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VOLATILITY SPILLOVER ACROSS SOVEREIGN BOND MARKETS BETWEEN AFRICAN, EMERGING AND USA ECONOMIES

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Abstract. This study attempted to examine the volatility spillover between the sovereign bond returns of South Africa and Ghana and the emerging market bond return, USA stock market return and the world long term interest rate using weekly data in the period of 2014–2022. The research used dynamic and constant conditional correlation generalized auto-regressive conditional Heteroskedas-ticsticity models. The result showed that the volatility of long-term world bond interest rate and USA stock market return affected the Ghana sovereign bond return positively and negatively, respectively. Similarly, the volatility of emerging market bond return and long-term world interest rate affected the South African sovereign bond return positively and negatively, respectively. Thus, policy intervention is needed to contain the negative impact of stock market and long-term world interest rates.

Keywords*: Emerging bond return, sovereign bond markets, US stock market return, volatility spillover.*

JEL Classification: D53, G12

INTRODUCTION

These days, issuing sovereign bonds has become common around the globe. Issuing sovereign bonds provides an alternative source of financing for infrastructure projects, social programs and other government spending when tax revenue is insufficient (Dittmar & Yuan, 2008; Arteta & Hale, 2008). It also helps refinance matured debts and future interest payments, including debt restructuring (Fabella & Madhur, 2003; Vellos, 2015).

Considering these advantages, Africans have given great emphasis to bond issuance. The total value of issued sovereign bond by countries in Sub-Saharan Africa resurged in 2021 to $21.1 billion. This was 225 % higher than the issuance in 2020. It implies that the sovereign governments and investors return to international bond markets after the shutdown in 2020 due to the impact of the COVID-19 pandemic (World Bank, 2021)

The "outstanding foreign currency-denominated sovereign debt" of the region reached $115 billion in 2017 (Allen, 2018).

However, recently the trend has been declining due to developed countries' response to the upsurge of government debt and liquidity problems because of the Covid-19 pandemic. The recent forecast by Fitch Ratings (2021) shows a declining

trend for bond returns of Ghana, South Africa and other countries. In contrast, the median government debt was projected to grow from 66 % of GDP in 2020 to 73 % in 2022 in sub-Saharan Africa. The monetary policy, particularly the exchange rate policy, also affects the bond market because most sovereign bonds of developing countries are denominated in US dollars, euros, or other exchanges (Jahjah et al., 2013). On the other hand, the return and volatility spillovers from developed and emerging bond markets to the sub-Saharan African sovereign bond market have a negative impact (Kletzer, 2005; Arteta & Hale, 2008).

Therefore, the aim of this study is to examine the volatility spillover from the USA stock market, emerging economies' bond market and the long-term world interest rate for Ghana and South Africa using the dynamic and constant conditional correlation generalized auto-regressive conditional heteroskedasticsticity (DCC-MGARCH) and constant conditional correlation generalized auto-regressive conditional heteroskedasticsticity (CC-MGARCH) models. The findings will help understand the direction and magnitude of volatility spillover. In turn, this contributes to devising the volatility spillover effect by handling policies and valuation of corporate bonds.

The remaining part is divided into four sections. Section 2 reviews the existing literature. Section 3 focuses on methodology and data description. Section 4 presents, interprets and discusses the empirical results, and Section 5 is the conclusion.

1. LITERATURE REVIEW

A considerable number of studies focus on the sovereign bond return volatility spillover across financial markets of global countries. The first strand of studies concentrates on theorizing the observed realisms in the developing sovereign bond market. Ideally, international financial markets are expected to provide opportunities for developing countries (Kletzer, 2005). In real terms, even sovereign bonds are resulting in liquidity risk and macroeconomic instability in Africa (te Velde, 2014). Due to mis-management and discriminatory acts of international financial institutions, these problems are common in Africa (Morsy & Moustafa, 2020).

The other strand of literature focuses on empirical scrutiny of the volatility spillover among developed, emerging and frontier bond markets. Claeys & Vasicek (2012), Azis et al. (2013), Belke et al. (2018) and Tsang et al. (2021) examined the linkage and direction of sovereign bond market volatility among European countries and Asia, USA and Europe, respectively. They documented the existence of significant volatility spillover among the EU countries' markets and the Asian market reacted substantially to the US and Eurozone markets, even though heterogeneity was observed in the direction of spillover. Vizek (2019) studied the role of individual countries in the bond market volatility spillover in 19 countries and the high impact of innovation in the USA bond market on volatility spillover.

In Africa, Emenike (2022) found a unidirectional bond market volatility spillover from Morocco to Egypt, bidirectional between Uganda and Kenya and Botswana and South Africa and no interaction between Ghana and Nigeria. Hooker

(2004) established a negative relationship between stock market returns and the interest rate for 29 emerging markets in Asia, Latin America, Africa and the Middle East, and Adjasi & Biekpe (2006) – for Africa.

However, few studies were conducted in the context of Africa. A literature review shows the existence of volatility spillover between different bond markets. Thus, this study was conducted to evaluate the volatility spillover from the USA stock market, emerging economies' bond market and long-term world interest rates to the South African and Ghana sovereign bond market.

2. DATA AND METHODOLOGY

2.1. Data Description

The research used the weekly sovereign bond price index of South Africa and Ghana, an emerging market bond index, the "world's long-term interest rate" and the Dow Jones Industrial Average price index for the period of week forty-nine of 2014 to week six of 2022.

To make the interpretation easy and to compare the returns across the different countries without unit difference, we changed the weekly price index stock market to constantly compounded percentage return (Tsay, 2005). It was computed as follows: $r_t = 100\times(\ln p_t - \ln p_{t-1})$ for $t = 1, 2,..., 374$; where r_t is the return index, p_t is the stock price index at time t and p_{t-1} is the stock index at time $t-1$. Finally, the series was transformed to a stationary series.

2.2. Methodology

In the last 20 years, the generalised auto-regressive conditional heteroskedasticity (GARCH) model was widely applied to analyse financial time series (Francq & Zakoïan, 2016). From the multiple GARCH families, the model proposed by Baba, Engle, Kraft and Kroner (BEKK), the constant conditional correlation (CCC) model contributed by Bollerslev (1990) and later improved by Jeantheau (1998), and the dynamic conditional correlation (DCC) models introduced by Tse & Tsiu (2002) are commonly used to examine the volatility spillover among stock markets. The MGARCH-BEKK model is frequently used to handle the asymmetric volatility and shock spillovers from each endogenous variable to other endogenous variables in the model and indicates the direction of the spillover by allowing interactions between conditional variances and covariance of two or more time series (Emenike, 2018). However, in terms of correlation and volatility studies, the DCC-MGARCH is preferred to the BEKK-MGARCH model as the former studies have a tendency to yield less volatile estimates. Furthermore, dynamic conditional correlation (DCC) analysis has a means to reduce the dimensionality problem by employing the time-varying correlation in two different volatile bond markets (Engle, 2002)

The other category of empirical work used variance decompositions integrated with a generalized vector autoregressive framework contributed by Diebold & Yilmaz (2009) and improved by themselves in 2012 for sovereign bond return volatility spillover analysis. The drawback of this model is exaggeration of causal

effect identification in the impulse response analysis. Finally, because of the advantages stated above, DCC-MGARCH and CCC-MGARCH models were selected. Based on Akaike information criterion (AIC) and Schwarz_Bayesian criterion (BIC) we tested in Table 2, CCC-MGARCH better fits the data than DCC-MGARCH. Thus, we adopted CCC-MGARCH from the Bollerslev (1990) as follows:

$$h_{i,t} = \omega + \sum_j^3 A_j \varepsilon^2_{t-1} + \sum_j^3 B_j h_{1-t} \qquad i = 1,2,\ldots n,$$

where ω shows $N\times1$ dimension vector, A_j and B_j represent $N\times N$ dimension diagonal matrices. In this model, the conditional covariance matrix is defined as follows:

$$H_t \equiv D_t P D_t, \;\; D_t = \text{dia}\left(h_{1,t}^{1/2},\ldots h_{N,t}^{1/2}\right) \text{ and } \;\; p = \left|p_{i,j}\right| \;\; i,j = 1,2,3,$$

where H_t is the conditional covariance matrix; P is the $(n\times n)$ time-invariant correlation matrix; D_t is the $(n\times n)$ diagonal matrix of time-varying standard deviations. The DCC model introduced by Engle (2002) is also estimated to compute the time-varying conditional correlation and robustness checking. For further detail see Engle & Sheppard (2001).

3. RESULT AND DISCUSSION

3.1. Descriptive Statistics

Table 1 provides the summary statistics of the USA stock market return, long-term world bond interest rate, the emerging market bond return and Ghanaian and South Africa sovereign bond returns.

Table 1. Summary of Descriptive Statistics

Indices	SAbondin	GANbonind	Emarboin	DowJoind	fed_10
Mean	−0.1186	0.0016	−0.0349	0.17924	1.1208
Median	1.48423	0.55916	1.28685	2.18391	0.68907
Maximum	−10.058	−3.239	−14.016	−16.384	−0.47
Minimum	3.2866	2.08054	4.14805	6.82459	2.48
Standard Deviation	−0.1186	0.0016	−0.0349	0.17924	1.1208
Skewness	(0.00)**	(72.09)**	(0.00)**	(0.00)**	(25.21)**
Jarque-Bera	(1397)**	(936.7)**	(2.5e+04)**	(1531)**	(14.2)**
ARCH-LM(1)	(68.373)**	(23.955)**	(20.110)**	2.511	(294.750)**

Note. Superscripts ** and * indicate significance at 1 % and 5 % levels, respectively.

The Wald test shown in the header of the DCC-MAGRCH estimation results presented in Appendices 1 and 2 indicates that at least one among the coefficients of independent variables in the mean equations is different from zero.

Akaike information criterion (AIC) and Schwarz_Bayesian criterion (BIC) test in Table 2 shows that CCC-MGARCH model better fits the data than DCC-MGARCH for both Ghana and South Africa sovereign bond returns.

Table 2. Akaike Information Criterion and Bayesian Information Criterion

Model	N	Df	AIC	BIC
MGARCH-DCC (Ghana)	373	23	4141.667	4231.864
MGARCH-CCC (Ghana)	373	21	4143.565	4225.918
MGARCH-DCC (South Africa)	373	23	4875.485	4965.681
MGARCH-CCC (South Africa)	373	21	4875.917	4958.27

Source: The author's computation.

3.2. Dynamic Conditional Correlation Analysis

Table 3 presents the descriptive statistics of the dynamic conditional correlations between the sovereign bond returns of Ghana and South Africa and USA stock market return, emerging markets' bond return and long-term world interest rate estimated employing DCC-MGARCH. Graphically, Figs. 1–4 portray the dynamic conditional correlation and the constant conditional correlation between Ghanaian and South African sovereign bond returns with emerging market bond return, USA stock market return and long-term world interest rate.

Fig. 1 depicts the conditional correlations between Ghanaian and South African sovereign bond returns and the US stock market return, emerging market bond return, and long-term world interest rates. The conditional correlation between the sovereign bond returns of Ghana and the average emerging market bond return varied widely between −0.117 (the minimum correlation exhibited in the 41st week of 2015) and 0.49 (the maximum correlation occurred in the 11th week of 2020). In the 48th week of 2018 and 12th week of 2020, 0.253 correlation and 0.223 correlation were established between the two variables, respectively. On the other hand, as observed in Fig. 1, there were 52 occasions in which the correlation fell below zero. As shown in Appendix 1, the average conditional correlation between the two variables is 0.0.26, which is statistically insignificant.

Likewise, the correlation between the US stock market return and the Ghana sovereign bond return fluctuates between −0.322 (which occurred in the 9th week of 2020) and 0.17 (established in the 48th week of 2018). The average correlation fell below zero, which is −0.15. As indicated in Appendix 1, the conditional correlation between these two variables is statistically insignificant at the conventional level of significance.

The conditional correlation between the sovereign bond return of Ghana and the long-term world interest rate changes between −0.34 (observed in the 9th week of 2020) and 0.041(revealed in the 52nd week of 2017). The average correlation is −0.152. The test statistics presented in Appendix 1 indicate that the correlation between Ghana's sovereign bond return and the world long-term interest rate is statistically significant at a 5 % level.

The conditional correlation between the South African sovereign bond return and the emerging market bond return varies between −0.76 (observed in the 11th

week of 2020) and −0.33 (observed in the 45th week of 2016), as shown in Fig. 3 below. The average correlation and the standard deviation of the conditional correlation between these two variables are −0.55 and 0.03, respectively. As shown in Appendix 2, the correlation is statistically significant at a 1 % level of significance.

On the other hand, the correlation between South African sovereign bond returns and the US stock market return changes between −0.55 (established in the 2nd week of 2020) and −0.09 (scored in the 45th week of 2016) and are statistically significant at 1 % level. The average and the standard deviation of this correlation are −0.31 and 0.033, respectively.

Similarly, the correlation established between South African sovereign bond returns and the long-term world interest rate varies between −0.037 (minimum correlation observed at the 45th week of 2016) and 0.37 (correlation spikes happened at the 12th week of 2020). The average correlation and standard deviation of the correlation between the two variables are −0.142 and 0.035, respectively. The relationship is statistically significant at a 5 % level. These results imply that the correlation between the South African sovereign bond return and the emerging market bond return is stronger than its correlation with the US stock market return and the long-term world interest rate.

Table 3. Descriptive Statistics of Dynamic Conditional Correlation

Variable	Obs	Mean	Std. Dev.	Min	Max
pEmarboinGANbonind	373	0.026	0.044	−0.117	0.492
pDowJoindGANbonind	373	−0.153	0.040	−0.322	0.169
pfed_10GANbonind	373	−0.314	0.034	−0.553	−0.097
pEmarboinSAbondin	373	−0.5507	0.03018	−0.7582	−0.3265
pDowJoindSAbondin	373	−0.3139	0.0337	−0.5528	−0.0970
pfed_10SAbondin	373	0.1415	0.0350	−0.0371	0.3730

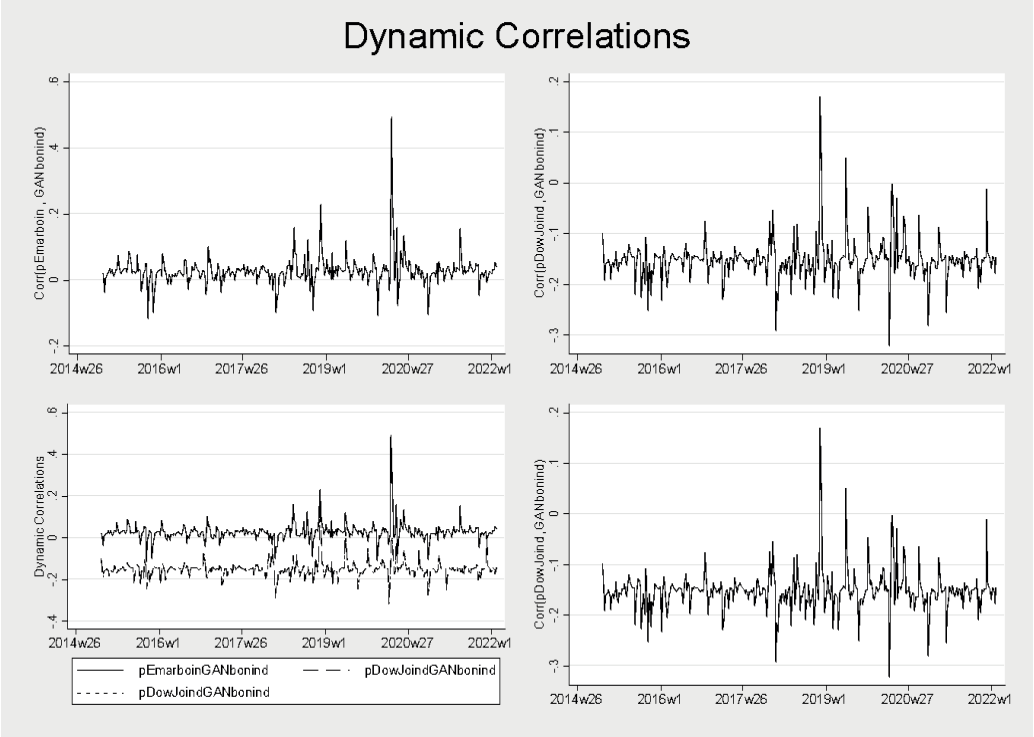

Fig. 1. DCC between exogenous variables and the sovereign bond return of Ghana.

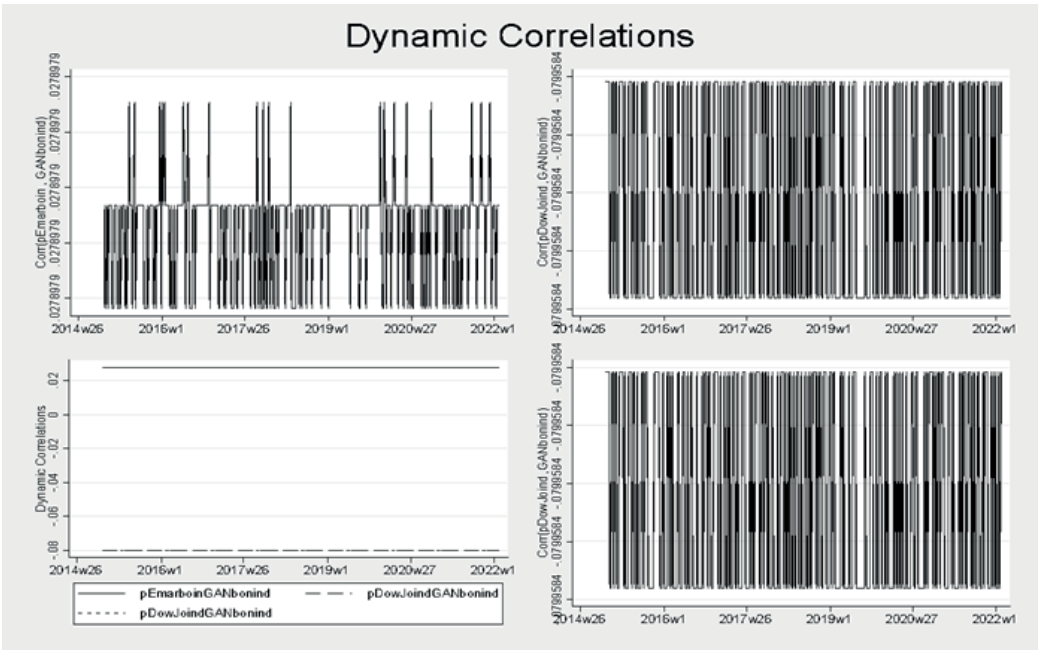

Fig. 2. CCC between the exogenous variables and sovereign bond return of Ghana.

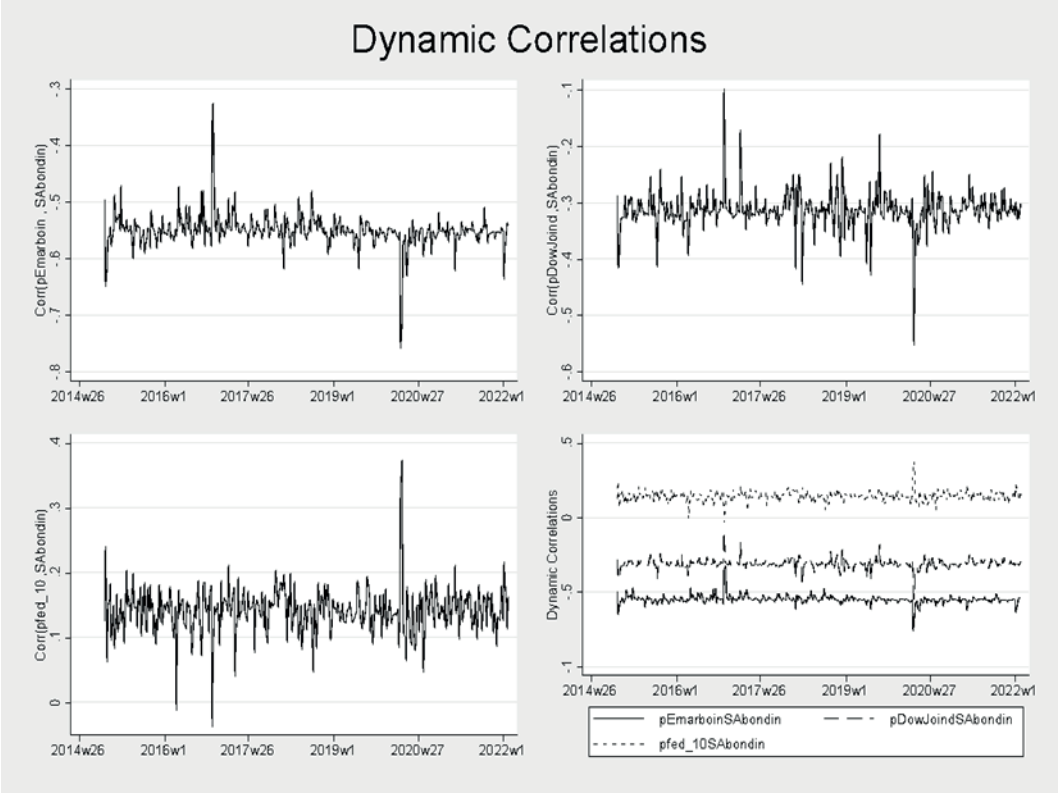

Fig. 3. DCC between the exogenous variables and South African sovereign bond return.

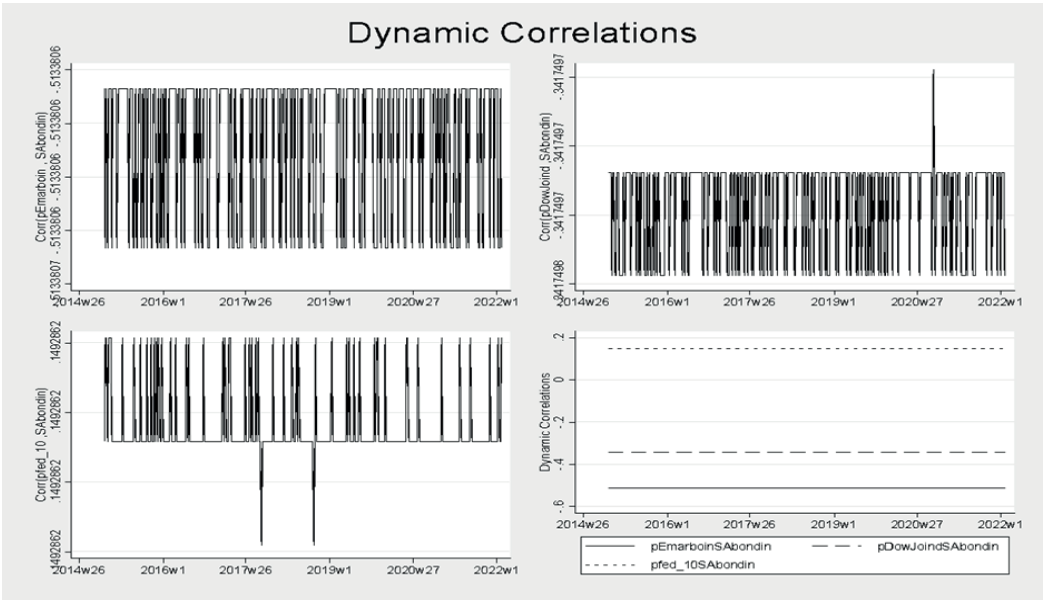

Fig. 4. CCC between the exogenous variables and sovereign bond return of South Africa.

3.3. Econometrics Results and Discussion

Table 4 and Table 5 provide the Lagrange Multiplier (LM) tests on the residuals of DCC(1,1)-MGARCH(1,1) and CCC(1,1)-MGARCH(1,1) model estimations for volatility spillover from the emerging market bond return, USA stock market return and long-term world interest rate to Ghana and South Africa sovereign bond return. LM tests in both cases fail to provide the evidence for the presence of ARCH effects in the residuals. Thus, there is no misspecification problem in the models.

Table 4. LM Test for DCC and CCC-MGARCH of Ghana Sovereign Bond Return

	chi^2	Df	Prob
LM test for DCC-MGARCH	20.877	1	0.0000
LM test for CCC-MGARCH	21.694	1	0.0000

Table 5. LM Test for DCC and CCC-MGARCH of South Africa Sovereign Bond

	chi^2	Df	Prob
LM test for DCC-MGARCH	24.824	1	0.0000
LM test for CCC-MGARCH	26.163	1	0.0000

Table 6 provides the results of CCC-GARCH and DCC-MGARCH model estimates for Ghana and South Africa sovereign bond returns. In the mean equation estimated for Ghana's sovereign bond return, the coefficients of USA stock market return and the long-term world interest rate are positive and significant at 1 % and 5 %, respectively. This implies that volatility spillover from the USA stock market return and the long-term world interest rate positively and significantly affect the sovereign bond return of Ghana. This disagrees with the empirical works (Maysami & Koh, 2000; Hooker, 2004; Rahmann et al., 2009; Adjasi & Biekpe, 2006). The possible reason might be the issuing of a zero-coupon Eurobond from the Ghana government.

As shown in Table 6, the coefficients of ARCH (1) and GARCH (1) terms for Ghana sovereign bond return are positive and significant. Their sum is about 0.82, which is below one and indicates the existence of long-term volatility spillover from previous sovereign bond return volatility. This also implies that the conditional variance is finite and stationary. The significant coefficient of short run persistence, i.e., coefficient of ARCH (1) = 0.489, indicates the short run volatility persistence of the Ghana sovereign bond. While the significant coefficient of GARCH (1) term implies the occurrence of long-run volatility due to the impact of a conditional correlation or shocks. The conditional correlation between the long-term world interest rate and the sovereign bond return of Ghana is −0.201 and statistically significant at 5 % level of significance.

In the case of South Africa sovereign bond return, the coefficient of emerging market bond return is positive and significant at 1 % level. While the coefficient of long-term world interest rate is negative and significant at 5 % level. These show the existence of volatility spillover from the emerging economies' bond market and the long-term world interest rate to South African sovereign bond returns. The

positive and significant coefficient observed for ARCH (1) term associated with South African sovereign bond return indicates the persistence of short run positive volatility spillover from the previous Ghanaian sovereign bond return to the present return. The conditional correlation between these two variables is negative and statistically significant at the conventional level of significance.

Table 6. Constant and Dynamic Conditional Correlation MGARCH Estimation

Sovereign bond return of Ghana			South Africa sovereign bond return		
GANbonind	Coef.CCC	Coef.DCC	SAbondin	Coef.CCC	Coef.DCC
Emarboin	–0.018	–0.041	Emarboin	(1.055)***	(1.169)***
	0.043	0.05		–0.179	–0.196
DowJoind	(0.056)**	(0.082)***	DowJoind	0.064	0.016
	–0.027	0.031		–0.082	0.089
fed_10	(0.056)**	(0.052)*	fed_10	(–0.272)**	(–0.254)***
	–0.026	–0.028		–0.084	0.088
arch(1)	(0.489)***	(0.454)***	arch(1)	(0.371)***	(0.335)***
	–0.117	–0.11		–0.112	0.098
garch(1)	(0.336)***	(0.371)**	garch(1)	–0.025	–0.036
	–0.095	–0.096		–0.081	0.084
Constant	(0.086)***	(0.083)***	Constant	(1.638)***	(1.729)***
	–0.019	–0.019		–0.33	0.348
corr(GANbonind, Emarboin)	0.056	0.036	corr(SAbondin, Emarboin)	(–0.445)***	(–0.477)***
	–0.089	–0.1		–0.098	0.102
corr(GANbonind, DowJoind	–0.126	(–0.241)**	corr(SAbondin, DowJoind)	(–0.22)**	(–0.146)
	–0.103	–0.112		–0.112	0.121
corr(GANbonind, fed_10)	(–0.201)**	(–0.194)**	corr(SAbondin, fed_10)	(0.21)**	(0.182)**
	–0.079	–0.087		–0.083	0.089
lambda1		(0.043)**			(0.036)*
		–0.022			0.02
lambda2		0.297			0.106
		–0.314			0.209

Mean dependent	10.118	SD dependent	0.688	Mean dependent	0.121	SD dependent	0.688
Number of obs	373	Chi-square	0.378	Number of obs	73	Chi-square	6.517

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses.

CONCLUSION

We have investigated the volatility spillovers from the USA stock market return, emerging market bond return and the long-term world interest rate for Ghana

and South Africa using the CCC and DCC MGARCH models. The result shows that the Ghana sovereign bond return has been affected positively by the volatility spillover transmitted from the long-term world bond interest rate volatility and negatively by the USA stock market return volatility. The volatility spillover from emerging economies' bond market and long-term world interest rates to the sovereign bond market of South Africa is presented in the result. Since the results show negative volatility spillover from the USA stock market and long-term world interest rates to the Ghana and South Africa sovereign bond markets, policy intervention is needed to contain the negative impact. Conversely, the volatility spillover from the emerging market's bonds to South Africa sovereign bond market shows promissory results. Thus, devising a mechanism to maximize the benefits is recommended to the South African government.

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CONSENT FOR PUBLICATION

This manuscript does not include details, images, or videos relating to individual participants.

COMPETING INTERESTS

The author ensures that there are no conflicts of interest concerning the publication of this article.

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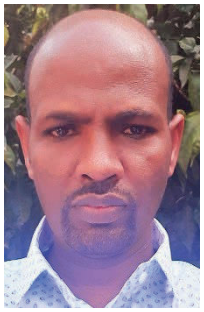

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Appendix 1. CCC-MGARCH Estimation for Sovereign Bond Return of Ghana

Constant conditional correlation MGARCH model
Sample: 2014w50 - 2022w6 Number of obs = 373
Distribution: Gaussian Wald chi2(3) = 10.38
Log likelihood = -2050.782 Prob > chi2 = 0.0156

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GANbonind						
Emarboin	-.0175561	.0430249	-0.41	0.683	-.1018835	.0667712
DowJoind	.056216	.0271424	2.07	0.038	.0030178	.1094142
fed_10	.0564341	.0257406	2.19	0.028	.0059835	.1068846
ARCH_GANbonind						
arch L1.	.4890002	.1167798	4.19	0.000	.260116	.7178845
garch L1.	.3357347	.0952117	3.53	0.000	.1491232	.522346
_cons	.0862402	.0194372	4.44	0.000	.0481439	.1243365
ARCH_Emarboin						
arch L1.	.1673109	.0482252	3.47	0.001	.0727913	.261830
garch L1.	.4534475	.1279529	3.54	0.000	.2026643	.7042306
_cons	.4255934	.119005	3.58	0.000	.1923478	.658839
ARCH_DowJoind						
arch L1.	.1568903	.0456922	3.43	0.001	.0673352	.2464453
garch L1.	.6602749	.0868769	7.60	0.000	.4899994	.830550
_cons	.7908552	.2651861	2.98	0.003	.2711	1.31061
ARCH_fed_10						
arch L1.	.5806461	.1136287	5.11	0.000	.3579379	.8033543
garch L1.	.4239646	.0991912	4.27	0.000	.2295533	.6183759
_cons	.0072901	.0032467	2.25	0.025	.0009267	.0136536
corr(GANbonind,Emarboin)	.0555035	.08944	0.62	0.535	-.1197956	.2308026
corr(GANbonind,DowJoind)	-.1260614	.1029197	-1.22	0.221	-.3277803	.0756574
corr(GANbonind,fed_10)	-.2012193	.0793959	-2.53	0.011	-.3568323	-.0456062
corr(Emarboin,DowJoind)	.3925065	.045008	8.72	0.000	.3042925	.4807206
corr(Emarboin,fed_10)	-.1002279	.0515316	-1.94	0.052	-.201228	.0007723
corr(DowJoind,fed_10)	.1161831	.0515067	2.26	0.024	.0152318	.2171344

Appendix 2. CCC-MGARCH Result for Sovereign Bond of South Africa

Constant conditional correlation MGARCH model

Sample: 2014w50 - 2022w6		Number of obs	=	373	
Distribution: Gaussian		Wald chi2(3)	=	66.52	
Log likelihood = -2416.958		Prob > chi2	=	0.0000	

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
SAbondin						
Emarboin	1.055335	.1788358	5.90	0.000	.7048229	1.405846
DowJoind	.0635343	.0824093	0.77	0.441	-.097985	.2250537
fed_10	-.2723401	.083853	-3.25	0.001	-.436689	-.1079912
ARCH_SAbondin						
arch L1.	.3706102	.1116639	3.32	0.001	.1517529	.5894675
garch L1.	-.0254051	.0809731	-0.31	0.754	-.1841094	.133299
_cons	1.638269	.3299883	4.96	0.000	.9915035	2.285034
ARCH_Emarboin						
arch L1.	.1601741	.0439172	3.65	0.000	.0740979	.2462503
garch L1.	.4162509	.126743	3.28	0.001	.1678392	.6646627
_cons	.472197	.123961	3.81	0.000	.229238	.7151561
ARCH_DowJoind						
arch L1.	.1540503	.0456693	3.37	0.001	.0645402	.2435605
garch L1.	.6536558	.0908654	7.19	0.000	.4755629	.831748
_cons	.8267615	.2830159	2.92	0.003	.2720604	1.381463
ARCH_fed_10						
arch L1.	.5724613	.11165	5.13	0.000	.3536314	.7912912
garch L1.	.4316744	.0974221	4.43	0.000	.2407305	.6226183
_cons	.0072037	.00321	2.24	0.025	.0009123	.0134951
corr(SAbondin,Emarboin)	-.4445507	.0981906	-4.53	0.000	-.6370008	-.2521006
corr(SAbondin,DowJoind)	-.2199851	.1119688	-1.96	0.049	-.4394399	-.0005303
corr(SAbondin,fed_10)	.2095558	.0832021	2.52	0.012	.0464828	.3726289
corr(Emarboin,DowJoind)	.3962554	.0449193	8.82	0.000	.3082152	.4842956
corr(Emarboin,fed_10)	-.0987974	.0515658	-1.92	0.055	-.1998644	.0022696
corr(DowJoind,fed_10)	.1152467	.051548	2.24	0.025	.0142145	.2162789