“An analysis of Granger causality between sovereign credit rating and economic growth in Sub-Saharan Africa”

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AN ANALYSIS OF GRANGER CAUSALITY BETWEEN SOVEREIGN CREDIT RATING AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA

Abstract

Interest in the relationship between credit rating and economic growth is growing as emerging economies increasingly integrate into international financial markets. Without credit ratings, developing economies would not have been able to successfully issue their sovereign bonds to support economic growth. Therefore, this paper examines a causality relationship between Standard & Poor's long-term foreign currency sovereign credit ratings and economic growth in 19 Sub-Saharan countries over the period from 2003 to 2018. The results of the Granger causality tests show a unidirectional causality from sovereign credit ratings to economic growth, not vice versa. This implies that economic growth is not significant in determining sovereign credit ratings. It can thus be concluded from these findings that sovereign credit ratings are proactive actions by rating agencies that are relevant in determining future economic growth. Thus, investors benefit from utilizing credit ratings to prevent inherent information asymmetry in fundamental economic factors. Therefore, it is important for policy makers to pay attention to sovereign credit ratings when formulating macroeconomic policies.

Keywords developing economies, sovereign bonds, international markets, Standard & Poor's, Moody's

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INTRODUCTION

Sovereign credit rating (SCR) has become one of the most topical subjects amongst African economic analysts, investors and ordinary citizens. The underlying assumption is that a change in a country's SCR has an impact on the overall economy and the well-being of all citizens (Cantor & Packer, 2007). Studies such as Cantor and Packer (2007) and White (2013) prove that SCRs have a direct impact on both the micro and macroeconomic dynamics of a country. Lagner and Knyphausen-Aufseß (2012) suggest that credit rating agencies act as 'gatekeepers' of financial markets to reduce the risk of market manipulations by issuers of debt instruments through information imbalances in the marketplace.

On the other hand, El-Shagi (2009), Papaikonomou (2010), and Freitag (2015) agree with the United States (US) Financial Crisis Inquiry Commission (2011) in arguing that credit ratings can contribute to a country's economic collapse. Some of the key examples cited are: the collapse of New York City's financial markets in the mid-1970s, the Enron scandal, the financial crisis in Asia and the Global Financial Crisis of 2008, when credit rating agencies failed to correctly apportion credit risk profiles. Following the 2008 Global Financial Crisis, a report by the US Financial Crisis Inquiry Commission (2011) accused

credit rating agencies of disseminating inaccurate information about the default risk of both the issuer of financial securities and the complex structured financial instruments they were issuing. Other studies such as Cesaroni (2015) and Freitag (2015) argue that credit ratings do not provide any new or unknown information to investors; instead they magnify the current underlying economic conditions through following already known macroeconomic events. Cesaroni (2015) extends that this phenomenon is more pronounced during economic recessions when rating agencies abruptly downgrade countries experiencing economic crises.

Seeing the above conflicting views and evidence in literature, there is therefore no consensus in the literature as to whether SCRs influence the economic conditions of a country or it is economic conditions that cause a country's SCR to change as its economic situation and probability of default deteriorate. This study contributes to the literature investigating the causal impact of long-term foreign currency SCRs on economic growth by examining if a downgrade or an upgrade of SCR leads to an economic downturn or boom. This implies that if the relationship between the two variables is significant, countries will need to pursue policies aimed at improving their credit ratings.

1. LITERATURE REVIEW

The credit rating process involves many macroeconomic, institutional and fiscal factors, as well as a country's susceptibility to event risk. An assessment of these risk factors evaluates a country's capability and willingness to honor its debt obligations in full and within the tenure of the loan contract (Cantor & Packer, 2007). In determining a country's SCR, Moody's Investor Service (2018) states that the economic growth risk factors are key determinants in their methodology of credit rating. Gross Domestic Product (GDP) shows the strength of an economy, which is measured by the fiscal state, diversification, competitiveness, national income and size of an economy. GDP also determines a country's resilience and its capability to absorb economic shocks. Economic growth also reflects a country's relative ability to generate revenue and service its debt over the medium term, which is also based on fostering fiscal health and prosperity. According to Moody's Investor Service (2018) methodology for SCR, low economic growth and weak fiscal strength have been decisive elements in past sovereign defaults, generally taking place when countries have had weak economic growth, which is represented by a low GDP.

In many cases, sovereign default follows an erosion of competitiveness, for instance, the economic shock driven by the fall in oil prices during the late 1990s in Russia, the sequence of smaller shocks that caused a fall of exports and a slump in tourism after September 11, 2001 in the Caribbean countries, entailing current account imbalances and the accumulation of excessive debt and defaults by these countries. Therefore, large and diversified economies are more resilient to external shocks than smaller non-diversified countries. Moody's sovereign rating methodology shows the significance of economic strength and its correlation with credit ratings, which was evident in 29 sovereign defaults between 1997 and 2012. In addition, according to the SCR methodology, historical data shows that long-term economic stagnation turned into an important underlying cause of 10 percent of past sovereign defaults and was a key contributing factor in many other default cases. In 41 percent of sovereign default cases, excessive sovereign debt burden was the primary driving force of the default.

While many other issues can contribute to the excessive debt burden, Cantor and Packer (2007) point out that a country's failure to generate sufficient financial strength to service debt and reduce excessive debt makes its fiscal position unsustainable. Past sovereign defaults have occurred in the context of severe economic stress, underscoring the significance of economic power in lowering the probability of default in the face of detrimental shocks or financial downturn. Thus, Avkiran and Cai (2012) suggest that sovereign credit scores are beneficial in predicting a country's economic misery and inform financial markets to correctly apportion sovereign credit risk. In addition, Dudian and Popa (2012) posit that macroeconomic factors show evidence that economic growth of the sovereign affects its GDP.

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The SCR literature is divided into two main and broad 'schools of thought' on the causality effect of SCR on economic growth. One school of thought argues that SCRs proactively stand between traders and issuers of financial instruments to prevent the inherent information asymmetry between the two parties (Boot et al., 2006; El-Shagi, 2009; Ganguin, 2010; Rhee, 2015). In support, other studies further assert that SCRs measure the improvement of a country's economic performance, and their deterioration implies casting a shadow over the borrowing country's future financial prospects (Chen et al., 2016; Dudian & Popa, 2012). This research study posits that a country's economic fundamentals exhibit a sizeable response to sovereign rating changes. Chen et al. (2016) reveal that a one-notch downgrade (upgrade) on a country's credit rating leads to a 0.6 percent (0.3 percent) annual average decrease (increase) in economic growth rate by way of suppressing (stimulating) interest rates, sovereign bond yield spreads and capital flow.

Another school of thought argues that SCRs are reactive actions by credit rating agencies, which make announcements of what the market already knows via macroeconomic or market statistics (Amato & Furfine, 2004; Cesaroni, 2015; Ferri et al., 1999; Freitag, 2015). Thus, based on the economic crises so far, this school of thought argues that credit ratings have very little or no effect on economic growth. Ferri et al. (1999) further argue that rating agencies place little significance on qualitative factors that may be used to investigate sovereign credit profiles. In support, Baghai et al. (2014) show how the immoderate conservatism of credit rating agencies amplifies the financial crises by failing to predict the emergence of these crises and, in turn, the sudden downgrades of crisis countries more than their economic fundamentals can justify. Hence, these undue changes in evaluations exacerbated the cost of borrowing for the crisis countries causing international capital to evaporate.

With regard to the reactive activities of rating organizations that create and magnify financial crises, Mora (2006) proves that credit ratings are rather rigid and pro-cyclical. Moreover, Mora contends that they notably react to new macroeconomic or marketplace information. Dudian and Popa (2012), basing their arguments on the World Bank and Fitch information on Central and Eastern Europe between 1996 and 2010, found a weak relationship between SCRs and GDP. Thus, the empirical evidence of a causality relationship between SCR and GDP is still inconclusive.

2. METHOD

The causality analysis between long-tern foreign currency sovereign credit ratings and economic growth, represented by GDP, makes use of the Granger causality test. Following the methodology in Mutize and Gossel (2018), the analysis hypothesizes that if SCRs Granger cause economic growth, then SCRs are proactive activities that have an effect on a country's GDP. In contrast, if economic growth Granger causes SCRs, then SCRs are reactive actions that have very little to no effect on a country's GDP. Following the model specification in Mutize and Gossel (2018), this study also specifies causal effect of the SCR on GDP using the following model:

$$P\left(SCR_{t+1} \in GDP \middle| \Omega_t\right) \neq \neq P\left(SCR_{t+1} \in GDP \middle| \Omega_{-x(t)}\right), \quad (1)$$

where P represents probability, GDP represents proxy for economic growth, SCR represents *SCR*s, Ω_t represents the available information at time t in an economy, and $\Omega_{-x(t)}$ is a modified economy where the information Ω_t is excluded.

As in Mutize and Gossel (2018), a key literature in the area of credit rating analysis in Africa, the Granger causality test in this analysis estimates the following two panel regression equations:

$$SCR_t = \gamma_1 + \sum_{i=1}^{n} \alpha_{1i} GDP_{t-i} + \sum_{j=1}^{m} \beta_{1j} SCR_{t-i} + \mu_{1i}, \quad (2)$$

$$GDP_t = \gamma_2 + \sum_{i=1}^{n} \alpha_{2i} GDP_{t-i} + \sum_{j=1}^{m} \beta_{2j} SCR_{t-i} + \mu_{2i}, \quad (3)$$

where n and m are lags sufficient to estimate the two panel regression equations, μ_i is a stochastic error, SCR is sovereign credit ratings, GDP is economic growth, and α_i and β_j represent constant terms.

It is a general approach in the analysis of Granger causality tests to complement it with the Impulse Response analysis. As in Mutize and Gossel (2018), having tested the Granger causality between the economic growth and credit ratings, the study applies the Impulse Response Function (IRF) to examine the impact of credit rating on GDP and the magnitude of response in economic growth within the Panel Vector Autoregressive (VAR) system. As justified in the past literature by Mutize and Gossel (2018), the IRF is essential to offer a full picture by using quantifiable variable responses in the VAR system. Thus, this study hypothesizes that if there are significant impulses in SCR to the shock in GDP, then it is concluded that it is economic growth that causes sovereign credit rating changes. The estimations of derivatives of the SCR and GDP in time are as follows:

$$\omega_t = \frac{dSCR_t}{d\varepsilon_t} + \frac{dGDP_t}{d\varepsilon_t}, \quad (4)$$

where ε_t is the impulse from SCR series as unit impulses.

The Granger causality test does not establish the relative causality effects beyond the selected time span. Hence, causality checks cannot indicate the response of an endogenous variable to an impulse in the exogenous variables when shock is applied to the residuals. Thus, the impulse response measures the impact of 1 unit shock to one of the variables on current and future values of all the endogenous variables in a system over various time horizons. Through IRF, both the negative and positive impact can be specifically identified and evaluated (Mutize & Gossel, 2018).

To examine the causal relationship, the analysis considers SCRs announced by Standard & Poor's on a total of 19 countries in Sub-Saharan Africa for the period 2003 to 2018. These Sub-Saharan countries were as follows; Angola, Benin, Botswana, Burkina Faso, Cameroon, Cape Verde, Congo, Ethiopia, Gabon, Ghana, Kenya, Mozambique, Nigeria, Democratic Republic of Congo, Rwanda, Senegal, South Africa, Uganda and Zambia. These countries were selected because they had significant SCR activities during this period. Furthermore, Standard and Poor's was the most active rating agency among the three international rating agencies during of this period. The time period of 2003 to 2018 represents an era when the number of Sub-Saharan African countries being assigned credit ratings rose sharply.

The sovereign ratings statistical data were retrieved from the selected rating company's website, while the economic growth (represented by GDP) data were obtained from the World Bank website. Following Gande and Parsley (2004), the research also applies a numerical transformation of the credit ratings beginning with zero for the lowest rating "D" up to 23 for the highest rating of "AAA". In addition, as suggested by Ismailescu and Kazemi (2010) and Mutize and Gossel (2018), positive (negative) modifications in rating outlook and positive (negative) additions to positive (negative) watchlists are accounted for by adding 0.5 (–0.5) and 0.25 (–0.25) to one credit rating notch to account for these SCR announcements, respectively. Long-term foreign currency SCRs of Standard and Poor's were used for the analysis. The preference of examining only Standard and Poor's ratings was also based on the rationale that its indices are widely followed by analysts and market participants throughout the globe. Standard & Poor's has rated the highest number of countries in Sub-Saharan Africa compared to its international credit rating counterparts. In addition, the decision to analyze only long-term foreign currency ratings was based on the view that they are more stable than short-term local currency ratings.

3. RESULTS AND DISCUSSION

According to econometric theory, testing for unit roots or the existence of a stochastic trend is important in determining whether a statistical process is stationary or not. Stationary processes addressed the problem of spurious regression output. Table 1 presents a summary of the unit root test results, which show considerable evidence that the residuals of the two series (SCRs and GDP) are stationary at the 1 percentage, 5 percentage and 10 percentage levels. Hence, their probability distributions remain consistent as time passes (Lee et al., 2010), which suggests that the series are mean-reverting, and stochastic shocks have brief effects.

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Table 1. Panel unit root test results

	GDP		SCR	
	t-statistic	Probability	*t*-statistic	Probability
Null: Unit root (assumes common unit root process)				
Levin, Lin and Chu t*	–12.5051	0.0000**	–2.1736	0.0149**
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin *W*-stat	–21.2556	0.0000**	–14.7702	0.0000**
ADF – Fisher Chi-square	449.606	0.0000**	51.787	0.0000**
PP – Fisher Chi-square	725.235	0.0000**	50.513	0.0000**

Note: ** represent significance at the 5 percent level.

To estimate the Pairwise Granger Causality and Impulse Responses tests, it is necessary to determine a sufficient number of lags for the Vector Autoregressive (VAR) model using the lag length selection criteria. To pick out the lag length, the analysis uses the VAR lag choice criteria with SCR and GDP as endogenous variables. Table 2 shows the outcomes of the VAR lag choice criteria, in which either 2 or 3 lags adequately model the VAR equations. According to Ng and Perron (2001), whose mathematical model proves that the bottom lag choice is sufficient for both parsimony and predictive strength of the model, two lags are used for the estimations. Thus, all the analyses in this research apply two lags as recommended via two standards (the HQ and the SC).

Having selected the appropriate lag length, the next step is to estimate the panel VAR model as shown in Table 3. In the GDP equation, the coeffi-

Table 2. Lag order selection criteria

Lag	LR	FPE	AIC	SC	HQ
0	3.3455	199.0438	10.9282	10.9375	10.9317
1	5.2682	8.3955	7.8034	7.8313	7.8140
2	3.4201	8.1914	7.7788	7.8253*	7.7964*
3	8.7108	8.1855*	7.7781*	7.8431	7.8027
4	2.2807	8.2292	7.7834	7.867	7.8151
5	10.4962	8.2092	7.7810	7.8832	7.8197
6	2.1884	8.2536	7.7864	7.9072	7.8321
7	6.9674	8.2609	7.7872	7.9266	7.8408
8	6.8182	8.2691	7.7882	7.9462	7.8481

Note: * appropriate number of lags.

Table 3. VAR model estimates

	GDP	SCR
GDP(–1)	–0.5289	0.2844
	(0.0302)	(0.3527)
	[–17.5289]	[0.8067]
GDP(–2)	–0.2324	0.2462
	(0.2039)	(0.3421)
	[–7.6913]	[0.7195]
SCR(–1)	0.0032	0.0064
	(0.0112)	(0.0007)
	[2.8253]	[8.1419]
SCR(–2)	0.0025	0.1444
	(0.0006)	(0.0439)
	[3.6402]	[3.2830]
C	0.0140	0.0062
	(0.1620)	(0.0208)
	[0.0865]	[0.3004]

Note: ( ) Standard errors, [ ] t-statistics.

Table 4. Pairwise Granger causality test results

Lags	2		4		6		8	
	F-statistic	Prob.	*F*-statistic	Prob.	*F*-statistic	Prob.	*F*-statistic	Prob.
SCR → GDP	3.8971	0.0000**	6.7774	0.000**	4.3150	0.0000**	2.3225	0.0020**
GDP → SCR	0.6088	0.9890	0.0113	0.4210	0.5221	0.7195	1.1488	0.3319

Note: → represents no Granger causality; ** represent significance at the 5 percentage level.

cicents of SCR are all significant as shown by the *t*-statistics. According to the hypotheses in this study, this result shows that SCRs are proactive activities that determine the economic growth of a country. On the contrary, the test statistics are not significant for GDP coefficients in the SCR equation. Similarly, according to the hypothesis of this study, this can be interpreted to mean that economic growth is not significant in determining SCR.

Having estimated the regression models, the study applies the Granger causality tests on SCR and GDP, results are presented in Table 4. According to the results, there is no sufficient statistical evidence to reject the null hypothesis of no causality from GDP to SCR at the 5 percent confidence level. Thus, there is unidirectional causality from SCR to GDP, and not in the opposite direction for all of the lags from 2 to 8 lags. It is deduced from the hypothesis that SCR Granger causes GDP, therefore, SCRs are proactive activities that have an impact on the economic growth of African countries. Consistent with the results of the VAR equations, GDP does not Granger cause SCR, implying that SCRs are not reactive actions.

These outcomes concur with studies arguing that SCRs proactively stand between investors and issuers of financial securities, such as studies by Cantor and Packer (2007), Kim and Wu (2008) and White (2013), who all find that SCRs have an effect on a country's micro and macroeconomic dynamics. Hence, the findings are in line with Lagner and Knyphausen-Aufseß (2012), who additionally advise that credit rating agencies should act as 'gatekeepers' of financial markets to avoid the danger of manipulations of buyers by issuers of debt through information asymmetry within the marketplace. The findings also align with Chen et al. (2016), Dudian and Popa (2012), Boot et al. (2006), El-Shagi (2009), Ganguin (2010) and Rhee (2015). All these researchers posit that a country's GDP significantly responds to SCR.

With regard to Impulse Responses (IR) on the same data set, the graphical results of the SCR and

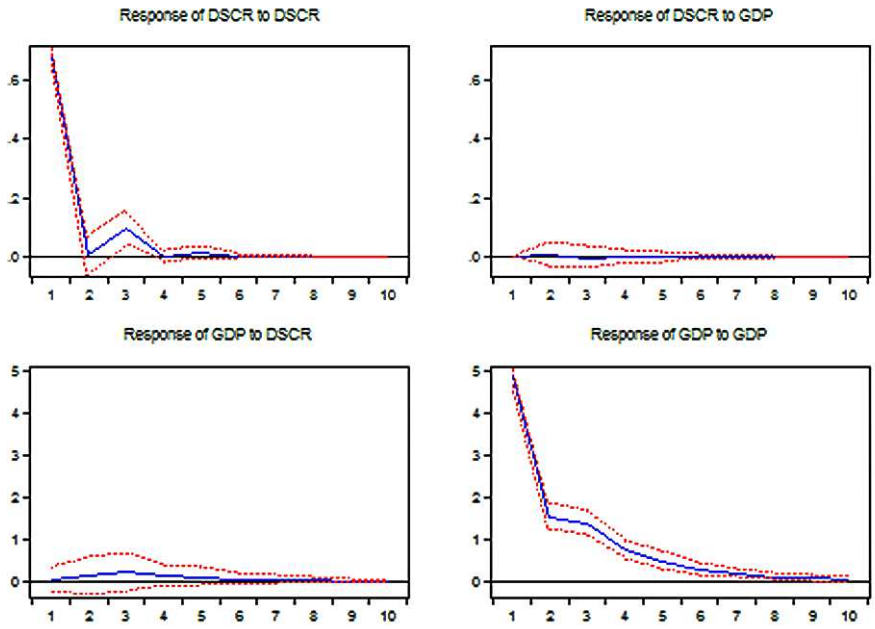

Figure 1. Responses to Cholesky's one S.D. impulse responses

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GDP impulse responses to Cholesky's one standard deviation shocks are presented in Figure 1. As can be seen from the results, a SCR shock through one standard deviation leads to the GDP generally responding by less than 1 percent, which persists for more than a year (five quarters) and fades away in the sixth quarter after the SCR announcement. Thus, the effect of SCR on GDP is significant, and its outcomes take a lengthy timespan to be absorbed in economic growth.

IRF results concur with Chen et al. (2016), who also observe that a one-notch downgrade (upgrade) on a country's SCR results in a 0.3 percent (0.6 percent) annual average decrease (increase) in GDP growth rate by means of suppressing (stimulating) growth potential through interest rates, sovereign bond yield spreads and capital flow.

To test the precision of the panel VAR model applied in the evaluation of Pairwise Granger Causality and IRF assessments, residual diagnostic assessments are vital to determine if the models are correctly fitted and specified as residuals need to be white noise. The preferred regression assumptions about residuals are that the errors should be normally distributed with mean 0 and uniform but unknown variance (normality assumption) and the errors are homoskedastic (homoskedasticity assumption). The following tables display normality and heteroskedasticity check results. Table 5 indicates outputs of the normality to determine if the data is effectively modeled using a normal distribution and to compute the likelihood for the random variables underlying the dataset. Jarque-Bera test results are not significant for both series, therefore, the null hypothesis of normal distribution of residuals cannot be rejected, hence, the residuals of the countries analyzed are normally distributed.

Table 5. VAR residual normality test for standardized residuals

Type of test	SCR	GDP
Mean	0.5136	0.9776
Median	–0.6469	1.8442
Maximum	7.8490	26.3378
Minimum	–9.0135	–10.9814
Std. Dev.	0.6782	2.7861
Skewness	–0.0335	0.4482
Kurtosis	3.1355	3.4489
Jarque-Bera	1.3757	0.4482
Probability	0.7746	0.3420

Regarding the residual heteroskedasticity effects, Table 6 indicates that the null hypothesis of no heteroskedasticity cannot be rejected at the 5 percent level. There is consequently homoskedasticity of residuals, which shows that the model is adequately fitted.

Table 6. VAR residual heteroskedasticity test results

Joint test					
Chi-Square	**df**	**Prob.**			
0.6164	24	0.8249			
Individual components					
Dependent	***R*-squared**	**F-stat**	**Prob.**	**Chi-sq.**	**Prob.**
res1*res1	0.0443	0.1266	0.3819	1.2366	0.5421
res2*res2	0.0019	0.2628	0.9776	2.1168	0.9772
res1*res2	0.0403	1.5448	0.5344	0.9326	0.7607

Note: ** represent significance at the 5 percent level.

CONCLUSION

The general assumption underlying SCRs is that a change in credit rating affects the overall economy and the well-being of all its citizens. Some papers in the literature have proved that SCR is proactive and causes a direct impact on a country's micro and macroeconomic dynamics, implying that economic growth exhibits an enormous reaction to SCR changes. On the other hand, other studies argue that SCRs are reactive actions by credit rating agencies who announce what the market already knows through macroeconomic factors and market information; consequently, they have little or no effect on GDP.

This study applied the Granger causality test on Standard & Poor's SCR for 19 Sub-Saharan countries over the period 2003 to 2018 to examine a causality relationship between SCR and GDP. The results of the causality test suggest that there is a unidirectional causality from SCRs to GDP, but not vice versa. The findings in this evaluation are in line with a frame of literature, which argues that the change in

SCR affects a country's economic conditions. Therefore, it is concluded that SCRs are proactive actions by credit rating agencies for investors to avert the inherent information asymmetry between them and issuers of financial instruments. Three implications can be drawn from these findings. First, sovereign rating announcements precede changes in economic dynamics such as real economic growth. Second, sovereign credit rating downgrades (upgrades) influence a country's economy towards a downturn (boom) by suppressing (stimulating) growth potential through interest rate, bond yields and capital flow. Lastly, SCRs are relevant information for evaluating a country's competitiveness and the key to making pre-investment decisions.

AUTHOR CONTRIBUTIONS

Conceptualization: Misheck Mutize, Virimai V. Mugobo.
Data curation: Misheck Mutize, Virimai V. Mugobo.
Formal analysis: Misheck Mutize, Virimai V. Mugobo.
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Validation: Misheck Mutize, Virimai V. Mugobo.
Visualization: Misheck Mutize, Virimai V. Mugobo.
Writing – original draft: Misheck Mutize, Virimai V. Mugobo.
Writing – review & editing: Misheck Mutize, Virimai V. Mugobo.

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