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Understanding Bank Demand for Sovereign Debt and Its Systemic Risk Implications: The Kenyan Experience

Rogers Ochenge

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Understanding Bank Demand for Sovereign Debt and Its Systemic Risk Implications: The Kenyan Experience

Rogers Ochenge

Abstract

This study investigates the demand for government securities by Kenyan banks using annual data from 2005 to 2022. Employing a fixed-effects panel regression model, the research examines the factors influencing banks' sovereign debt holdings and their implications for systemic risk. Key findings reveal that fiscal deficits, attractive bond yields, and capital adequacy requirements significantly drive banks' appetite for government securities. Over time, the similarity in sovereign holdings across banks has increased, raising concerns about systemic risk due to potential correlated exposure to sovereign debt shocks. The study also identifies a negative relationship between private sector lending and sovereign debt holdings, highlighting potential "crowding out" effects. These insights are critical for informing regulatory policies aimed at mitigating systemic risks in the Kenyan banking sector.

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1.0 Introduction

In recent years, Kenyan banks have steadily increased their exposure to domestic sovereign debt. On average, the share of total bank assets accounted for by sovereign debt securities increased by about 9 percentage points (from 19 percent to about 30 percent) between 2015 and 2022. According to the International Monetary Fund (IMF), Kenya ranks among the top Sub-Saharan countries in terms of banks' exposure to sovereign debt (IMF, 2020).

The elevated banks' exposure to sovereign debt has significant implications for financial stability. While sovereign securities are considered safe assets, their safety is contingent upon the government's fiscal health. In Kenya, where public debt has been rising sharply (for instance grew from 45 to 68 percent over the period 2015-2022), banks' heavy reliance on sovereign debt increases their vulnerability to fiscal policy shocks (IMF,2020). This interconnectedness means that fiscal shocks can be transmitted to banks' balance sheets and compromise financial stability. Farhi and Tirole (2018) describes this mutual relationship as a "deadly embrace". That is, while in normal times, this relationship is beneficial to both parties, in times of distress it leads to the so called "doom loop", where, sovereign distress jeopardizes banks and in turn bank crisis endangers fiscal balances.

For instance, the spectacular collapse of the Silicon Valley Bank (SVB- a large U.S bank) in 2023 easily demonstrates the risks embedded in the sovereign-bank exposures. SVB had invested about $91 billion (about half of its assets) in long-dated government bonds which tend to be quite sensitive to interest rate changes. Thus, when interest rates in U.S rapidly rose, the value of SVB's bond holdings fell by about $21 billion. When word on the bank's potential losses started coming into light, depositors started to withdraw their funds. To meet the elevated withdrawals, SVB had to sell the bonds realizing the losses. The realized losses inspired more withdrawals and the situation spiraled into a full-blown bank run leading to the bank's closure.

Several papers have examined the sovereign-bank nexus in developed markets but the empirical analysis in developing economies remains scanty to date. These

studies have provided useful insights on the causes and implications of high banks' exposure to sovereign debt in contexts where markets are well developed and regulatory designs are more robust. However, empirical analysis in frontier economies, such as those in Kenya (and Africa in general), remains limited. In these regions, the banking sector's exposure to sovereign debt is often higher, and the economic and regulatory environments are markedly different (Beck & Hesse, 2009). This gap in the literature underscores the need for focused studies on frontier economies to understand better the unique challenges and dynamics at play. Such research is crucial for developing tailored policy recommendations that enhance financial stability and support economic development in these emerging markets (Bua, Pradelli, & Presbitero, 2014).

More specifically this study focuses on understanding the factors driving banks' appetite for government securities, particularly within the context of Kenya. This is a critical addition to the existing literature as Kenya, like many emerging economies, faces unique challenges in its financial sector, including government borrowing pressures and evolving regulatory frameworks. Understanding what motivates Kenyan banks to hold significant amounts of government securities can provide insights into the broader dynamics of financial stability in the region.

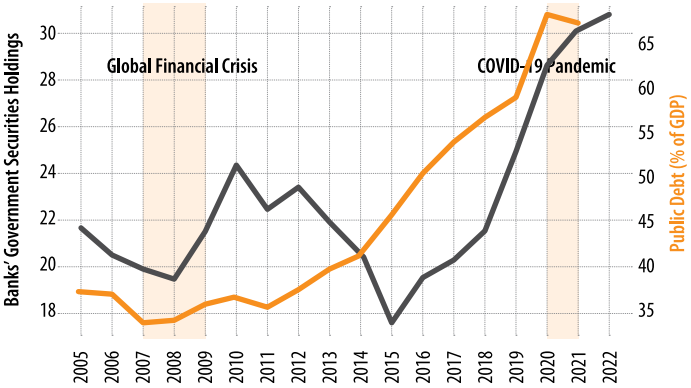
Additionally, the implications of high sovereign debt holdings on systemic risk in Kenya's banking sector are profound. When banks hold large volumes of government securities, their balance sheets become increasingly exposed to sovereign credit risk. In the event of government default or restructuring, this exposure can trigger widespread instability across the financial system. Given the interlinked nature of financial institutions, such risks could lead to a contagion effect, amplifying the potential for a systemic crisis. Therefore, examining the relationship between banks' holdings of government securities and the broader systemic risk is crucial for policymakers seeking to safeguard financial stability in Kenya. In summary, this study answers two key questions;

- What are the key factors driving Kenyan banks' demand for government securities?
- Are there systemic risks embedded in Kenyan banks' exposure to government securities?

2.0 Some Stylized Facts on Banks' Exposure to Sovereign Debt in Kenya

This section presents some trends in Kenyan banks' exposure to sovereign debt over the period 2005 to 2022. The banking sector's holding of the government securities has grown steadily over the considered period (Figure 1). This steady growth suggests a growing appetite among Kenyan banks for government securities, plausibly, due to their perceived safety and relatively attractive returns compared to other asset classes. The Kenyan banks' claims on government rose by more than 10 percent between 2015 and 2022 to close at about 30 percent of total assets.

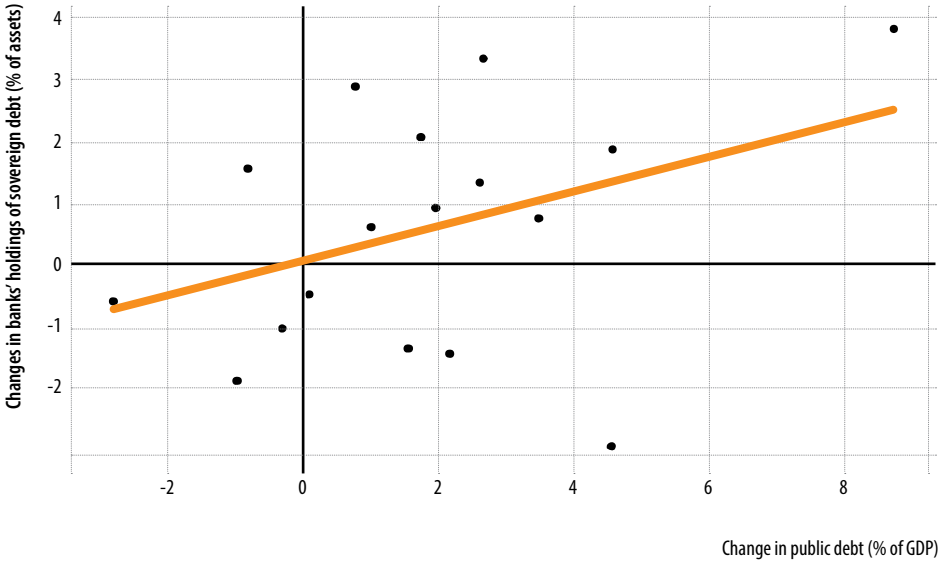
Figure 1: Banks' Sovereign Debt Holdings and Public Debt (2005-2022)



Source: Kenyan Treasury and CBK and author's calculation

This figure presents the development of Kenyan banks' holdings of government securities (as a % of assets) and the public debt (as a % of GDP).

Figure 2: Changes in Banks' Holdings of Sovereign Debt (% of Assets) and in Public Debt (% of GDP), 2005-2022.



The bank sovereign exposure in Kenya is almost twice the average for emerging and developing economies (EMDEs) recently documented by Deghi *et al.* (2022). As pointed out by Deghi *et al.* (2022) the increased overreliance of the government on domestic banks for financing needs reflects the limited external financing options available to many governments in EMDEs. It is also worth noting that in EMDEs, capital markets are still not well developed which implies that banks have also limited investment options besides loans to private sector and government securities. There is therefore mutual interest amongst these two sectors. Indeed, as depicted in **Figure 2**, there is a fairly strong link between public debt and banks' holdings of government securities. Given that public debt has been rising steadily (**Figure 1**), there has been concerns about the debt sustainability. Given these developments it is important for banks to reflect on what sovereign debt distress may imply for the industry's stability.

The other stylized fact is that Kenyan banks' holdings of government bonds appears to be fairly heterogeneous. **Figure 3** presents the distribution of banks' holdings of Kenyan government securities as a percentage of their total assets. The density plot reveals a right-skewed distribution, indicating that most banks hold between 10% and 30% of their assets in government

securities, with a peak around 20%. This suggests that while a significant number of banks maintain a moderate exposure to government bonds, there is a tail extending toward higher percentages, with a few banks holding as much as 60-70% of their assets in these securities. The presence of this long tail may reflect varying risk appetites or strategic choices among banks, possibly influenced by regulatory requirements, market conditions, or the pursuit of a safer asset portfolio. This distribution highlights the heterogeneity in the investment strategies of banks regarding government securities, which could have important implications for financial stability, particularly in times of economic stress when the value of these securities may fluctuate significantly.

Given the wide dispersion of the bank sovereign exposure revealed in **Figure 3**, it is instructive to explore these differences further. In this spirit, **Figure 4** presents a tiered analysis of government paper holdings of large, medium, and small banks over the period 2005 to 2022. **Figure 4** reveals that medium-sized banks shows the highest exposure to sovereign debt compared to large and small banks.

Figure 3: Heterogeneity of Bank Holdings of Sovereign Debt.

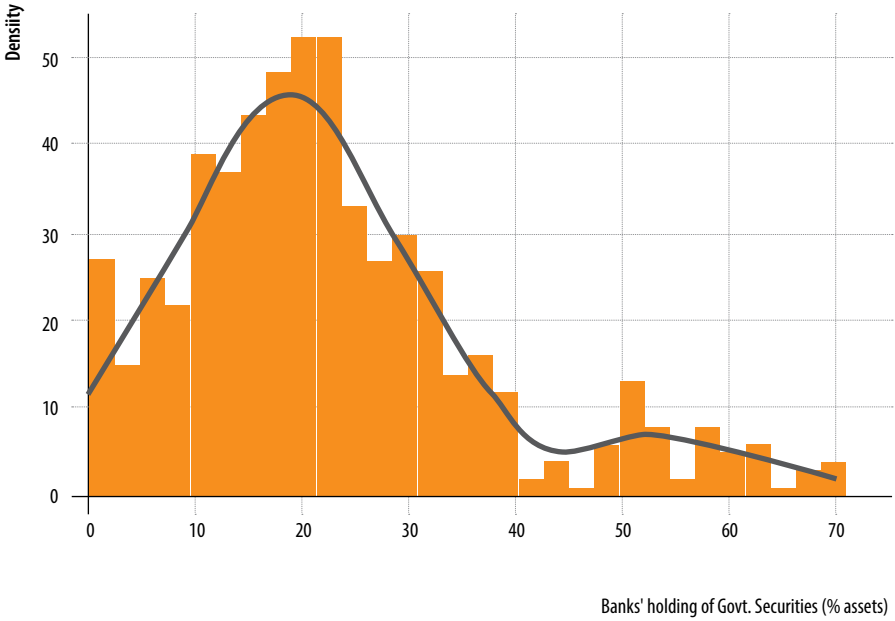
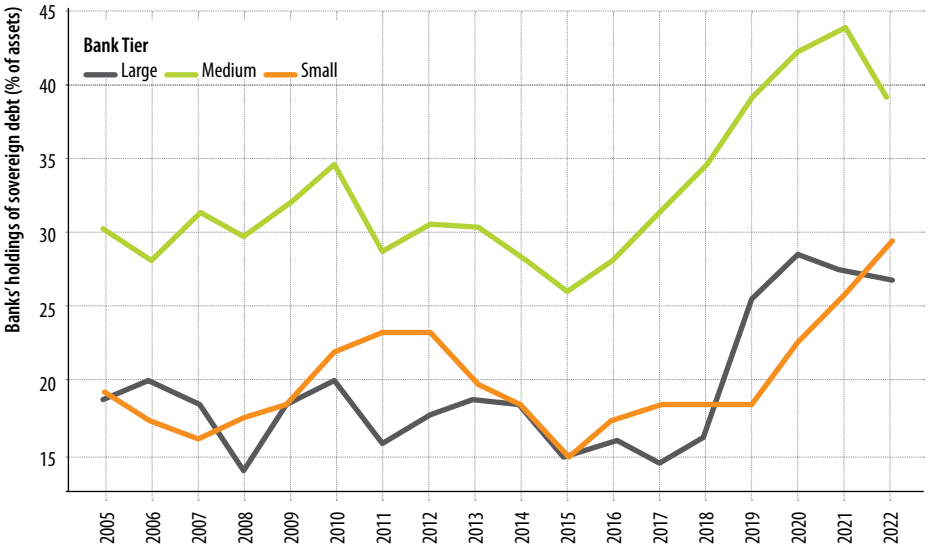


Figure 4: Sovereign Debt Holdings by Bank Tier, 2005-2005

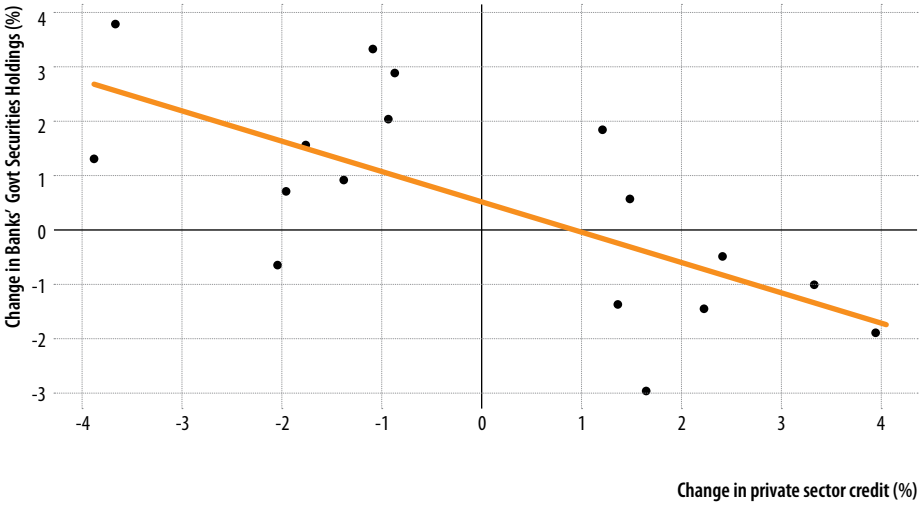


This significant involvement in holding government securities may be due to their strategic focus on relatively safer investments. Empirical studies suggest that medium-sized banks may prioritize stability and lower risk profiles, leading them to hold a higher proportion of sovereign debt (Blundell-Wignall & Roulet, 2013).

The differences in sovereign debt exposure among large, medium, and small banks highlight varying risk management strategies. Medium banks may leverage their position to engage more in sovereign debt for stable returns, while large banks might diversify more, and small banks adopt a conservative approach. This aligns with findings from the literature, which suggest that medium-sized banks often exhibit higher risk aversion and prioritize liquidity (Diamond & Rajan, 2001).

Further, in line with earlier evidence from other emerging countries, the Kenyan data reveals a clear negative relationship between private sector credit growth and banks' holdings of sovereign debt (**Figure 5**). The negative relationship suggests that banks may be substituting between private credit (loans) and government securities. When banks increase their loan output, they might simultaneously reduce their holdings in government securities, possibly to manage liquidity and risk or to comply with regulatory capital requirements. Importantly, when banks

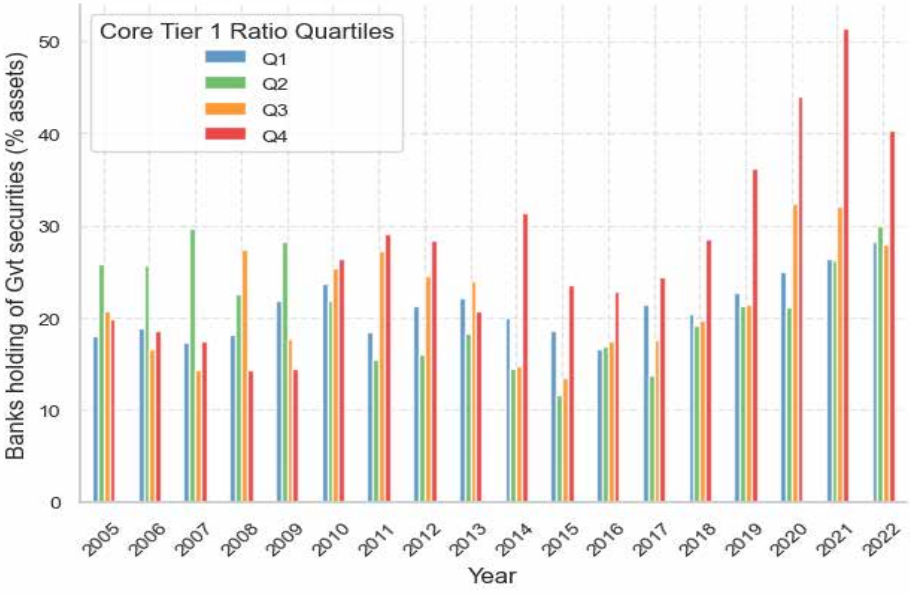
Figure 5: Changes in banks' holdings of sovereign debt private sector credit, 2005-2022.



purchase more government securities, they may have fewer resources available for private sector lending. This is known as the "crowding-out" effect, where government borrowing absorbs the capital that could otherwise be available for private borrowers.

The last stylized fact relates bank capital and sovereign debt holdings. Specifically, Figure 6 presents the banks' holdings of government securities as a percentage of their total assets across different core tier 1 ratio quartiles over the period from 2005 to 2022. The data is disaggregated into four quartiles (Q1 to Q4), with Q1 representing the lowest quartile of core tier 1 ratios and Q4 the highest. The variability across quartiles suggests that banks with lower capital ratios (Q1) tend to hold fewer government securities compared to their better-capitalized counterparts. This might be due to the differing risk management strategies, where banks with weaker capital positions might be more constrained in their ability to invest in low-yield, safer assets. Conversely, well-capitalized banks might be better positioned to absorb lower yields for the safety and liquidity that government securities provide.

Figure 6: bank capital and sovereign debt holding, 2005-2022.



3.0 Literature Review

3.1 Theoretical Literature Review

The appetite of commercial banks for government bonds has been a subject of extensive study in financial literature, with various theories proposed to explain the underlying motivations. This section synthesizes the key theoretical perspectives that have been advanced to elucidate why banks tend to hold significant amounts of sovereign debt.

Liquidity Needs Hypothesis: One of the primary reasons for banks to hold government bonds is to fulfill liquidity requirements. Banks, as highly leveraged institutions, need to maintain a buffer of liquid assets to manage short-term liabilities and unexpected withdrawals. Government bonds, given their low risk and deep markets, serve as an ideal instrument to meet these liquidity needs. Dell'Ariccia et al. (2018) highlight that in developed markets, the liquidity of government bonds makes them an attractive asset for banks. This is particularly pertinent in under-developed capital markets, such as in Kenya, where alternative safe and liquid assets are scarce, making government securities the de facto choice for liquidity management.

Regulatory Arbitrage Hypothesis: The Basel regulatory framework, which governs capital adequacy for banks, assigns a zero-risk weight to sovereign debt. This regulatory treatment creates an incentive for banks, especially those with lower capital buffers, to increase their holdings of government bonds to improve their capital adequacy ratios without raising additional capital. Horvath et al. (2015) argue that this regulatory arbitrage opportunity drives banks to favor government bonds over other assets, contributing to the strong bank-sovereign nexus observed in many markets.

Deficit Absorption Hypothesis: During periods of fiscal stress, governments may rely on domestic banks to absorb increased issuance of government bonds, a phenomenon often referred to as "moral suasion." As deficits rise, so do financing needs, leading to an increased supply of government bonds in the market. Banks, acting as buyers of last resort, step in to support the government's funding needs. Altavilla et al. (2017) emphasize this dynamic, suggesting that banks' bond

holdings can be seen as a function of the government's fiscal position, particularly in times of crisis.

Reach-for-Yield Hypothesis: In environments where interest rates are low, banks may engage in a reach-for-yield behavior, seeking higher returns by investing in government bonds that offer a yield premium over other available assets. This strategy is particularly appealing when the yield differential between government bonds and traditional lending is significant. Altavilla et al. (2017) discuss how this reach-for-yield behavior can drive banks to hold more government bonds, particularly when faced with a low interest rate environment and limited high-yield investment opportunities.

Lack of Opportunities Hypothesis: The lack of attractive alternative investment opportunities, such as loans, can also drive banks to increase their holdings of government bonds. During periods of weak loan demand or rising non-performing loans, banks may prefer the relative safety of government securities. Rodrigues (1993) and Buljan *et al*. (2020) argue that in such scenarios, government bonds become a safe haven, offering a stable return at a time when other investment options may be underperforming or too risky.

Systemic Risk Concerns: While these hypotheses explain the rationale behind banks' significant holdings of government debt, it is crucial to consider the systemic risks associated with such practices. High concentrations of sovereign debt in bank portfolios can create a dangerous feedback loop between banks and governments, often referred to as the "doom loop." This term describes the situation where banks heavily invested in government bonds become vulnerable to sovereign default risks, which in turn can exacerbate financial instability and lead to broader economic crises (Acharya & Steffen, 2015). Furthermore, in times of sovereign distress, the value of government bonds may decline sharply, eroding bank capital and potentially leading to a banking crisis. This interconnectedness between banks and sovereign debt highlights the critical need for regulatory oversight to prevent excessive risk-taking and ensure financial stability in the broader economy.

3.2 Empirical Literature

The relationship between commercial banks and government bonds has been the subject of extensive empirical investigation, revealing a complex interplay of factors that drive banks' investment behaviors and the systemic risks associated with these decisions. A central finding in this body of literature is that banks' liquidity needs are a significant driver of their holdings of government bonds. In highly leveraged institutions like banks, maintaining a buffer of liquid assets is crucial for managing short-term liabilities and ensuring compliance with regulatory requirements such as the Liquidity Coverage Ratio (LCR) under Basel III. Government bonds, due to their low-risk profile and high liquidity, are frequently the preferred assets for fulfilling these requirements. Empirical studies, such as those by Bonner (2016), have shown that European banks notably increased their holdings of sovereign debt following the introduction of the LCR, which classified government bonds as high-quality liquid assets. This trend highlights the impact of regulatory frameworks on banks' portfolio choices, as banks exploit the zero-risk weight assigned to sovereign debt under Basel regulations to bolster their capital adequacy ratios without the need to raise additional capital.

Another important strand of empirical research focuses on the role of banks as buyers of last resort during periods of fiscal distress, a phenomenon often driven by "moral suasion." Governments, particularly during times of rising deficits, may exert pressure on domestic banks to absorb increased issuances of government bonds to meet their financing needs. Acharya and Steffen (2015) provide compelling evidence of this dynamic in the Eurozone, where banks in countries with higher sovereign risk increased their holdings of domestic government bonds during periods of fiscal stress. This behavior is often seen as banks responding to implicit or explicit government pressure, thereby stabilizing sovereign bond markets in times of economic uncertainty. This interplay between sovereign debt issuance and bank holdings is further corroborated by Ongena, Popov, and Van Horen (2019), who find similar patterns in emerging markets, where banks significantly increase their sovereign debt holdings in response to rising government deficits.

In addition to these regulatory and fiscal pressures, banks' investment in government bonds is also influenced by their search for yield, particularly in low-interest-rate environments. As interest rates decline, banks may engage in "reach-for-yield" behavior, seeking higher returns by investing in government bonds that offer a yield premium over other low-risk assets. This behavior has been empirically observed in several studies, including Altavilla, Pagano, and Simonelli (2017), who document that banks increased their holdings of higher-yielding government bonds in response to the European Central Bank's monetary easing policies. This tendency is especially pronounced in banks with lower capital ratios, indicating that the search for yield is driven not only by the desire for higher returns but also by the need to maintain profitability in a low-margin environment.

Moreover, the availability of alternative investment opportunities plays a crucial role in shaping banks' sovereign debt holdings. During periods of weak loan demand or rising non-performing loans, banks may shift their portfolios towards safer assets such as government bonds. This defensive investment strategy is well documented in the literature, with studies like Buljan et al. (2020) showing that banks in Central and Eastern European countries increased their holdings of government bonds during economic downturns when loan demand was subdued, and credit risk was elevated. Similarly, Gennaioli, Martin, and Rossi (2018) find that banks in countries with high levels of non-performing loans tend to allocate a larger portion of their portfolios to sovereign debt, reflecting a strategic retreat to safer investments during times of financial distress.

While these drivers of banks' appetite for government bonds are well-documented, they also give rise to significant systemic risks. High concentrations of sovereign debt in bank portfolios can create a dangerous feedback loop between banks and governments, often referred to as the "sovereign-bank nexus" or the "doom loop." Empirical studies, such as those by Farhi and Tirole (2018), illustrate how banks' exposure to sovereign debt can amplify the negative impact of sovereign default risk on the banking sector, leading to deteriorating bank balance sheets and increasing the risk of bank runs. Acharya, Eisert, Eufinger, and Hirsch (2019) further emphasize the systemic risks posed by this nexus during the European debt crisis, showing that banks in countries with high sovereign risk experienced significant declines in

their stock prices and increases in their credit default swap (CDS) spreads, reflecting market concerns about the interconnectedness between banks and sovereign debt. This systemic risk is not limited to developed markets, as Brown, Ongena, and Yeşin (2011) demonstrate in emerging markets, where high sovereign debt holdings can lead to a crowding-out effect, reducing bank lending to the private sector and potentially prolonging economic crises.

In summary, the empirical literature paints a detailed picture of the multiple factors driving commercial banks' appetite for government bonds, including liquidity needs, regulatory incentives, fiscal pressures, search for yield, and the lack of alternative investment opportunities. However, these drivers are not without significant systemic risks, particularly the creation of a feedback loop between banks and sovereigns that can exacerbate financial instability. Understanding these dynamics is crucial for policymakers aiming to mitigate the risks associated with high levels of sovereign debt in the banking sector and to ensure the stability of the broader financial system.

4.0 Data and Methodology

The dataset used in this study spans the period from 2005 to 2022, comprising annual data for Kenyan banks. To ensure the reliability and relevance of the analysis, the sample was carefully refined. Banks that exited the industry, merged with others, or had missing data on key variables of interest were excluded. Additionally, banks with fewer than 10 years of data within the 18-year span were omitted. Data was obtained from the Central Bank of Kenya (CBK) and the Kenya National Treasury. To improve the robustness of the results, outliers were identified and trimmed, resulting in a dataset that accurately reflects the factors influencing banks' sovereign debt holdings over time.

4.1 Empirical Model

The following panel model was specified to analyze the determinants of banks' sovereign debt holdings:

$$y_{i,t} = \alpha_i + \beta X_{i,t} + \delta Z_{i,t} + \lambda_t + \epsilon_{i,t} \quad \text{..... [1]}$$

Where $y_{i,t}$ is the dependent variable, $X_{i,t}$ includes the main explanatory variables, $Z_{i,t}$ represents the vector of control variables, α_i are bank fixed effects, λ_t are time effects and $\epsilon_{i,t}$ is an error term. The dependent variable is the annual percentage change in bank sovereign debt holdings (as a % of total bank assets). The main explanatory variables are: fiscal deficit (% of GDP), government 5-year bond Yields, capital adequacy ratio and loans to private sector. The control variables include; previous bank exposure to sovereign debt, GDP to control for general macroeconomic conditions, bank profitability (ROA) and liquidity risk. A full description of the data and sources, along with their expected signs are presented in **Table 1**.

Table 1: Data Description

Category	Variable	Unit	Source	Expected effect	Mechanism
Dependent variable	Sovereign debt securities	% change	CBK		
Main explanatory variables	Budget deficit / Change in public debt	% of GDP	Kenya Treasury	+	Rise in deficit increases financing needs of the government, which leads to higher supply of government bonds.
	Yields Spreads	%	Kenya Treasury	+	Higher yields on local government bonds make them more attractive for banks.
	Capital adequacy ratio (CAR)	%	CBK	+	Banks are motivated to hold debt securities to improve their CAR.
	Private sector loans	% change	CBK	-	Rising of corporate/household loans indicates that banks see investment opportunities in private sector.
Control variables	Exposure	%	CBK	-	Higher exposure to sovereign debt in previous period reduces the absorption capacity for additional sovereign bonds in banks' balance sheets.
	GDP	growth rate %	CBK	-	Stronger GDP growth has positive effect on demand for loans from private sector, i.e. during expansions banks have more investment opportunities.
	ROA	% (Net profit/ total assets)	CBK	-	Higher profitability (ROA) suggests that banks may prefer more profitable investments, such as loans, rather than low-yield government securities.
	Liquidity	% (loans-deposits)/total assets	CBK	-	Higher liquidity risk may drive banks to hold more government securities to manage liquidity and balance sheet risks, as these are safer and more liquid assets.

4.3 Econometric Procedure

The fixed effects (FE) model was selected as the primary estimation technique, given its ability to address bank-specific unobserved heterogeneity. This approach captures unique, time-invariant characteristics of individual banks, such as differences in risk appetite or institutional strategies, which might influence their sovereign debt holdings. Unlike pooled OLS, which assumes homogeneity across entities, the fixed effects model accounts for variations within each bank over time, thereby eliminating bias from omitted time-invariant variables.

To validate the appropriateness of the fixed effects model, several diagnostic tests were conducted. The Breusch-Pagan test rejected the null hypothesis of pooled OLS being suitable, highlighting significant heterogeneity among banks. The Hausman test favored the fixed effects model over the random effects model, confirming that the former provides consistent estimates for this dataset. Furthermore, tests for heteroskedasticity, serial correlation, and cross-sectional dependence revealed potential issues, which were addressed by employing robust standard errors, clustered standard errors, and Driscoll-Kraay standard errors, respectively.

Although dynamic modeling approaches, such as Panel VAR or GMM, could potentially provide deeper insights into long-term or lagged effects, the fixed effects model remains well-suited to the objectives of this study. Its focus on within-bank dynamics over time aligns with the research aim of identifying key drivers of sovereign debt holdings and their implications for systemic risk in the Kenyan banking sector.

The fixed effects model does have limitations. For instance, time-invariant variables, such as structural bank policies, cannot be estimated within this framework. Additionally, potential endogeneity concerns, such as reverse causality between sovereign debt holdings and fiscal deficits, warrant further investigation. Despite these limitations, the fixed effects model offers robust and reliable estimates for understanding the determinants of sovereign debt holdings in Kenyan banks, making it the most appropriate choice for the dataset at hand.

5.0 Empirical Results and Discussion

5.0 Descriptive Statistics

Table 2 presents the summary statistics of the variables considered in this study. The securities variable which defines the percentage of a bank's assets held in government securities, shows an average value of 23.2%. This suggests that, on average, banks allocate nearly a quarter of their assets to government securities. The standard deviation of 14.3% indicates a moderate level of variation among banks in terms of their exposure to government securities. The range from 0% to 66.7% reflects a significant diversity in strategy. Some banks may hold no government securities, potentially indicating a focus on more aggressive or alternative investment strategies. On the other end, some banks have as much as two-thirds of their assets in government securities, suggesting a very conservative risk profile, possibly due to risk-averse management.

The public deficit, an indicator of fiscal health, averages at 5.42% with a median slightly higher at 5.75%. The yield on 5-year securities stands at an average of 11.39%, closely matching the median of 11.46%, and shows modest fluctuation with a standard deviation of 1.41%, suggesting relatively stable interest rate conditions during the period studied. Loan portfolios, which represent the percentage of loans to total bank assets, average at 53.74%, with a median notably higher at 55.83%. This suggests a robust lending activity among the majority of banks, though the range from 23.42% to 73.19% indicates diverse lending strategies and risk appetites. The capital adequacy ratio (CAR), crucial for bank stability, averages 22.76% with a wider range from 4.55% to 56.92%. This wide range highlights significant differences in capital buffers among banks, crucial for understanding risk management practices across the sector.

Return on assets (ROA), a key profitability metric for banks, shows an average of 2.86% and a median slightly lower at 2.71%. The range from 0.18% to 7.85% underscores

the varied profitability across banks, linked to differing business models and operational efficiencies. Lastly, liquidity risk, calculated as the ratio of (loans-deposits) to total bank assets, stands at an average of -19.55%, indicating that on average, banks maintain more deposits than loans, with some variability evident in the range from -56.50% to 17.94%.

Table 2 also shows that the average fiscal deficit relative to GDP over the period 2005 to 2022 stood at about 5.42% with a range of between 0.95% (near-balanced budget) and 8.13% (significant deficit). During this sample period economic growth average about 4.62% with growth rates swinging from slight contraction (-0.25%) to robust expansion (8.06%).

Table 2: Summary Statistics of Key Variables of Interest

	N	Mean	Median	Min	SD	p25	p75	Max
Securities	312	23.94	21.02	0.34	13.82	15.21	29.72	66.67
Deficit	312	5.42	5.75	0.95	2.04	3.67	7.14	8.13
Yield (5 year)	312	11.39	11.46	8.40	1.41	10.44	12.40	13.88
Loans	312	53.74	55.83	23.42	11.49	48.09	62.82	73.19
CAR	312	22.76	20.28	4.55	8.24	17.01	27.30	56.92
Public debt	312	47.29	41.28	34.19	12.05	36.69	56.45	67.94
GDP	312	4.62	5.02	-0.25	2.11	3.82	5.37	8.06
ROA	312	2.86	2.71	0.18	1.72	1.39	4.17	7.85
Liquidity risk	312	-19.55	-18.21	-56.50	13.78	-26.91	-10.25	17.94

5.2 Panel Estimation Results

This section provides the estimation results of the determinants of banks' holdings of domestic government securities. Specifically, the regression results of model 1 are presented. However, before delving into the results, it is instructive to perform diagnostic tests to ensure the validity of the model used and the robustness of the results. **Table 3** summarizes the results of various diagnostic tests performed on the panel dataset, including tests for poolability, model preference, heteroskedasticity, serial correlation, and cross-sectional dependence.

Table 3: Summary of Diagnostic Tests

Null Hypothesis	Test	Statistic	Pvalue	Conclusion
H0: Pooled OLS is appropriate	Breusch-Pagan poolability test	528.18	0.000	Pooled OLS not appropriate
H0: Random effect model is preferred	Hausman RE vs FE test	60.97	0.000	FE is appropriate
H0: Errors are homoscedastic	Modified Wald test of GroupWise heteroskedasticity	1,383.60	0.000	Errors are heteroskedastic
H0: Errors are not serially autocorrelated	Wooldridge test for autocorrelation	79.10	0.000	Errors are serially correlated
H0: Errors are cross-sectionally independent	Pesaran's test of cross-sectional independence	2.71	0.000	Presence of cross-sectional independence

The diagnostic tests highlight the necessity of using a fixed effects model with robust standard errors to account for heteroskedasticity, serial correlation, and cross-sectional dependence in the panel data. These steps ensure more reliable and valid inference from the model estimates.

This section presents the results of panel analysis. The estimation results are presented in **Table 4**.

Table 4: Panel Estimation Results

	(1)	(2)	(3)	(4)	(5)
Deficit	1.036* (.54)			.933* (.538)	
Yield (5 year)	1.944 (1.956)	6.17*** (1.438)	4.969*** (1.257)	2.155 (2.02)	4.758*** (1.07)
Loans growth	-.417*** (.093)	-.417*** (.093)	-.417*** (.093)	-.480*** (.091)	-.480*** (.091)
CAR (lagged)	.266*** (.062)	.266*** (.062)	.266*** (.062)	.228*** (.06)	.228*** (.06)
Exposure (lagged)	-.543*** (.083)	-.543*** (.083)	-.543*** (.083)	-.579*** (.076)	-.579*** (.076)
Change in debt		2.293* (1.195)			.227* (.131)

	(1)	(2)	(3)	(4)	(5)
GDP growth			-.429* (.224)	-.011 (.309)	-.44** (.212)
ROA (lagged)				.092 (.323)	.092 (.323)
Liquidity risk (lagged)				-.149** (.066)	-.149** (.066)
_cons	-17.438 (19.24)	-59.649*** (15.377)	-44.232*** (13.154)	-20.833 (19.16)	-43.418*** (11.36)
Observations	261	261	261	261	261
R-squared	.474	.474	.474	.490	.490
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

The panel fixed-effects regression results offer a comprehensive view of the determinants of sovereign debt holdings within the Kenyan banking sector, reflecting broader trends observed in similar contexts globally. This analysis, when placed in the context of existing literature, not only validates previous findings but also provides new insights into the specific dynamics at play in Kenya's financial system.

The positive and significant relationship between government deficits and banks' sovereign debt holdings observed in models (1) and (5) aligns with the "moral suasion" hypothesis, where governments, particularly in developing countries, may rely on domestic banks to absorb increasing issuances of sovereign debt during times of fiscal stress. This finding is consistent with the results of Acharya and Steffen (2015), who documented a similar pattern in the Eurozone during periods of heightened sovereign risk. The Kenyan context reflects this broader trend, where banks appear to support government financing needs in response to widening deficits, a behavior that has also been noted in emerging markets by Ongena, Popov, and Van Horen (2019). These studies underscore the critical role that banks play in stabilizing sovereign bond markets, particularly when government deficits rise.

The significant positive coefficients on the yield of 5-year government bonds, particularly in models (2), (3), and (5), highlight the reach-for-yield behavior that banks engage in under certain market conditions. This result resonates with the findings of Altavilla, Pagano, and Simonelli (2017), who observed that banks in the Eurozone increased their holdings of higher-yielding government bonds in response to the European Central Bank's monetary easing policies. The Kenyan banks' behavior, as captured in this analysis,

suggests that the pursuit of higher yields in a low-interest-rate environment is a significant driver of sovereign debt holdings. This aligns with more recent studies, such as those by Gennaioli, Martin, and Rossi (2018), which also identified yield-seeking behavior as a key factor in banks' portfolio decisions, particularly in settings where alternative high-yield investments are limited.

Loan growth, which consistently exhibits a negative and significant relationship with sovereign debt holdings across all models, reflects a strategic shift by banks toward more profitable assets when loan demand is strong. This finding is corroborated by the work of Buljan et al. (2020), who noted that in periods of robust loan growth, banks in Central and Eastern Europe reduced their holdings of sovereign debt in favor of expanding their loan portfolios. The inverse relationship between loan growth and government bond holdings suggests that Kenyan banks, like their counterparts in other regions, prioritize lending over holding government securities when market conditions favor lending. This behavior is indicative of the broader trend where banks adjust their asset allocations in response to the relative profitability of different asset classes, as also observed by Brown, Ongena, and Yeşin (2011) in emerging markets.

The positive association between lagged Capital Adequacy Ratio (CAR) and sovereign debt holdings, as seen across all models, highlights the role of regulatory capital requirements in influencing banks' investment in government securities. This result is consistent with the findings of Horvath et al. (2015), who demonstrated that better-capitalized banks tend to hold more government bonds, leveraging the zero-risk weight assigned to sovereign debt under Basel regulations to enhance their capital adequacy ratios. In the Kenyan context, this suggests that banks with stronger capital positions are more likely to increase their holdings of government bonds, potentially as a strategy to optimize their regulatory capital buffers while maintaining liquidity.

Conversely, the negative and significant impact of lagged exposure to government securities on current holdings suggests that banks may be cautious about over-concentrating their portfolios in sovereign debt. This finding aligns with the literature on risk management in banking, where excessive exposure to a single asset class, particularly government bonds, is seen as a potential source of systemic risk. Farhi and Tirole (2018) discuss how high concentrations of sovereign debt can create a feedback loop between banks and governments, increasing the vulnerability of the banking sector to sovereign default risks. The Kenyan data suggests that banks with substantial previous exposure to government bonds may strategically reduce their holdings to mitigate such risks.

The change in public debt, which shows a positive and significant relationship with sovereign debt holdings in models (2) and (5), supports the deficit absorption hypothesis, where banks absorb new issuances of government debt as public debt levels rise. This is particularly relevant in emerging markets, where domestic banks often play a critical role in financing government debt, as noted by studies such as those by Ongena, Popov, and Van Horen (2019). The Kenyan banking sector's response to increasing public debt appears to be in line with these findings, suggesting

that banks act as a stabilizing force in the face of rising sovereign debt.

GDP growth's negative and significant impact on sovereign debt holdings, particularly in models (3) and (5), further illustrates the counter-cyclical nature of government bond holdings. During periods of economic expansion, banks are likely to reduce their exposure to government securities, favoring more profitable opportunities such as loans or corporate bonds. This behavior is consistent with the findings of Gennaioli, Martin, and Rossi (2018), who observed similar patterns in banks' asset allocation during economic upturns. The Kenyan banks' behavior suggests a preference for reallocating resources to higher-yielding assets during times of economic growth, a strategy that is in line with broader global trends.

Lastly, the negative relationship between liquidity risk and sovereign debt holdings, as seen in models (4) and (5), indicates that banks facing higher liquidity risks are less likely to hold government bonds, possibly due to the need to maintain more flexible and liquid asset portfolios. This finding echoes the concerns raised by Acharya et al. (2019) regarding the potential for liquidity crises in banks with high sovereign debt exposure, particularly during times of financial stress.

In conclusion, the results from this panel fixed-effects regression analysis of Kenyan banks provide strong empirical support for several key hypotheses regarding the determinants of sovereign debt holdings. The findings align well with existing literature, particularly recent studies that emphasize the importance of fiscal pressures, regulatory incentives, yield-seeking behavior, and the availability of alternative investments in shaping banks' sovereign debt portfolios. Moreover, the results highlight the systemic risks associated with high concentrations of government bonds in bank portfolios, underscoring the need for careful risk management and regulatory oversight in the Kenyan banking sector. These insights contribute to the broader understanding of the bank-sovereign nexus, particularly in the context of emerging markets, and offer valuable guidance for policymakers and regulators aiming to ensure financial stability.

5.1 Systemic Risk Concerns of Banks Exposure to Sovereign Debt

The intertwining of bank holdings of government securities and systemic risk presents a crucial area of study, especially given the substantial implications for financial stability and regulatory frameworks. Government securities, traditionally viewed as risk-free assets, have become a significant component of bank assets, especially in environments of economic uncertainty or fiscal expansion (Acharya and Steffen, 2015). However, the concentration of such assets can propagate systemic risk through various channels, including market and liquidity risks. When banks heavily invest in government securities, they expose themselves to price volatility and interest rate risks, which can be exacerbated during periods of financial or political turmoil (Gennaioli, Shleifer, and Vishny, 2012). This exposure was notably highlighted during the European debt crisis, where banks with significant holdings in domestic sovereign securities faced heightened solvency concerns as bond yields spiked (Brunnermeier, 2014).

Moreover, the correlation of banks' investment in government securities across the system can lead to a homogenization of balance sheets, which reduces diversification and increases systemic susceptibility (Aikman et al., 2015). Such homogeneity can amplify shock transmissions within the banking sector, potentially leading to cascading effects that affect the broader financial system. Additionally, the procyclical nature of such investments—where banks increase holdings in good times and decrease in bad—can lead to further destabilization during economic downturns (Adrian and Shin, 2010). Given these considerations, it is imperative to explore the systemic risks associated with banks' strategic allocations to government securities, to inform both macroprudential policy and individual bank risk management practices.

In this study, we employ network analysis to examine the temporal evolution of correlations in banks' holdings of government securities in Kenya, offering insights into the potential systemic risks within the financial sector. By analyzing the interconnectedness and the strength of these correlations over time, we can identify patterns and trends that signal increased systemic vulnerabilities. This methodological approach allows us to pinpoint clusters of banks that may be disproportionately exposed to sovereign risk, thereby affecting the overall stability of the financial system (Glasserman and Young, 2016). The findings from this analysis are intended to provide policymakers and regulators with crucial data-driven insights, aiding in the formulation of targeted regulatory measures that mitigate systemic risks while promoting a stable and resilient banking environment. This proactive assessment is vital in preempting financial crises that could stem from correlated exposures, ensuring that the banking sector remains robust against both idiosyncratic and systemic shocks.

This study investigates the correlation of sovereign holdings among banks over three distinct periods: 2005-2010, 2011-2016, and 2017-2022. By constructing network graphs based on these correlations, the exercise aims to provide insights into the evolving nature of systemic risk and interdependencies among banks. Each period reflects different economic conditions and regulatory environments, allowing us to observe how banks' strategies in managing their sovereign exposures have adapted over time. The network graphs enable a visual and quantitative analysis of the degree of interconnectedness among banks, highlighting potential vulnerabilities within the sector. This longitudinal approach not only captures shifts in risk dynamics but also assists in understanding the broader implications of banks' portfolio choices on financial stability.

To construct the network graph illustrating the correlation of sovereign holdings among banks, the study followed a structured procedure with the dataset encompassing annual data on sovereign holdings for each bank, identified by unique IDs, over three defined periods: 2005-2010, 2011-2016, and 2017-2022. Initially, the data was filtered to only include entries relevant to each period. Subsequently, we calculated the average sovereign holdings for each bank within these intervals. This processed data was then pivoted to form a matrix with years as rows, banks as columns, and average holdings as values, facilitating the calculation of Pearson correlation coefficients among banks.

For the network graph construction, a correlation threshold of 0.7 was set to delineate significant interbank relationships. Using these correlations, network graphs were created where each node represented a bank, and edges linked nodes with correlations that met or exceeded the threshold. The Kamada-Kawai layout algorithm was employed to position the nodes effectively, enhancing the graph's clarity and interpretability. Nodes were color-coded—'navy' for banks with holdings above the median and 'skyblue' for those below—to visually signify the scale of sovereign holdings. Edge widths were adjusted proportionally to the strength of the correlations, emphasizing more substantial relationships. This visual and analytical approach provided a clear depiction of the evolving interdependencies and potential systemic risks within the banking sector across the studied periods.

The analysis of network graphs over three distinct periods provides a nuanced understanding of the evolving patterns of interconnectivity among banks and their implications for systemic risk, centered around their sovereign debt holdings.

During the first period, 2005-2010, the network graph displays relatively sparse connections among banks, indicating limited strong correlations in their sovereign holdings. This suggests that banks employed more diversified investment strategies during this time, potentially due to less synchronized market conditions or varied individual institutional strategies prior to the global financial crisis. The interpretation of these findings suggests a lower systemic risk due to the reduced interconnectivity, implying that fewer banks were closely coupled, thereby maintaining varied investment profiles and reducing the likelihood of simultaneous impacts from adverse shocks.

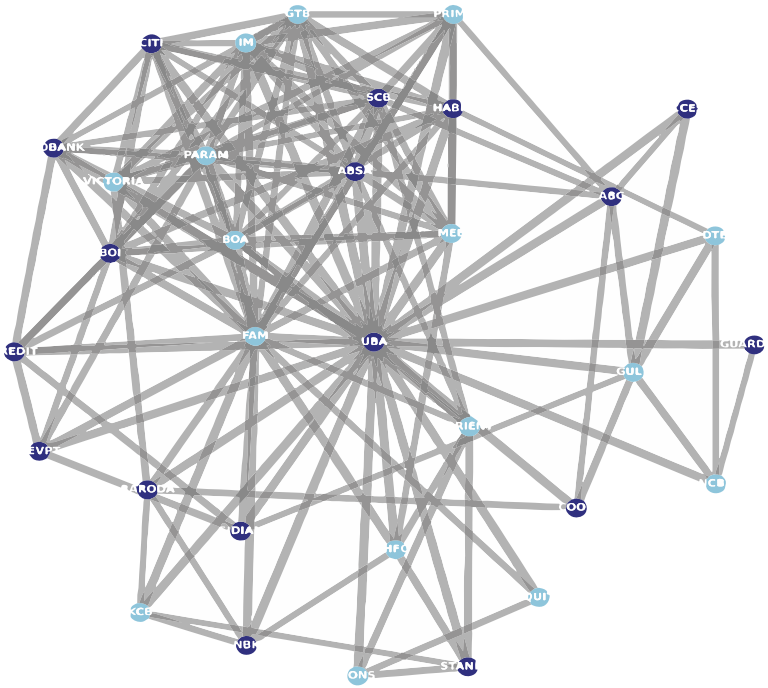
In contrast, the network graph for the second period, 2011-2016, shows significantly increased connectivity, with a greater number of edges denoting stronger correlations among banks. This period, following the global financial crisis, likely saw banks' investment strategies becoming more aligned, influenced by similar regulatory pressures and economic environments. The enhanced interconnectivity during this period suggests an increased systemic risk, as banks became more susceptible to common shocks affecting the sovereign debt markets. This aligns with Adrian and Brunnermeier's (2016) findings, which indicate that post-crisis regulatory environments may lead to more synchronized risk management practices among financial institutions.

The trend of high connectivity continues into the third period, 2017-2022, indicating a persistent alignment in banks' approaches to sovereign debt investments. This ongoing trend may be attributed to prevailing economic trends and regulatory frameworks that promote similar investment behaviors across banks. The sustained high level of interconnectivity suggests that systemic risk remains elevated, with banks being closely linked through similar exposures to sovereign debt, increasing their vulnerability to systemic shocks. This observation resonates with the work of Allen and Gale (2000), who emphasize the critical role of interconnectedness in determining financial stability.

In conclusion, the network analysis across these periods highlights a clear trend of increasing interdependencies among banks through their

sovereign debt holdings, underscoring the critical need for continued monitoring and management of these connections to mitigate potential systemic crises. Future research directions may include the use of more granular data and the application of advanced network metrics to provide deeper insights into these complex dynamics, thereby enhancing our understanding of systemic risk factors in the banking sector.

Figure 7(a): Network Graph of Banks Based on Average Sovereign Holdings Correlations 2005-2010



Correlation ≥ 0.7

Figure 7(B): Network Graph of Banks Based on Average Sovereign Holdings Correlations 2011 - 2016

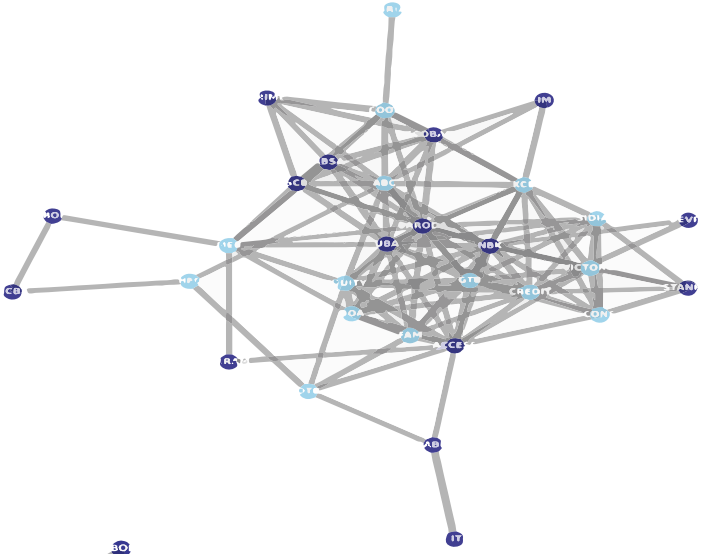
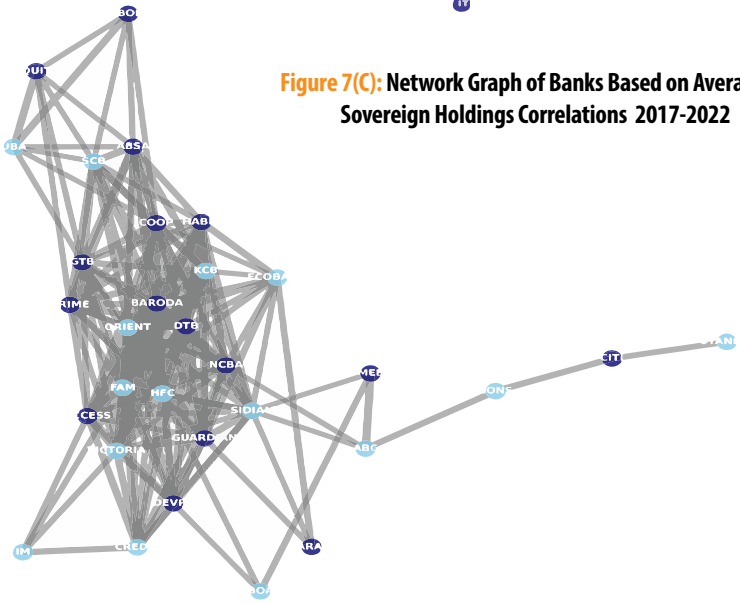


Figure 7(C): Network Graph of Banks Based on Average Sovereign Holdings Correlations 2017-2022



6.0 Conclusions and Policy Recommendations

This study set out to explore the factors driving Kenyan banks' demand for government securities and the systemic risks associated with these holdings. Using a fixed-effects panel regression model on data spanning 2005 to 2022, key findings indicate that fiscal deficits, attractive bond yields, and capital adequacy requirements significantly influence banks' sovereign debt holdings. Additionally, the study found a growing similarity in banks' sovereign debt portfolios, which raises systemic risk concerns, particularly in the context of correlated exposures during periods of sovereign distress. Moreover, a negative relationship between private sector lending and sovereign debt holdings suggests that increased government borrowing may crowd out private investment.

6.1 Policy Recommendations:

1. **Regulatory Reforms:** Given the strong influence of capital adequacy on banks' demand for government securities, there is a need to revise capital adequacy frameworks. These revisions should consider the risks associated with high concentrations of sovereign debt in banks' portfolios. Enhanced capital requirements for sovereign exposures could help mitigate correlated risks during sovereign distress, as highlighted by the study's findings.
2. **Encouraging Diversification:** The increasing homogeneity in sovereign debt holdings across banks points to the necessity of promoting asset diversification strategies. Diversification can reduce the potential for systemic shocks and alleviate the crowding-out effect on private sector lending observed in this study. Policymakers could incentivize diversification through tax benefits or reduced regulatory burdens on diversified portfolios.
3. **Enhanced Monitoring:** Strengthening regulatory oversight to monitor banks' sovereign debt exposures is critical. The study underscores the need for robust supervisory mechanisms to ensure that banks effectively manage the systemic risks associated with concentrated sovereign debt holdings. Enhanced

monitoring could include stress testing banks' portfolios under various sovereign risk scenarios, providing early warning signals and enabling timely regulatory interventions to safeguard financial stability.

These policy recommendations aim to address the systemic vulnerabilities identified in the study, ensuring that the Kenyan banking sector remains resilient to sovereign risks and continues to support economic growth through sustained private sector lending.

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