. Kruskal Wallis test indicates that at least one sample stochastically dominates one other sample. The test does not assume a normal distribution and compares variances (Kruskal & Wallis, 1952). The study uses the above three tests, although the Kruskal-Wallis test is given more weight due to the nature of our data, which is ordinal.

3.4 Survey Findings and Discussions

This section presents key findings from the survey questionnaire responses.

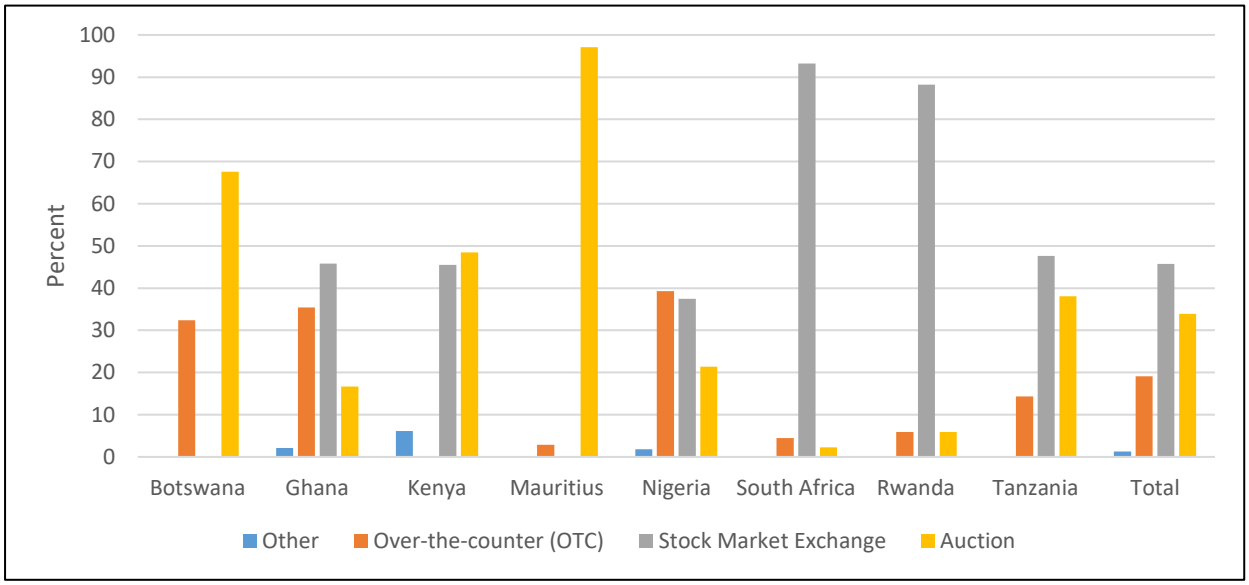
3.4.1 Government securities market

In this section, we review the state of the government debt securities market, focusing on the systems used in the trading of government debt securities, the frequency of government securities trading, issuance of benchmark securities instruments, the effectiveness of the government yield curve, and the average maturities of government debt instruments traded in domestic markets.

3.4.1.1 Debt securities trading systems

Countries use a variety of trading systems for debt securities. Figure 3.2 below shows the distribution of the trading systems commonly used for trading government securities in SSA countries. Respondents in all countries except Botswana and Mauritius show that securities exchanges are popularly used in SSA bond markets. In addition, the auction system follows the securities exchange system in all countries. Finally, the over-the-counter (OTC) is the third-ranked trading system used in the SSA public debt markets. A relatively large proportion of respondents in SA (93.2%), Rwanda (88.2%) and Tanzania (47.6%) ranked stock market exchanges as the most dominant system for trading sovereign debt securities in their countries.

Figure 3.2: System (s) that is popularly used for trading government securities in the countries



Source of data: Authors assembled data from the SSA cross-country survey. The bar graphs in Figure 1 represent the percentage of survey participants who selected each option.

Respondents in Mauritius (97.1%), Botswana (67.6%) and Kenya (48.5%) selected auctioning as the most popular system of trading sovereign debt securities in their countries' primary markets. Notably, the survey results show that the auctioning system is also used in the other six countries but not as a dominant trading system, judging by the relatively small proportion of respondents who selected this option.

Although all markets (except Kenya) use the OTC system, its use, according to the survey responses, appears to be relatively high in Nigeria, Ghana and Botswana, with a share of 39.3%, 35.4% and 32.4% of respondents, respectively. This result is predictable since literature suggests that government and non-government bond trading in small economies is commonly over-the-counter (Sophastienphong et al., 2008). Moreover, Onyuma (2020)acknowledges that Kenyan rules do not cater for OTC bond trading. However, one primary concern about using the OTC trading system is that it makes trading data more difficult to aggregate and report publicly (Lin, Xue & Raschid, 2020).

All sampled SSA countries use the auction system to different degrees. As a result, different auction systems are used but differ from country to country. The auction systems range from competitive to non-competitive auction bidding systems[46]. However, choosing the most

[46] There are two categories of bidders participating in auction systems, namely, non-competitive and competitive (MEFMI, 2013; World Bank & IMF, 2001). Non–competitive auction bids are usually limited to non-professional bidders (e.g. retail investors): under this class, participants bid for the quantity not on price. The participants are

appropriate auction system is subject to an individual country's experience. Developing bond markets should usually start with a multiple-price auction and then upgrade to a single-price auction after market participants have gained expertise in bidding (Ahwireng-Obeng, 2016; Hashimoto et al., 2021). Table 3.1 shows that a range of countries uses hybrid auctioning systems (i.e. a combination of competitive and non-competitive auction bids) followed by multiple auction bids. According to Clevy, Pedras and Ruiz (2021), hybrid auction systems are more suitable for countries with less developed bond markets primarily because they allow for an equitable distribution of assets and prevent the domination of a single major player. On the other hand, more mature and liquid bond markets with a more extensive investor base are better suited to the single-price auction bid system (as in South Africa) because the system promotes more aggressive bidders to benefit the issuers. Additionally, competitive auctions are most useful for benchmark bonds issued regularly in large amounts to skilled market participants (Ahwireng-Obeng, 2016).

Table 3.1: Type of auction system in SSA countries

Country	Auction system
Botswana	*Multiple price-Competitive bid*
Ghana	*Hybrid auction system*
Kenya	*Hybrid auction system*
Mauritius	*Multiple price-Competitive bid*
Nigeria	*Hybrid auction system*
Rwanda	*Hybrid auction system*
South Africa	*Single price bid*
Tanzania	*Multiple price-Competitive bid*

Source: Ahwireng-Obeng (2016)

We run a chi-square test of independence to establish whether the choice of a bond trading system is country dependent. The test yields a chi-squared value of 14 (p-value = 0.001). The Chi-square test has a null hypothesis of no relationship (independence) and an alternative hypothesis of relationship. Therefore, the test rejects the null hypothesis at all conventional levels of significance in favour of the alternative hypothesis. This statistic implies that the choice of bond trading systems is country-dependent.

price-takers as they are allocated the weighted average rate of the auction corresponding to the cut-off rate (World Bank & IMF, 2001). Under competitive auction bids, the participants bid for both the bid price and the volume of trade. Such a system comes with other sub-categories which include uniform price, multiple prices, mixed or hybrid auction systems, among others. These sub-categories come with their advantages and disadvantages. Uniform price auction allows all successful participants to pay the same price which is usually the auction cut-off rate. The multiple price auction permits some successful bidders to pay allocated volume of securities at different respective prices at which their bid was accepted. The hybrid auction systems use a mixture of the above two subcategories.

3.4.1.2 Benchmark securities/ instruments

Creating benchmark securities is essential to a well-functioning government securities market (Batten & Szilagyi, 2007). Table 3.2 shows the instrument and associated interest rate used by the governments to benchmark securities pricing.

Table 3.2: Instruments/rates used as benchmark securities for pricing domestic corporate

Country	*Central Bank Certificates*	*Treasury Bills*	*Prime Lending Rate*	*Government-issued Saving Instrument*	*Treasury Bond*	*Inter-bank rate*	*FABI index*	*JIBAR*
Botswana	*23.4*	*22.3*	*18.1*	*1.1*	*28.7*	*1.1*	*5.3*	*0.0*
Ghana	*8,7*	*43.5*	*9.8*	*7.6*	*26.1*	*13.0*	*0.0*	*0.0*
Kenya	*0,0*	*37.8*	*2.2*	*0.0*	*60.0*	*0.0*	*0.0*	*0.0*
Mauritius	*1.7*	*10.3*	*6.9*	*5.2*	*32.8*	*43.1*	*0.0*	*0.0*
Nigeria	*13.2*	*36.4*	*9.9*	*2.5*	*24.0*	*14.0*	*0.0*	*0.0*
SA	*0.0*	*25.4*	*8.4*	*19.7*	*36.6*	*8.5*	*0.0*	*1.4*
Rwanda	*0.0*	*10.3*	*0.0*	*2.6*	*84.6*	*2.5*	*0.0*	*0.0*
Tanzania	*3.2*	*29.0*	*6.5*	*0.0*	*61.3*	*0.0*	*0.0*	*0.0*
*All countries**	*8.7*	*28.9*	*9.3*	*5.3*	*35.4*	*11.3*	*0.9*	*0.2*

Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the table reflect the percentage of survey participants who selected each option. * indicates all countries' averages.

This question elicited multiple responses where the respondents were allowed to select a number of options. According to Fabozzi (2005), the most liquid securities in the debt securities markets are Treasury securities (bills, notes and bonds) because of their risk-free nature. Thus, it is not surprising that Treasury bonds and Treasury bills with a share of 35.4% and 28.9%, respectively, were selected as the most preferred instruments for benchmarking. In addition, a mix of Treasury bills and bonds gives a wide variety of maturity instruments of short-term and long-term tenors to serve as benchmark yields for pricing corporate bonds across various maturity tenors.

The idea is to use longer-maturity debt instruments as preferred benchmarks where the government prefers to enhance market development and raise capital for developmental projects (Dafe et al., 2018; Manroth & Irving, 2009). Treasury bonds were, therefore, more preferred benchmarks in Rwanda (84.6%), Tanzania (61.3%) and Kenya (60%), among others, while Treasury bills were selected more in Ghana (43.5%) and Nigeria (36.4%).

Some respondents in SA and Botswana cited country-specific indexes that the governments also use to benchmark corporate bond prices. For example, Botswana and SA use the Fleming

Aggregate Bond Index (FABI)[47] and Johannesburg Interbank Average Rate (JIBAR)[48], respectively.

3.4.1.3 Maturities of government securities issuances

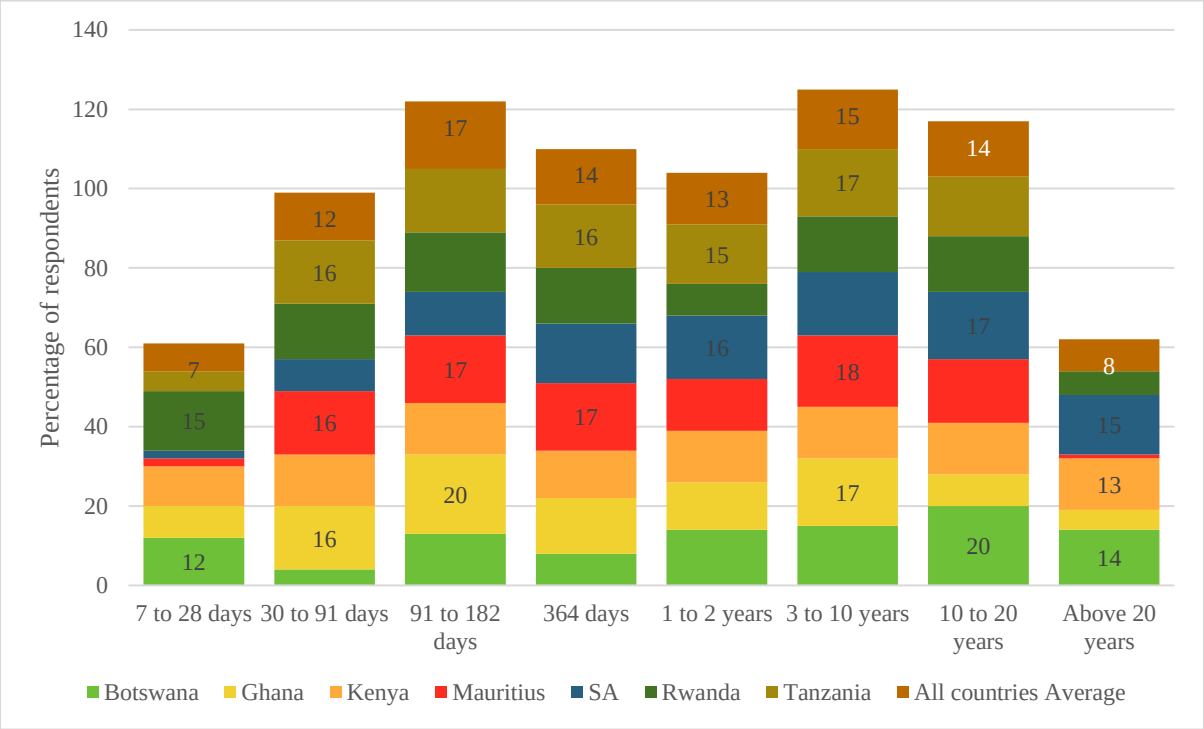
A bond term to maturity is the period over which the issuer has promised to meet the conditions of the obligation (Fabozzi, 2005). In other words, it is the period over which the investor receives interest payments, and capital is redeemed[49]. Figure 3 below shows different average maturities of debt instruments traded across countries. The average maturities of debt instruments range from a minimum of 7 days to a maximum of above 20 years. The modal maturity of debt instruments traded in SSA LCBMs is 91 to 182 days, as 17% of the responses cited this maturity period in their respective countries.

[47] The FABI is a market capitalization-weighted total return bond index. The index was established in 2003. The index comprises of a basket of corporate, government and quasi-government fixed-rate bonds listed on the Botswana Stock Exchange (Fleming Advisors, 2014).

[48] The JIBAR is the money market rate that is used in South Africa. The rate comes in one-month, three-month, six-month, and twelve-month discount terms. The three-month JIBAR rate is the most widely used and accepted (SARB, 2020). JIBAR is used as the benchmark for short-term interest rates in the South African markets. It is determined as an average of the borrowing and lending rates indicated by several local and international banks.

[49] Though some bonds' maturity may be extended for the case of call/ conversion provision or even reopened, such experience is relatively low in Africa with Botswana and Mauritius being a few countries which had used such initiatives in the past (Bank of Botswana, 2020; Bank of Mauritius, 2020).

Figure 3.3: Average maturities of government instruments



Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the bar charts reflect the percentage of survey participants who selected each choice.

This finding is not surprising because most governments popularly issue the Treasury bills (T-bills) of this tenor to meet fiscal needs. Besides, regular issuance through consistent weekly auctions of T-bills with tenors of 91,182 and 364 days is recommended by researchers because it reduces fragmentation and facilitates the development of a reliable money market pricing benchmark (Essers et al., 2016).

Additionally, short-term instruments are used to boost the money market, a starting point for developing a broader and long-term bond market (Hashimoto et al., 2021). The literature further suggests that a well-developed money market eliminates liquidity risks for bondholders by offering access to the immediate cash market (see Mihaljek, Scatigna & Villar, 2002; Turner, 2002). It also makes it easier for a sovereign yield curve to emerge, as money market benchmarks lead to long-term yield curves being established. On the other hand, investors face increased liquidity risks that restrict their ability to pursue maturity transformation when the money market is not well established and the overnight rate is unstable. The volatility of the regular interbank rate is a reflection of the growth of money markets, as illiquid markets also experience high-interest rate volatility.

The 3-year to 10-year maturity period is the second most popular bond tenor in SSA, with 15% of the respondents choosing this option. Tanzania, Mauritius, and Ghana are the countries with a relatively high number of respondents (i.e., 17% in each country) who suggest that the 3-year

to 10-year maturity bonds are dominant in their LCBMs. This is because issuing benchmark Treasury bonds in this range is a good base for developing the yield curve for longer maturities (Turner, 2002). However, debt securities issued in the range of 3-year to 10-year maturities are probably inappropriate for long-term financing projects such as infrastructure, which have high exposure to redemption and refinancing risk (Sophastienphong et al., 2008).

The survey results in Figure 3.3 show that only 8% of respondents (all countries average) indicate that government securities with tenors of above 20-year maturity, respectively, are issued in LCBMs. Long-tenor bonds provide an opportunity for nonbank financial institutions (e.g., PFs and insurance companies) to hold long-tenor securities, which match liabilities in their balance sheets[50]. Further, the lengthening of maturities in government bonds helps provide a reliable benchmark for pricing long-term assets and the foundation for building corporate bond markets. In turn, Corporate bond markets offer platforms for raising long-term project finance for infrastructure investments by PPPs, for example (Hyun et al., 2017, 2019; Mezui & Hundal, 2013; Park, 2017).

3.4.1.4 Effectiveness of the government yield curve in benchmarking corporate bonds

Table 3.3 below unpacks the effectiveness of the government yield curve in benchmarking the corporate bond market. The survey questionnaire asked the participants to select options on a Likert-like scale ranging from *not effective at all* (L1) to *very effective (L7),* as shown in Table 3.3. Like earlier analysis, the all-countries average share is high in the *somewhat*[51] *effective (46%)*, followed by the *effective* category (16.4%). In addition, the *somewhat effective* option (L5) is also high at the individual country level, with the highest share recorded in Nigeria at 83.6%, Tanzania at 57.1%, Kenya at 45.5%, and Botswana at 42.4%. In other words, most survey samples perceive the government yield curve as *somewhat effective*.

[50] Note, in underdeveloped LCBMs the nonbank institutions are forced to hold short-term debt securities, which expose them to mismatch risk (Adelegan & Radzewicz-Bak, 2009; Croce & Gatti, 2014)

[51] The Merriam-Weber dictionary defines the adverb "somewhat" to have any of the following meanings: "a little", "to some degree or extent", "slightly" or "moderately," etc.

Table 3.3: Effectiveness of government yield curve in benchmarking corporate bonds

Likert scale: L1=Not effective at all, L2=Not effective, L3 =Somewhat ineffective, L4=Neither ineffective nor effective, L5=Somewhat effective, L6=Effective, L7=Very effective**.**

SCALE	L1	L2	L3	L4	L5	L6	L7
Botswana	***3***	***18.2***	***9.1***	***18.2***	***42.4***	***9.1***	***0***
Ghana	***4.3***	***8.5***	***34***	***4.3***	***31.9***	***14.9***	***2.1***
Kenya	***0***	***3***	***12.1***	***27.2***	***45.5***	***6.1***	***6.1***
Mauritius	***0***	***0***	***17.6***	***2.9***	***35.3***	***32.4***	***11.8***
Nigeria	***0***	***5.5***	***7.3***	***0***	***83.6***	***3.6***	***0***
SA	***2.3***	***2.3***	***18.6***	***4.7***	***27.9***	***23.3***	***20.9***
Rwanda	***2.9***	***0***	***5.9***	***20.6***	***35.3***	***23.5***	***11.8***
Tanzania	***0***	***4.8***	***0***	***4.8***	***57.1***	***28.5***	***4.8***
*All countries**	***1.7***	***5.3***	***14.3***	***9.3***	***46.0***	***16.4***	***7***

Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the table reflect the percentage of survey participants who selected each choice. * indicates all countries' averages.

This result means that a significant proportion of respondents are sceptical about the usefulness of the government's yield curve as a credible reference for private-sector pricing bonds. This result could imply a few things. First, government debt markets are evolving at a slow pace, to the extent that the government bond markets either lack market depth (i.e., liquidity in secondary markets) or breadth (i.e. variety of tenors) (Sophastienphong et al., 2008). Second, some markets could be using other instruments as benchmarks, e.g., central bank certificates, prime-lending rate, interbank rate, FABI and JARBAR indices, as mentioned in section 3.4.1.2.

Third, the reserve and capital adequacy requirements (e.g. on commercial banks, pension funds, and insurance companies) might deter trading in instruments that are not issued regularly and limit trading in the secondary markets (Gallati, 2022). Fourth, lack of trading can be compounded in instances where demand for government securities outstrips supply, which eventually further induces investors who have such securities to hold them to maturity. As a result, the prevalence of either of the above factors in the government bond market is likely to impede the building of a robust and efficient yield curve, thus raising doubts about its reliability. What should countries do to remedy the perceived lack of credibility in government securities as a pricing reference?

We suggest, first, that policymakers implement sound debt management strategies to build government credibility as borrowers. Such strategies should include coherent public cash management plans, which factor in the volume and tenors of each sovereign debt issuance and

increases transparency and predictability of auctions by pre-announcing the bond auction calendar (Leonard, 2022).

Second, countries should institute strategies to broaden the investor base by, among others, relaxing restrictions on the allocation of assets to domestic institutional investors, removing capital account controls, reforming tax systems[52] and alleviating political risk (Felman et al., 2014). Thirdly, improving countries' legal and regulatory frameworks should promote the confidence and participation of both the issuers and investors, including retail investors (Essers et al., 2015; Luengnaruemitchai & Ong, 2005). The presence of these weaknesses often constrains liquidity and demand. Finally, in markets with dominant shorter-maturity issuances, gradually lengthening the yield curve to 20 years and higher would be useful (Dafe et al., 2018).

Despite the near-unanimity in respondents' choice of the government bond/bills yield curve as *somewhat effective*, the Kruskal-Wallis test (H = 32.706; p-value, 0.001) finds that respondents in countries differ significantly in their perception of the effectiveness of the yield curve. Therefore, this means that respondents' perceptions across countries are not exactly the same as those of respondents within sample countries.

3.4.2 Non-Government debt securities market

This section assesses the proportion of corporate bonds in LCBMs

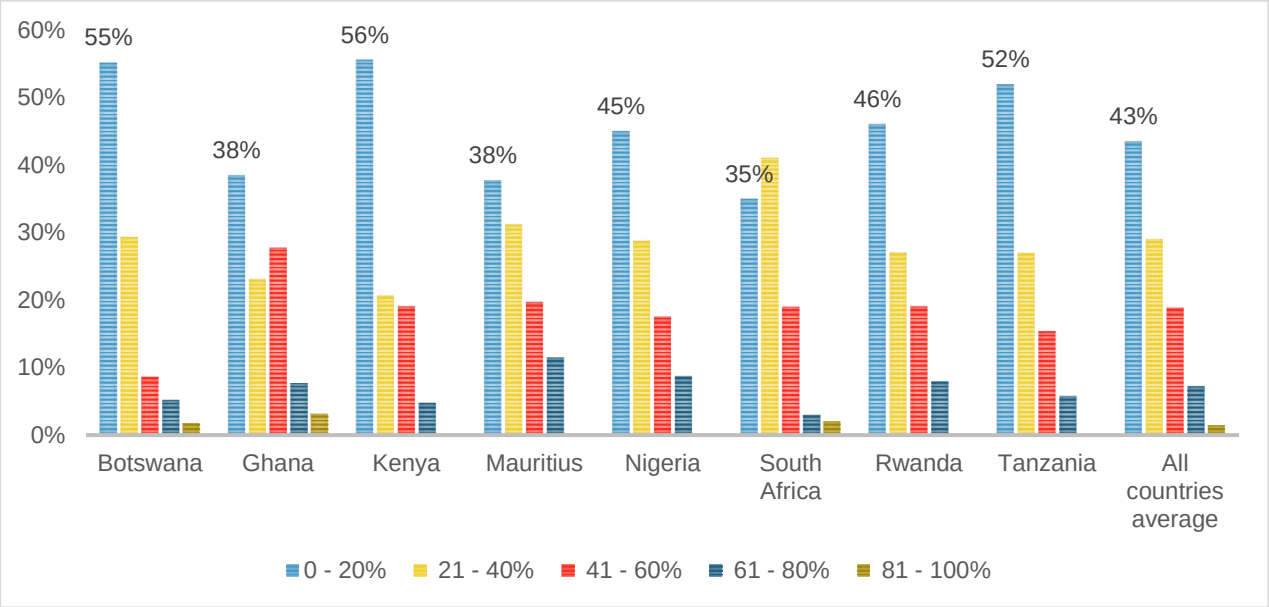
3.4.2.1 Ratio of corporate bonds in the public bond markets

According to World Bank (2006), the measurement of the domestic private sector bonds to total domestic bonds (Government bonds + Corporate bonds) outstanding is vital in that it shows how convenient the private sector can obtain capital from the public domestic debt market. Figure 3.4 analyses the relative size of corporate bonds issued as a proportion of total[53] domestic bonds issued over the past three years.

[52] Withholding tax (WHT), in particular has to be eliminated in the public debt markets. Luengnaruemitchai and Ong (2005) observed that existence of WHT, and threats of increasing other taxes strongly deters foreign investors from participation in domestic markets.

[53] Total=government bonds +corporate bonds

Figure 3.4: Proportion of corporate bonds issued in the past 36 months relative to the total[54]



Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the bar charts reflect the percentage of survey participants who selected each option.

We can observe from Figure 3.4 that most of the respondents estimate that Corporate bonds constitute only about 0-20% of the domestic bond markets. On the other hand, most South African respondents estimate the ratio of Corporate bonds to overall bonds outstanding to be between 21% and 40%. These responses are consistent with the data which is in the secondary market. According to Smaoui, Grandes and Akindele (2017), the percentage of corporate bonds in South Africa is 39.1% of all outstanding bonds. In the rest of SSA, the proportion ranges between 1% and 19%. Similarly, Essers et al. (2016) estimate that the proportion of corporate bonds to all bonds outstanding in Nigeria, Mauritius, Botswana, Kenya, Ghana, Tanzania and Rwanda, as of 2013, was 20%, 18%, 16%, 10%, 9%, 3% and 1%, respectively.

The low proportion of Corporate bonds in SSA relative to all bonds outstanding confirms the well-documented observation in the empirical literature that sovereign bonds dominate long-term diversified portfolios (Dafe et al., 2018; Mu et al., 2013). Also worrying is that private corporations in countries with low corporate bond market development have limited access to corporate debt finance and rely on banks or the equity market for corporate finance. However, some scholars (e.g., Adelegan & Radzewicz-Bak, 2009; Christensen, 2005) are concerned that government bonds crowd out private investments; and suggest both the government and the

[54] Total=government bonds +corporate bonds

private sector should be able to share the domestic savings. Thus, the picture in Figure 3.4 shows the need to accelerate the growth of the corporate bond markets in the SSA region.

3.4.2 Investor Base

This section analyses the investor base in LCBMs, focusing on the buyers of government long-term debt securities, the estimated size of securities held by each category of investors, the extent to which foreign investors participate in domestic bond markets, and the associated impediments/constraints they face in domestic markets. Sections 3.4.3.1 to 3.4.3.3 discuss these issues.

3.4.3.1 Investors in government long debt securities

Respondents were asked to provide information about buyers of long-term debt securities in their capital markets. Table 3.4 displays the distribution of the eight most commonly mentioned investors in government bonds.

Table 3.4: Investors in government long-term debt securities as a per cent share of respondents

Investor Category	*Botswana*	*Ghana*	*Kenya*	*Mauritius*	*Nigeria*	*South Africa*	*Rwanda*	*Tanzania*	*Average*
Commercial Banks	***18***	***22***	***13***	***20***	***21***	***14***	***18***	***22***	***18***
National Development Banks	***10***	***9***	***2***	***0***	***2***	***8***	***8***	***4***	***5***
Insurance Companies	***17***	***13***	***15***	***18***	***17***	***15***	***15***	***20***	***16***
Pension Funds	***18***	***15***	***15***	***15***	***17***	***14***	***15***	***18***	***16***
Foreign Investors	***10***	***14***	***16***	***16***	***14***	***13***	***16***	***1***	***13***
Domestic Individual Investors	***10***	***12***	***12***	***12***	***10***	***12***	***13***	***18***	***12***
Asset Managers	***18***	***12***	***14***	***18***	***15***	***14***	***11***	***17***	***15***
Hedge Funds	***0***	***3***	***13***	***1***	***4***	***10***	***4***	***0***	***5***

Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the table reflect the percentage of survey participants who selected each choice.

Based on the all-country average (column 10), the survey results show that a relatively large proportion of respondents point to Commercial Banks as the most prominent investors in government bonds, with a percentage share of 18%, followed by Insurance Companies and Pension Funds, both with a percentage share of 16%. In other words, these three traditional investors are known to provide a captive market for government debt issues (Essers et al., 2015). Kenya's largest buyers of government bonds are Foreign Investors[55], according to 16% of the respondents. In South Africa, about 15% of the respondents believe Insurance Companies are the biggest buyers of government bonds. In comparison, about 18% of the respondents in

[55] See explanation for this unusual pattern in sub-section 4.3.3

Botswana estimate that Commercial Banks, Pension Funds, and Asset Managers dominate the government bond market. We presume that these institutional investors are dominant in the bond markets because they can invest in long-term bonds (where they are issued) – e.g., the survey results in section 3.4.1.3 confirm that Botswana and South Africa issue bonds beyond 20 years, consistent with (Agyemang-Badu et al., 2021; Muzhoba, 2021).

These findings are consistent with several recent studies, such as Essers et al. (2015) and Irving (2017), which acknowledge that commercial banks hold more than 50% of outstanding government debt instruments. Commercial banks' dominance as government debt instruments investors is easy to explain. First, in almost all the markets in SSA, government bond market intermediaries (i.e., primary dealers or brokers) are mainly commercial banks and ordinarily, they have more incentives to market their products in secondary markets. Second, most governments prescribe high statutory liquidity ratios for commercial banks, for which they have to hold Treasury bills and bonds to satisfy the statutory requirements. The desire to meet these statutory requirements forces commercial banks to buy government bonds every time they are issued. Third, commercial banks have direct access to pools of savings that, in small financial markets such as those in SSA, have limited investment opportunities, leaving government securities as perhaps the most plausible asset class (Beck & Maimbo, 2012; Beck et al., 2011). Fourth, Commercial Banks are incentivised to hold domestic government bonds relative to foreign bonds to minimize potential currency mismatches (Beck & Maimbo, 2012).

However, some researchers (e.g., Blommestein & Horman, 2007; Essers et al., 2016) believe that the continued domination of commercial banks in African public debt markets is a reflection of some forms of financial repression wherein financial regulatory and supervisory authorities compel banks to hold government debt in their portfolio.

3.4.3.2 Proportion of debt securities held by various investors

The questionnaire asked the survey participants to estimate outstanding debt securities held by various types of investors. Table 3.5 shows the respondents' estimates of the aggregate proportion of government debt securities held by different investors. The survey results, presented in Table 3.5, show that the majority of respondents (36.6%) believe that different categories of investors hold between 0 to 20% of outstanding government securities. This result reflects the small market size of the LCBMs in SSA, as reported in the literature (Essers et al., 2015; Ojah & Kodongo, 2015).

Table 3.5: Outstanding government debt securities held by investors

Investor Category	*0 - 20%*	*21 - 40%*	*41 - 60%*	*61 - 80%*	*81 - 100%*
Commercial Banks	*11.3*	*32.9*	*33.6*	*19.7*	*2.5*
National Development Banks	*40.6*	*31.3*	*12.5*	*13.3*	*2.3*
Pension Funds	*19.9*	*46.3*	*21.0*	*12.1*	*0.7*
Insurance Companies	*36.2*	*38.8*	*21.3*	*3.7*	*0.0*
Domestic Individual Investors	*52.4*	*30.3*	*13.0*	*2.7*	*1.6*
Foreign Investors	*45.1*	*35.0*	*13.0*	*6.1*	*0.8*
Asset Managers, Brokers, etc.	*51.0*	*37.3*	*5.9*	*5.8*	*0.0*
*All countries**	*36.6*	*36.0*	*17.2*	*9.1*	*1.1*

Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the table represent the percentage of survey participants who selected each option. * indicates all countries' averages.

As evident in Table 3.5, a plurality of respondents (52.4%, 51%, 45.1%, 40.6%) singled out the domestic individual investor (also known as "retail investors"), Asset Managers and Brokers, Foreign Investors and National Development Banks (NDBs) [56], respectively, as relatively minor investors in SSA LCBMs–holding between 0 to 20% of outstanding government debt securities. These findings are not surprising. As alluded to in the literature, retail investors are not active participants in many SSA debt markets, primarily due to lack of a higher level of protection in the capital market, limited technical knowledge, experience in dealing with capital markets, low savings culture among potential individual investors and their risk aversion attitude (Tyson, 2015). For example, Raubenheimer (2019) noted that Mauritians have a limited understanding of investments in bonds, stocks, or other asset classes because they are conservative investors who prefer bank deposits, fixed deposits and property purchases. Notably, some SSA countries are making policy reforms to attract increased participation from the retail investor segment. For example, Kenya introduced an M-Akiba retail bond accessible through a mobile phone platform (Ndung'u, 2018). The minimum investment of the M-Akiba retail bond is Kshs.3000 (US$30), which makes it affordable to retail investors. Similarly, to attract retail investors, Tanzania reduced the minimum amounts required to invest in Treasury bills and bonds from the local currency equivalent of US$500 to US$50) and US$25, respectively (Kamba, 2015).

Secondly, the extant literature supports our finding concerning the level of foreign investor participation (see, e.g., Dafe et al., 2018; Essers et al., 2015). Some reasons for low foreign investor participation in LCBMs include the prevalence of political and macroeconomic risks in

[56] According to Bradlow and Humphrey (2016), National Development Banks (NDBs) consists of those financial institutions owned and controlled by national governments and have a developmental mandate as their central priority. Examples of NDBs in the sampled countries: Botswana Development Corporation (BDC), Industrial and Commercial Bank Corporation (Kenya), Bank of Industry (Nigeria), Development Bank of Rwanda, Development Bank of South Africa (DBSA), Industrial Development Corporation (IDC) of South Africa, TIB Development Bank (Tanzania), etc.

some SSA economies (WEF, 2019) and strict exchange controls (Essers et al., 2016; Essers et al., 2015).

Finally, whilst NDBs get the bulk of their funding from government budgets, they also raise additional capital from bond markets (Bradlow & Humphrey, 2016; Griffith-Jones, Attridge & Gouett, 2020; Ocampo & Griffith-Jones, 2019). Since these banks are not subject to statutory reserve requirements, they are rarely compelled to buy government bonds, as is the case with commercial banks and other nonbank financial institutions. It is, therefore, correct that this segment of investors holds almost 0% of government debt securities.

About 39% and 46% of the respondents believe that Insurance companies and PFs hold 21-40% of outstanding bonds. Achadinha (2020) supports this finding, adding that local currency bonds dominate pension allocations in Nigeria and East Africa (a fact also notable in Appendix Table 2A). We view the high allocation of pension fund assets to government bonds in the said markets to reflect regulation and lack of domestic investment opportunities. For example, restrictive regulations compel institutional investors to allocate a large proportion of their assets to fixed-income assets (Barnor, 2018; Manroth & Irving, 2009), while lack of domestic opportunities may be compounded by fund managers who are risk-averse and prefer safe investment in government bond markets (Africa Investor, 2014; Maurer, 2017). Additionally, because of the lack of secondary trading and low liquidity in these markets, pension funds hold short-term government debt securities (27four, 2013; Gondo, 2018; Sy, 2017).

About 53.4% of respondents (33.6% plus 19.8%) perceive Commercial Banks to hold between 41% and 80% of all government-issued bonds. This estimate is consistent with many studies (e.g., Essers et al. (2015), which, as already explained, have demonstrated that commercial banks are the most dominant class of investors in LCBMs. An important concern of this finding is that a high proportion of government debt held by banks portends a crowding effect on the private sector, thereby raising the cost of capital for private investors (Abbas & Christensen, 2010; Adelegan & Radzewicz-Bak, 2009).

3.4.3 Pension funds

Several African countries, notably Côte d'Ivoire, Gabon, Ghana, Kenya, Nigeria, Senegal, Tanzania, Uganda and others, have, over the past few decades, undertaken comprehensive pension reforms (Beck et al., 2011; Danida, 2020; Ezugwu & Alex, 2014; Mwakisisile, 2018; NPRA, 2016; OECD, 2019; Sy, 2017; Westerman, 2016; Zubair, 2016). The pension reforms undertaken covered four trends that took place in parallel. The first reform trend involved

switching from publicly administered, pay-as-you-go (PAYG) defined benefit (DB) pension systems towards the more fully-funded, privately administered defined-contribution (DC) pension funds[57]. The second reform trend was to expand social security protection coverage to both the private and the informal sector working population, generating more savings from fully-funded private pension funds, reducing the cost of capital for corporations, creating higher pension investments, and fostering the development of capital markets, among others. The third trend was reforming regulatory and supervisory frameworks to strengthen regulatory oversight[58]. This reform trend also addressed the weak corporate governance structures in PFs. Finally, the fourth reform trend reviewed investment policies and guidelines and lifted restrictions on pension asset investments.

This section seeks to highlight the extent to which the pension sector in SSA countries is reformed to mobilize savings towards infrastructure financing and the barriers they face in the domestic bond markets.

3.4.4.1 Pension fund reforms in SSA

The survey questionnaire asked participants to indicate on the seven-point Likert-scaled response options the extent to which they believe the pension sector in their countries is reformed or allowed to mobilize domestic savings for infrastructure investments. The options ranging from "Reformed' (L6) to 'very reformed' (L7) imply that at least all reform trends discussed above are fully implemented in the pension sector. The option 'somewhat reformed' (L5) means that implementation of about 40-50% of the reforms exists in the respective pension sectors. Finally,

[57] According to Beck et al. (2011), the pension sector in many African countries is dominated by obligatory, state-owned pay-as-you-go pension schemes administered by national social security parastatals..

According to Mwakisisile (2018), the defined benefit (DB) scheme specifies the level of benefit, usually based on the level of salary near to retirement age (final salary), while the defined contribution (DC) specifies how much the member will contribute, often as a fixed percentage of the salary. In the case of the pay-as-you-go DB scheme, the contributions from employer and employees are accumulated to reach the level of benefit, while in the DC scheme, the amount of contributions accumulated in the individual account that participates in profit sharing determine the benefit. Furthermore, the main distinction between these two schemes is how the financial risk is treated. In DC schemes, the financial risk is born by the contributors, while in DB schemes, the sponsors of the scheme bear the financial risk.

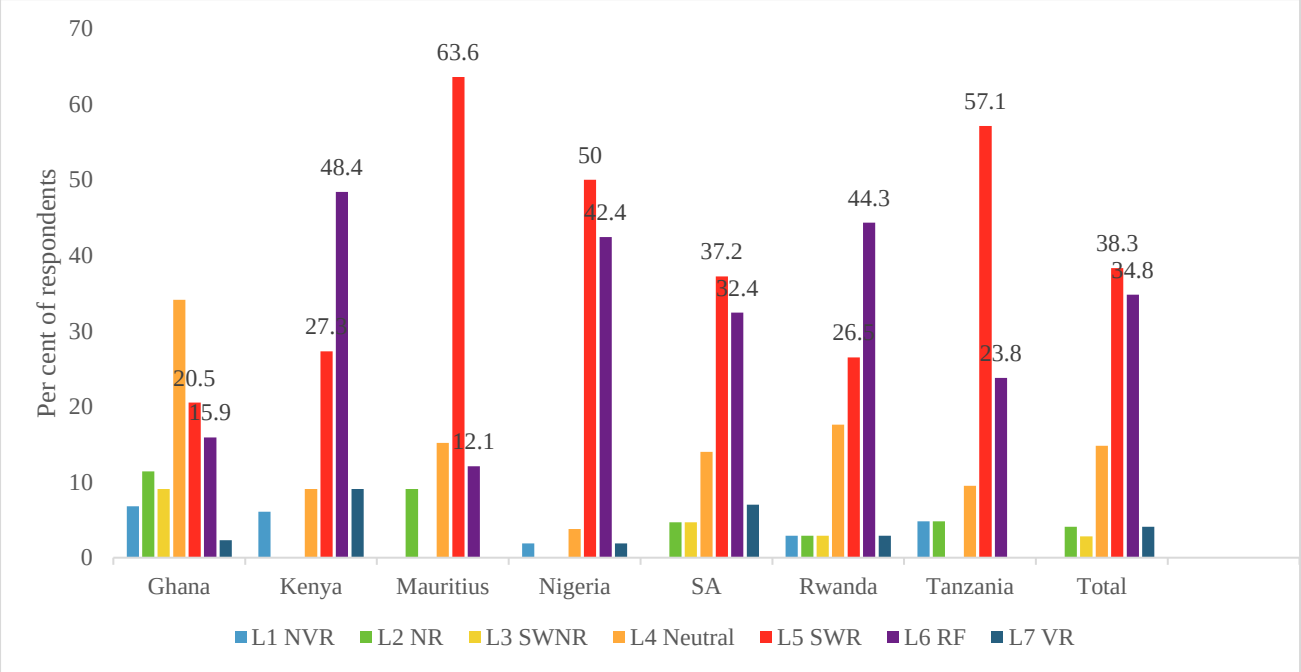
[58] Beck et al. (2011) find that most PFs in Africa lacked autonomy and are at risk of political interference, since they are largely controlled by ministries of finance. The authors also note that supervisory structure is weak because most African countries do not have adequate supervisory resources, particularly analytical tools, consumer and investor protection regulations and skills. The recommended international best practice is that the supervisory and regulatory oversight of nonbank institutions (PFs included) should be through established independent and specialized regulators/administrators in conjunction with central banks (Beck et al., 2011; Danida, 2020).

the options 'not reformed' (L2) or 'not very reformed' (L1) imply that the reforms mentioned above are either superficially implemented or not implemented at all, respectively.

Figure 3.5 below shows the perceptions of survey participants on the extent to which the pension fund sector is reformed in their countries. The all-country average shows a relatively high share of respondents who selected the *somewhat reformed (SWR)* and *reformed (RF)* options, with about 38.3% and 32.8%, respectively. Under the option, *SWR* countries driving the high share are Mauritius, Tanzania and Nigeria, with percentage shares of 63.6%, 57.1% and 50.0%, respectively. For option *RF*, Kenya, Rwanda, and Nigeria are the leading ones, with 48.5%, 44.1%, and 42.3%.

Figure 3.5: The extent of how the pension funds sector is reformed

Key for Likert scale: L1=NVR (Not very reformed), L2=NR (Not reformed), L3 =SWNR (Somewhat not reformed, L4=Neutral, L5=SWR (Somewhat reformed), L6=RF (Reformed), L7=VR (Very reformed)



Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the bar charts reflect the percentage of survey participants who selected each option.

The Kruskal-Wallis (Kruskal-Wallis H value of -3.584, p<.001) and Mann-Whitney U ($\chi 2$ (7) = 37.440, p<.001) tests found that there are statistically significant differences among respondents from different countries regarding the extent to which the respondents believe that the pension

funds in their countries are reformed or allowed to mobilize domestic savings for infrastructure investments[59]. Figure 3.5 displays this inter-country difference.

On average, the picture in Figure 3.5 shows that pension funds in the SSA are SWR – somewhat reformed. As explained above, the SWR option implies that most of the respondents, whilst aware of some reform efforts taking place in the pension sector, a relatively large proportion was not entirely satisfied with the pace and achievement of the pension reform goals. This perception is likely to arise from shortcomings noted in implementing pension reforms. The first reform issue evaluated is the migration of pay-as-you-go (PAYG) defined benefit (DB) pension systems towards the more fully-funded, privately administered defined-contribution (DC) pension funds and increasing savings and, by implication boosting pension fund assets. Although several SSA countries are migrating from the traditional PAYG DB schemes to fully-funded defined contributory systems, the pace is relatively slow in many countries. For example, Dorfman (2015) found that Nigeria started converting the PAYG DB schemes into a funded DC scheme in 2004, but the process is still ongoing; Ghana adopted the hybrid type of scheme, combining the partially funded PAYG-DB social security scheme (for some public sector staff) and the privately funded-DC schemes. In addition, Tanzania is battling to clear an accumulation of significant arrears to pension funds (approximately 3.3% of GDP), including government obligations to the Public Service Pension Fund on pre-1999 reform pension benefits (IMF, 2016).

The slow pace in transitioning pension systems from the traditional unfunded DB PAYG schemes is retarding the collection of savings, hence no potential funds for investments. Consequently, the pension assets as a share of GDP are low, as in many SSA countries (apart from Botswana, Kenya, Nigeria and South Africa) (Danida, 2020; Maurer, 2017; Sy, 2017). Since African infrastructure require substantial financing (around US$130-170billion per annum), the low mobilisation of savings is an obstacle to pension funds investing in infrastructure.

The second reform issue relates to the governance of pension funds and their regulation and supervision framework– which are fundamental for guiding the allocation of pension assets to infrastructure (Beck et al., 2011; Danida, 2020; Sy, 2017). Scholars found that regulation, supervisory, and governance frameworks in African pension funds are weak and not aligned with international best practices (Beck et al., 2011; Dorfman, 2015; Moleko & Ikhide, 2019).

Addressing these issues is proceeding slowly and impacting pension funds' investment potential (Sy, 2017).

The third reform issue addressed the restrictions on pension funds' asset allocations. Several countries have revised the investment guidelines allowing pension funds to invest more in private equity, infrastructure bonds, corporate bonds, and offshore investments. However, most pension funds still invest in government bonds because of restrictions on investing in corporate bonds and other asset classes that still exist in many countries. For example, in Kenya, the limits are 20% in corporate bonds, including infrastructure bonds, 70% in listed equity, and 5% in unlisted equity. In Nigeria, the investment limit in corporate bonds is 40%, while 25% and 10% are the limits for infrastructure bonds and infrastructure funds, respectively (Danida, 2020; OECD, 2019; PenCom, 2019). In South Africa, Regulation 28 (released in April 2011) prescribes the following ceilings: 100% for government debt instruments, a maximum of 75% in debt instruments issued and guaranteed by a South African bank against its balance sheet[60], a maximum of 75% in listed equities (local and offshore), 10% in unlisted equities, investment properties, 25% in investment in foreign assets (excluding African countries), 5% in African investments (excluding South Africa), etcetera (Danida, 2020; Mhanda, 2020; OECD, 2019; Sy, 2017).

Table A-3.1 in the Appendix shows the limits on PF investments in sampled countries. There is no minimum level of investment in any assets, except in Tanzania, where 20% is the minimum threshold. Notably, PFs in Mauritius are not subject to investment limits for domestic and offshore investments (OECD, 2019). PwC (2020) reports that Botswana's PFs portfolio comprises offshore equities (49%), domestic equities (27%), government bonds (14%), and offshore bonds (5%).

We view the pension reforms of lifting asset restrictions as a positive development in many ways. First, the lifting of the requirement for PFs to hold only government instruments provides an opportunity for LCBMs to develop other instruments (e.g., inflation-indexed bonds, mortgage bonds, green bonds, asset-backed bonds, infrastructure bonds) in which PFs can invest, especially in corporate bond markets. Such an experience also happened in Latin America in the 1980s when pension reforms took place (Thompson, 2003; Walker & Lefort, 2000). Thompson (2003) also found that long-term and inflation index bonds are the most suitable assets for retirement-related investment, which emerged after pension system reforms in OECD countries.

[60] Note: previously the investment limit for listed corporate bonds within specified credit rating bands was 25%, and 5% for unlisted corporate bonds.

Secondly, raising the limits to invest in listed equity and unlisted equity provides more diversification opportunities for pension funds to invest directly in equity infrastructure via listed companies (e.g., utilities, energy or transport companies) or indirectly via infrastructure funds (Croce & Yermo, 2013; OECD, 2015b) – availing more funding to infrastructure projects. Inderst (2009) and Chuckun (2010) suggest that infrastructure stock funds and private equity funds are indirect investments favoured by institutional investors, mainly pension funds[61].

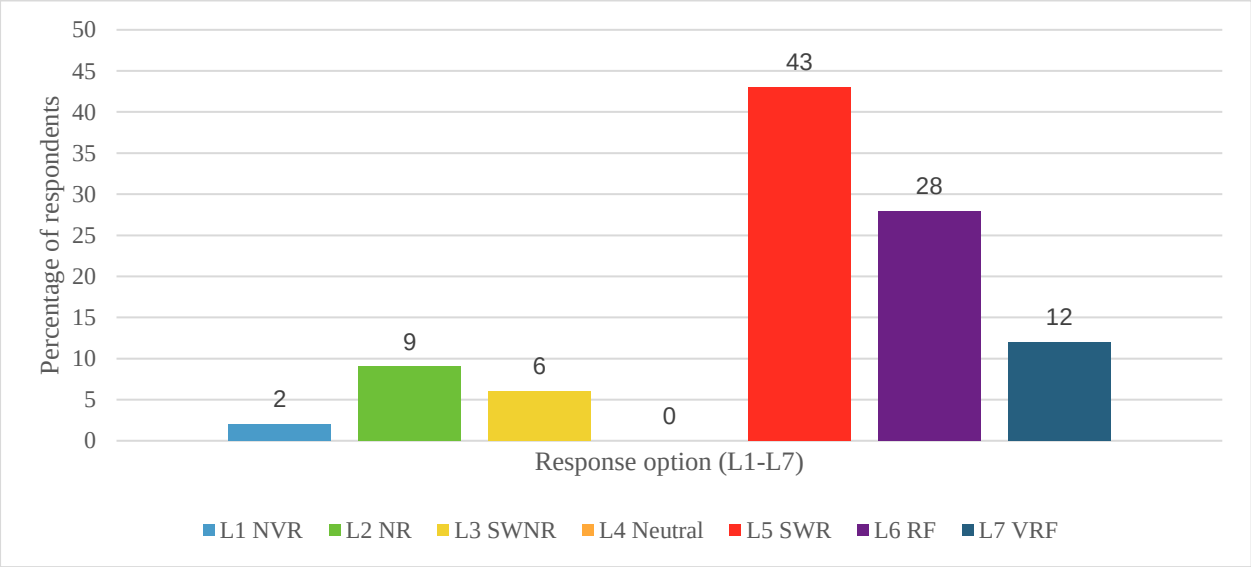
As mentioned above, about 82 out of 261 (31%) respondents chose to answer the open-ended question (OEQ) to justify their selection. We used a thematic analysis approach and deductive coding to analyse open-ended response data (by using NVivo software). Figure 6 categorises the number of respondents who supported their response options.

Out of the 82 respondents, the most significant proportion are those who selected the SWR (43%), followed by RF (28%) and VRF (12%). Of those who perceived otherwise, 9% supplied justification leaning towards NR, whilst 6% supported the SWNR response. We noted that the themes used in the explanation mirrored the pension reform trends discussed in section 3.4.4.1 above, namely, the expanded coverage to workers in private and informal sectors, the implementation of policies, the regulatory and supervisory frameworks, the policy framework on investment, and others. We now discuss the justifications, starting with the SWR.

[61] The direct route to access listed equity is by buying infrastructure stocks on the exchange, whilst market traded debt is accessed by buying a wide range of infrastructure bonds issued by government (government infrastructure bonds), corporates (corporate bonds) or Special Purpose Vehicles (project bonds). Unlisted equity can be accessed directly via infrastructure projects or special purpose vehicles. Equally, infrastructure companies or Special Purpose Vehicles (SPVs) can access private debt by arranging loans or project loans directly with financiers, e.g., banks or pension funds. According to GIZ (2017, p. 4), "direct investment gives direct ownership and control over investment, but requires much stronger in-house resources in the process of building, acquiring, managing and disposing assets." Indirectly, infrastructure investments can be accessed by buying into infrastructure stock funds on listed market, whilst the private equity mutual funds can be accessed over-the-counter.

Figure 3.6: Justification for selection of response option

Key for Likert scale: L1=NVR (Not very reformed), L2=NR (Not reformed), L3 =SWNR (Somewhat not reformed, L4=Neutral, L5=SWR (Somewhat reformed), L6=RF (Reformed), L7=VR (Very reformed).



Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the bar charts reflect the percentage of the 82 survey participants who explained why they selected the option.

Of the respondents who selected the SWR option, several (approximately 50%) believed that despite reform laws enacted, the government remained in control, directing the pension funds where to invest. For example, one respondent remarked:

> *"Pension funds still get directives from the government in which projects to support."*

Other respondents lamented that government ministries or departments still control pension fund regulators.

> "*Although, in my country, the Pensions Authority established through the Pension Act is the regulator of the pension sector, the Minister of Labour has unfettered power over the Pensions Authority."*

Some respondents observed that the participation of informal sector workers was limited; the perception was that it reduced the potential of the pension sector to mobilise more savings. Another issue raised was the existence of investment limits. About 40% of respondents felt the limits set to invest in corporate bonds and infrastructure assets are too low, and prior government permission is required in some jurisdictions.

> *"In my country, pension funds are allowed to invest between 15 and 30% of their capital in corporate bonds – but with government approval. The rest of capital is still held in government debt instruments."*

"Somewhat reformed because PFs are allowed to invest in infrastructure funds and bonds – but not as a direct investor in the asset class."

Those who selected RF and VRF options presented almost similar justifications. In other words, both groups agreed that the reforms in the area of investments are progressive and encouraged governments to continue to do more and motivate pension funds to invest in all asset classes of their choice, including infrastructure.

"We have no restrictions on investment portfolios."

"Regulations do not limit pensions to invest in government or non-government instruments."

In other words, they acknowledge that pension funds can mobilise savings and channel them towards projects without the need for government approval.

Others were pleased with the pension reform laws in their jurisdictions that permitted private or voluntary pension schemes to register and mobilise more investment savings.

"Pension fund sector is now liberalised. We used to have one public pension fund. We now have private pensions which can invest in instruments they want."

"Laws to reform the pension sector were passed and have legalised private pensions."

Other respondents within this group are happy with the pension sector's supervisory, monitoring and governance framework.

"Policies have been instituted that effectively oversee the workings of the pension sector."

Finally, those who supported the NR and SWNF responses stated their unhappiness over the government's continued demand for PFs to buy a significant portion of its debt instruments, lack of good governance in the pension sector, which makes the public lose confidence in their ability to mobilise savings for their benefit and national development.

"Government still demands what pension funds should invest into, with a large proportion of it being bonds issues."

"There is a lot of misappropriation of funds in the pension sector."

In other words, the dominance and monopoly of government and politicians in managing pension funds cast doubt on the success of the pension sector reforms in Africa. We now discuss the barriers or factors that participants felt are hampering the participation of PFs in LCBMs and infrastructure financing.

3.4.4.2 Barriers/Factors affecting pension funds' participation in domestic bond markets

A survey question asked the respondents to state the barriers or factors that negatively affect the pension funds' participation in the local bond markets. Using NVivo, we sifted through the responses to this open-ended question and picked 12 themes. The themes are listed and quantified in Table 3.7 below. The table shows the observation number, mean values, standard deviation, standard error of the mean, minimum values, maximum values, and skewness. We can observe that only 87 people answered this question. The Skewness and Kurtosis values of 9.165 and 85.011 point to a highly skewed distribution and peaked (see Appendix Table A-3.2 for skewness and kurtosis values of each variable). The minimum and the maximum values show the number of times a single respondent mentioned the respective theme. A minimum value of zero means some respondents did not speak to the particular theme, while a maximum value of 2 means that other respondents spoke to the same theme twice in their answers.

The mean value shows the average number of times all 87 respondents raised a particular theme. A high mean value means that the specific theme was presented more often, which points to the importance of the theme.

Table 3.7: Factors affecting the pension market participation in the local bond markets

Themes	*Observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Infrastructure	*87*	*0.0575(0.03)*	*0.2794*	*0*	*2*
Equity	*87*	*0.0345 (0.02)*	*0.1835*	*0*	*1*
Legislation	*87*	*0.1724 (0.04)*	*0.4094*	*0*	*2*
Capital	*87*	*0.0345 (0.02)*	*0.1835*	*0*	*1*
Education	*86*	*0.1395 (0.04)*	*0.3485*	*0*	*1*
Policy	*87*	*0.1149 (0.03)*	*0.3208*	*0*	*1*
Rating	*87*	*0.0345 (0.02)*	*0.1835*	*0*	*1*
Inflation	*87*	*0.0115 (0.01)*	*0.1072*	*0*	*1*
Political	*87*	*0.0345 (0.02)*	*0.1835*	*0*	*1*
Issuance	*87*	*0.2184 (0.05)*	*0.4426*	*0*	*2*
Liquidity	*87*	*0.0575 (0.03)*	*0.2341*	*0*	*1*
Listed	*87*	*0.0230 (0.02)*	*0.1507*	*0*	*1*

Source of data: Authors' assembled data from the SSA cross-country survey.
The standard error of mean is in brackets.

The main issues highlighted as the significant factor against pension funds' participation in LCBM surround the topic of *issuance, listing and rating*. Specific barriers related to these issues include the lack of frequent issues of bonds, relatively less volume of issuance, low volumes of issuance from listed companies, and limited diversification of issuers, as most bonds are issued by the government and a few by corporations.

"We do not have diversification of issuers –e.g. in this country (Y), there are very few corporate issues – only government, SOEs (e.g., A, B, C, etc.). So a lot of the pension funds allocations go to the equity market."

Given the issues mentioned above, it is not surprising that respondents had to raise concerns over the lack of sizeable issuance from listed corporates. Pension funds are known to have a strong preference for listed securities that are low-risk and liquid (Croce & Yermo, 2013). This also implies that a strong base of listed shares creates an environment where the pension sector can participate in infrastructure financing. Due to the nature of the pension sector mentioned earlier, some respondents recommended the need to list more infrastructure investments project/assets if the infrastructure benefits more from the pension sector. The literature also supports these sentiments. For example, Oberholzer et al. (2018) observed a shortage of publicly-listed infrastructure securities in several SSA countries. The lack of publicly-listed infrastructure securities is a significant restriction that prevents pension funds and other institutional investors from investing in infrastructure projects.

Others believed that the absence of issuers with investment-grade debt instruments and bankable infrastructure projects is a significant barrier to the participation of PFs in bond markets and infrastructure investments.

"Even if pension funds want to invest in corporate bonds or infrastructure, the fund managers struggle to find issuers with investment-grade debt instruments or bankable infrastructure projects on the market."

Indeed, the investment policies of many pension funds limit the investment of pension assets to countries and corporates with good credit ratings to minimise credit risks (PenCom, 2019; SAVCA, 2014; Sy, 2017). Thus, the concern over bankable projects also has merit and needs to be addressed. Several authors have also raised similar issues before (see, e.g., Collier & Cust, 2015; Manroth & Irving, 2009; Maurer, 2017; Sy, 2016). For example, Maurer (2017), in a review of the constraints and barriers to investments in infrastructure assets in Africa, cited the lack of well-prepared, bankable projects as limiting investment opportunities for institutional investors (pension funds included). Also, Collier and Cust (2015) noted that the pipeline of bankable infrastructure projects is limited in Africa.

Some respondents are worried about the lack of long-tenor instruments in the market. For example, a respondent from one country said:

"From the supply side– how much on offer depends on what the Central Bank is putting on offer? For instance, the 10-year paper comes out irregularly, but pension funds want to hold 65% in fixed-income instruments and 35% in equity. However, the long-term fixed-income instrument shortage impacts attaining that goal."

These barriers point to the broader problem of underdeveloped LCBMs that do not issue varied tenor financial instruments. In other words, the institutional investors' desires for long-term assets matching the liabilities in their balance sheets are not being met (Oberholzer et al., 2018). Yet, ACBF (2016) finds that pension funds and other institutional investors have an appetite for Public-Private Partnership (PPP) projects that they believe can issue debt instruments long enough to match their liabilities. The issuance theme's high standard deviation (0.4426) suggests broad differences in how this construct is viewed across countries. This statistic means respondents have varying views on issuance matters as barriers to pension sector participation in the local bond markets.

The next most significant barrier to pension sector participation in the local bond markets participants selected is *legislation* (mean: 0.1724). *Legislation* covers issues on regulation, laws, and restrictions. In many countries, significant issues raised about legislation include limits placed on pension funds for infrastructure investments and the mandatory requirement still requiring pension funds to buy government securities. These legal hurdles are limiting and frustrating to an investor.

Though *issuance and legislation* were the top barriers to pension sector participation in the local bond market, the other important factor was *education* (mean = 0.1395), as shown in Table 3.7 above. Regarding education, the respondents believe that the public is unaware of why contractual savings are essential for economic development. Secondly, they think some fund managers and trustees lack the expertise to assess some investments' risk and return profiles. Hence the participants encourage pension fund administrators (PFAs) and trustees to develop the expertise required to understand and evaluate investment portfolios' risks and returns. Barnor (2018) also expressed similar sentiments after noting that most pension funds in Botswana, Kenya, Nigeria and South Africa invest heavily in specific assets (e.g. government bonds, equity and Treasury bills). That choice is informed by what investment managers understand. Oberholzer et al. (2018) recommended the urgent need for fund managers and investment managers to develop the skills required to understand and assess infrastructure projects.

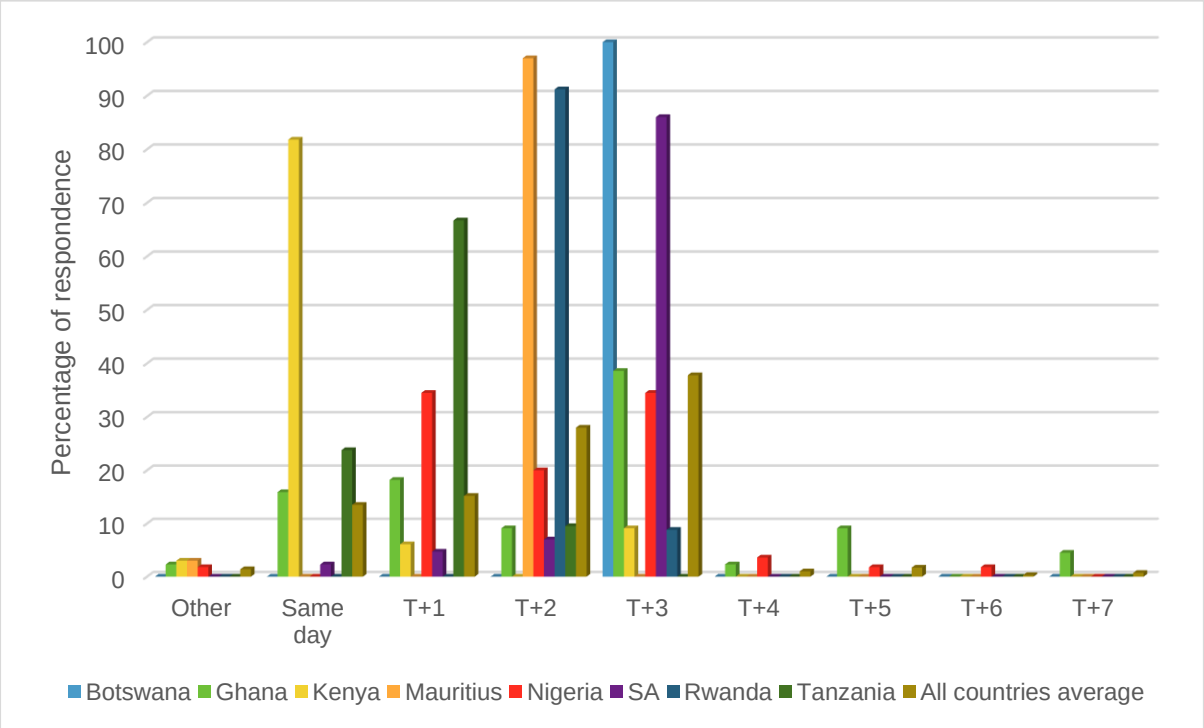
3.4.5 Clearing and settlement systems

This section assesses the clearing and settlement systems focusing on the settlement cycle period for bond market transactions and the respondents' views on the efficiency and security of the clearing and settlement systems in their domestic bond market.

Clearing and settlement refer to the time between the trade date of executing an order and the settlement date when a trade is considered finalised (Endo, 2000; World Bank & IMF, 2001).

Figure 3.7 below shows the different settlement periods across SSA countries. The settlement periods range from the same day to 7 days (T+7). The statistics in Figure 3.7 show the percentage of respondents who chose a settlement option.

Figure 3.7: The settlement cycles for domestic bond transactions



Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the bar charts reflect the percentage of survey participants who selected each option.

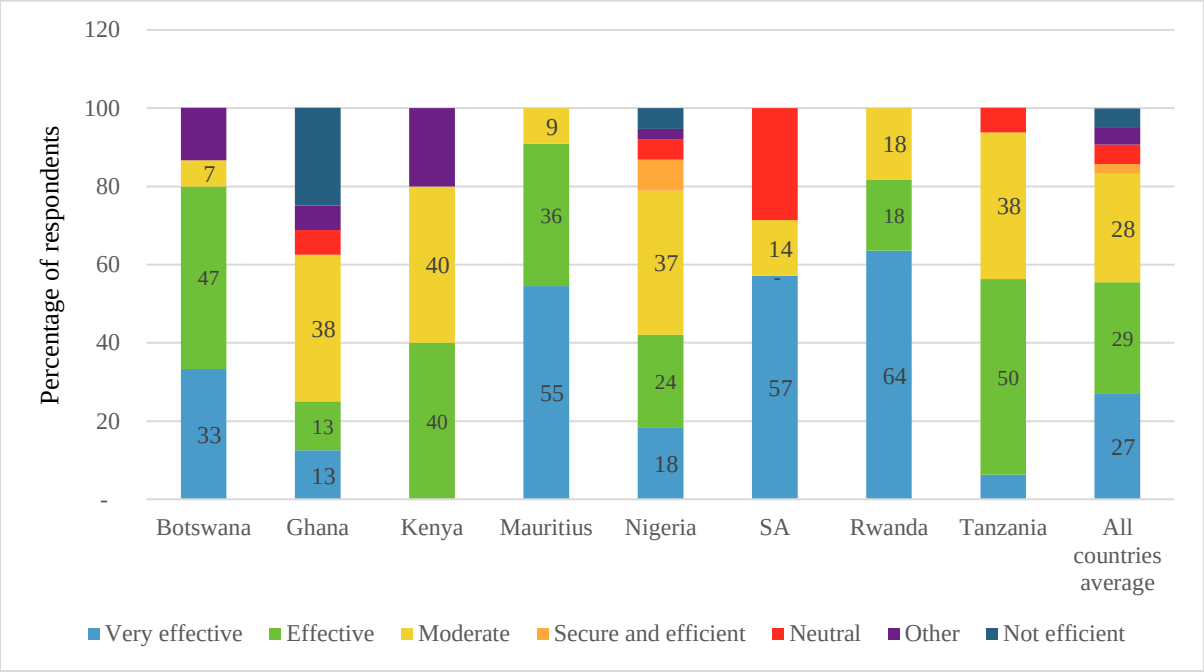
Kenya has the shortest settlement cycle, with an 81.8% share of respondents citing the use of same-day settlement. Most respondents affirm that Tanzania's settlement period is in the T+1 category. The remaining countries have a settlement period of T+3, except for Mauritius and Rwanda (T+2). Most sample countries have electronic clearing and settlement systems based on a delivery versus payment – essential for a smooth transaction in primary and secondary markets. On average, Table 12 indicate that the SSA settlement period (averaging T+3) is not bad for containing both credit and settlement risks. However, the preferred settlement cycle should be in the range of T+0 to T+2, which is standard for bond markets in emerging markets (e.g. India, Hong Kong, Singapore, Thailand, Israel, etcetera.) (Mihaljek et al., 2002).

The Kruskal-Wallis test produced a Kruskal-Wallis H value of 134.887 and a p-value of 0.001, meaning inter-country differences regarding settlement cycles.

Figure 3.8 expands on the settlement analysis as it looks at how the participants evaluated the efficiency levels of clearing and settlement systems in the respective countries. From the below figure, on average, SSA's clearing and settlement systems are perceived to be effective. However,

ideally, investors will trade bonds only if they are confident of the settlement of their trades; hence SSA countries should strive to enhance the efficiency of clearing and settlement systems to match settlement cycles in emerging markets between T+0 and T+2.

Figure 3.8: Efficiency of the clearing and settlement system in the domestic bond market



Source of data: Authors' assembled data from the SSA cross-country survey. The numbers in the bar charts reflect the percentage of survey participants who selected each option.

The advantage of T+2 is that it coincides with the international currency settlement period, making it easier for international investors to purchase bonds in the LCBMs (Mihaljek et al., 2002).

3.5 Concluding Remarks

3.5.1 Summary and Conclusion

As the main purpose of this study is to explore how bond markets can be developed into viable mechanisms for closing the infrastructure funding gap in the SSA region, this chapter examined the state of public bond markets development in eight SSA countries. In these countries, we found that while the stock market exchange is the most widely used system, a combination of stock market exchanges, auction systems and over-the-counter trading platforms for government debt securities is used in all countries studied. The auction system is used in all countries surveyed, but it appears to be the primary trading system in Mauritius and Botswana. In Nigeria and Ghana, the over-the-counter trading system is ranked third in terms of popularity. However, most countries in the sample prefer the non–competitive auction system to the competitive auction system, so choosing the most appropriate one is a concern. Developing bond markets

should typically begin with a multiple-price auction and then progress to a single-price auction after market participants have gained bidding experience.

We also examined the effectiveness of the government yield curve in providing a benchmark for corporate issues. We found that a significantly high number of respondents ranked the government yield curve as *somewhat effective* as a benchmark for Corporate bonds. This ranking implies that respondents perceive the government yield curve not to be very effective in providing a reliable benchmark for corporate issues. The main cause is that local currency bond markets (LCBMs) do not regularly expand the maturity structure of their different benchmark financial instruments. Besides, in LCBMs that expand benchmark instruments, issuance is not regular. This finding reinforces the importance of developing the government bond market as the base for building up the corporate debt markets. In turn, corporate bond markets provide platforms for raising long-term project finance for infrastructure investments by PPPs and infrastructure SPVs, among others.

We also discovered that the evolution of corporate LCBMs is still uneven. The corporate bond market in South Africa is very developed, while the corporate bond markets in Botswana, Mauritius and Nigeria are only moderately developed. The corporate bond markets in Ghana and Kenya are still developing. Corporate LCBMs in Rwanda and Tanzania are still in their infancy. As a result, corporations are not able to enter markets that are less developed.

Our analysis found that commercial banks hold the largest share of government debt securities (41-60%), followed by pension funds and insurance companies, each holding 21-40%. Clearly, a limited amount of trading is taking place in secondary markets, with these major investors preferring buying and holding. Specifically, the fact that banks hold so much of the government debt has serious implications for the private sector since it raises the cost of private investment capital.

We also discovered that pension funds in the- eight SSA countries had been moderately reformed to engage in infrastructure financing, albeit within statutory limits. A limited base of listed and credit-rated issuers, a lack of long-term financial instruments, a limited pipeline of bankable projects, stringent regulatory practices, and fund managers and trustees with limited skills and knowledge to assess risk/return profiles of infrastructure are among the barriers that prevent pension funds from participating in corporate bond markets and infrastructure funding.

3.5.2 Policy recommendations

We suggest the following policy recommendations:

3.5.2.1 Accelerate the growth of the corporate bond markets in the selected SSA countries by ensuring that the government yield curve is robust, effective and reliable. Therefore, a government bond market framework must be set up and/or concurrently strengthened before a corporate bond market can be established or thrive.

3.5.2.2 Relax and amend regulations that allow pension funds to invest in corporate debt to help lengthen the maturity of corporate debt and participation in infrastructure financing.

3.5.2.3 Furthermore, accelerate the transition to fully-funded defined contribution pension schemes, which will encourage more savings, grow PF investments, and give fund managers more flexibility in investing their funds.

CHAPTER 4- IMPROVING LIQUIDITY IN THE DOMESTIC PUBLIC DEBT MARKETS FOR ENABLING INFRASTRUCTURE FINANCING

4.1 Introduction and Motivation for the Study

The potential of domestic public debt markets to mobilise resources from diverse savers and channel them towards infrastructure financing in SSA is being widely discussed in the literature (Dafe et al., 2018; Kodongo, 2013; Mu et al., 2013). For example, Dafe et al. (2018) observe that between 2009 and 2014, the Kenyan government issued six domestic bonds to raise capital for roads, water, and energy infrastructure projects. Similarly, between 2008 and 2014, Nigeria raised funds from the Local Currency Bond Market (LCBM) to fund the reduction of its infrastructure deficit. Further, Juvonen et al. (2019) observed that between 2007 and 2017, about a dozen countries in SSA (e.g., Angola, Ghana, Rwanda, Senegal, Tanzania, and others) issued sovereign bonds, raising over US$35 billion of debt funds, for infrastructure projects investments.

In light of the huge regional infrastructure gaps (deficits) within the SSA region, scholars and policymakers (e.g., Brixiova et al., 2011; Mezui, 2013) advocate and hope that domestic public bond markets will evolve substantially and begin to contribute towards closing the existing infrastructure funding gap in SSA region[62]. This concern comes against the backdrop that the traditional infrastructure financing sources – namely, fiscal budgetary allocations and official development assistance – have been dwindling lately (Gutman et al., 2015; Mu et al., 2013). Furthermore, under the new Basel III rules, banks are tightening lending terms, thus limiting the availability of long-tenure loans for infrastructure project finance (Ng & Tao, 2016; Tendulkar & Hancock, 2014). Consequently, the world over, governments are increasingly encouraging the participation of the private sector in infrastructure financing through Public-Private Partnerships (PPPs) procurement arrangements in order to reduce fiscal pressures and enhance risk-sharing[63]

[62] Scholars and policy makers estimate the infrastructure financing gap in SSA to range from US$68 billion to US$108 billion (AfDB, 2018b; Juvonen et al., 2019).

(Babatunde & Perera, 2017; Hyun et al., 2019). Such funding is raised from capital markets, using market-based instruments like listed project bonds and stocks (Croce et al., 2015). As a result, the issuing of PPP infrastructure bonds in developing and emerging markets, has risen over the last two decades[64] (Babatunde & Perera, 2017; Hyun et al., 2017; Tendulkar & Hancock, 2014). This trend provides hope for developing regions, such as the SSA, to use public debt markets as a platform for attracting private capital for infrastructure projects.

However, the challenge facing domestic public debt markets in most sub-Saharan African economies is that they are small and illiquid, thereby limiting their capacity to provide long-term infrastructure financing (Christensen, 2005; Essers et al., 2016). A liquid public bond market has several buyers and sellers of securities, thus having many bids and ask offers, low bid-ask spreads, and low volatility. It is easy to execute a trade quickly at desirable prices. In other words, such a public bond market has the potential to attract a large pool of investors willing to commit capital to long-term infrastructure investments on the condition they can quickly and profitably liquidate their investment (Oladapo & Molele, 2019).

The benefits accruing from infrastructure projects as far as fostering liquidity in LCBMs in the SSA region include facilitating price-discovery, improving market efficiency and lowering transactions costs, which in turn improves the efficient mobilisation of savings, resource allocation and risk-sharing / diversification (Levine & Zervos, 1996; Merton & Bodie, 1995).

A liquid government bond market reduces African governments' dependency on international bond markets for raising capital for projects, thereby reducing exposure to risk in the global financial markets, such as exchange rate fluctuation and currency mismatches[65] (Dafe et al., 2018; Mu et al., 2013).

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[63] As a result of increased fiscal budgetary constraints, the financing of infrastructure are taking the form of project finance (Croce, Paula & Laboul, 2015; Gatti & Caselli, 2017). According to Croce et al. (2015, p. 13), project finance "*is the financing of long-term infrastructure, industrial, extractive, environmental and other projects based upon a limited recourse financial structure, where project debt and equity used to finance the project are paid back from the cash flow generated by the project (typically, a special purpose entity (SPE) or vehicle (SPV).*" Therefore, infrastructure project finance is distinct from corporate finance in that the former represents the financing of a stand-alone economic unit.

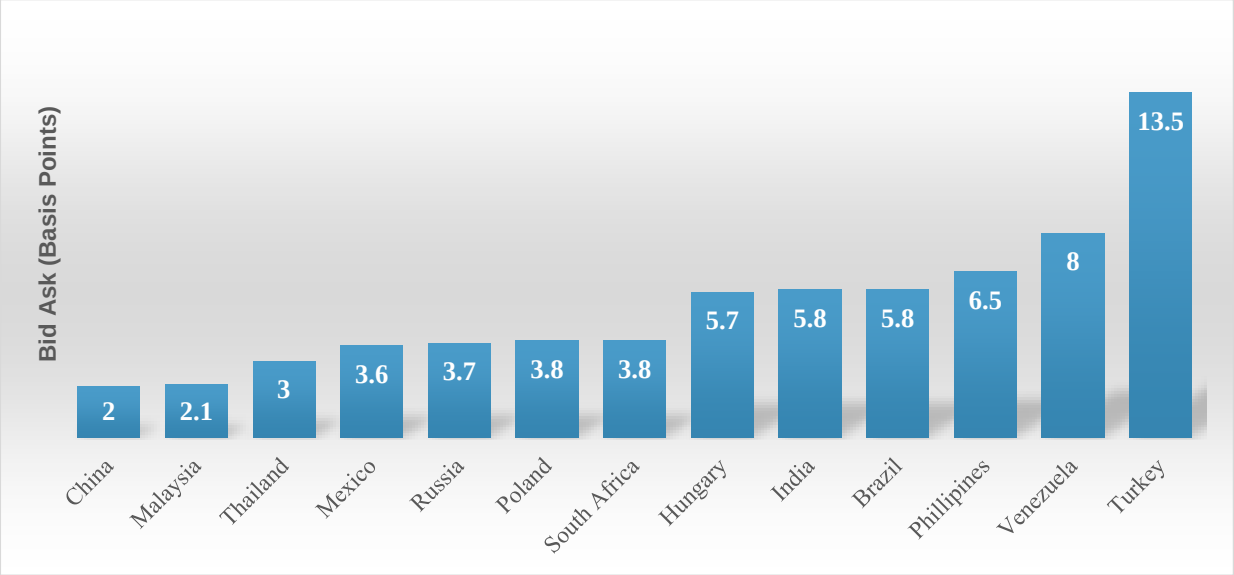
[64] According to Tendulkar and Hancock (2014), between 2000 and 2013, over US$171 billion worth of infrastructure bonds for financing infrastructure was issued in both developed and emerging markets. On the other hand, Babatunde and Perera (2017) report that between 1996 and 2009, a total of 663 PPP projects were signed in the UK, of which, about GBP 905 million (70%) was raised from public bond markets as bond finance.

[65] This is because infrastructure projects are usually financed with hard currency and generate revenue in domestic currency, and are thus often exposed to exchange and interest rates volatility (Ba et al., 2017; Prud'homme, 2005).

Furthermore, a liquid government bond market promotes corporate bond markets by providing a pricing benchmark for corporate instruments and a tool for managing interest rate risk. Corporate bond markets are the primary source for raising project finance required by PPPs for infrastructure projects (Croce & Yermo, 2013; Croce et al., 2015).

Liquid public bond markets provide opportunities for nonbank financial institutions (e.g., pension funds, insurance companies, mutual funds, etc.) to invest in longer-term maturities that match their liabilities' maturities, thereby strengthening the management of their balance sheets. If these investors want to exit from long-term bonds before their maturity, they can do so because liquidity would exist in such public bond markets. Given this background, it is essential to investigate the challenges causing the domestic public debt markets in SSA to exhibit low liquidity. For example, Figure 4.1 shows the bid-ask spread of South Africa (SA)'s public debt market (one of the African countries classified as Emerging Markets) against other bond markets in emerging markets (EMs). Despite this, the South African bond market is more liquid than India, Brazil or Turkey, with bid-ask spreads of 5.7, 5.8 and 5.8 basis points, respectively. Since the government debt markets in the SSA countries are not as developed as those in SA, the bid-ask spreads in these markets are wider than in SA and other emerging markets.

Figure 4.1: Comparison of bid-ask spread trend in Emergent Markets



Source: IMF and World Bank Group (2020). Emergent markets government bond: Bid-ask spreads for 10-year benchmark bond over 2018.

Moreover, a liquid public bond market provides relatively cheaper capital for financing capital projects, such as infrastructure investments. Ideally, risk-averse investors holding illiquid assets seek higher returns as compensation for taking liquidity risk, and that will, in turn, affect the

infrastructure firm's cost of capital. The high cost of capital will, in turn, affect the cost of infrastructure services (e.g., electricity tariffs, toll road fees, transportation fares, etc.). The relatively higher cost of capital limits the amount of capital demanded, thereby perpetuating the financing gap.

Since there are huge funding gaps in SSA infrastructure, there is a need for greater awareness of the importance of building deep and liquid domestic public debt markets as alternative sources for bridging the existing infrastructure-funding gap. However, empirical studies on improving liquidity in the domestic bond markets for enabling bond financing for infrastructure projects in SSA are limited. Previous studies on bond market liquidity in Africa include Kapingura and Ikhide (2015), which used secondary data to explore the macroeconomic determinants of the South African bond market's liquidity. Kamba (2015) used volume-based liquidity measures to study the liquidity factors in Tanzania's government bond market. Eke, Adetiloye and Adegbite (2020) investigated the relationship between secondary corporate bond market liquidity and the real sector growth in 13 African countries. These studies' findings were about the status of liquidity and not causes of illiquidity in SSA public debt markets.

Besides, these researchers, and others, did not pay particular attention to liquidity factors impeding bond financing of infrastructure in SSA. Most studies used secondary data, which is both scarce and patchy in most SSA public debt markets, largely because these markets are young and/or trade infrequently.

Our study fills this gap by using survey data from chosen SSA countries, thereby contributing hitherto non-existent data (information) to the literature. Survey data enriched this study by drawing insights and expert knowledge from fixed-income experts and practitioners about the state of liquidity in public bond markets and the probable causes of that. By providing empirical evidence about the barriers to liquidity that stall bond financing for SSA infrastructure projects, this study will benefit practitioners, regulators, investors (local and foreign), academics, and policymakers, by helping formulate effective policy recommendations.

A preview of our main findings is that the markets for government debt in South Africa, Nigeria, Ghana, Kenya, and Tanzania are relatively liquid compared to Botswana, Mauritius, and Rwanda. These LCBMs suffer from decreased liquidity due to irregular issuances, a lack of primary dealers, and a narrow investor base, among other factors.

Our second main finding was that, except for South Africa and Nigeria, corporate bond markets in the sampled SSA countries are underdeveloped and illiquid and, thus, are not well prepared to finance infrastructure. The reasons for this can be attributed to a number of factors. First,

corporate bond markets lack reliable government yield curves for pricing corporate issues. Secondly, there are few creditworthy issuers of long-term financial instruments, particularly those pertaining to infrastructure. Thirdly, there are fewer nonbank financial institutions investors (e.g. pension funds and insurance companies, etc.) due to regulatory restrictions that limit investments in corporate bonds and infrastructure debt instruments. Apart from these factors, high dependence on banking sector finance by the private sector, low trading volumes in the corporate bond market, and underdeveloped and illiquid secondary markets, among others, have also contributed to the underdeveloped corporate bond markets.

Finally, we found that introducing more sophisticated financial instruments, such as infrastructure project bonds, diaspora bonds, green bonds, and securitised debt assets, will deepen LCBMs and equip them to finance infrastructure. This initiative includes increasing the issuance of state-owned enterprise bonds and municipal bonds backed by government guarantees. Under this initiative, state-owned companies and municipal entities will issue bonds backed by government guarantees[66].

The remainder of the chapter is structured as follows. Section 4.2 reviews the existing literature, followed by a description of the methodology employed in section 4.3. Section 4.4 details the survey findings and discussion. Finally, section 4.5 presents the summary and concluding remarks. The following sub-section focuses on the background literature on liquidity in public debt markets.

4.2 Background Literature

This section reviews the literature on factors affecting public debt markets' liquidity. We start with the theoretical literature, followed by empirical literature, and conclude by examining the literature on the liquidity of Africa's public debt markets.

[66] It is acknowledged, however, that raising liquidity in bond markets does not always lead to an increase in infrastructure investment, since governments may borrow from the debt markets to meet other demands, for example to increase food production capacity (Nechifor et al., 2021), to strengthen social safety nets (Garcia, 2013), to accelerate research and development (Loxley, 2016), to service debt and/or build military defense capacity (Choudhry, 2001), among others.

4.2.1 Theoretical literature

In this paper, we depend on two different theoretical perspectives to explain the concept of market liquidity. They are namely, the Efficient Market Hypothesis theory, and the Liquidity Preference Theory

4.2.1.1 Efficient Market Hypothesis theory

Fama (1970), in postulating the Efficient Market Hypothesis (EMH), states that financial asset prices fully reflect all available information. That is, stocks or bonds always trade at a fair value, making it impossible for investors to buy undervalued securities or sell at overvalued prices. In other words, the theory postulates that on a risk-adjusted basis, one cannot consistently outperform the market-determined values because the market participants react to new information, thus making financial markets "informationally efficient" (Young & Auret, 2018).

The EMH theory identifies three forms of market efficiency: the weak form, semi-weak form, and strong form (Fama, 1970; Naseer & Bin Tariq, 2015). The weak form states that prices on traded financial assets reflect already all past publicly available relevant information. The semi-strong form of an efficient market is where traded financial assets' prices reflect both past and all publicly available relevant information and instantly change to reflect any new public information. At the same time, the strong form of the EMH holds that financial asset prices instantly reflect both new publicly and even hidden relevant private or" insider" information possessed by company managers, employees, bankers and auditors, etc. (Doffou, 2003; Young & Auret, 2018).

The Efficient Market theory assumes that investors are rational. This assumption implies that investors follow the flow of information relevant to the pricing of securities they hold (Mishkin & Eakins, 2012). As a result, EMH assumes that financial assets are liquid because all investors receive and perceive all relevant information in the same manner. According to Muchimba-Sinyangwe (2017), the more liquid the market, the higher the turnover of traded instruments and the more homogeneous the instruments traded, the stronger the form of market efficiency that is likely to prevail. Neave (2009) also asserts that the only difference between instruments traded in efficient versus inefficient markets is their risk-return characteristics. The market becomes inefficient if it does not incorporate all available relevant information into the true reflection of an asset's fair value.

Amihud, Mendelson and Pedersen (2006) surmise that besides information asymmetries, market efficiencies also exist due to transaction costs (e.g. brokerage fees, transaction taxes, processing

costs, etc.), demand pressure[67] and inventory risks, and difficulty in locating a counterparty who is willing to trade. All of which cause market illiquidity. Furthermore,

Amihud et al. (2006) and Amihud and Mendelson (1991) assert that investors require compensation for bearing the cost of illiquidity. Therefore, risk-averse investors holding illiquid assets will seek higher returns as compensation for taking liquidity risk, which will, in turn, affect infrastructure firms' cost of capital, as these firms traditionally rely on capital market securities for funding infrastructures.

4.2.1.2 Liquidity Preference Theory

The Liquidity Preference Theory (LPT), developed by John Maynard Keynes and John Richard Hicks,[68] argues that the maturity premium is determined by investors' and borrowers' maturity preferences in the market. Investors prefer short-term assets because of their high liquidity, but they are ready to buy long-term bonds if compensated by a higher interest (Hicks, 1937; Keynes, 1936). In contrast, borrowers prefer long-term debt and are ready to pay a higher interest rate to establish a more permanent debt structure. The interest rate structure observed in the market reflects the relative importance of these preferences' strength among the two groups (Keynes, 1936).

Thus, the liquidity preference theory shows other alternatives that investors express regarding managing securities. The interest rate structure theory does not highlight those preferences. This means that preference theory suggests that an investor demands a higher interest rate or premium on securities with long-term maturities, which carry greater risk. All other factors being equal, investors prefer cash or other highly liquid holdings (Culham, 2020; Millikan, 1938). More liquid investments are easier to sell fast at a fair value. According to the LPT, the interest rates on short-

[67] Demand pressure emanates from the fact that not all agents are present in the market at all times, meaning that if an agent needs to sell a bond security urgently, buyers would not be immediately available. As a result, the agent ends up selling to a market marker (dealer) who buys in anticipation of re-selling later. This exposes the dealer to risk of price changes whilst holding the asset in stock. The dealer hence must be compensated for this inventory risk, which in turn is a cost to the seller.

[68] These authors are very prominent in economics. John Maynard Keynes is world-renowned economist who first introduced the liquidity preference theory in chapter 13 of his book The General Theory of Employment, Interest and Money. According to Keynes, individuals value money for "the transaction of current business and its use as a store of wealth." Meanwhile, John Richards Hicks was a British economist considered as the most important and influential economists of the twentieth century. The most familiar of his many contributions in the field of economics are his statement of consumer demand theory in microeconomics, and the IS/LM model (1937), which summarized a Keynesian view of macroeconomics.

term securities are lower because investors sacrifice less liquidity than they do by investing in medium-term or long-term securities (Bartkiewicz, 2020).

Many studies of the term structure of interest rates have ignored credit risk (Hoelscher, 1983; Kamara, 1994; Kempf & Uhrig-Homburg, 2000; Scott, 1965). Many investors rely on credit ratings provided by rating agencies, such as Moody's Investor Service, Standard and Poor's or Fitch ratings (Muchimba-Sinyangwe, 2017; Thotho, 2017). Bond issuers pay the agencies a fee for this service. Institutional investors subscribe to current information from rating agencies. These credit rating agencies rate securities according to the performance of their companies. When difficulties appear from the issuers' companies, the rating agencies will downgrade them, which may cause investors to sell their bonds. Some companies, such as pension funds, and insurance companies, are instructed by their boards to invest in only high-rated bonds. These restrictions on portfolios lead to a situation known as the "market segmentation effect," which reflects a preference for highly-rated bonds to down-graded or lowly-rated bonds.

4.2.2 Empirical evidence on stimulating liquidity in public debt markets

Choudhry (2010, p. 955) defines market liquidity as “the ability to buy or sell an asset quickly, and in large volumes without substantially affecting the asset’s price” Other authors (e.g., Fama, 1970; Naseer & Bin Tariq, 2015; Neave, 2009) suggest that the level of liquidity in the bond market reflects the degree to which prices of securities incorporate all available and relevant public and private information.

Several authors (e.g., Mohanty, 2002; Sarr & Lybek, 2002; Yamaguchi, 1999) discuss the three most commonly used dimensions or measures of market liquidity: tightness, depth, and resiliency. *Tightness* refers to how far the buy and sell prices diverge from mid-market prices– the lower the spread, the higher the market liquidity. The bid-ask spreads measure tightness. *Depth* is the extent to which the market can handle a large volume of trades without affecting prevailing market prices. *Resilience* describes the speed with which price fluctuations resulting from trades dissipate (Yamaguchi, 1999). Among the many measures of market liquidity, the bid-ask spread is the most commonly used proxy for market liquidity because its data is readily available and easy to interpret (see, Chordia, Sarkar & Subrahmanyam, 2005; Choudhry, 2010; Goyenko & Ukhov, 2009; Kapingura & Ikhide, 2015; McCauley & Remolona, 2000; Njiinu, 2007; Wanyama, 2017). Amihud and Mendelson (1988) describe the spread as a major transaction cost or a measure of illiquidity.

Several factors act as triggers of illiquidity in public bond markets. These factors include weak and inadequate regulatory and supervisory frameworks, lax macroeconomic policies, lack of

transparency and political instability (see, Adelegan & Radzewicz-Bak, 2009; Fabella & Madhur, 2003; Park, 2016; Wyman, 2015). A narrow investor base and weak investor protection contribute to illiquid bond markets (Braun & Briones, 2006a; Dafe et al., 2018; Luengnaruemitchai & Ong, 2005; Park, 2016; Peiris, 2010). A lack of active secondary market trading with no primary dealership system is also a deterrent to market liquidity (Christensen, 2005; Kapingura & Ikhide, 2015). Low trading volumes in bond markets reflect the small size of markets and/or the existence of poor market infrastructure (which is not sufficiently developed) and the inability to handle large volumes of transactions (Chabchitrchaidol & Panyanukul, 2008; Tendulkar & Hancock, 2014). Adetiloye et al. (2015). Lastly, illiquid markets are characterized by a limited issuer base and range of tradable instruments (Kim, Mauer & Sherman, 1998; Mohanty, 2002; Spiljard, 2011; Tripathi & Dixit, 2019).

Liquidity in corporate bond markets has also received significant attention from researchers. For example, Ojah and Kodongo (2015) noted that investors in corporate bond markets highly value a stable political environment, more substantial investor rights, and general long-term debt instruments. Sophastienphong et al. (2008) observed that the dominance of state-owned banks in Asian economies during 1990-1995 negatively affected corporate bond markets in two ways. Firstly, the state-owned banks provided loans to state-owned enterprises (SOEs) at a low cost, and as such, undermining corporate bond markets. Secondly, these banks accumulated nonperforming assets but kept on making bad loans and robbing the bond market of needed investors. All these in turn diminished liquidity in Asian bond markets.

Hashimoto et al. (2021) posit that having a universal, reliable government benchmark yield curve can enhance and improve the development of the corporate bond market. The AFMI (2016) found that Botswana, Ghana, Kenya, Nigeria, and Tanzania face challenges in building stable and reliable yield curves. The challenges cited include the existence of narrow investor bases (most investors buy and hold securities to maturity), limited and illiquid secondary markets, market fragmentation (either small bond issues or infrequent issue), few intermediaries, lack of transparency (e.g., no platforms to guide on prices/yields on a daily basis), etc.

KPMG (2017) observed that the lack of participation of nonbank financial institution investors in corporate bond markets is primarily due to regulatory restrictions on pension funds and insurers' investments in corporate bond markets. Africa Investor (2014) observed that many African pension funds (PFs) face regulatory restrictions on infrastructure investments, thus hindering their participation in infrastructure financing via corporate or project bonds. Kamba (2015) and Ndung'u (2018) found that using innovative, user-friendly digital platforms improve retail investors' access to government debt instruments, as is the case in Kenya following the launch of the Retail bond in 2017.

Adetiloye et al. (2015) recommended that the public be financially educated to understand the benefits of savings/investments. The authors observed that many potential investors had low financial literacy levels and did not understand the market's investment options nor how capital markets operate, thus, impeding a greater chance of broadening retail investors' base. Swamy (2014) posited that communicating information on debt assets on a timely basis, adopting transparency in primary auctions, standardization, harmonisation of documentation, and improved price disclosure will strengthen debt markets and stimulate their liquidity. Musah, Badu-Acquah and Adjei (2019) and Panizza (2008a) add that to attract and maintain investor interest, the government should publish bonds issue calendar and the outcome of auctions and develop mechanisms to make inter-day pricing more transparent, in addition to a consistent secondary market pricing.

IOSCO (2002) found that tax on bond market transactions impedes liquidity and is a deterrent to bonds' issuance, particularly in the primary market. Researchers encourage governments to remove withholding taxes to promote investor participation in public debt markets and make them more liquid (Fabella & Madhur, 2003; Mbewa, Ngugi & Kithinji, 2007).

The literature also discusses other ways of deepening and fostering liquidity in LCBMs. These options include developing repurchase (repo) agreements[69], broadening the range of debt securities (e.g., by including infrastructure project bonds, securitised assets, green bonds[70], diaspora bonds, state-owned enterprises bonds, municipal bonds, etcetera, with all of them dedicated to infrastructure projects), and opening up LCBMs to regional participants (ACBF, 2016; Kamba, 2015; Mezui, 2012; Mezui & Hundal, 2013; Mohanty, 2002; Plummer & Click, 2005).

4.2.3 Summary literature on the state of liquidity in African bond markets

Several studies which have examined the state public bond market liquidity in Africa have mixed views. For example, in a study of 27 sub-Saharan African countries from 1980-2000, Christensen

[69] "Repos enhance bond market liquidity by allowing market participants to borrow against their portfolio or securities, generally below the unsecured borrowing rate" (Mohanty, 2002, p. 63). For example, Park (2016) found that the introduction of bond buybacks and exchanges, stimulated secondary market liquidity in Asian LCBMs.

[70] According to Ehlers and Packer (2017, p. 1), "green bonds are fixed income securities which finance investments with environmental or climate-related benefits." The green bonds can be packaged in the form of corporate bonds, project bonds or asset-backed security (ABS) bonds to finance climate-resilient projects via the capital market. Several scholars posit that green bonds have potential to bridge the infrastructure funding gap (AfDB, 2016; Caminha, 2020; Humphrey, 2015; Ng & Tao, 2016; Ordonez, Uzsoki & Dorji, 2015).

(2005) found that African public debt markets lack depth and offer debt instruments with a highly short-term tenor and narrow investor base. Furthermore, Masetti et al. (2013) observe low turnover in SSA bond markets, particularly in the secondary markets. Primarily, short-maturity debt securities are issued, except in South Africa and Nigeria. Thus, the authors argue that lack of long-term maturities impairs investment by foreign investors and institutional investors (e.g., pension funds, insurance companies, mutual funds, etc.). Essers et al. (2016) noted that most SSA debt markets, except for South Africa and Nigeria, are characterised by very low liquidity, mainly because of 'buy-and-hold investor strategies/or culture.

Essers et al. (2016) reviewed the liquidity status of government secondary bond markets of 21 SSA countries in terms of the bid-ask spread measures (in basis points (bps)) as of 2013. Their findings are that 43% of bond markets are illiquid, including Burundi, Eswatini, Lesotho, Madagascar, Malawi, Rwanda, etc. About 29% of secondary markets are considered mildly liquid, with bid-ask spreads ranging between 50bps and 100bps. These countries include Ghana, Kenya, Mauritius, Tanzania, Uganda and Zambia. The Botswana market recorded the bid-ask spread averaging 20bps, making it a moderately liquid bond market. Nigeria and South Africa are the most liquid secondary markets, with bid-ask spreads ranging from 3-12bps and 2-5bps, respectively.

Tyson (2015) observed that weak policies exist in some SSA countries, hindering the flow of private bond liquidity. Adetiloye et al. (2015) also find that ineffective policies and transparency contributed to the erosion of investor confidence in the Nigerian capital market. The lack of transparency in the market manifested from the Capital Market Authorities, who withheld information about markets' operations.

4.3 Methodology and Description of the Survey-Dataset

We conducted this study using a survey instrument on 304 respondents from Botswana, Ghana, Kenya, Mauritius, Nigeria, Rwanda, South Africa (SA), and Tanzania. These countries were selected because they have active capital markets; hence, we had a greater chance of accessing data from the bond market participants (Agyemang-Badu et al., 2021; Dafe et al., 2018). Secondly, as of 2010, approximately 81% of the SSA LCBM capitalisation is concentrated in these eight countries (Essers et al., 2016). Finally, these countries are representative of the low-income, lower-middle-income and upper-middle-income groups as classified by the World Bank (Berensmann et al., 2015c).

Figure 4.2 displays the profiles of the 304 respondents whose opinions were captured in the survey.

Figure 4.2: Profile of survey participants

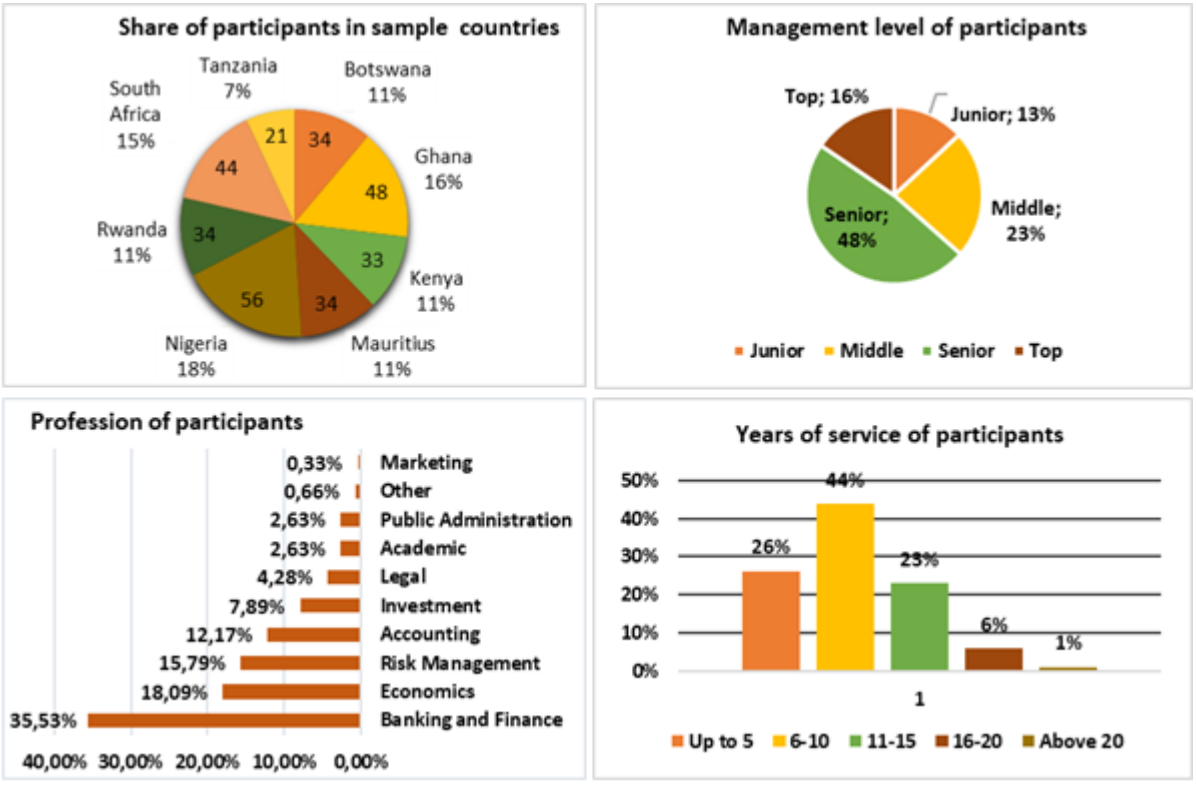


Figure 4.2 shows that the study engaged professionals in various areas with banking and finance, investments, risk management, and economics, constituting over 70% of the sampled respondents. All respondents are on multiple levels of management; the bulk (74%) had over 6 years of work experience and, therefore, would have good knowledge of the economics and microstructure of financial markets. Almost 50% of the respondents were from Nigeria, South Africa, and Ghana, but the rest of the countries were also well represented.

The largest share of respondents was from financial institutions, which constituted 75.7% of the sample size, followed by 10.2% from public institutions, which included security issuers, investors, intermediaries, and debt market participants. In particular, the survey covered 24 business types, with commercial banks (28.3%), insurance (13.2%), and central banks (11.5%) constituting the majority of participating organizations.

The questionnaire, attached as Appendix A-5.1[71], was developed based on existing literature. The questionnaire consists of questions using a seven (7)-point Likert scale (such as strongly disagree (L1) to strongly agree (L7), dichotomous questions requiring a choice of either a "Yes"

[71] Please note that the questions for this chapter are Q1-6 & 20-25 on the Survey Questionnaire.

or “No”, and open-ended questions (OEQs). The OEQs were used to enrich the dataset. This survey was preceded by a pilot study as widely recommended in the literature (e.g. Creswell, 2013; Hassan et al., 2006).

We use tables, figures, and graphs to present survey findings and qualitative content analysis in NVivo QSR to analyse and interpret data from open-ended questions. The debt market literature themes guided inductive coding using NVivo (Braun & Clarke, 2006; Christensen et al., 2016; Singer & Couper, 2017; Züll, 2016).

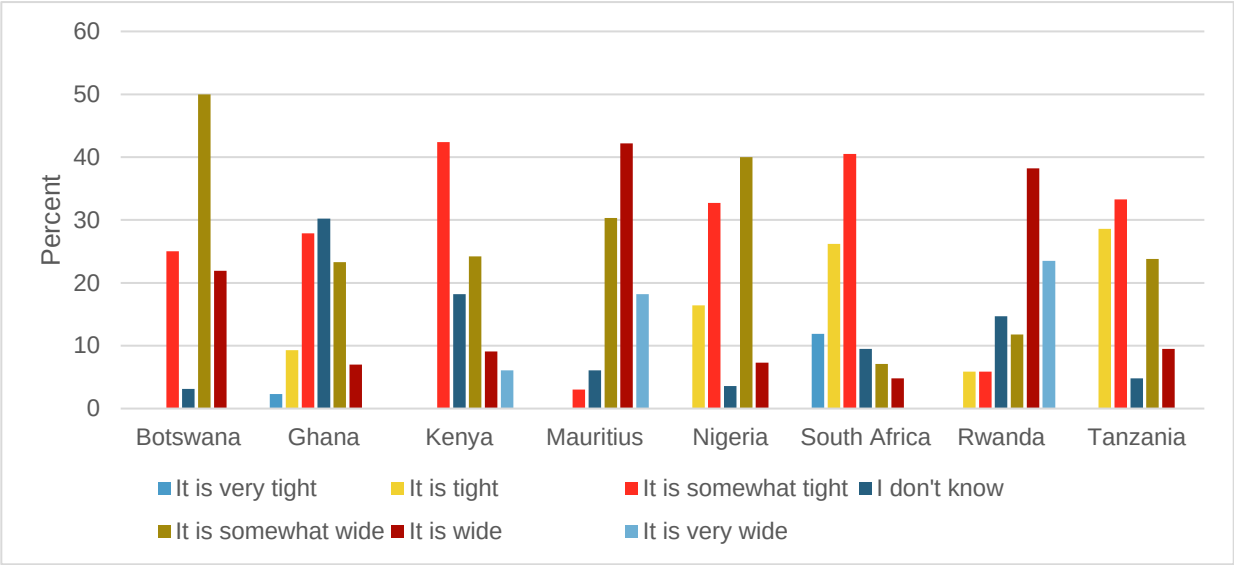
We also conduct some statistical difference tests to establish relationships within groups in tables. Specifically, we employ the t-test for independent samples; the Mann-Whitney U test to compare differences between two independent groups when the dependent variable is either ordinal or continuous; and the Kruskal-Wallis H test to test the independence of more than two groups. Kruskal Wallis test indicates that at least one sample stochastically dominates one other sample. The test does not assume a normal distribution and compares variances (Kruskal & Wallis, 1952). The study uses the above three tests, although the Kruskal-Wallis test is given more weight due to the nature of our data which is ordinal.

4.4 Findings and Discussion

4.4.1 Bond market liquidity

Table 4.3 below shows how the respondents viewed the state of liquidity of government public debt markets of selected SSA countries in terms of tightness, measured using the bid-ask spread of a 10-year government debt security. Bid-ask spread provides an idea of the transaction costs (i.e., the difference between buying and selling prices). A relatively lower spread reflects greater market liquidity (Mohanty, 2002).

Figure 4.3: Liquidity measured by the bid-ask spread[72]



Source: Authors' assembled data from SSA cross-country survey. On the vertical axis, we have the %age share of respondents who selected respective government debt tightness; on the horizontal axis, we have a country name and the different tightness categories.

Respondents have mixed views on the liquidity state of government public debt markets in the sampled countries. On the top of the list is South Africa, ranked liquid as it recorded a higher share of debt market tightness[73]. This is followed by Ghana, Kenya, Nigeria, and Tanzania, with respondents ranking the government public debt markets as moderately liquid. The government public debt markets with relatively low liquidity[74] are in Botswana, Mauritius and Rwanda. The findings regarding Nigeria's liquidity status and South Africa's are consistent with the literature, which records that they are largely liquid (Dafe et al., 2018; Essers et al., 2016; Kapingura & Ikhide, 2015). The findings concerning Ghana, Kenya, and Tanzania are unsurprising, given Essers et al. (2016) recorded the bid-ask spread of secondary markets in these countries to be

[72] (a) "Very tight" = up to 20bps (very liquid) (b) "Tight" = >20 – 50 bps (Liquid) (c) "Wide" = >50 – 100 bps (poor liquidity) (d) "Very wide" = >100bps (extremely poor liquidity) (Essers et al., 2016). Additionally, the prefix "somewhat" means 'just barely and/or not very much at all.'

[73] South Africa: it is very tight per 11.9% of the respondents, it is tight per 26.2% of the respondents. Ghana: it is very tight per 2.3% of the respondents, it is tight per 9.3% of the respondents. Kenya: it is somewhat tight per 42.4% of the respondents. Tanzania: It is somewhat tight per 33.3% of the respondents, it is tight per 28.6% of the respondents. Nigeria: It is somewhat tight per 32.7% of the respondents, it is tight per 16.4% of the respondents.

[74] Rwanda: it is wide per 38.2% of the respondents, it is very wide per 23.5% of the respondents. Mauritius: it is wide per 42.2 % of the respondents, it is very wide per 18.2 of the respondents. Botswana: it is somewhat wide per 50% of the respondents, wide per 21.9% of the respondents.

approximately 50 basis points (bps) as of 2013. On the other hand, the respondent's perception of liquidity levels in Botswana and Mauritius is surprising because Essers et al. (2016) ranked the liquidity in the secondary market of these two countries to range between 50 bps and 100 bps, which places them in a mild liquidity range. Essers et al. (2016) found secondary markets in Rwanda to be very illiquidity; hence, our finding about this market is not surprising.

Since the public corporate bond market development takes a cue from government bond market developments, respondents in almost all sampled countries except South Africa and Nigeria perceive the liquidity in this segment of the public debt market as largely illiquid. Authors such as Andrianaivo and Yartey (2010) and Dafe et al. (2018) concur. The implication is that the illiquid corporate bond markets would not have the capacity to facilitate the mobilisation of and channelling of debt funds towards plugging the huge financial infrastructure gap in SSA unless drastic policy reforms are implemented to stimulate growth of public debt markets.

4.4.2 Determinants of public debt market liquidity

When asked to consider how important the list of measures/factors that affect government and corporate debt markets' liquidities, the respondents' rankings which range from 'not at all important' to 'very important', are reported in Table 4.1 below. Judging by the proportion of respondents who highly ranked the options "important" or "very important" (combined), the results in the table reveal that the respondents ranked the following five top factors as necessary for enhancing both the government and corporate bond markets' liquidity, with the percentage of respondents who ranked both "important" and "very important" in parenthesis*: issuance of long-term maturity government bonds* (74.6%), *widening the investor base* (73.2%), *availability of a wide range of instruments in bond markets* (71.8%), *enhancing information disclosure systems* (62.8%, and, *promoting the activities of primary dealers* (62.4%). Also, 57% of respondents ranked both *'reducing issuer costs'* and *'integration of regional bonds'* in the 6th position. In other words, this finding implies that if attention is paid to addressing the six factors identified, there is a chance that liquidity in public bond markets in SSA would improve. These findings are consistent with the literature (see Braun & Briones, 2006a; Fabella & Madhur, 2003; Mohanty, 2002; Musah et al., 2019; Park, 2016; Peiris, 2010).

Table 4.1: Factors That Determine Government Debt Market Liquidity

	Scale	L1	L2	L3	L4	L5	L6	L7
1	***Issuance of long-term maturity government bonds***	***0.0***	***5.2***	***2.7***	***6.2***	***11.3***	***52.7***	***21.9***
2	***Widening the investor base***	***0.0***	***3.9***	***2.8***	***6.7***	***13.4***	***45.6***	***27.6***
3	***Availability of a wide range of instruments in bond markets***	***0.0***	***3.2***	***3.9***	***7.0***	***14.1***	***43.6***	***28.2***
4	***Enhancing information disclosure systems***	***1.4***	***9.1***	***4.6***	***7.4***	***14.7***	***35.1***	***27.7***
5	***Promoting activities of primary dealers***	***0.0***	***3.6***	***3.6***	***7.9***	***22.5***	***41.3***	***21.1***
6	***Reducing issuance costs***	***1.1***	***7.5***	***3.6***	***8.2***	***20.4***	***36.7***	***22.5***
7	***Integration of regional bond markets***	***0.7***	***6.3***	***4.5***	***9.1***	***22.4***	***40.9***	***16.1***
8	***Easing restrictions on market access***	***1.4***	***9.5***	***5.6***	***8.1***	***18.4***	***32.4***	***24.6***
9	***Introducing more sophisticated financial instruments***	***1.1***	***6.3***	***5.6***	***15.1***	***22.2***	***36.3***	***13.4***
10	***Other enhancing measures***	***1.6***	***4.8***	***7.9***	***15.9***	***20.6***	***33.3***	***15.9***
11	***Relaxing investment criteria for institutional investors***	***1.4***	***9.1***	***6.7***	***11.9***	***22.1***	***35.4***	***13.4***

Source: Authors' assembled data from SSA cross-country surveys

Key for Likert scale: *L1=Not at all important, L2=Unimportant, L3 = Somewhat unimportant, L4=Neither important nor unimportant, L5=Somewhat important, L6=Important, L7=Very important*

Notably, Table 4.1 hides the inter-country differences in ranking the most critical factors driving government bond market liquidity. We conducted a Kruskal-Wallis difference test to determine the inter-country differences in terms of essential factors in enhancing government public debt market liquidity. The results of the test are reported in Table 4.2 below. The p-values are all below the 0.005 significance level for all the Kruskal-Wallis H Statistic[75]. This result means that the Kruskal-Wallis test found significant differences among respondents from different countries regarding the importance of the liquidity factors listed in Table 4.1. These inter-country differences are shown in how respondents ranked the factors reported in Table 4.1. For the factor of relaxing investment criteria of institutional investors, Botswana has the highest share of 34.4 % of the respondents, pointing out that this factor is unimportant to them. Similar patterns for Botswana are also shown for factors about reducing issuance cost (31.3 %), enhancing the information disclosure system (18.8 %), and easing restrictions on market access (34.4 %). Under these factors, Botswana has the highest share of its respondents rating these factors as unimportant. Rwanda has 15.2 % of its respondents mentioning that promoting activities of primary dealers is unimportant. With a 12.5 % share of its respondents, Ghana is the highest, stating that introducing more sophisticated financial instruments is unimportant. Kenya and

[75] Issuance of long-term maturity government bonds ($\chi2(7) = 39.786$, $p<.001$), Integration of regional bond markets ($\chi2(7) = 58.603$, $p<.001$), Availability of wide range of instruments in bond markets ($\chi2(7) = 28.955$, $p<.001$), Widening the investor base ($\chi2(7) = 34.817$, $p<.001$), Easing restrictions on market access ($\chi2(7) = 42.813$, $p<.001$), Enhancing information disclosure systems ($\chi2(7) = 38.707$, $p<.001$), Promoting activities of primary dealers ($\chi2(7) = 36.554$, $p<.001$), Reducing issuance costs ($\chi2(7) = 20.653$, $p<.001$), Introducing more sophisticated financial instruments ($\chi2(7) = 46.572$, $p<.001$), and Relaxing investment criteria for institutional investors ($\chi2(7) = 31.283$, $p<.001$) were documented as measures for enhancing government and corporate bond markets' liquidity.

Nigeria have 14.3 and 16.7 %, respectively, of their respondents asserting that other enhancing measures are unimportant. These country variations are masked in Table 4.1, as is now revealed by the Kruskal Wallis difference test outcomes.

Table 4.2: Kruskal Wallis difference test

	Kruskal-Wallis H Statistic	*df*	*P-value*
Issuance of long-term maturity government bonds	*39.786*	*7*	*0.000*
Integration of regional bond markets	*58.603*	*7*	*0.000*
Availability of a wide range of instruments in bond markets	*28.955*	*7*	*0.000*
Widening the investor base	*34.817*	*7*	*0.000*
Easing restrictions on market access	*42.813*	*7*	*0.000*
Enhancing information disclosure systems	*38.707*	*7*	*0.000*
Promoting activities of primary dealers	*36.554*	*7*	*0.000*
Reducing issuance costs	*20.653*	*7*	*0.000*
Introducing more sophisticated financial instruments	*46.572*	*7*	*0.000*
Relaxing investment criteria for institutional investors	*31.283*	*7*	*0.000*
Other enhancing measures	*13.786*	*7*	*0.055*

Source: Authors' assembled data from SSA cross-country surveys.

The Mann-Whitney test (reported in Appendix Table A-4.1) showed significant differences between Nigeria and Tanzania and between Mauritius and Tanzania. The share of Tanzania respondents is more significant than those from Nigeria, as they ranked the option *very important* under all the factors displayed in Table 4.1. The most remarkable difference is shown by the *very important* category for relaxing investment criteria, with Tanzania having a share of 38.1 % while Nigeria has a share of 0.0 %. Under the *very important* category of "availability of a wide range of instruments in bond markets", Tanzania has a share of 66.7 %, and Nigeria has a share of 22.2 %. There is more similarity of views between South Africa and Kenya and between South Africa and Rwanda in all the ten categories displayed in Tables 4.1 and 4.2. South Africa and Kenya both have their greatest shares found under the option *very important* for all the factors. The two countries' highest similarity of views comes under the factor "relaxing investment criteria for institutional investors," where they all have a 50 % share in the *very important* category. These country differences show the presence of country-specific variations in factors that influence government debt market liquidity.

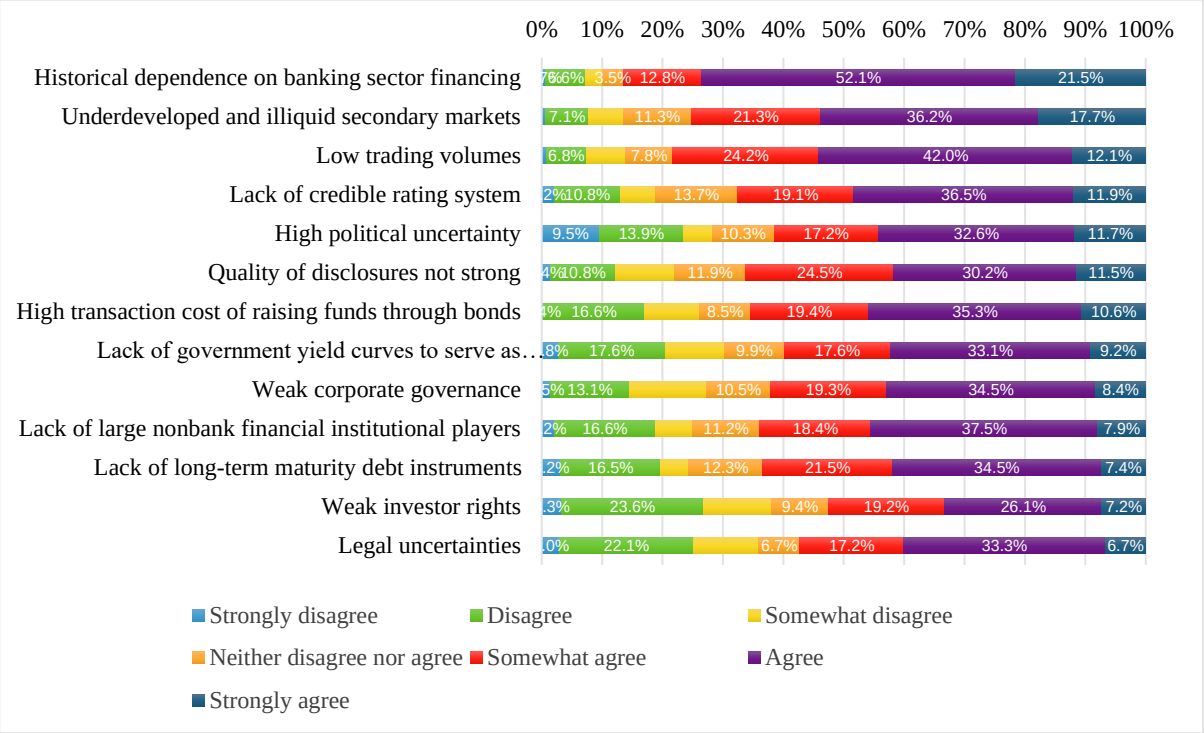
4.4.3 Factors that impede corporate public debt markets development

A survey question asked the extent to which respondents agreed or disagreed with the list of statements deemed to be the causes of the lack of development in corporate bond markets in their countries. The responses are reported in Figure 4.4. Findings revealed that "the historical dependence on banking sector finance" (73.1 %)[76], followed by "low trading volumes" (54.1%)

[76] The percentage figures in parenthesis are a combination of respondents who selected options "agree" and "strongly agree" (e.g., 52.1%+21.5%= 73.6%).

and "underdeveloped and illiquid secondary markets" (53.9%) are the key factors that impede the development of corporate public debt markets in SSA. The literature affirms these findings (see Beck et al., 2011; Sophastienphong et al., 2008).

Figure 4.4: Factors causing lack of development in the corporate bond market



Source: Author's assembled data from SSA cross-country survey

Table A-4.2 in the Appendix shows the Kruskal-Wallis test results, which found significant differences among respondents from different countries regarding all the factors captured in Figure 4.3. A good example is the overall low priority given to factors like "legal uncertainties," "weak investors' rights," "high political uncertainty," and "lack of long-term maturity debt instruments," as shown in Figure 4.2. We, however, observe that some countries give relatively high priority to these factors. These inter-country differences reported in Table A-4.2 support the finding of the Kruskal-Wallis test. Nigeria (49.1%), Kenya (44.8%), and Rwanda (43.8%) are the countries that give high priority to *legal uncertainties*, while the remaining countries provide a low priority to this factor.

Contrary to other countries in the survey, South Africa (36.6 %), Nigeria (33.3%), and Mauritius (30%) give more priority to weak investor rights. Unlike other countries, Kenya (55.2%), Nigeria (45.1%) and Rwanda (34.4%) provide relatively high priority to high political uncertainty. This could be because, at some point in their history, these countries have experienced political crises that have negatively impacted investor confidence. For instance, the Rwandese civil war in the early 1990s is one such political crisis still in respondents' memory. Adetiloye et al. (2015), in a

study of constraints on capital market growth in African countries, found instability of political and government policies to impact the development of the Nigerian capital market negatively. The inter-country difference is driven by different country dynamics and evolutions of their public debt markets.

4.4.4 Effects of tax policies on debt market development

Taxation policies on debt securities differ from country to country. This particular survey question aimed to assess the degree to which tax policies in the countries surveyed are similar or different, as well as see if it influences investor participation in public debt markets and perhaps affect liquidity through increased transaction volumes (in that of favourable tax policy). Of the 304 total participants in the survey, only 163 answered this question on tax; the remainder, 141, opted out as they were unfamiliar with tax systems in their countries[77].

Our findings in Table 4.3 reveal that a significant number of respondents (50.6%) report no differences in the tax rates applied to securities investment on local or foreign investors. This practice is good for the general bond market liquidity (Fabella & Madhur, 2003; Kamanga, 2010). Second, about 49.1% of the respondents note that their countries have double tax treaties with other nations whose residents invest in the domestic capital markets. This taxation policy is favourable for bond market liquidity, as tax treaties exempt tax payments by investors from those particular countries. More foreign investors will earmark investing in such countries to enjoy tax exemption treaties, which improves bond market liquidity. Third, according to about 50.1% of the respondents, most countries have no withholding taxes for resident investors. Again, this policy is progressive and is confirmed in the extant literature (Luengnaruemitchai & Ong, 2005), except for Botswana, which has differential tax rates for residents and non-resident investors.

[77] The online Survey Monkey questionnaire was designed in a way that it checks the competence of respondents to answer the Tax questions before proceeding to the Tax questions. After answering the competence check question, those respondents who make either of the following selections: "moderately familiar", "quite familiar" or "extremely familiar" on the 5-point Likert scale, were led to answer the questions in the relevant section. On the other hand, a selection of either "slightly familiar," or "not at all familiar" guided the respondent to skip answering the applicable questions. Such structuring of questions are designed to ensure that respondents answer questions in the area they are familiar with. At the same time the perceived questionnaire length is reduced since the software program manages the skip patterns (Evans & Mathur, 2005).

Table 4.3: Tax treatments of debt securities

SCALE	L1	L2	L3	L4	L5	L6	L7
There are no withholding taxes (WHTs) for resident investors	14.7	19.0	8.0	3.1	4.3	39.9	11.0
There are no WHTs for non-resident investors	12.5	26.3	8.8	8.1	13.6	24.4	6.3
Treasury bills are tax-exempt	5.6	21.1	6.2	13.7	10.6	31.6	11.2
There is an exemption on capital gains tax on specific securities listed on capital markets	0.6	9.4	13.1	10.6	18.1	35.0	13.2
The country has double tax treaties with other nations whose residents invest in the domestic capital markets	2.5	6.9	5.0	11.3	25.2	42.8	6.3
There are no differences in the tax rates that are applied to securities investment on local or foreign investors	2.5	11.3	10.6	11.3	13.7	45.0	5.6
Interest on Treasury bills is subject to personal and corporate taxes	3.8	16.5	9.5	19.6	15.2	31.0	4.4
Interest paid to non-resident investors in bonds issued by the government is exempt from tax	6.3	24.5	6.9	14.5	15.1	28.9	3.8
Capital gains realized on disposal of listed securities are tax exempt	3.1	14.4	5.6	10.0	16.3	38.1	12.5

Source: Authors' assembled data from SSA cross-country survey.

***Key for Likert scale**: L1=Strongly disagree, L2=Disagree, L3 =Somewhat disagree, L4=Neither disagree nor agree, L5=Somewhat agree, L6=Agree, L7=Strongly agree*

The Kruskal-Wallis test found significant differences among respondents from different countries regarding their agreement level on the effects of the tax on government debt markets' liquidity (see Appendix Table A-4.3)[78]. The difference is brought by some countries, which still have stringent tax systems on government debt instruments. Unlike other countries, respondents in Botswana (50 %), Ghana (42.9 %), and Tanzania (20 %) strongly disagree that there are no withholding taxes for resident investors. Distinct from other countries, respondents from Tanzania (20 %) and Botswana (37.5 %) strongly disagree that there are no withholding taxes for non-resident investors. Dissimilar to other countries, respondents from Kenya (40.9 %), Botswana (39.1 %), and Tanzania (53.3 %) disagree that treasury bills are tax exempted.

Concerning interest paid, respondents from Tanzania (53.8 %), Kenya (42.9 %), Rwanda (42.1 %), and Botswana (33.3 %) disagree that interest paid to non-resident investors in bonds issued by the government is exempted from tax. The observation shows that Botswana, Tanzania, and Kenya are among the SSA countries that need tax system reforms to enhance debt market liquidity. One area that needs rationalisation is "withholding tax." Several countries (e.g., Mauritius, Nigeria, and South Africa) exempt all investors in debt securities from paying WHTs.

[78] There are no withholding taxes for resident investors ($\chi2(7) = 64.166$, $p<.001$), There are no withholding taxes for non-resident investors ($\chi2(7) = 76.354$, $p<.001$), Treasury bills are tax-exempt ($\chi2(7) = 70.209$, $p<.001$), There is an exemption on capital gains tax on specific securities listed on capital markets ($\chi2(7) = 15.081$, $p<.05$). The country has double tax treaties with other nations whose residents invest in the domestic capital markets ($\chi2(7) = 15.764$, $p<.05$). Interest on Treasury bills is subject to personal and corporate taxes ($\chi2(7) = 14.209$, $p<.05$) , and Interest paid to non-resident investors in bonds issued by the government is exempt from tax ($\chi2(7) = 56.739$, $p<.001$) as statements regarding bond markets tax policy.

Luengnaruemitchai and Ong (2005) observed that WHT and threats of increasing other taxes strongly deter foreign investors from participating in domestic markets.

4.4.5 Strategic issues to improve the liquidity of the public debt market and policy reforms

Two questions (23 and 25) addressed issues regarding enhancing public debt market liquidity and related policy reforms. Question 23 addressed any other information respondents thought would enhance the bond market's liquidity. The second question (number 25) required the respondents to suggest any policy reforms they believe should be implemented in their country or region to stimulate the development of bond markets as a financing vehicle for infrastructure. Fifty-six (56) or 18.4% and 47 (15.5%) respondents provided information to the first and second questions, respectively. The thematic analysis approach and inductive coding were employed to analyse open-ended response data using NVivo software. We also note that some responses provided in answer to the two OEQs overlapped to a certain extent. Hence, we categorize the findings into sub-sections 4.4.5.1-4.4.5.2 below.

4.4.5.1 Thoughts on how to enhance liquidity in public debt markets

Several respondents recommended that some governments lift capital controls to attract foreign investors, particularly Hedge Funds. Issues raised were centred on permitting foreign investors to buy all types of debt market securities (without capital controls). The absence of capital controls facilitates the development of bond markets since openness to foreign portfolio investments would encourage access to domestic debt markets by non-resident investors, which often promotes good corporate governance in local firms (Adelegan & Radzewicz-Bak, 2009). This concern implied that not all SSA countries currently allow foreign investors to participate in trading all debt instruments. Some interviewees cited that other SSA countries allow foreigners to invest in bond markets but are restricted to sovereign debt securities with lower maturity.

One respondent said:

> *"Open a capital account for foreigners to mobilise capital from external sources."*

Second, some respondents repeatedly raised education, training, and publicity themes. This theme focused on raising primary dealers' skills to efficiently and effectively execute their duties in promoting liquidity in government and corporate secondary markets.

> *"We need capacity building of market, e.g., professional certification and continuous professional development (CPD) programs for the dealers."*

Some of the constraints to bond market development in Rwanda are attributable to the lack of institutional capacity and human capital, particularly in primary dealerships. This observation is consistent with Kamanga (2010) and Thotho (2017), who found that primary dealers in the MEMFI region generally lacked the competency to do their work.

Notably, the respondents also identified the need to educate the public to increase awareness about the bond market. Respondents suggested that the public should be financially educated to understand the benefits of savings/investments. Such ideas emanate from the view that many potential investors have low levels of financial literacy and do not understand the investment options in the market nor understand how capital markets operate. As one respondent remarked:

> "*Educate the public about the benefits, risks, and liabilities associated with capital markets, particularly the fixed income market."*

Others suggest that when floating government bonds, the mass media should be requested to publicise the information and encourage the public to participate.

> *".....when floating government bonds, the mass media should publicise the information and encourage the public to participate."*

The issue of educating the public about capital markets is fundamental. The idea is that when the public is equipped with financial knowledge and information, this will encourage the public to buy government securities when floated, and there is a greater chance of broadening retail investors' base as a result of such awareness campaigns (Adetiloye et al., 2015; Musah et al., 2019; Swamy, 2014).

Third, we found that some respondents encouraged their governments to widen the captive base of retail investors by attracting more informal sector participation by introducing user-friendly digital platforms. They cited the Kenyan development, where the government launched a retail bond market platform called M-AKIBA, which sells fixed-income contracts via mobile phones. Ndung'u (2018) and Kamba (2015) concur.

Fourth, respondents also raised issues surrounding the yield curve. Several respondents noted that the lack of a reliable yield curve in their LCBMs affected development and liquidity in secondary debt markets. These sentiments were expressed more by respondents from Botswana, Mauritius, and Rwanda, who felt that introducing a wide range of benchmark issuances with more tenors, e.g., 2, 3, 5, 7, 10, 15, 20, 25, 30-year government bonds, will help to regularly provide reliable yield curves and stimulate liquidity in secondary markets. One respondent mentioned that:

"Policymakers should implement measures to improve the government debt-based yield curves, e.g., by regularly issuing government securities, particularly with long tenors."

These findings concur with the literature, emphasising that government benchmark securities' creation is an essential element of a well-functioning government securities market (Batten & Szilagyi, 2007; Musah et al., 2019; World Bank & IMF, 2001).

Finally, respondents suggested deepening LCBMs by introducing more sophisticated financial instruments, such as infrastructure project bonds, diaspora bonds, green bonds, and securitised debt assets[79]. This initiative includes increasing the issuance of state-owned enterprise bonds and municipal bonds backed by government guarantees. For example, one of the respondents had this to say:

"*Allow state-owned enterprises, municipalities, and diaspora bonds for dedicated infrastructure."*

"Introduce bonds for long-term infrastructure projects and provide legislation that allows securitisation of assets to be issued against infrastructure assets…."

In support of the above initiative, some respondents recommended that public bond markets in SSA should broaden their issuer base by attracting, for example, state-owned enterprises, municipalities and supranational institutions such as the African Development Bank, the International Finance Corporation, Afreximbank, etc. Literature supports the initiatives and/or recommendations (Kim et al., 1998; Mohanty, 2002; Spiljard, 2011; Tripathi & Dixit, 2019).

Other initiatives suggested also include the development of markets for repurchase (repo) agreements. The literature also supports all the suggestions mentioned above (see Biekpe & Kodongo, 2019; Ehlers & Packer, 2017; Ehlers, Packer & Remolona, 2014; Kodongo, 2013; Lemmon et al., 2014; Mezui, 2013; World Bank Group, 2016).

4.4.5.2 Policy reforms and thoughts

The issues around infrastructure funding support include introducing special purpose vehicles, issuing bonds against infrastructure, enforcing pertinent disclosure laws, introducing

[79] Bond derivatives such as infrastructure project bonds, diaspora bonds, green bonds, and securitized credit obligations enable capital markets for infrastructure financing by allowing investors to gain exposure to the performance of infrastructure projects while protecting themselves from potential credit risk. Infrastructure project bonds are typically issued by governments, private-sector companies, or development finance institutions (DFIs) and are designed to provide long-term financing for infrastructure projects, such as construction and engineering projects, energy projects, and transportation projects.

infrastructure bonds, creating long-term infrastructure bonds, and fostering tax exemption on infrastructure bonds, among other ideas. The overall thrust of the above issues suggests that the respondents advocate for implementing policy reforms that promote the issuance of infrastructure project bonds in domestic bond markets to facilitate raising funds for infrastructure development. Secondly, they suggest implementing regulatory policy reforms for pension funds and mutual funds to enable these instruments and/or institutions to play a more significant role in promoting liquidity in the domestic public debt markets.

Thirdly, the participants emphasise the need for securitisation legislation to support project bonds issued against infrastructure assets, Public-Private Partnership (PPP) policy, and regional integration of bond markets. They recommend securitising infrastructure assets against corporate bond issuance and provide legislation allowing long-term infrastructure project bonds to be issued. The issue of confidence and governance was also cited, alongside the need for meaningful tax incentives to institutions that fund infrastructure; for instance, the interest income on infrastructure bonds should be tax-exempt.

4.5 Summary Findings and Associated Recommendations

Considering the primary purpose of the study is to explore how bond markets can be developed into viable mechanisms for closing the infrastructure funding gap in the SSA region, this chapter examines how liquidity on Africa's public debt markets can be increased to provide financing for infrastructure. Surveys were conducted in 8 SSA countries: Botswana, Ghana, Kenya, Mauritius, Nigeria, Rwanda, South Africa, and Tanzania. Using the bid-ask spread as a measure of liquidity, we found that Ghana, Kenya, Nigeria, South Africa, and Tanzania have relatively more liquid government bond markets among the sample countries. We also found that Botswana, Mauritius, and Rwanda had relatively low levels of liquidity in their government bond markets.

To promote market liquidity in LCBMs, the study found that offering government bonds with long maturities, broadening the investor base, providing a range of instruments, promoting the activities of primary dealers and integrating regional bond markets are the five most important factors considered to be very important.

Similarly, the study found that the five main factors hindering the development of corporate bond markets are: the heavy dependence of companies on financing from the banking sector, the low trading volumes in the corporate bond market, the underdeveloped and illiquid secondary markets, the lack of large institutional investors outside the banking sector and the lack of an efficient reference curve for government yields. Furthermore, Botswana, Kenya, and Tanzania need to reform their tax systems to enhance debt market liquidity, especially concerning WHT.

Finally, we found that introducing more sophisticated financial instruments, such as infrastructure project bonds, diaspora bonds, green bonds, and securitised debt assets, will deepen LCBMs and equip them to finance infrastructure. This initiative includes increasing the issuance of state-owned enterprise bonds and municipal bonds backed by government guarantees.

Given the identified shortcomings in the LCBMs, and the desire to utilise public debt markets to provide long-term financial resources for bridging the infrastructure funding gap in existing SSA, we make the following policy recommendations.

Policymakers should put in place a comprehensive policy roadmap and sound regulatory framework that supports the sequential development of both types of bond markets. For example, start by creating efficient primary markets for government securities with a range of maturities (e.g., from 91 days to 30 years). The deep government debt markets are essential for creating robust yield curves, a base for benchmarking prices of other issues, particularly corporate bonds. Second, establish robust and vibrant secondary markets for government issuances to facilitate trading and availability of yield curves to serve as a risk-pricing vehicle. After this phase is achieved, governments can encourage and/or support the development of primary and secondary corporate bond markets.

Institute banking sector reforms as a strategy to make it more effectively complementary to public debt markets and, thus, capable of stimulating bond markets development. Notably, top-level banks can serve as primary market dealers of Treasury debt auctions, particularly as natural users of Treasury bills and bonds for liquidity management. The terms of their primary dealership must be carefully nuanced to avoid the temptation of parking deposits in the purchase of Treasury debts at the expense of credit creation and full intermediation.

Implement policy reforms that promote the issuance of infrastructure project bonds, green bonds, and securitized debt assets in domestic bond markets to facilitate raising funds for infrastructure development. Additionally, implement regulatory policy reforms for pension funds, mutual funds, and WSFs to significantly enable these instruments and/or institutions to promote liquidity in the domestic public debt markets.

Introduce measures to promote a stable macroeconomic environment, strengthen institutions to encourage a wide range of issuers to participate in the market (such as PPPs, SOEs, municipalities, supranational institutions, etc.), enable regulatory reforms

for pension funds and other institutional investors to have more flexibility in holding financial assets in the infrastructure sector.

Implement policy reforms that broaden the investor base, e.g. by liberalising investment and regulatory restrictions, to encourage more resident and non-resident institutional investors and private individuals to participate in public debt markets. To attract non-resident investors, address regulatory barriers, capital controls, taxes and political risks that could limit the deepening of debt markets. To encourage retail investor participation, consider introducing a retail investor education programme/policy, promoting innovative, user-friendly digital technologies for conducting transactions, and lowering the amounts required to invest in sovereign and corporate debt.

CHAPTER 5 - CONCLUDING REMARKS AND POLICY RECOMMENDATIONS

5.1 Introduction

In this chapter, we summarise the key findings of this thesis and provide policy recommendations for each research objective.

5.2 Summary of Key Findings and Policy Implications

This study explored how the public bond markets can be developed into viable mechanisms for closing the infrastructure financing gap existing in the SSA region. Specifically, the thesis provides answers to the following research questions:

> What is the level of development at which bond markets in SSA countries can optimally fund infrastructure development?
>
> What is the current state of development of domestic bond markets in the SSA region?
>
> What possible ways can SSA countries use to make their bond markets more liquid and able to sustainably bridge the region's huge infrastructure gap?

5.2.1 Closing the Infrastructure Deficit in SSA: Is there a Role for Domestic Bond Markets?

We use panel data from 40 SSA countries from 2003 to 2018 to empirically examine the relationship between public debt markets development and the infrastructure gap. The main aim is to establish the potential of debt markets to reduce Africa's infrastructure financing gap. The main findings of the paper are as follows. First, the provisioning of government and/or corporate public debt finance reduces the infrastructure financing gap (i.e., a statistically significant negative association). Specifically, the results show that an increase of 10% in the size of government bond markets reduces the infrastructure financing gap by between 0.16% and 0.54 % of GDP, while the same change in the size of *corporate* bond markets has a larger effect on the infrastructure financing gap, reducing it by 0.36% to 1.10%. This significant finding can be interpreted in light of the fact that the private sector contributes not only financial capital but also managerial expertise to infrastructure projects that deliver low-cost and better-quality of infrastructure services.

Our second major finding is that the relationships between government public debt markets and corporate public debt markets, and the infrastructure financing gap, are nonlinear and largely indicate single to triple threshold values. The single threshold for public debt markets for SSA's overall infrastructure gap is 80.71% of GDP (against the current mean endowment of only 35.6% of GDP). In comparison, the double threshold capitalisation for corporate debt markets is 75.99% and 91.61% of GDP (against an observed mean of 15% of GDP).

Our third major finding is that the current average size of sovereign public debt markets needs to double more than the corporate public debt markets should increase more than six-fold for SSA to realise a significant reduction in its legendary colossal infrastructure financing gap. This means that debt market sizes should grow from the current average levels to these threshold levels for the SSA economies to experience substantial reductions in infrastructure deficits.

5.2.2 Domestic Public Debt Markets Development in SSA: Evidence from a Survey

To answer the second research question, we used survey data to investigate the state of public bond markets development in 8 sample SSA countries. This analysis shows that all countries sampled use a combination of the stock market exchanges, auction issuance systems, and over-the-counter as trading platforms for government debt securities. However, the stock market exchange is the most used system in the 8 SSA countries. Generally, all sampled countries use the auction system, but in Mauritius and Botswana, it appears to be the primary trading system of choice. The over-the-counter trading system is thirdly ranked and used highly in Nigeria and Ghana. However, the choice of the most appropriate auction system is a concern since most countries in SSA prefer the non–competitive auction relative to the competitive auction system. Developing bond markets should usually start with a multiple-price auction and then upgrade to a single-price auction after market participants have gained experience in bidding.

We also looked at the instruments used in benchmarking market securities, and we found that Treasury bonds and Treasury bills are the most used financial instruments used for benchmarking purposes. However, Treasury bonds are the most preferred benchmark instrument to Treasury bills. The reason is that the regular issuance of medium to long-dated debt instruments deepens the government public debt markets and facilitates the establishment of the benchmark yield curves, which are essential for reference in the pricing of corporate bond issuances.

Regarding the average maturity period of government securities, we found that the 91-day and 182-day bills are short-term financial instruments used in most SSA countries. In contrast, the 3-year to 10-year maturity bonds are the most popular medium-to-long-term financial instruments. However, the short-term nature of government securities in most African countries exposes

governments to refinancing risk. On the other hand, short-term instruments are traded in the money market to enhance their effectiveness in building up the government bond market.

We also examined the effectiveness of the government yield curve in providing a benchmark for corporate issues. We found that a significantly high number of respondents ranked the government yield curve as *somewhat effective* as a benchmark for corporate bonds. This ranking implies that respondents perceive the government yield curve not to be very effective in providing a reliable benchmark for corporate issues. The main reason is that many LCBMs do not regularly expand the maturity structure of different financial instruments. This finding reinforces the importance of developing the government bond market as the base for building up the corporate debt markets. In turn, corporate bond markets provide platforms for raising long-term project finance for infrastructure investments by PPPs and infrastructure SPVs, among others.

We also found that the development of corporate LCBMs remains uneven. The corporate bond market in South Africa is very developed, whereas the corporate bond markets in Botswana, Mauritius and Nigeria are only moderately developed. The corporate bond markets in Ghana and Kenya are still developing. Corporate LCBMs in Rwanda and Tanzania are still in their infancy stages. As a result, private investors wanting to invest in infrastructure projects in economies with less developed corporate bonds have limited access to corporate debt finance and rely on either banks or the equity market for corporate finance. Commercial banks are the captive market for government securities, followed by insurance companies and pension funds. For South Africa, insurance companies and pension funds are the most prominent big investors, while for Botswana, pension funds and Asset Managers also invest as much as commercial banks. We noticed that foreign investors, pension funds, and insurance companies hold a significant amount of outstanding government debt, but commercial banks hold most.

We found that most countries in SSA permit foreign investors to participate in their respective countries' government bond markets. However, existing laws constrain foreign investor participation, mainly in Ghana and Tanzania.

We also found that pension funds are moderately reformed in many countries in SSA to engage in infrastructure financing, albeit within statutory thresholds. The barriers that discourage pension funds from participating in corporate bond markets and infrastructure funding range from a narrow base of listed and credit-rated issuers, lack of long-term financial instruments, a limited pipeline of bankable projects, stringent regulatory practices to fund managers and trustees with limited skills and knowledge to assess risk/return profiles of infrastructure investments.

5.2.3 Improving Liquidity in Domestic Public Debt Markets for Enabling Infrastructure Financing

Finally, to answer research question three, we conducted surveys in 8 SSA countries: Botswana, Ghana, Kenya, Mauritius, Nigeria, Rwanda, South Africa, and Tanzania. Our findings suggest that liquidity in the eight- surveyed SSA countries are mild except for South Africa and Nigeria. Kenya, Mauritius, and Rwanda were found to have government bond markets with relatively low liquidity.

The study revealed that the issuance of long-term maturity government bonds; widening of the investor base; availability of a wide range of instruments in government bond markets; promotion of activities of primary dealers; and integration of regional bond markets are the top five factors that are important for fostering market liquidity in SSA public debt markets. Similarly, the study identified that the top five factors hampering liquidity and development of corporate bond markets to be corporate businesses' high dependence on banking sector finance, low trading volumes in the corporate bond market, lack of large nonbank financial institutional investors, and lack of efficient benchmark government yields curve.

The study assessed the extent to which tax policies in countries are similar or different, as well as to see if they influence investor participation in public debt markets and perhaps affect liquidity. We found that tax policies in most countries are progressive. For example, most countries do not apply different tax rates to securities investment on resident and non-resident investors, exempt tax on Treasury bills and capital gains on listed securities, have double tax treaties with other nations and have no withholding tax (WHTs) on both resident and non-resident investors. The exceptions are the following: Botswana, Ghana, and Tanzania have WHTs for resident investors. In Botswana, Kenya and Tanzania, treasury bills are not tax-exempt. This result suggests that tax reforms are in these countries to enhance liquidity.

Furthermore, this chapter also examined the thoughts and strategic issues advanced by respondents to enhance public debt market liquidity, focusing on policy issues. The respondents recommended first that some governments lift capital controls so that foreign investors can purchase debt securities of all kinds. Second, to enhance primary dealers' skills to foster liquidity in government and corporate secondary markets. Third, to educate the public about government securities so they can invest in them when the securities are floated, thereby broadening the retail investor base. Finally, introduce more sophisticated financial instruments, such as infrastructure project bonds, diaspora bonds, green bonds, and securitised debt assets, to deepen LCBMs and enable them to finance infrastructure. In addition, this initiative includes increasing the issuance

of state-owned enterprise and municipal bonds backed by government guarantees; and attracting supranational institutions such as the AfDB, IFC, and Afreximbank, among others.

5.3 Policy Implication and Recommendations:

Indeed, the empirical results strongly confirm that the public debt markets in some of the 8 SSA countries are underdeveloped and cannot significantly plug the infrastructure financing gap in the region unless substantial capital (especially public debt) markets growth and/or development are embarked upon. A valuable and clear policy implication emanating from our findings is that attention should be paid to designing policies and strategies that boost the level of government and corporate bond markets to facilitate the mobilization and channelling of substantial debt funds towards infrastructure investment. Such policy initiatives would reduce the current excessive reliance on tax revenues and official development assistance, the supplies of which are declining.

Given the identified shortcomings in the LCBMs, and the desire to utilise public debt markets to provide long-term financial resources for bridging the infrastructure funding gap in existing SSA, we make the following policy recommendations.

Overall, African governments should adopt policies that promote the development of both sovereign and corporate bond markets, focusing on deepening corporate bond markets to enable more effective infrastructure financing by a better-financed private sector. Such policy initiatives would reduce the current over-reliance on tax revenues and official development assistance, the supply of which is declining.

5.4 Limitation of the Study, and Suggestions for Future Studies

Several limitations characterised the study. The first is found in Chapter 2, where the econometric techniques were applied to a panel of 40 SSA countries covering the period 2003-2016. The length of the study period and the number of countries were determined by the availability of data for the relevant variables. However, due to the proportion of SSA countries in the panel (83%)[80], the results in Chapter 2 are generalisable to the entire SSA region. Future studies should consider including more SSA countries and increase time of study period as more data becomes available.

[80] Total number of countries in SSA is 48 [(data from: https://data.worldbank.org/country/ZG)(accessed 22.10.2022)]. Therefore 40/48 = 83.33%.

Second, the econometric work in Chapter 2 has focused narrowly on government and corporate bond capitalisation, ignoring other dimensions of LCBM development (e.g. total government and corporate bond capitalisation/issuance, bid-ask spreads, government bond yields, etc.), the role of international debt markets. Further studies that include these variables would complement this thesis and enrich the understanding of SSA LCBM's ability to finance infrastructure.

Third, the surveys in Chapters 3 and 4 included only eight (8) countries in sub-Saharan Africa. Furthermore, the countries in the sample are mainly from the economic sub-regions of Southern Africa, East Africa and West Africa, but none from Central Africa. As a result, the research findings primarily apply to the eight countries in the sample, which limits the external validity of the findings beyond Botswana, Ghana, Kenya, Mauritius, Nigeria, Rwanda, South Africa and Tanzania. However, as these countries reflect the different socio-economic and political conditions that prevail in many SSA countries, the results can be extrapolated to the entire region by inference.

The fourth limitation stems from the fact that the study in Chapters 3-4 relied on primary data collected from bond market participants. The results in these chapters are based on the accuracy and reliability of the responses. Therefore, the integrity of the results in these chapters may be affected by the accuracy and reliability of the answers provided by the respondents.

Finally, while the study has highlighted the possibilities of more innovative types of bond issuance (e.g. green bonds, diaspora bonds, infrastructure project bonds, securitised bonds, etc.) as an alternative for rapid bond market development, we have not explored this area further due to the limited amount of relevant data. As data become available, we encourage future studies to, among other things: (a) examine how the innovative types of bond issuance, including diaspora bonds, green bonds, securitised bonds, etc., will contribute to the deepening of LCBMs (b) investigate the relationship between diaspora remittances and infrastructure investment and the moderating role of bond markets in SSA, (c) empirically test the relationship between green bonds and GHG emissions[81] to provide evidence on whether green bonds can promote investment in green energy infrastructure in SSA.

[81] GHG refers to greenhouse gas emissions which includes, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) which are emitted during the combustion of fossil fuels, such as coal, oil and natural gas during the production of electricity.

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APPENDICES

Table A-2.1: List of countries sampled

	Country	Income group
1	Burkina Faso	Low Income
2	Burundi	Low Income
3	Central African Republic	Low Income
4	Chad	Low Income
5	Comoros	Low Income
6	Congo, Dem, Rep,	Low Income
7	Eritrea	Low Income
8	Ethiopia	Low Income
9	The Gambia	Low Income
10	Ghana	Low Income
11	Guinea	Low Income
12	Kenya	Low Income
13	Liberia	Low Income
14	Madagascar	Low Income
15	Malawi	Low Income
16	Mali	Low Income
17	Mozambique	Low Income
18	Niger	Low Income
19	Sierra Leone	Low Income
20	Tanzania	Low Income
21	Togo	Low Income
22	Uganda	Low Income
23	Zambia	Low Income
24	Angola	Lower middle income
25	Cameroon	Lower middle income
26	Cape Verde	Lower middle income
27	Congo, Rep,	Lower-middle-income
28	Cote d'Ivoire	Lower-middle-income
29	Nigeria	Lower middle income
30	Sao Tome and Principe	Lower middle income
31	Senegal	Lower middle income
32	Sudan	Lower middle income
33	Swaziland	Lower middle income
34	Benin	Upper-middle-income
35	Botswana	Upper middle income
36	Mauritius	Upper middle income
37	Namibia	Upper middle income
38	Seychelles	Upper middle income
39	South Africa	Upper middle income
40	Equatorial Guinea	High income

Table A-2.2: Correlation matrix

	Overall_index	infgap_index	elec_inv	elec_gap	wss_inv	wss_gap	tran_inv	tran_gap	ict_inv	ict_gap	gdpcp	gov_debt	corp_debt	smkt_cap	hdi	exch_rate	rint_rate	Δgfcfp	fdi_gdp	gov_index	infinv_index
Overall_in	1.0000																				
infgap_in	-1.0000	1.0000																			
elec_inv	-0.0373	0.0373	1.0000																		
elec_gap	-0.8476	0.8476	0.0759	1.0000																	
wss_inv	0.2050	-0.2050	0.1919	-0.0070	1.0000																
wss_gap	-0.8157	0.8157	0.0604	0.5538	-0.2683	1.0000															
tran_inv	0.0122	-0.0122	0.6459	0.0997	0.6116	-0.0146	1.0000														
tran_gap	-0.8346	0.8346	-0.0290	0.5909	-0.3238	0.7202	-0.1209	1.0000													
ict_inv	0.2035	-0.2035	0.2485	-0.0324	0.5341	-0.2137	0.5101	-0.3034	1.0000												
ict_gap	-0.7284	0.7284	0.0322	0.5693	-0.0144	0.5184	0.0364	0.4188	-0.0709	1.0000											
gdpcp	-0.0366	0.0366	-0.0374	0.0148	-0.0668	0.1019	-0.0015	-0.0267	0.0285	0.0812	1.0000										
gov_debt	0.2740	-0.2740	0.0270	-0.2673	-0.2269	-0.1527	-0.0959	-0.1050	-0.0291	-0.3697	-0.0047	1.0000									
corp_debt	0.4463	-0.4463	0.1595	-0.5115	-0.1648	-0.3989	0.0275	-0.2413	-0.0607	-0.3675	-0.0257	0.4254	1.0000								
smkt_cap	0.4999	-0.4999	-0.0913	-0.7438	-0.1347	-0.3408	-0.0958	-0.1812	-0.0608	-0.3153	-0.0232	0.1826	0.5096	1.0000							
hdi	0.8051	-0.8051	-0.0076	-0.6307	0.0686	-0.7257	0.0551	-0.7514	0.2272	-0.5654	-0.0058	0.2330	0.3589	0.3384	1.0000						
exch_rate	-0.2109	0.2109	-0.1152	0.1919	-0.1044	0.1905	-0.0677	0.1794	-0.0773	0.0830	-0.0035	0.0300	-0.1962	-0.1150	-0.2222	1.0000					
rint_rate	0.0116	-0.0116	-0.0125	0.0219	0.1693	0.0421	0.0881	-0.0040	0.1489	-0.0075	0.0021	-0.0448	-0.0476	-0.0356	0.0859	0.1125	1.0000				
Δgfcfp	0.1333	-0.1333	0.0209	-0.1165	-0.3128	-0.0420	-0.2108	-0.1265	-0.1463	-0.1481	0.0659	0.3232	0.1083	-0.0121	0.1911	0.0714	-0.0456	1.0000			
fdi_gdp	0.0114	-0.0114	0.2367	-0.0243	0.1860	0.0215	0.1026	-0.0698	0.1103	0.0584	0.0264	-0.0926	-0.1077	-0.0802	-0.0153	-0.0257	0.0680	0.0826	1.0000		
gov_index	0.5229	-0.5229	0.0260	-0.4392	0.0751	-0.4196	0.0625	-0.5117	0.1531	-0.2983	0.1273	0.2645	0.5094	0.2862	0.4714	-0.1886	0.0589	0.2031	0.0222	1.0000	
infinv_ind	0.0849	-0.0849	0.6436	0.0680	0.7444	-0.0995	0.9660	-0.2090	0.6603	0.0125	-0.0164	-0.1154	-0.0084	-0.1160	0.0897	-0.0970	0.1199	-0.2308	0.1607	0.0878	1.0000

Table A-2.3: Cross-sectional dependence test

		Breusch-Pagan LM	*Pesaran scaled LM*	*Bias-corrected scaled LM*	*Pesaran's CD*
$infgap\_index$	*Statistic*	*12257.49 (0.0000)*	*282.428 (0.0000)*	*281.062 (0.0000)*	*110.582 (0.0000)*
$elec\_gap$	*Statistic*	*4379.063 (0.0000)*	*87.884 (0.0000)*	*86.518 (0.0000)*	*41.461 (0.0000)*
$tran\_gap$	*Statistic*	*4583.132 (0.0000)*	*92.923 (0.0000)*	*91.557 (0.0000)*	*8.711 (0.0000)*
wss_gap	*Statistic*	*13011.71 (0.0000)*	*301.052 (0.0000)*	*299.686 (0.0000)*	*102.996 (0.0000)*
ict_gap	*Statistic*	*12515.03 (0.0000)*	*288.788 (0.0000)*	*287.421 (0.0000)*	*111.833 (0.0000)*
$elec\_inv$	*Statistic*	*3559.577 (0.0000)*	*67.649 (0.0000)*	*66.282 (0.0000)*	*16.341 (0.0000)*
wss_inv	*Statistic*	*8902.681 (0.0000)*	*199.587 (0.0000)*	*198.220 (0.0000)*	*84.015 (0.0000)*
ict_inv	*Statistic*	*4153.938 (0.0000)*	*82.325 (0.0000)*	*80.959 (0.0000)*	*2.997 (0.0000)*
$tran\_inv$	*Statistic*	*7660.249 (0.0000)*	*168.907 (0.0000)*	*167.541 (0.0000)*	*67.567 (0.0000)*
gov_debt	*Statistic*	*5460.186 (0.0000)*	*114.581 (0.0000)*	*113.214 (0.0000)*	*55.850 (0.0000)*
$corp\_debt$	*Statistic*	*4456.633 (0.0000)*	*89.800 (0.0000)*	*88.433 (0.0000)*	*29.860 (0.0000)*
$gdpcp$	*Statistic*	*1220.146 (0.0000)*	*9.880 (0.0000)*	*8.514 (0.0000)*	*6.817 (0.0000)*
fdi_gdp	*Statistic*	*2613.290 (0.0000)*	*44.282 (0.0000)*	*42.817 (0.0000)*	*10.208 (0.0000)*
gov_index	*P-value*	*2715.112 (0.0000)*	*46.796 (0.0000)*	*45.429 (0.0000)*	*13.097 (0.0000)*
	Statistic	*0.0000*	*0.0000*	*0.0000*	*0.0000*
$infinv\_index$	*Statistic*	*6259.250 (0.0000)*	*134.312 (0.0000)*	*132.946 (0.0000)*	*57.654 (0.0000)*
$\Delta gfcfp$	*Statistic*	*65,473 (0.0000)*	*1,408 (0.0000)*	*1,394 (0.0000)*	*0,893 (0.0000)*
$exch\_rate$	*Statistic*	*29.633 (0.0000)*	*30.947 (0.0000)*	*32.64 (0.0000)*	*35.159 (0.0000)*
hdi	*Statistic*	*62.911 (0.0000)*	*65.9173 (0.0000)*	*69.602 (0.0000)*	*75.162 (0.0000)*

Notes: P-value (in parentheses)

Source: Authors' assembled data

Table A-2.4: Robustness checks: Fixed Effects regression output (Government debt markets)

Variable	Model 1 Infrastructure Gap	Model 2 Transport Gap	Model 3 Electricity Gap	Model 4 ICT Gap	Model 5 WSS Gap
Constant	38.29 (5.60)	44.12 (6.88)	43.12 (5.11)	42.38 (5.61)	49.92 (5.53)
Government debt	-0.033 (-2.05)	-0.052 (-3.06)	-0.079 (-3.06)	-0.081 (-5.06)	-0.000 (-4.06)
Control variables	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes
R squared	0.434	0.480	0.469	0.466	0.429
Durbin-Watson	5.894	12.35	7.873	8.631	9.314
Akaike	10.93	9.476	9.425	11.364	11.536
Schwarz	15.07	12.650	9.475	10.320	9.146
Hannan-Quinn	10.624	11.409	10.039	11.716	11.094

This table reports FEM regression for the linear model in Eq. (1). The dependent variables are the infrastructure gaps of overall/aggregate infrastructure, transport, electricity, information, and communications technology (ICT) and water and sanitation infrastructure types. T-statistics are in parentheses.

Table A-2.5: Robustness checks: Fixed Effects regression output (Corporate debt markets)

Variable	Model 1 Infrastructure Gap	Model 2 Transport Gap	Model 3 Electricity Gap	Model 4 ICT Gap	Model 5 WSS Gap
Constant	38.57 (5.25)	35.62 (4.92)	42.47 (5.56)	49.93 (5.28)	45.12 (5.21)
Corporate debt	-0.307 (-4.70)	-0.212 (-4.97)	-0.214 (-5.96)	-5.331 (-4.38)	-5.428 (-3.30)
Control variables	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes
R squared	0.434	0.480	0.469	0.466	0.429
Durbin-Watson	5.894	12.35	7.873	8.631	9.314
Akaike	10.93	9.476	9.425	11.364	11.536
Schwarz	15.07	12.650	9.475	10.320	9.146
Hannan-Quinn	10.624	11.409	10.039	11.716	11.094

This table reports FEM regression for the linear model in Eq. (1). The dependent variables are the infrastructure gaps of overall/aggregate infrastructure, transport, electricity, information, and communications technology (ICT) and water and sanitation infrastructure types. T-statistics are in parentheses.

Table A-2.6: Robustness check: PMG regression output using IFG data (Government debt markets)

Variable	Model 1 Infrastructure Gap	Model 2 Transport Gap	Model 3 Electricity Gap	Model 4 ICT Gap	Model 5 WSS Gap
Constant	-6.09 (-0.05)	-4.99(-0.20)	-4.46(-0.41)	-2.52 (-1.07)	-2.52(-1.07)
Government debt	-8.56(-1.84)	-6.15(-1.25)	-1.35 (-0.10)	-2.27(-0.6)	-2.28 (-0.08)
Control variables	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes
R squared	0.02	0.38	0.51	0.51	0.51
Durbin-Watson	3.98	4.06	3.07	3.40	3.94
Akaike	8.47	5.91	7.25	9.32	7.22
Schwarz	6.39	5.14	5.54	8.03`	9.16
Hannan-Quinn	10.64	14.21	12.26	8.24	13.44

This table reports FEM regression for the linear model in Eq. (1). The dependent variables are the infrastructure gaps of overall/aggregate infrastructure, transport, electricity, information, and communications technology (ICT) and water and sanitation infrastructure types. Standard errors are in parentheses.

Table A-2.7: Robustness check: PMG regression output using IFG data (Corporate debt markets)

Variable	Model 1 Infrastructure Gap	Model 2 Transport Gap	Model 3 Electricity Gap	Model 4 ICT Gap	Model 5 WSS Gap
Constant	6.30 (0.07)	5.35(0.21)	5.11(0.41)	4.11(0.73)	4.11(0.73)
Corporate debt	-0.02 (0.01)	-0.01 (0.01)	-0.03 (0.014)	-0.03 (0.02)	-0.04 (0.02)
Control variables	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes
R squared	0.43	0.47	0.44	0.43	0.43
Durbin-Watson	17.26	7.21	6.98	9.87	7.51
Akaike	5.51	7.45	8.49	5.62	7.04
Schwarz	6.58	10.18	9.48	8.86	10.01
Hannan-Quinn	12.20	9.49	9.58	5.58	12.12

This table reports FEM regression for the linear model in Eq. (1). The dependent variables are the infrastructure gaps of overall/aggregate infrastructure, transport, electricity, information, and communications technology (ICT) and water and sanitation infrastructure types. Standard errors are in parentheses.

Table A-2.8: Robustness check: Threshold regression output using IFG data –full sample models (Government & Corporate debt markets)

1		Infrastructure financing gap (IFG)	
2	Debt market	Government	Corporate
3	Est. threshold value (share of GDP)	29.31, 45.38	75.99, 82.30
4	Beta for regime #1	-1.763 (-0.693)	-4.565 (-0.854)
5	Beta for regime #2	-0.308 (-0.108)	-01.072 (-0.563)
6	Beta for regime #3	6.586 (0.604)	0.892 (0.827)
7	Control variables	Yes	Yes
8	Number of countries	42	42
9	R-squared	0.4991	0.4975
10	Durbin-Watson statistic	4.972	4.973
11	Akaike info criterion	2.527	4.859
12	Schwarz criterion	4.124	8.369
11	Hannan-Quinn criterion.	7.907	3.413

Note: The dependent variable is the infrastructure financing gap (IFG) scaled by GDP.

Standard errors are in parentheses.

Table A-3.1: Limits on Pension Fund Investments in selected SSA countries

Country	*Fund/Plans*	*Bills and Bonds issued by public administration*	*Bonds issued by the private sector*	*Equity*	*Other*
Botswana	*All licensed Retirement Funds*	*100%*	*Statutory bonds: 40%, Foreign bonds:50%*	*Listed companies (excluding property companies): 70%, Unlisted:20%*	
Ghana	*All Pension Schemes*	*60%*	*35%*	*20%*	*Alternative Investments: Real Estate (10%), Private Equity Funds (10%), External investment in securities (5%)*
Kenya	*All licensed Retirement Schemes*	*90% -including East African Community (EAC) Government securities and infrastructure bonds issued by public institutions*	*Listed bonds: 20%, Non-listed bonds:10%*	*Listed companies: 70%, Listed equities in EAC:70%, Unlisted:5%*	*Immovable property in Kenya:30%, Retail investment funds (direct): 100%*
Mauritius	*(1) Occupational Voluntary Pension Schemes (2) Non-occupational (Personal) Voluntary Pension Schemes*	*100 (Total exposure)*	*100% (Total exposure)*	*100% (Total exposure)*	*Real Estate (100%, rules require pension schemes to consider diversifying their investments to mitigate risks*

Cont.

Country	Fund/Plans	Bills and Bonds issued by public administration	Bonds issued by the private sector	Equity	Other
Nigeria	*(a) Defined Contribution Pension Scheme -Fund 1 (Below 50 years by choice)*	*Federal Government Bonds:60%, State:10%*	*Corporate: 35%, (Infrastructure Bond: 25%) Supranational:20%*	*30%*	*Effective date: Q2- 2018, Infrastructure Fund global limit: 10%*
	(b) Defined Contribution Pension Scheme-Fund II (Below 50 years by default Fund)	*Federal Government Bonds:70%, State:15%*	*Corporate: 40%, (Infrastructure Bonds: 20%) Supranational:20%*	*25%*	*Corporate bonds allocation is based on the credit rating of the bond Infrastructure Fund global limit 5%*
	(c) Defined Contribution Pension Scheme-Fund III (Default fund for 50 years and above)	*Federal Government Bonds:80%, State:20%*	*Corporate: 45%, (Infrastructure Bond: 20%) Supranational:20%*	*10%*	*Corporate bonds allocation is based on the credit rating of the bond Infrastructure Fund: 0%*
	(c) Defined Contribution Pension Scheme-Fund IV (Default fund for Retirees only)	*Federal Government Bonds:80%, State:20%*	*Corporate: 45% (Infrastructure Bond: 10%), Supranational:20%*	*5%*	*Corporate bonds allocation is based on the credit rating of the bond Infrastructure Fund: 0%*
Rwanda	*Rwanda Social Security Scheme Board*	*Bonds: 50%, Bills: 5%*	*20%*	*Listed + Non-listed:40%*	
South Africa	*All Pension Schemes*	*Debt instruments issued by, and loans to, the Government, or any debt or loan guaranteed by the Government of South Africa: 100% Government Bonds (offshore): 10% per issue*	*Debt instruments issued or guaranteed by a South African bank against its balance sheet: 75%*	*Listed equities: 75%, Unlisted equities:10 %*	*Listed property:25%, Unlisted property:15%, Combined property and equities:75% Hedge funds and Private Equity funds:15%, Hedge Funds or funds of hedge funds:2.5%*
Tanzania	*All mandatory and supplementary social security schemes*	*20-70%*	*Listed 20% , Non-listed 5%*	*20% (Direct)*	*Pension Funds and Managers can invest in other asset classes not stipulated in the guidelines subject to prior approval by the Central Bank*

Source: OECD (2019), NPRA (2016), Mwakisisile (2018), PenCom (2019), According to PenCom (2019), Pension Fund Assets can be invested in infrastructure projects through eligible bonds, Sukuk, provided of the following provisions: any infrastructure projects shall be of a minimum of N5billion (US$12.5million), the bond or Sukuk issued to finance the infrastructure has credit enhancements, e.g. guarantees by the Federal Government of Nigeria or a Multinational Development Finance Organisation (MDFO)/DFI, or if financed via Infrastructure Funds, Pension fund investments should have the value of not less N5billion, Infrastructure Fund should have well defined, and publicized investment objectives and strategy, a minimum of the Infrastructure Fund invested in Nigeria should be 60%. Pension Fund Assets can be invested in Asset-Backed Securities (ABS) provided they meet standards set –e.g., the fair value of not less than N1billion, are tradable, and make full disclosure of information on the ABS. Also, PFAs can be invested in PE Funds subject to conditions

Table A-3.2: Skewness and Kurtosis

Themes	Observations	Skewness	Kurtosis
Infrastructure	87	5.269	32.064
Equity	87	5.102	27.035
Legislation	87	2.232	7.252
Capital	87	5.102	27.035
Education	86	2.080	5.328
Policy	87	2.414	6.829
Rating	87	5.102	27.035
Inflation	87	9.165	85.011
Political	87	5.102	27.035
Issuance	87	1.760	5.079
Liquidity	87	3.802	15.460
Listed	87	6.365	41.523

Source of data: Authors' computation (from survey question No. 19).

Note: Skewness measures the distribution of the variable. A skewness value that is less than -1 or greater than 1 means the distribution is highly skewed. A skewness value between -1 and -0.5 or between 0.5 and 1 means the distribution is moderately skewed. If the skewness is between -0.5 and 0.5, then the distribution is approximately symmetric or normally distributed. All the variables in the above appendix are highly skewed, giving skewness values greater than 1. Kurtosis is a measure of the "tailedness" of the probability distribution. A standard normal distribution has a kurtosis of 3 and is recognized as mesokurtic. If the kurtosis value is greater than 1, the distribution is right-skewed, while if it is less than -1, the distribution will be left-skewed. All the variables in the table above are rightward skewed.

Table: A-4.1 Mann-Whitney Test

			Instrument-related measures to enhance government and corporate bond markets' liquidity			*Non-Instrument related measures to enhance government and corporate bond markets' liquidity*		
		N	*Mean Rank*	*Z-value*	*P-value*	*Mean Rank*	*Z-value*	*P-value*
Botswana and Ghana	*Botswana*	*32*	*45.27*	*-2.948*	*0.003*	*31.66*	*-1.760*	*0.078*
	Ghana	*40*	*30.55*			*40.38*		
Botswana and Kenya	*Botswana*	*32*	*32.89*	*-0.169*	*0.866*	*26.42*	*-2.633*	*0.008*
	Kenya	*32*	*32.11*			*38.58*		
Botswana and Mauritius	*Botswana*	*32*	*38.50*	*-2.322*	*0.020*	*32.31*	*-0,29*	*0.772*
	Mauritius	*33*	*27.67*			*33.67*		
Botswana and Nigeria	*Botswana*	*32*	*59.47*	*-4.371*	*0.000*	*40.67*	*-0,941*	*0.347*
	Nigeria	*55*	*35.00*			*45.94*		
Botswana and South Africa	*Botswana*	*32*	*35.19*	*-0.48*	*0.631*	*29.38*	*-2.605*	*0.009*
	South Africa	*40*	*37.55*			*42.20*		
Botswana and Tanzania	*Botswana*	*32*	*22.19*	*-2.819*	*0.005*	*20.73*	*-3.673*	*0.000*
	Tanzania	*21*	*34.33*			*36.55*		
Ghana and Kenya	*Ghana*	*40*	*30.74*	*-2.864*	*0.004*	*33.89*	*-1.192*	*0.233*
	Kenya	*32*	*45.02*			*39.77*		
Ghana and Mauritius	*Ghana*	*40*	*35.12*	*-1.063*	*0.288*	*42.36*	*-2.387*	*0.017*
	Mauritius	*33*	*40.45*			*30.50*		
Ghana and South Africa	*Ghana*	*41*	*32.22*	*-3.418*	*0.001*	*37.75*	*-1.066*	*0.287*
	South Africa	*40*	*50.00*			*43.25*		
Ghana and Rwanda	*Ghana*	*41*	*32.09*	*-2.588*	*0.010*	*38.91*	*-0.615*	*0.539*
	Rwanda	*34*	*45.13*			*35.84*		
Ghana and Tanzania	*Ghana*	*41*	*24.16*	*-4.485*	*0.000*	*26.29*	*-2.878*	*0.004*
	Tanzania	*21*	*45.83*			*39.98*		
Kenya and Mauritius	*Kenya*	*32*	*37.95*	*-2.114*	*0.034*	*40.61*	*-3.247*	*0.001*
	Mauritius	*33*	*28.20*			*25.62*		
Kenya and Nigeria	*Kenya*	*32*	*58.91*	*-4.217*	*0.000*	*54.77*	*-3.052*	*0.002*
	Nigeria	*55*	*35.33*			*37.74*		
Kenya and Tanzania	*Kenya*	*32*	*21.95*	*-2.986*	*0.003*	*24.14*	*-1.711*	*0.087*
	Tanzania	*21*	*34.69*			*31.36*		

Cont.

			Instrument-related measures to enhance government and corporate bond markets' liquidity			***Non-Instrument related measures to enhance government and corporate bond markets' liquidity***		
		N	*Mean Rank*	*Z-value*	*P-value*	*Mean Rank*	*Z-value*	*P-value*
Mauritius and Nigeria	*Mauritius*	*33*	*52.38*	*-2.248*	*0.025*	*40.52*	*-1.140*	*0.254*
	Nigeria	*55*	*39.77*			*46.89*		
			Instrument-related measures to enhance government and corporate bond markets liquidity			*Non-Instrument related measures to enhance government and corporate bond markets liquidity*		
Mauritius and South Africa	*Mauritius*	*33*	*29.39*	*-2.829*	*0.005*	*27.91*	*-3.376*	*0.001*
	South Africa	*40*	*43.28*			*44.50*		
Mauritius and Tanzania	*Mauritius*	*33*	*19.71*	*-4.593*	*0.000*	*19.27*	*-4.900*	*0.000*
	Tanzania	*21*	*39.74*			*40.43*		
Nigeria and South Africa	*Nigeria*	*55*	*36.51*	*-4.787*	*0.000*	*41.22*	*-2.831*	*0.005*
	South Africa	*40*	*63.80*			*57.33*		
Nigeria and Rwanda	*Nigeria*	*55*	*36.65*	*-3.892*	*0.000*	*44.06*	*-0.437*	*0.662*
	Rwanda	*34*	*58.51*			*46.51*		
Nigeria and Tanzania	*Nigeria*	*55*	*29.41*	*-5.819*	*0.000*	*31.11*	*-4.754*	*0.000*
	Tanzania	*21*	*62.31*			*57.86*		
South Africa and Tanzania	*South Africa*	*40*	*27.20*	*-2.347*	*0.019*	*27.71*	*-2.046*	*0.041*
	Tanzania	*21*	*38.24*			*37.26*		
Rwanda and Tanzania	*Rwanda*	*34*	*21.57*	*-3.806*	*.000*	*22.31*	*-3.380*	*0.001*
	Tanzania	*21*	*38.40*			*37.21*		

Source: *Authors' assembled data from SSA cross-country survey.*

Table A-4.2: Kruskal Wallis difference test

	Kruskal-Wallis H Statistic	*df*	*P-value*
Historical dependence on banking sector financing	*51.790*	*7*	*0.000*
The high transaction cost of raising funds through bonds	*69.390*	*7*	*0.000*
Lack of government yield curves to serve as benchmarks for pricing and hedging	*19.707*	*7*	*0.006*
Low trading volumes	*16.151*	*7*	*0.024*
Legal uncertainties	*54.342*	*7*	*0.000*
Weak investor rights	*48.932*	*7*	*0.000*
Weak corporate governance	*50.340*	*7*	*0.000*
Quality of disclosures is not strong	*20.777*	*7*	*0.004*
Underdeveloped and illiquid secondary markets	*43.618*	*7*	*0.000*
Lack of credible rating system	*28.881*	*7*	*0.000*
High political uncertainty	*90.030*	*7*	*0.000*
Lack of long-term maturity debt instruments	*25.072*	*7*	*0.001*
Lack of large nonbank financial institutional players	*32.298*	*7*	*0.000*

Source Authors' assembled data from SSA cross-country survey.

Table A-4.3: Kruskal Wallis difference test

	Kruskal-Wallis H Statistic	*df*	*P-value*
There are no withholding taxes (WHTs) for resident investors	54.7	7	0.000
There are no WHTs for non-resident investors	42.5	7	0.000
Treasury bills are tax-exempt	35.6	7	0.002
There is an exemption on capital gains tax on specific securities listed on capital markets	16.6	7	0.002
The country has double tax treaties with other nations whose residents invest in the domestic capital markets	32.5	7	0.000
There are no differences in the tax rates that are applied to securities investment on local or foreign investors	23.5	7	0.000
Interest on Treasury bills is subject to personal and corporate taxes	34.8	7	0.000
Interest paid to non-resident investors in bonds issued by the government is exempt from tax	16.3	7	0.001
Capital gains realised on disposal of listed securities are tax exempt	33.1	7	0.000

Source: Authors' assembled data from SSA cross-country survey.

Document A-5.1: Sample of Questionnaire

Bond Market Development and Infrastructure Financing in Sub-Saharan Africa

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All respondents will be treated confidentially, and the responses will only be used for academic purposes.

SECTION A: PROFILE OF THE RESPONDENT

*1. Please provide your profession (e.g., Economist, Engineer, etc.)

*2. Please provide your designation or title (e.g., Chief Economist, Chief Executive Officer, etc.).

*3. Number of years in the service (select the appropriate)

- o Below 1 year
- o 1-5 years
- o 6-10 years
- o 11-15 years
- o 16-20 years
- o Above 20 years

*4. Country where the company/organization is located:

- o Botswana
- o Ghana
- o Kenya
- o Mauritius
- o Nigeria
- o Rwanda
- o South Africa
- o Tanzania

*5. Please tick one of the following Organisation Categories that best describes you or you're the organisation you represent:

5.1 Financial Institution	
○ Central Bank	
○ Commercial bank	
○ Investment Bank	
○ National Development Bank	
○ Regional Development Bank	
○ Multilateral Development Bank	
○ Asset Management Company	
○ Pension Fund	
○ Insurance Company	
○ Mutual Fund	
○ Other (please specify in the space below)	
5.2 Market Enabler	
○ Securities Exchange	
○ Securities Regulator	
○ Securities Exchange Commission	
○ Primary Dealer	
○ Nominated Advisor	
○ Securities Broker	
○ Other (please specify in the space below)	
5.3 Public Institution	
Federal Government	
Central Government	
Provincial/County) Government	
State Government	
Municipality	
State-Owned Entity/Parastatal	
University	
Public Research Institution	
Other (please specify in the space below)	
5.4 Public-Private Partnership	

5.5 Private Institution	
Infrastructure Company	
Special Purpose Vehicle (SPV)	
Other (please specify in the space below)	
5.6 Information Provider	
Rating Agency	
Other (please specify in the space below)	
5.7 Other ((please specify in the space below)	

*6. Please indicate which of the following best describes your participation in bond markets and/or infrastructure development. *Please select all that apply.*

- ☐ Public Debt Issuer
- ☐ Private Debt Issuer
- ☐ Bank/Dealer - Primary Market
- ☐ Bank/Dealer - Secondary Market
- ☐ Investor: Bank
- ☐ Discount House
- ☐ Investor: Pension Fund
- ☐ Investor: Pension Fund Administrator
- ☐ Investor: Insurance Company
- ☐ Investor: Mutual Fund
- ☐ Investor: Asset Management Company
- ☐ Investor: Infrastructure Fund Manager
- ☐ Credit Rating Agency
- ☐ Regulator (e.g., Securities Exchange, Securities Commission)
- ☐ Infrastructure Developer
- ☐ Infrastructure Service Provider
- ☐ Researcher
- ☐ Other (please specify in the space below)

SECTION B: GOVERNMENT SECURITIES MARKET

7. Please indicate the system that is popularly used for trading government securities in your country.
   - Over-the-counter (OTC)

- Stock Market Exchange
- Auction
- Other (please specify below)

8. What government instruments/rates are used to benchmark securities for pricing the domestic corporate bonds in your country? *Please tick all the appropriate.*
   - Central Bank Certificates
   - Treasury bills
   - Commercial paper
   - Prime Lending Rate
   - Government-issued Saving Instrument
   - Treasury Bond
   - Inter-bank rate
   - No Benchmark
   - Other (please specify in the space below)

9. Please indicate the average maturity of the relevant government instruments offered in your country. *Please tick all the appropriate.*

	Central Bank Certificates	Treasury Bills	Government Retail Saving Bond	Treasury Bonds	Other (Refer to Q? above)
7-28 days					
30-91 days					
91-182 days					
364 days					
1-2 years					
3-10 years					
10-20 years					
Above 20 years					

10. The longest government securities yield curve extends to (Please *tick the appropriate box*).

- 1 year
- 3 years
- 5 years
- 6-10 years
- 11-15 years
- 16-20 years
- Above 20 years

SECTION C: NON-GOVERNMENT SECURITIES MARKET

11. Over the last 36 months, what is the approximate proportion of corporate bonds issued in your country's capital market relative to the total bonds issued?
    - 0-20%
    - 21-40%
    - 41-60%
    - 61-80%
    - 81-100%
    - Not sure/Not applicable

12. In your view, how effective is the government yield curve in providing the requisite benchmark for corporate bonds?
    - Not effective at all
    - Not effective
    - Somewhat ineffective
    - Neither ineffective nor effective
    - Somewhat effective
    - Effective
    - Very effective

SECTION D: INVESTOR BASE

13. Please indicate by ticking the appropriate boxes who the buyers of government long-term debt securities (bonds) are. *You may tick more than one box.*

- ☐ Commercial banks
- ☐ National Development Banks
- ☐ Insurance Companies
- ☐ Pension Funds
- ☐ Foreign Investors
- ☐ Domestic Individual Investors
- ☐ Asset Managers
- ☐ Hedge Funds
- ☐ Other (please specify in the space below)

14. Please estimate the approximate percentage of outstanding government securities held by the following investors:

	0-20%	21-40%	41-60%	61-80%	81-100%
Commercial banks	○	○	○	○	○
National Development Banks	○	○	○	○	○
Insurance Companies	○	○	○	○	○
Pension Funds	○	○	○	○	○
Foreign Investors	○	○	○	○	○
Domestic Individual Investors	○	○	○	○	○
Other (please specify below).	○	○	○	○	○

15. To what extent is the pension sector in your country reformed or allowed to mobilise domestic savings for infrastructure investments?
    - Not very reformed
    - Not reformed
    - Somewhat not reformed
    - Neutral
    - Somewhat reformed
    - Reformed
    - Very reformed

16. Please briefly explain your answer to the previous question above.

17. Please briefly state the barriers/factors you believe may be affecting the pension funds' participation in the local bond markets in your country, if any.

SECTION E: SETTLEMENT SYSTEMS

18. The settlement cycles for domestic bond transactions in your country is _____
    - o Same day
    - o T+1
    - o T+2
    - o T+3
    - o T+4
    - o T+5
    - o T+6
    - o T+7
    - o Other (please specify in the space below)

19. What are your views on the efficiency and security of the clearing and settlement system in the domestic bond market?

SECTION F: BOND MARKET LIQUIDITY

20. Liquidity is measured by the bid-ask spread (bps) of benchmark 10-year issues. Please indicate your views about the bid-ask spread in your country's 10-year government debt security by selecting the appropriate option below.
    - ○ It is very tight
    - ○ It is tight
    - ○ It is somewhat tight
    - ○ I don't know
    - ○ It is somewhat wide
    - ○ It is wide
    - ○ It is very wide

21. Please evaluate the importance of the following measures in enhancing the liquidity of government and corporate bond markets.

	Not at all important	Unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Important	Very important
Issuance of long term maturity government bonds	○	○	○	○	○	○	○
Integration of regional bond markets	○	○	○	○	○	○	○
Availability of a wide range of instruments in bond markets	○	○	○	○	○	○	○
Widening the investor base	○	○	○	○	○	○	○
Easing restrictions on market access	○	○	○	○	○	○	○
Enhancing information disclosure systems	○	○	○	○	○	○	○

	Not at all important	Unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Important	Very important
Promoting activities of primary dealers	○	○	○	○	○	○	○
Reduce issuance costs	○	○	○	○	○	○	○
Introduce more sophisticated financial instrument	○	○	○	○	○	○	○
Relax investment criteria for institutional investors	○	○	○	○	○	○	○
Other (please specify below)	○	○	○	○	○	○	○

Please specify the 'Other' referred to above.

22. Please provide any other information that you think will enhance liquidity in the bond market.

SECTION G: DEVELOPMENT OF CORPORATE BOND MARKET

23. Please indicate the extent to which you agree or disagree with the following statements as the causes for the lack of development in corporate bond markets in your country.

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Historical dependence on banking sector financing	○	○	○	○	○	○	○
High transaction cost of raising funds through bonds	○	○	○	○	○	○	○
Lack of government yield curves to serve as benchmarks for pricing and hedging	○	○	○	○	○	○	○
Low trading volumes	○	○	○	○	○	○	○
Legal uncertainties	○	○	○	○	○	○	○
Weak investor rights	○	○	○	○	○	○	○
Weak corporate governance	○	○	○	○	○	○	○
Quality of disclosures is not strong	○	○	○	○	○	○	○
Underdeveloped and illiquid secondary markets	○	○	○	○	○	○	○
Lack of credible rating system	○	○	○	○	○	○	○
High political uncertainty	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Lack of long-term maturity debt instruments	○	○	○	○	○	○	○
Lack of large non-bank financial institutional players	○	○	○	○	○	○	○

24. Please suggest any policy reforms you believe should be implemented in your country or region to stimulate the development of bond markets as a financing vehicle for infrastructure.

SECTION H: THE BOND MARKET TAX POLICY ISSUES

N.B. ***The questions in this section 'H' are relevant for professionals who are familiar with Bond Market Tax Issues***

25. For each of the following statements, please indicate the extent of your agreement or disagreement.

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
There are no withholding taxes for resident investors	○	○	○	○	○	○	○
There are no withholding taxes for non-resident investors	○	○	○	○	○	○	○
Treasury bills are not taxable	○	○	○	○	○	○	○
There is an exemption on capital gains tax on specific securities listed on capital markets	○	○	○	○	○	○	○
The country has double tax treaties with other nations whose residents invest in the domestic capital markets	○	○	○	○	○	○	○
There are no differences in the tax rates that are applied to securities investment on local or foreign investors	○	○	○	○	○	○	○
Interest on Treasury bills is subject to personal and corporate taxes	○	○	○	○	○	○	○
Interest paid to non-resident investors in bonds issued by the Government is exempt from tax	○	○	○	○	○	○	○
Capital gains realized on disposal of listed securities are tax exempt	○	○	○	○	○	○	○

END

Thank you!

Document A-5-2: Ethics Clearance Certificate-Protocol Number H17/11/41

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Mukoki

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H17/11/41**
PROJECT TITLE	Infrastructure financing and bond market development in Sub-Saharan Africa
INVESTIGATOR(S)	Mr P Mukoki
SCHOOL/DEPARTMENT	Wits Business School/
DATE CONSIDERED	17 November 2017
DECISION OF THE COMMITTEE	Approved Two year extension only
EXPIRY DATE	11 December 2022

DATE 12 December 2017 **CHAIRPERSON** J-Knight
(Professor J Knight)

cc: Supervisor : Dr O Kodongo

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature **Date** 20/10/2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Document A-5.3: Sample Letter soliciting support to distribute Survey Monkey survey questionnaires to potential respondents in sample countries.

The University of Witwatersrand, Johannesburg
Graduate School of Business Administration

2 St David's Place, Parktown, Johannesburg, 2193, South Africa
P O Box 98, WITS, 2050
Telephone: +27 11 717 3621
Email: Mmabatho.Leeuw@wits.ac.za
Website: www.wbs.ac.za

15 January 2019

To whom it may concern

Surveys on Botswana domestic bond market

This letter serves to introduce Paul Mukoki who is a PhD student at the Wits Business School. He is doing a study on ***"Bond market development and infrastructure financing in Sub-Saharan Africa"***. Mr Mukoki is currently on the data gathering phase of his study. He wishes to distribute questionnaires through Survey Monkey to various potential respondents in Botswana to collect data.

Please assist him in this endeavor.

Yours Sincerely,

Prof. Kalu Ojah
PhD Supervisor
Wits Business School
011 717-3764