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ARTICLE

Measuring Sub-Saharan Africa Economic Resilience to External Shocks: The role of Adaptive Policy Space

Tonuchi E. Joseph[1†*]; Oladapo G. Awolaja[1†]; Olusegun J. Ajibola[1†]

[1] Economics Department, Babcock University, Ileshan, Remo, Nigeria.
[†] Authors contributed equally
* Corresponding Author: tonuchijoseph@gmail.com
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Abstract
This study proposes a framework for assessing and improving the economic resilience of Sub-Saharan African (SSA) countries in the face of common external shocks. The study employed graph methodology, specifically the augmented Min-Max normalization approach to estimate the Economic Resilient Index (ERI). The ERI, an average of five sub-indices representing five major macroeconomic fundamentals that either help to dampen the effect of external shocks or facilitate the recovery from external shock. The study reveals that on an average, SSA economic resilience ranges between 0.48 to 0.54. The index is between 0 to 1 index scale, with the latter representing highest resilience. Furthermore, the study revealed that Southern Africa is the most resilient sub-region, with an average ERI ranging from 0.58 to 0.65, while East Africa emerges as the least resilient, albeit with significant variations among its constituent countries. Botswana consistently maintains its position as the most resilient country throughout the sample period (1998-2021), except in 2016 where it ranks second. Similarly, Southern African countries such as Mauritius, Namibia, and South Africa demonstrate robust resilience performance.

Comparing the computed average ERI with inflation and output growth rates, the study observes a consistent correlation, highlighting the relevance of the ERI in tracking macroeconomic performance. The findings underscore the importance for SSA countries to establish frameworks for monitoring economic resilience, facilitating targeted improvements and ensuring a comprehensive understanding of comparative strengths and areas in need of enhancement.

Keywords: *Economic Resilience, External shock, policy space, Sub-Saharan Africa, SSA.*

JEL Classification: *C32, E50,*

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1. Introduction

As the forces of globalization intensify, nations grapple with an array of external shocks. These shocks manifest in the form of shocks in the global supply chain, disruptions in financial markets, fluctuations in commodity and energy prices, and the impacts of global health pandemics, wielding significant influence over the economic activities of nations (**Masik & Grabkowska, 2020**; **Jolles, Meyermans & Vašíček, 2023**). The resulting risks and uncertainties can have far-reaching consequences for households, investors, and governments, potentially triggering crises and derailing economies from their growth trajectories for prolonged periods. Specifically, three major sources of common

external shocks, identified in the literature, have far-reaching consequences on economic activities including shocks in supply chain, global demand shock, and fluctuation in financial market (**Oladunni, 2020**; **Ojeyinka & Yinusa, 2023**). However, the impact of common external shocks on domestic economic activities differs. While no country is entirely immune to external shocks, those with greater resilience demonstrate the ability to insulate themselves and recover more effectively from the disruptive effects of these shocks.

From a policy perspective, understanding the determinants of a country's resilience to adverse shocks becomes imperative. Economic resilience, loosely defined as the capacity of an economy to maintain output close to its potential post-shocks, involves two critical dimensions: the extent to which shocks are dampened and the speed at which economies revert to normal growth rates following external shocks (**Jolles et al., 2023**). Resilient countries exhibit distinct attributes, including robust fiscal, monetary, and trade spaces (**Kose et al., 2022**), diversified productive bases, flexible and developed labor and financial markets, and robust institutions. These characteristics enable these nations to insulate themselves from the adverse effects of shocks and recover more efficiently (**Briguglio et al., 2009**; **Gallagher and Heredia-Ortiz, 2014**; **Jolles et al., 2023**; **Oladunni, 2020**).

Existing literature underscores the crucial role of fiscal space (government's effective revenue mobilization and prudent spending), monetary space (efficient implementation of expansionary monetary policies without causing crises), and trade space in the recovery process. Additionally, structural fundamentals such as robust institutions, flexible labor and financial markets, and diversification of the productive base act as insulators against external shocks (**Briguglio et al., 2009**; **Jolles et al., 2023**; **Ngouhouo & Nchofoung, 2021**).

In the context of Sub-Saharan Africa (SSA), where recent policies have embraced increased economic openness and heightened susceptibility to global shocks, the task of developing and measuring economic resilience becomes crucial. A multitude of studies, including those by **Duval Elmeskov and Vogel (2007)**, **Briguglio (2014)**, **Brůha and Kucharčuková (2017)**, highlight varying levels of resilience exhibited by countries in response to common external shocks. It is essential to consider the unique characteristics, macroeconomics, and structural issues of each SSA country when developing a resilient index. Notably, many studies developing economic resilience indices in SSA or elsewhere have given insufficient attention to policy space variables—fiscal, monetary, and trade space—that are instrumental in the recovery process and addressing vulnerabilities created by the economy itself. Therefore, developing a framework tailored to the distinctive challenges and opportunities of SSA is essential for accurately assessing and enhancing the region economic resilience in the face of external shocks.

2. Literature

2.1 Theoretical Foundation

Theoretically, various economic frameworks, while not explicitly focused on economic resilience, offer valuable insights into why certain countries, deemed more economically resilient, can effectively mitigate the impacts of external shocks and swiftly recover compared to their less resilient counterparts. Economic theories such as the New Keynesian and Post Keynesian economics unveils the implicit acknowledgment of external shocks' potential repercussions on domestic economic activities. These shocks, ranging from shifts in global preferences and demand to uncertainties in financial and commodity markets, changes in Central Banks' policies, and supply chain disruptions prompted by geopolitical tensions, are recognized as potent source of domestic economic fluctuations (**Allan e t al., 2021**; **Dakhlallah, 2020**).

In terms of economic resilience, countries endowed with strong fiscal space, representing the government's capacity to spend and restore the economy without compromising fiscal sustainability, exhibit a remarkable ability to attenuate the adverse effects of external shocks (**Kose et al., 2022**; **Deleidi, 2020**). Likewise, a robust monetary space, wherein a nation can respond to negative external shocks without triggering extraordinary inflation or exchange rate crises, contributes significantly to dampening external shock's impact. These theories recognized the prominent role of labor market flexibility and financial stability in mitigating the effects of external shocks. The flexibility of the labor market facilitates efficient resource reallocation in response to changing economic conditions, fostering adaptability (**Jolles et al, 2023**; **Deleidi, 2020**).

Additionally, institutional economic theory emphasizes the indispensable role of strong institutions governed by effective governance. Institutions ensuring the prevalence of the rule of law, voice and accountability, and control of corruption are deemed instrumental in crafting and implementing policies capable of effectively dampening the effects of external shocks. The underlying principle is that nations with sound institutional foundations possess the resilience needed to navigate challenges by virtue of efficient policy responses. Therefore, the institutional framework acts as a crucial determinant in a country's ability to withstand and recover from external shocks (**Murakami, 2022**). Expanding the discourse on economic resilience and external shocks within these economic theories unveils a nuanced understanding of the multifaceted factors at play. It underscores the interconnectedness of fiscal, monetary, and institutional dimensions in shaping a nation's resilience capacity, providing valuable insights for policymakers seeking to fortify their economies in an increasingly uncertain global landscape (**Kose et al., 2022**).

2.2 Towards Developing an Economic Resilient Index (ERI)

Attempt to develop an index for measuring a country's resilience to external shocks can be traced back to the pioneering work of **Briguglio** in 1992. He focused on small island countries aimed at estimating an index that could elucidate the vulnerability of nations to external shocks. Since then, several studies, including **Angeon and Bates (2015)**, **Feindouno and Goujon (2016)**, **Briguglio et al. (2009)**, **and Ngouhouo & Nchofoung (2021)**, have delved into the development of indices measuring both vulnerability and resilience, employing different methodological approaches.

One common methodological approach utilized in literature to compute economic resilience index is the composite indicator-based approach. **Briguglio (2014)**, **Ngouhouo & Nchofoung (2021)**, along with other scholars, employed this approach due to its transparency, interpretability, and appeal to policymakers. This method involves combining various indicators into a single index, providing a comprehensive measure of economic resilience. However, criticisms have been directed at this approach, particularly regarding the subjective assignment of weights to indicators. While some authors advocate for equal weights to mitigate subjectivity issues, it has been argued that not all indicators carry equal importance, potentially affecting the credibility of the index.

Several other studies such as **Wells (1997)**, **Atkins et al. (1998)**, **and Jolles et al. (2023)** employed the regression-based method. This method assumes that GDP volatility reflects vulnerability or resilience and can serve as a proxy for economic resilience in the index computation. Despite its advantage of determining weights objectively through statistical analysis, the regression-based approach faces criticism for using GDP volatility as a proxy for resilience, which might not accurately capture the complexity of economic systems. Moreover, the assumed linear relationship between variables and issues of transparency in understanding by policymakers have been cited as drawbacks.

The third methodological approach is the modeling-based approach, which incorporates system dynamics or agent-based models. This approach, offering a dynamic representation of the economic system and the ability to capture non-linear relationships, presents challenges due to its complexity and data-driven nature. **Wang and Wei (2021)** highlighted that these models demand a profound understanding of the economic system, potentially limiting their applicability. While they provide a nuanced view, their intricate nature may hinder widespread adoption.

The IMF studies championed by **Gallagher and Heredia-Ortiz (2014)** has also used what they referred as traffic light approach — red, yellow, green — reflecting the degree of space. Red is considered problematic, green favorable, and yellow neither. While the approach is very simple and communicable to policy maker, it lacks appropriate scaling and standardization process that makes the outcome questionable.

3. Methodology

3.1 Economic Resilient Index computation strategy

The present study followed the research strategy of **Angeon and Bates (2015)**, **Briguglio et al. (2009)**, and **Ngouhouo & Nchofoung (2021)** in computing the economic resilient index. While previous studies, such as those by **Angeon and Bates (2015)** and **Ngouhouo & Nchofoung (2021)**, have traditionally included both economic resilient and vulnerability indices in their analyses, this study concentrates solely on the economic resilient index.

Unlike previous studies, the current study deliberately excludes the computation of a vulnerability index. The rationale behind this decision stems from the recognition that many features contributing to vulnerability used in the previous studies, such as population size, remoteness from the world market, exports concentration, share of agriculture, land size, and the share of the population living in low elevated coastal zones, are relatively inherent features and not easily influenced by policy interventions. In contrast, the study is strategically focused on identifying and assessing factors amenable to policy-induced improvements, thus emphasizing the dynamic nature of economic resilience.

To this end, concentrating solely on the economic resilient index aligns with a policy-oriented perspective. By excluding inherently stable features that contribute to vulnerability, the research aims to highlight elements that can be positively influenced through effective policy measures. This strategic decision reflects a departure from conventional methodologies, emphasizing the importance of fostering economic resilience through targeted and actionable policy interventions. The initial step of the algorithm involves normalizing the chosen variables. This normalization process is crucial as the components of the resilience index are measured in different units. This step ensures a consistent and comparable basis for evaluating the selected variables within the context of economic resilience (**Bruguglio, 2014**; **Ngouhouo & Nchofoung, 2021**). As presented in equation (1 & 2).

$$Resil_{scaledij,t} = \frac{y_{ij,t} - \min\left(y_{ij,t}\right)}{\max\left(y_{ij,t}\right) - \min\left(y_{ij,t}\right)} * (\gamma - \rho) + \gamma \dots\dots 1$$

$$Resil_{scaledij,t} = \frac{max\left(y_{ij,t}\right) - y_{ij,t}}{\max\left(y_{ij,t}\right) - \min\left(y_{ij,t}\right)} * (\gamma - \rho) + \gamma \dots (2)$$

Specifically, equation (1) is employed when an increase in the value of the economic indicator is theoretically considered as a positive development, such that a higher original value results in a higher normalized value (closer to 1, for 0-1 indicators), reflecting a positive association and indicating a more resilient economy. This is often associated with factors such as economic diversification, a flexible labor market, and financial system stability. On the other hand, equation (2) is utilized when an increase in the indicator value is theoretically associated with a negative impact on economic resilience, as such a higher original value results in a lower normalized value (closer to 0), suggesting that the economy is less resilient to external shocks, for instance, high debt-to-GDP ratio or a higher incidence of non-performing loans, which may increase the vulnerability of the economy to external disturbances. This simple but important step is often ignored by several literature making it the computed index questionable.

Where; $Resil_{scaledij,t}$ denotes the normalized values for each indicator across all 26 Sub-Saharan African (SSA) countries at any given point in time (t). Similarly, $y_{ij,t}$ represents the observed values for each indicator (j) across the 26 SSA countries (refer to the Appendix for the complete list of countries) at any given point in time (t). Moreover, $max(y_{ij,t})$ signifies the maximum observed value for indicator j at time t, while $\min(y_{ij,t})$ denotes the minimum observed value for indicator j at time t among the 26 SSA countries. Where $\gamma \; and \; \rho$ represent the lowest and maximum expected value for economic resilient index. To this end, the economic resilient index will be between 1 and 99, with 1 representing the lowest level of economic resilient and 99 representing the highest value of economic resilience. Having normalized the indicators using equation (1 or 2), the sub-index $Resil_{jk}$ containing sub-variable, $y_{ij,t}$, of $ny_{ij,t}$ variables as in equation (3).

$$Resil_{jk} = \frac{1}{nY_{ijk}} * \sum_{k=1}^{5} y_{ijk} \dots\dots\dots\dots\dots\dots\dots (3)$$

Where $Resil_{jk}$ represents the sub-indexes of the five different economic fundamentals used in the computation of the overall index of each country in the region. The third step is the aggregation and averaged from the sub-index for each of the economic fundamentals as in equation (4).

$$RI_{i,t} = \frac{1}{5} * \sum_{k=1}^{5} y_{jk} \dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

And k represents the number of economic resilience fundamentals in our study. As such, the five economic fundamentals that makes up the overall index is discussed in the next sub-section.

3.2 Indicators and Justification

Studies on economic resilience employs various indicators to compute the economic resilience index. The choice of indicators often depends on the study's objectives and influenced by the author's discipline. Economists and macroeconomic modelers typically prefer macroeconomic indicators, while regional and social studies often prioritize environmental and social indices. Despite numerous studies, there is no consensus in the literature on the definitive indicators for economic resilience, although some indicators are commonly used across studies.

In this study, we focus on two main categories of indicators. The first category includes indicators that help a country mitigate the impact of external shocks, acting as insulators against these shocks. We refer to these as foundational elements. The second category comprises indicators that assist a country in recovery and enhance its resilience after experiencing shocks. These are referred to as policy space fundamentals, as partly outlined by **Jolles et al. (2023)**.

Specifically, we identify five key fundamentals: structural, financial (monetary space), public sector (fiscal space), institutional, and external sector (trade space) fundamentals. Among these, structural and institutional fundamentals serve more as foundational elements, acting as shock absorbers. On the other hand, policy space fundamentals including fiscal, monetary, and trade space, represents elements that facilitate recovery from external shocks. This structured approach aims to provide clarity and coherence in understanding the components that contribute to economic resilience.

Structural Fundamentals: The indicators under Structural Fundamentals serve as foundational elements shaping the economic structure, acting as absorbers in the face of common shocks (**Caldera-Sánchez et al., 2015**; **Rojas-Suarez, 2015**). Key structural indicators include economic diversification, labor market flexibility, human capital development, technology adoption, CO2 emission, and misery indices. For example, a more diversified productive base is believed to mitigate the impact of external shocks (**Feng et al., 2023**), while a flexible labor force can effectively adjust wages, reducing the shock's impact (**Briguglio et al., 2009**; **Briguglio, 2016**).

The Human Capital Development Index is another favored indicator, as an educated and healthy workforce proves more resilient, innovative, and adaptable during external shocks (**Caldera-Sánchez et al., 2015**; **Jolles et al., 2023; Joseph & Obikaonu, 2021**). Such a workforce can develop competitive products and services, thereby increasing a country's resilience in the international market (**Amiri et al., 2021**). Literature also suggests that technology adoption leads to diversified and innovative industries, reducing

sector-specific dependence and enhancing overall economic stability. Lastly, a high misery index may reflect economic vulnerability to external shocks, as a pronounced incidence of inflation and unemployment erodes consumer and investor confidence, limiting the effectiveness of monetary and fiscal policies in the country (**Briguglio et al., 2009**; **Ngouhouo & Nchofoung, 2021**).

Institutional fundamentals: Institutions play a pivotal role in shaping the economic landscape, extending beyond formal rules and regulations to encompass the accepted informal ways of life governing economic agents' interactions in a society. Existing literature strongly asserts that robust institutions act as a lubricant for sustainable economic development, facilitating effective policy formulation and decision-making processes within an economy (Jolles et al., 2023). Various indicators have been employed to gauge a nation's institutional quality, such as the rule of law, effective governance, property rights, voice and accountability, control of corruption, and political stability.

An illustrative example is the belief that an effective and responsive government serves as a crucial buffer against external shocks. This effectiveness hinges on established mechanisms that ensure efficient crisis management, prompt policy responses, effective resource allocation, and the ability to stabilize the economy during turbulent times (**Briguglio et al., 2009; Oprea et al., 2020**). Legal and property rights also emerge as critical institutional variables in assessing a nation's resilience. Foreign investors carefully evaluate the risks and uncertainties within a country, including the rights they possess, making these variables pivotal considerations for investment decisions (**Ngouhouo & Nchofoung, 2021**; **Rojas-Suarez, 2015**).

Furthermore, societies fostering mechanisms for citizen participation and accountability are more likely to withstand shocks. When citizens have a voice, governments are compelled to implement sound policies prioritizing the well-being of the population (**Oprea et al., 2020**). The control of corruption is equally paramount in building a resilient economy. Countries grappling with high levels of corruption, where public funds are diverted, struggle to muster resources for effective recovery from shocks. Moreover, corruption diminishes the attractiveness of a country to both foreign and domestic investors, thereby limiting the diversification potential of the economy. In this study, five key institutional variables are considered: political stability, rule of law, voice and accountability, government effectiveness, and control of corruption. These variables collectively provide a comprehensive framework for evaluating the institutional underpinnings of a nation and their implications for economic resilience.

Financial Market (Monetary space): The financial system assumes a dual role as both a shock absorber and a potential source of vulnerability to external shocks, with specific characteristics determining the monetary space within a country (**Jolles et al., 2023**; **Allegret & Allegret, 2018**; **Bhat et al., 2018**). The efficacy of the financial system in either fostering resilience or exacerbating vulnerability is contingent upon several factors, including leverage and risk-taking, liquidity, currency mismatch, interconnectedness, and common exposure (**Röhn et al., 2015**).

Within the realm of monetary policy, crucial financial variables shape the level of resilience or vulnerability to external shocks. These variables encompass the level of financial development, the financial stability index, capital adequacy ratio, liquidity ratio, level of non-performing loans, interest rate spread, among others (**Röhn et al., 2015**; **Jolles et al., 2023**). The prevailing belief is that increased financial development or deepening enhances a country's resilience against common external shocks, fostering improved consumption and investment while mitigating output volatility (**Röhn et al., 2015**).

For example, a financial sector burdened by a high volume of non-performing loans may impede its ability to absorb shocks during external crises, limiting its capacity to extend new loans. External shocks often erode borrowers' ability to service debt, escalating non-performing loan ratios, thereby weakening banks' lending capabilities and compromising the nation's ability to withstand external shocks. Monetary authorities typically intervene in the financial sector's balance sheet to expedite economic recovery during external shocks by injecting money into the economy and reducing borrowing costs. However, a prevalence of non-performing loans can constrain the monetary space, limiting the extent to which the monetary authority can influence the economy through the banks' balance sheets. This constraint may lead to currency crises and structural problems rather than fostering a robust recovery process (**Röhn et al., 2015**). Again, a stable financial system enhances a country's capacity to absorb external shocks, facilitate recovery, and sustain economic activities. The stability of the financial sector, characterized by prudent risk management and effective policymaking, plays a pivotal role in safeguarding against vulnerabilities and supporting the overall resilience of the economy (**Allegret & Allegret, 2018**; **Idowu et al., 2020**).

Public Sector (Fiscal space): The role of fiscal space in determining a nation's economic resilience is crucial, extending beyond the capacity to recover from common external shocks to the ability to withstand such shocks (**Carrillo and Díaz, 2019**; **Ismail Cevik et al., 2022**). This concept, first highlighted by **Keynes (1936)**, underscores the significance of a robust fiscal balance and sustainable debt levels in enabling counter-cyclical measures during external

shocks (**Jolles et al., 2023**). Fiscal space is commonly assessed through metrics such as the debt-to-GDP ratio, reflecting a government's capacity to deploy fiscal measures in the face of negative external shocks, as well as indicators like external debt to exports, fiscal budget deficit to GDP, and debt service to revenue (**Amiri et al., 2021**).

Measuring fiscal sustainability involves evaluating the size of public debt, budget deficits, debt-servicing capabilities, interest rates on debts, and the diversity of revenue sources. For instance, nations heavily reliant on a single revenue source, such as crude oil in many African oil-producing countries, may confront significant economic challenges during external shocks, especially when burdened with a high debt-to-GDP ratio and fiscal deficit. The ability of a government to navigate such challenges depends on the sustainability and diversity of its fiscal policies and revenue streams.

Furthermore, a large budget deficit relative to GDP suggests that a country is spending more than it generates in revenue. While moderate deficits can be strategic during economic downturns, persistent and excessive deficits may strain fiscal resources, limiting the government's capacity to implement counter-cyclical measures during external shocks (**Jolles et al., 2023**). Most SSA countries perform poorly in the ratio of debt service to revenue. A high ratio implies a significant portion of revenue is committed to debt payments, leaving less room for essential public spending. A lower capacity to service debt may constrain a government's ability to respond effectively to external shocks.

External Sector (Trade Space): External sector macroeconomic as often called trade space is another fundamental that facilitate recovery from the events of common external shock. Like the financial system, the external sector often serves as conduit for spillage of external shock on the domestic economy (**Briguglio et al., 2009**; **Jolles et al., 2023**). Key indicators employed to gauge economic resilience from a trade policy perspective encompass the current account balance to GDP, export diversification indices, reserve to short-term debt ratio, reserve to months of import, and exchange rate stability. A higher surplus in the current account balance or a lower deficit is indicative of a country's presumed resilience. Additionally, the ratio of a nation's total external debt (comprising public and private debt) to GDP serves as a crucial measure of its capacity to service and repay external obligations, functioning as a solvency indicator, particularly for highly indebted countries (**Jolles et al., 2023**; **Rojas-Suarez, 2015**; **Salvati, 2017**).

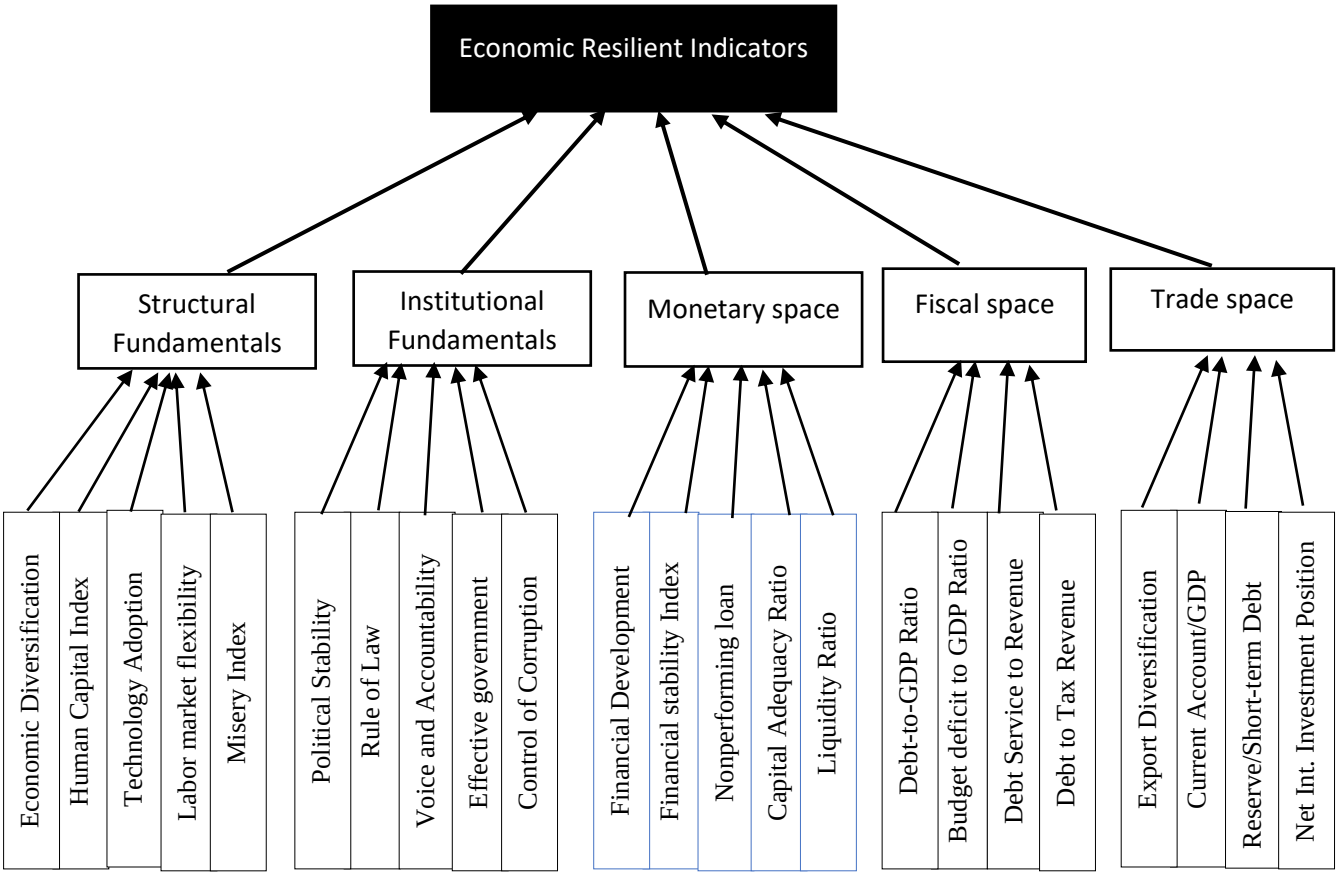

Figure 1: Economic Resilient Index framework

This specific indicator gains prominence in highly indebted nations, with a reduction in the total debt relative to GDP contributing to enhanced resilience against external shocks. Likewise, the ratio of short-term external debt to gross foreign reserves serves as a metric assessing a nation's susceptibility to liquidity constraints. A country's ability to demonstrate resilience during external shocks is measured by its reserves' adequacy to meet short-term external debt obligations. High foreign reserves coupled with low short-term debt obligations enhance a country's creditworthiness and augment its capacity to secure funds needed to revitalize the economy in times of external shocks (**Oprea et al., 2020**; **Salvati, 2017**).

4. Result and Discussion

Details of the computed Economic Resilient Index (ERI) for 26 selected Sub-Saharan African (SSA) countries can be seen in Appendix 1, while the sub-regional indices spanning from 1998 to 2021 is presented in Table 1. Data in Table 2 at the appendix provide the complete sub-index and ERI for all countries from 2016 to 2021, while data for other years will be provided upon request, primarily due to limitations in article page space. This index, on a scale from 1 to 99, with 1 indicating the least economic resilience to external shocks and 99 signifying the most resilient situation, provides an innovative dimension to measuring economic resilience from policy space perspective.

Table 2 in Appendix 1 reveals that Botswana emerges as the most economically resilient country in 2021 among the sampled SSA countries with an ERI of 68.64. Botswana is not just the most economic resilient country in 2021 but also consistently remains the most economic resilient country across the period of observation except for 2016, with an ERI ranging between 64 in 2016 to 78 in 2001 over the observation period. The country's robust economic resilience is mostly attributed to its strong position in fiscal space, institutional fundamentals, and favorable external position. Although Botswana maintained its position as the most resilient country, there is a noteworthy decline in its ERI from 78 in 2001 to 68 in 2021, which should concern Botswana policymakers. Despite this decline, Botswana's strong fiscal and trade space empower it to adeptly utilize fiscal instruments during external shocks without compromising fiscal sustainability and external trade positions. Furthermore, the country's robust performance in governance indicators (institutional fundamentals), as evident in Table 2, solidifies its ability to withstand external shocks. However, there is room for improvement in financial indicators, particularly the capital adequacy ratio of financial institutions, a critical aspect that exposes countries to external financial shocks. Thus, enhancing prudential guidelines is imperative to ensure the holistic robustness and stability of its financial system. These findings align with existing literature, including the works of **Briguglio (2016)**, **Sondermann (2018)**, and **Ngouhouo & Nchofoung (2021)**.

Similarly, the ERI of 2021, as captured in Table 2 in the Appendix, highlights the impressive performance of other Southern countries, including Mauritius, Namibia, South Africa, and Lesotho. These nations exhibit strong fiscal fundamentals, good governance practices, and a favorable external trade position, positioning these countries strategically to mitigate external shocks through the adoption of appropriate fiscal instruments, including external debt, without fear of creating fiscal unsustainability. While the Southern African countries exhibit strength in external positions, akin to Botswana, most of them lag in financial and structural fundamentals. Thus, a focused effort to improve in these areas will contribute significantly to enhancing resilience to economic shocks. These findings echo the conclusions drawn by **Ngouhouo & Nchofoung (2021)**, underscoring Southern Africa as the most resilient sub-region in Sub-Saharan Africa.

In particular, South Africa's position as the second-ranked country in the 2021 Economic Resilience Index (ERI) contrasts starkly with its struggle in essential structural areas, evident in its high misery index. Despite strong fiscal space, robust institutional frameworks, and a favorable external position, the nation faces challenges that demand strategic interventions to fortify its resilience against external shocks as manifested in high misery index across the years of observation. It becomes imperative that South Africa must embark on a strategic fiscal spending; prioritizing infrastructure development aimed at modernizing key sectors and targeted financing schemes that incentivize the growth of nascent industries while sustaining existing ones. These measures will effectively diversify the economy, curbing its vulnerability to sector-specific downturns, thereby fostering job creation and stabilizing supplies to alleviate inflationary pressures.

Leveraging its strong institutional fundamentals, the government can capitalize this advantage by instituting far-reaching reforms designed to overhaul the business landscape. Streamlining bureaucratic processes, enhancing legal frameworks, and offering incentives for innovation to attract foreign investment, stimulate entrepreneurial endeavors, and consequently, foster job creation and human capital development. These actions hold the potential to address the nation's structural weaknesses, thereby fortifying its resilience against potential external shocks.

Conversely, Sudan emerges with an ERI of 29, designating it as the least economically resilient country in SSA in 2021 and consistently across most years, as shown in Table 6. The vulnerability notably stems from poor institution/governance indicators and an unfavorable external position. This underscores the urgent need for Sudan to address governance issues and fortify policymaking processes to shield the country from the impacts of external shocks.

Table 1: Sub-Regional Trends of Economic Resilient Index in Sub-Saharan Africa.

Year	Sub-Saharan	West Africa	Central Africa	East Africa	Southern Africa
1998	52.183	52.678	50.48	44.322	61.232
1999	50.47	50.579	48.183	43.105	60.004
2000	49.431	49.074	49.243	42.224	57.173
2001	49.876	49.639	45.778	43.194	60.905
2002	51.322	51.609	48.56	43.58	61.519
2003	49.262	49.401	47.896	41.164	58.568
2004	47.659	47.154	47.5	39.63	56.361
2005	48.312	47.362	49.074	40.075	56.737
2006	46.956	46.629	47.084	39.095	55.014
2007	49.688	47.975	52.797	40.392	57.598
2008	47.332	46.649	49.421	38.184	55.084
2009	50.391	48.975	50.738	43.808	55.064
2010	49.876	48.272	53.48	41.907	55.856
2011	49.985	48.975	53.688	40.016	57.252
2012	54.074	53.678	56.618	44.619	61.776
2013	54.163	52.272	58.044	45.778	60.558
2014	53.272	52.708	55.499	45.273	59.598
2015	50.282	50.926	50.084	42.877	57.242
2016	49.777	51.53	48.579	43.966	55.044
2017	52.49	53.331	50.47	46.688	59.45
2018	52.143	52.628	48.827	47.104	60.024
2019	51.629	51.104	49.698	46.104	59.588
2020	48.926	47.777	47.134	42.719	58.073
2021	52.054	51.757	50.827	46.916	58.707

Source: Authors

In a broader context, the ERI indices expose vulnerability across SSA countries, primarily rooted in poor performance in institution fundamentals. For instance, the findings in 2021 (see Apendix) emphasize that only a select few countries, including Mauritius, Botswana, Namibia, South Africa, and Ghana, exhibit strong institutional fundamentals. institution, a foundational element crucial for quality decision-making processes and income distribution, emerges as a critical determinant of economic resilience. Notably, Ghana stands out as the only country outside Southern Africa performing well in governance fundamentals. Additionally, a significant number of countries fare poorly in financial (monetary space) fundamentals, highlighting their exposure to financial shocks globally. The data in Table 2 highlights that only South Africa, Nigeria, Mauritius, Mozambique, and Rwanda are adjudged to have sufficient monetary space, essential for dealing with price stability, appropriate price levels, exchange rate stability, and investment-friendly policy rates in 2021.

Across the Sub-Saharan African continent and its sub-regions between 1998 and 2021, noticeable fluctuations in Economic Resilience Index scores are evident. Analyzing Table 1, which illustrate the average performance of the SSA region and sub-regions across the years for West Africa,

Central Africa, East Africa, and Southern Africa, offers valuable insights. The SSA ERI, ranging from 46.95 to 54.13 from 1998 to 2021, indicates an average performance that consistently falls below the average threshold. The reason behind the poor performance is not far-fetched, given that the region faces a myriad of structural and institutional challenges. These include limited diversification in its economic base, primarily relying on primary commodities for most of their foreign exchange, making it vulnerable to global market fluctuations. Additionally, inadequate infrastructure, coupled with political instability and governance issues in certain countries, hinders the region's ability to effectively absorb and recover from external shocks.

Moreover, recurring issues with weak fiscal policies, high debt burdens relative to revenue, and limited fiscal space constrain governments' capacity to implement countercyclical measures during economic downturns as suggested by both Keynes and Post Keynesian economist. Furthermore, limited access to financing, along with challenges in developing robust and flexible labor markets, restricts the region's ability to cushion against economic shocks and foster resilience. Additionally, factors such as inadequate investment in education and healthcare, affecting human capital development, and susceptibility to environmental challenges, including climate change and natural disasters, contribute to the region's struggle to consistently surpass the assumed 55 thresholds for economic resilience. Addressing these multifaceted challenges remains crucial to bolstering Sub-Saharan Africa's resilience and enhancing its capacity to withstand and rebound from various economic shocks.

Analyzing the sub-regional dynamics, Southern Africa[1] emerges as the most resilient region within Sub-Saharan Africa. Notably, the region witnessed its lowest resilience in 2006 (55.01) and its peak resilience in 2012 (61.78). Consistently surpassing the assumed threshold of 55, Southern Africa demonstrates clear resilience to external shocks on average. Moreover, the region consistently exhibits relatively higher resilience compared to other sub-regions, with slight fluctuations while maintaining a generally elevated index score. A striking feature across most countries in Southern Africa is their robust performance in institutional/governance and fiscal space variables. These two elements stand as key fundamental components essential for mitigating the impact of external shocks and facilitating recovery.

Conversely, East Africa[2],emerges as the least resilient sub-region, showcasing considerable variability in each country's economic resilience throughout the observation period. Specifically, East Africa experienced a notable decline in economic resilience, plummeting to its lowest point (38.1) in 2009 in the aftermath of the global financial shock. However, there was a gradual recovery leading up to its highest level (47.1) in 2019, just before the onset of the global Covid-19 pandemic in 2020.

In comparison, West Africa and Central Africa exhibited moderate resilience, experiencing periodic fluctuations but generally maintaining scores within a mid-range spectrum. West Africa, akin to East Africa, hit its lowest economic resilience (46) in 2008 post the global financial shock but typically ranged between 46.5 and 54.1, underscoring its vulnerability in achieving consistent economic resilience. These findings shed light on the persistent macroeconomic challenges faced by West Africa, negatively impacting the welfare of the populace. The observations underline the need for targeted interventions and structural reforms in East Africa to enhance its resilience in the face of economic shocks and ensure sustainable development.

To assess the performance of the ERI, the study compares the behavior of the index over time and its correlation with key macroeconomic indicator in particular economic growth rate. This comparison holds significant importance as it unveils crucial insights for policymakers. Despite the ERI not being normalized across time for each country but rather at a specific time across countries, a positive co-movement between the ERI and output growth rate signifies that enhancing economic resilience leads to higher economic growth, a focal point for any government policy.

[1] Including South Africa, Lesotho, Botswana, Malawi, Mauritius, Namibia, Mozambique, and Zambia.

[2] Kenya, Ethiopia, Rwanda, and Sudan

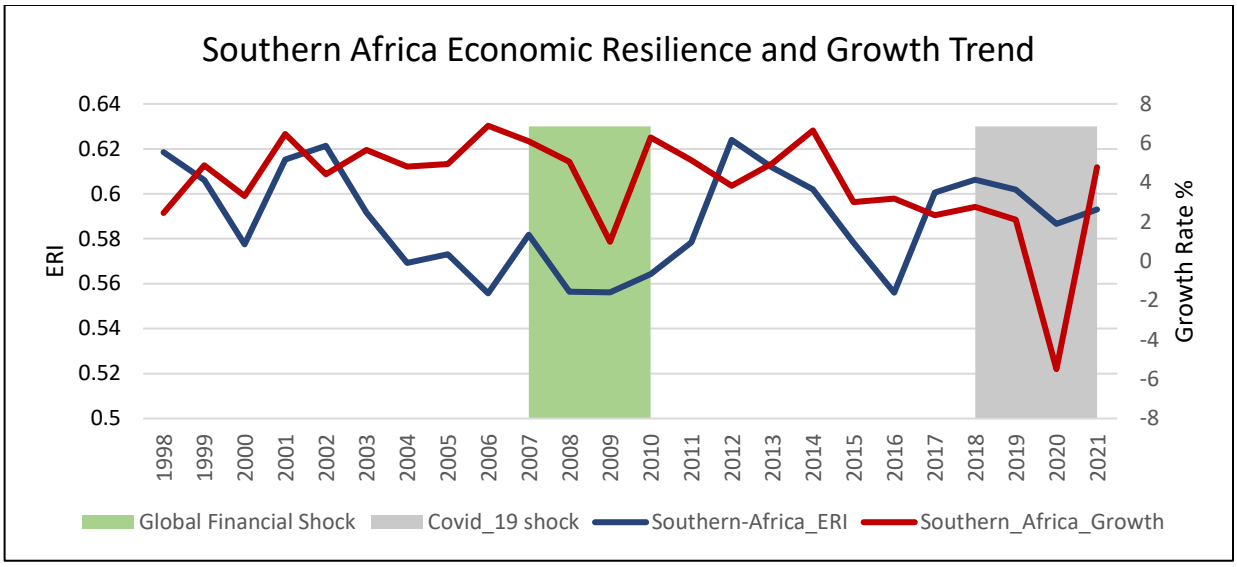

Figure 2: Southern Africa economic growth trend and ERI

Table 1 revealed that both Southern and West Africa emerge as the most economically resilient regions over the sampled period. To see the relevance of the ERI to policy makers we plotted the economic resilience alongside the average economic growth rate for Southern Africa in Figure 2. Figure 2 revealed the relationship between the average economic growth rate and economic resilience index of Southern African countries. Notably, the graph reveals a clear positive co-movement between the economic resilience index of Southern Africa and the region's output growth rate.

This positive correlation between the Economic Resilience Index (ERI) and output growth rate holds significant implications for policymakers. It signifies that more economic resilience countries enjoy higher economic growth and that economic growth is more likely achieved when key indicators of economic resilience are improved. Furthermore, these correlations endow the ERI with the role of an early warning system, offering insight into potential global or internal shocks that might disrupt economic activities within the region or specific countries. By pinpointing vulnerabilities such as rising debt unsustainability, over-reliance on specific economic sectors, inadequate financial regulations, or dwindling foreign reserves, the ERI aids policymakers in prioritizing strategic interventions. It highlights areas necessitating immediate attention or policy adjustments to bolster overall economic resilience and enhance the macroeconomic well-being of the respective countries or regions. Ultimately, this aids policymakers in making informed decisions to fortify economic stability and growth.

Again, similar to the approach **of Briguglio et al (2009), Angeon and Bates (2015)**, and **Ngouhouo & Nchofoung (2021)**, the study regressed the ERI against the output growth rate of SSA, the essence is to see the predictability of the ERI on output growth similar to what implemented in Figure 2 to 5.

GDPG = 1.892 + 0.683ERI…… …… (4)

(0.000 (0.000)

Equation (4), revealed that ERI has positive significant impact on output growth rate of SSA over the period of observation which implies that countries with higher level of resilience enjoys higher economic growth rate. This is because higher economic resilience means that such countries can effectively navigate external pressures during periods of economic shocks, facilitating sustained economic activity even in challenging times. Additionally, countries that are more resilient are able to sustain consumption, investment, and economic activities during periods of crisis, undoubtedly experiencing less impact on their output compared to those with lower levels of economic resilience.

5. Conclusion and Policy Implication

The study proposed a framework utilizing graph theory and an augmented Min-Max approach to measure the economic resilience of Sub-Saharan African (SSA) countries (see Figure 1). Across the observed period, Botswana emerged as the most economically resilient country in SSA. Notably, Southern African countries such as Mauritius, Namibia, South Africa, and Lesotho displayed remarkable resilience against external shocks. Conversely, substantial variation in resilience levels was evident among SSA's regions, with West Africa experiencing higher volatility in economic resilience while East Africa consistently exhibited the least resilience to external shock. Moreover, our study highlighted

a robust correlation between our ERI and key macroeconomic variables like output growth rate and inflation rate, signaling the ERI's relevance in tracking and stabilizing prices and output within the region. However, it also revealed widespread challenges across the region, particularly in governance and financial fundamentals, emphasizing the necessity for policymakers, especially beyond the Southern Region, to prioritize governance reforms and fortify financial and structural foundations to bolster overall resilience.

This research underscores the imperative of proactive strategies aimed at fortifying resilience against external shocks, aligning with prior studies in the field. Moreover, the detailed examination of sub-regional dynamics offers a nuanced comprehension, allowing for targeted policy interventions tailored addressing specific challenges unique to each sub-region and country. As such, this study contributes significantly to the ongoing discourse surrounding economic resilience in Sub-Saharan Africa and elsewhere, offering valuable insights for policymakers and stakeholders navigating the region's economic landscape.

References

Allan, G., Figus, G., McGregor, P. G., & Swales, J. K. (2021). Resilience in a behavioural Keynesian regional model. *Environment and Planning A*, *53*(4), 858–876. https://doi.org/10.1177/0308518X20941775

Allegret, J. P., & Allegret, A. (2018). The role of international reserves holding in buffering external shocks. *Applied Economics*, *50*(29), 3128–3147. https://doi.org/10.1080/00036846.2017.1418075

Amiri, H., Sayadi, M., & Mamipour, S. (2021). Oil Price Shocks and Macroeconomic Outcomes; Fresh Evidences from a scenario-based NK-DSGE analysis for oil-exporting countries. *Resources Policy*, *74*, 1–12. https://doi.org/10.1016/j.resourpol.2021.102262

Angeon, V., Bates, S. (2015). Reviewing composite vulnerability and resilience indexes: a sustainable approach and application. *World Development, Elsevier, 72(C), 140-162.*

Atkins, J., Mazzi, S., & Easter, C. (1998). A study on the vulnerability of developing and island states: A composite index. London: Commonwealth Secretariat.

Baritto, F. (2008). Disasters, vulnerability and resilience from a macro-economic perspective. Background paper for the 2009 ISDR Global Assessment Report on Disaster Risk Reduction

Briguglio, L (2014). A vulnerability and resilience framework for small states.

Briguglio, L. (1997). Alternative economic vulnerability indices for developing countries. Report prepared for the United Nations Department of Economic and Social Affairs.

Briguglio, L., Cordina, G., Farrugia, N., & Vella, S. (2009). Economic vulnerability and resilience: Concepts and measurements. *Oxford Development Studies, 37(3), 229-247*.

Caldera Sánchez, A., Rasmussen, M., & Röhn, O. (2015). *Economic resilience: what role for policies?* (No. 1259; OECD Working Papers). https://doi.org/10.1787/5jrxhgf61q5j-en

Carrillo, M. P., & Díaz, C. J. (2019). *An anatomy of external shocks in the Andean Region*. https://doi.org/10.18235/0001949

Cordina, G. (2008). The macroeconomic and growth dynamics of small states. In Small States: Economic Review & Basic Statistics (pp. 21-37). London: Commonwealth Secretariat.

Dakhlallah, K. M. (2020). Public debt and fiscal sustainability: the cyclically adjusted balance in the case of Lebanon. Middle East Development Journal, 1–20. doi:10.1080/17938120.2020.1773076

Deleidi, M. (2020). Post-Keynesian endogenous money theory: Horizontalists, structuralists and the paradox of illiquidity. *Metroeconomica*, *71*(1), 156–175. https://doi.org/10.1111/meca.12271

Duval, R., & Vogel, L. (2008). Economic resilience to shocks: The role of structural policies. OECD Economic Studies No. 44, 2008/1.

Feindouno, S., Goujon, M. (2016). The retrospective economic vulnerability index, 2015 update, *Working Papers P147, FERDI.*

Feng, Y., Lee, C.-C., & Peng, D. (2023). Does regional integration improve economic resilience? Evidence from urban agglomerations in China. *Sustainable Cities and Society*, *88*, 104–273. https://doi.org/10.1016/j.scs.2022.104273

Gallagher, M., Heredia-Ortiz, E. (2014). Developing alternatives- the macroeconomic resilience of nations. Retrieved online The Macroeconomic Resilience of Nations (dai-global-developments.com)

Idowu, P., Baba, Y. N., Olufunso, A. O., Aduni, T. O. E., & Tonuchi, J. (2020). How Effective is Monetary Policy in the Presence of High Informality in Nigeria. *Journal of Accounting, Business and Finance Research, 10(2), 84-93.*

Ismail, C. E., Fatih, B. M., Mehmood, U., & Han, H. (2022). Macroeconomic effects of crude oil shocks: Evidence from South Asian countries. *Frontiers in Psychology*, *13*, 1–10.

Jollès, M., Meyermans, E., & Vašíček, B. (2023). Determinants of macroeconomic resilience in the euro area: An empirical assessment of national policy levers. *Economic Systems,* 101093. https://doi.org/10.1016/j.ecosys.2023.101093

Joseph, T., & Obikaonu, P. (2021). Economic growth and quality adjusted human capital equation: Moderating role of social capabilities in Africa. *Applied Journal of Economics, Management and Social Sciences, 2(2), 1-9.*

Kose, M. A., Sergio, K., Franziska, O., Naotaka, S. (2022). A Cross-country database of fiscal space. *Journal of International Money and Finance, 128, 102682.*

Masik, G., & Grabkowska, M. (2020). Practical dimension of urban and regional resilience concepts: A proposal of resilience strategy model. *Miscellanea Geographica*, *24*(1), 30–34. https://doi.org/10.2478/mgrsd-2019-0028

Murakami, H. (2022). The unique limit cycle in post Keynesian theory. *Chaos, Solitons & Fractals*, *154*, 111597. https://doi.org/10.1016/j.chaos.2021.111597

Ngouhouo, I., & Nchofoung, T. N. (2021). Economic resilience in Sub-Saharan Africa: Evidence from Composite Indicators. *Journal of the Knowledge Economy*, *13*(1), 70–91.

Ojeyinka, T. A., & Yinusa, D. O. (2023). External Shocks and Their Transmission Channels in Nigeria: A Dynamic Stochastic General Equilibrium Approach. *Global Journal of Emerging Market Economies*, *15*(1), 132–153. https://doi.org/10.1177/09749101211067311

Oladunni, S. (2020). External shocks and optimal monetary policy in oil exporting small open economies. University of Bath: Bath

Oprea, F., Onofrei, M., Lupu, D., Vintila, G., & Paraschiv, G. (2020). The Determinants of Economic Resilience. The Case of Eastern European Regions. Sustainability, 12(10), 4228. https://doi.org/10.3390/su12104228

Röhn, O., A. Caldera-Sánchez, M. Hermansen and M. Rasmussen (2015), "Economic resilience: A new set of vulnerability indicators for OECD countries", OECD Economics Department Working Papers, No. 1249, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jrxhgjw54r8-en

Rojas-Suarez, L. (2015). *Emerging Market Macroeconomic Resilience to External Shocks: Today versus Pre–Global Crisis*.

Rose, A., Krausmann, E. (2013). An economic framework for the development of a resilience index for business recovery. International Journal of Disaster Risk Reduction, 5(1), 73-78

Salvati, L. (2017). Economic resilience, demography and local systems: a commentary on theory and assessment. *Romanian Journal of Regional Science*, *11*(2), 1–11.

Sondermann, D. (2018). Towards more resilient economies: The role of well-functioning economic structures', Journal of Policy Modeling, 40(1), 97-117.

Wang, Z., & Wei, W. (2021). Regional economic resilience in China: measurement and determinants. Regional Studies, 55(7), 1228–1239.

Appendix 1

Table 2: All countries Economic Resilient Index

Country	Year	Structural	Financial	Fiscal	Institution	External	ERI	Rank
Angola	1998	31.25	37.27	69.12	7.38	43.87	37.78	25
Angola	1999	27.36	37.70	75.12	6.15	40.97	37.46	24
Angola	2000	28.92	38.55	68.60	5.52	66.48	41.62	24
Angola	2001	24.67	39.19	62.66	5.86	43.77	35.23	25
Angola	2002	26.17	38.19	75.27	6.99	64.24	42.17	24
Angola	2003	27.09	40.97	84.07	10.34	44.48	41.39	24
Angola	2004	27.43	41.15	77.41	7.08	51.73	40.96	23
Angola	2005	32.73	40.42	74.62	12.87	69.62	46.05	17
Angola	2006	37.30	36.71	78.72	11.38	75.47	47.92	14
Angola	2007	36.08	42.01	78.92	11.34	86.24	50.92	14
Angola	2008	47.87	48.30	83.19	15.06	82.91	55.47	6
Angola	2009	41.19	43.94	74.88	19.00	57.38	47.28	20
Angola	2010	46.18	42.77	70.81	16.93	88.58	53.06	9
Angola	2011	51.82	51.74	65.61	14.75	88.54	54.49	9
Angola	2012	53.82	51.14	71.19	19.01	86.08	56.25	13
Angola	2013	59.54	54.50	71.07	17.39	86.77	57.86	9
Angola	2014	60.37	41.88	75.97	18.26	71.93	53.68	14
Angola	2015	42.17	45.99	60.19	18.17	52.96	43.90	23
Angola	2016	30.09	35.77	60.24	21.79	45.96	38.77	24
Angola	2017	35.01	33.34	69.54	21.13	67.10	45.22	22
Angola	2018	45.72	38.27	57.66	23.52	79.02	48.84	18
Angola	2019	49.58	36.17	53.95	21.07	70.64	46.28	20
Angola	2020	51.34	44.19	52.05	19.53	56.04	44.63	23
Angola	2021	55.96	45.39	52.11	17.62	73.96	49.01	19
Benin	1998	48.94	46.90	71.15	72.16	69.95	61.82	5
Benin	1999	48.64	47.78	73.70	67.50	59.14	59.35	6
Benin	2000	47.70	46.20	87.74	69.29	38.47	57.88	5
Benin	2001	49.95	46.56	88.71	67.16	49.84	60.44	5
Benin	2002	48.89	49.89	89.24	62.57	51.53	60.42	7
Benin	2003	48.33	48.31	89.33	60.65	36.40	56.60	7
Benin	2004	48.63	45.80	90.74	56.41	31.65	54.65	7
Benin	2005	52.08	40.47	90.75	55.05	37.54	55.18	6
Benin	2006	48.59	36.36	91.34	59.22	41.57	55.42	5
Benin	2007	50.46	41.00	83.05	56.48	51.18	56.43	4
Benin	2008	49.25	41.39	85.60	55.42	45.66	55.46	7
Benin	2009	52.35	43.28	76.19	56.83	58.03	57.34	6
Benin	2010	52.79	42.56	74.97	52.54	51.53	54.88	6

Benin	2011	48.44	42.58	61.21	52.38	56.55	52.23	13
Benin	2012	51.38	40.39	81.55	54.26	62.15	57.95	9
Benin	2013	51.63	42.44	81.37	55.64	67.46	59.71	7
Benin	2014	55.66	42.46	79.79	51.87	73.89	60.73	4
Benin	2015	53.78	43.40	73.77	48.93	73.61	58.70	4
Benin	2016	52.75	42.85	75.97	51.15	83.26	61.19	3
Benin	2017	52.79	44.88	80.40	48.21	76.29	60.51	4
Benin	2018	52.57	44.00	83.76	46.54	64.53	58.28	6
Benin	2019	53.12	43.70	80.41	41.69	61.74	56.13	7
Benin	2020	57.31	45.06	81.86	40.65	57.76	56.53	7
Benin	2021	54.73	46.13	86.59	42.28	52.12	56.37	10
Botswana	1998	59.51	57.91	78.83	90.44	88.95	75.13	1
Botswana	1999	58.85	58.80	78.91	91.63	89.02	75.44	1
Botswana	2000	69.52	59.62	85.15	89.18	58.97	72.49	1
Botswana	2001	69.09	58.35	95.87	89.18	80.43	78.59	1
Botswana	2002	61.21	58.41	97.71	88.64	62.43	73.68	1
Botswana	2003	57.82	61.81	91.47	92.43	59.72	72.65	1
Botswana	2004	51.84	57.11	88.92	92.90	53.47	68.85	1
Botswana	2005	46.57	51.15	81.28	91.34	69.57	67.98	1
Botswana	2006	39.52	49.79	87.88	89.45	72.79	67.89	1
Botswana	2007	38.65	56.56	87.62	88.70	80.62	70.43	1
Botswana	2008	44.53	54.05	94.34	85.65	62.05	68.13	1
Botswana	2009	40.99	58.55	93.00	87.95	64.85	69.07	1
Botswana	2010	39.90	57.81	86.50	87.57	59.55	66.27	1
Botswana	2011	49.07	53.85	75.75	85.81	69.31	66.76	1
Botswana	2012	61.18	53.50	80.44	86.01	74.72	71.17	1
Botswana	2013	53.50	55.35	70.66	86.74	92.05	71.66	1
Botswana	2014	47.01	48.74	74.35	85.95	97.80	70.77	1
Botswana	2015	43.85	54.31	77.51	87.33	93.35	71.27	1
Botswana	2016	55.48	42.85	75.97	51.15	83.26	61.74	2
Botswana	2017	46.50	55.52	81.12	85.82	92.47	72.29	1
Botswana	2018	48.60	53.15	88.38	86.73	74.23	70.22	1
Botswana	2019	46.61	54.34	92.23	88.67	66.53	69.68	1
Botswana	2020	50.67	56.53	92.40	84.08	57.72	68.28	1
Botswana	2021	46.69	53.82	90.99	86.08	65.67	68.65	1
Burkina Faso	1998	37.68	40.65	79.13	34.59	67.39	51.89	16
Burkina Faso	1999	37.83	41.13	77.80	35.43	66.55	51.75	14
Burkina Faso	2000	39.14	41.23	85.96	44.31	43.78	50.88	13
Burkina Faso	2001	37.48	39.13	87.14	43.99	56.10	52.77	11
Burkina Faso	2002	39.94	40.93	86.02	35.56	67.89	54.07	13
Burkina Faso	2003	37.15	42.94	86.51	41.08	44.62	50.46	14
Burkina Faso	2004	37.91	41.96	92.39	42.35	38.06	50.53	12

Burkina Faso	2005	41.11	35.29	92.10	45.55	27.92	48.39	13
Burkina Faso	2006	41.92	35.21	82.97	46.42	33.92	48.09	13
Burkina Faso	2007	40.33	37.17	93.25	45.93	37.94	50.92	13
Burkina Faso	2008	38.08	34.86	91.85	47.88	24.55	47.44	18
Burkina Faso	2009	44.89	38.97	86.72	50.32	45.04	53.19	9
Burkina Faso	2010	39.47	42.71	85.23	49.20	41.53	51.63	14
Burkina Faso	2011	38.60	39.18	86.02	43.23	44.07	50.22	17
Burkina Faso	2012	54.49	39.18	88.55	40.01	55.79	55.60	14
Burkina Faso	2013	53.94	40.92	88.11	38.04	47.85	53.77	15
Burkina Faso	2014	49.36	40.20	79.21	33.15	63.05	52.99	17
Burkina Faso	2015	50.03	40.90	74.29	38.00	55.59	51.76	14
Burkina Faso	2016	53.97	40.25	77.23	39.91	55.53	53.38	13
Burkina Faso	2017	50.31	43.85	90.57	39.75	55.16	55.93	10
Burkina Faso	2018	51.42	43.15	86.55	35.62	41.76	51.70	17
Burkina Faso	2019	49.85	44.70	82.85	31.51	45.74	50.93	17
Burkina Faso	2020	56.72	44.62	84.01	31.39	56.90	54.73	11
Burkina Faso	2021	56.76	45.30	89.72	31.48	58.11	56.27	11
Cameroon	1998	41.71	41.15	56.86	27.36	65.94	46.60	21
Cameroon	1999	41.44	43.98	57.27	18.99	51.69	42.68	23
Cameroon	2000	42.50	46.83	61.24	23.51	38.30	42.48	23
Cameroon	2001	41.54	38.75	65.55	22.20	47.88	43.18	22
Cameroon	2002	41.04	45.17	64.69	18.69	49.55	43.83	23
Cameroon	2003	40.34	42.98	71.95	23.10	36.05	42.88	21
Cameroon	2004	37.76	42.06	74.40	24.48	30.31	41.80	22
Cameroon	2005	40.77	38.65	75.36	23.99	33.56	42.47	23
Cameroon	2006	35.93	31.20	61.89	23.46	40.83	38.66	22
Cameroon	2007	39.61	33.93	77.81	21.51	55.22	45.61	19
Cameroon	2008	41.86	33.45	83.92	19.07	47.86	45.23	20
Cameroon	2009	37.61	42.82	77.71	20.87	58.36	47.47	19
Cameroon	2010	38.85	43.56	83.24	18.36	51.94	47.19	18
Cameroon	2011	37.25	36.27	75.15	19.82	57.01	45.10	21
Cameroon	2012	40.85	39.87	88.81	20.96	62.60	50.62	21
Cameroon	2013	39.62	45.85	88.72	21.49	65.75	52.29	18
Cameroon	2014	40.15	39.57	86.17	18.15	70.66	50.94	19
Cameroon	2015	39.36	40.07	75.37	18.10	71.06	48.79	18
Cameroon	2016	38.10	37.28	80.33	18.15	69.66	48.70	20
Cameroon	2017	39.64	42.19	81.74	16.89	68.21	49.73	19
Cameroon	2018	40.69	36.03	82.64	12.60	57.70	45.93	22
Cameroon	2019	39.90	38.28	81.50	11.63	57.05	45.67	21
Cameroon	2020	40.91	37.07	81.64	10.59	48.34	43.71	25
Cameroon	2021	42.30	36.32	84.47	11.85	46.05	44.20	24
Congo, Rep.	1998	57.12	49.81	72.34	6.80	83.46	53.91	14

Congo, Rep.	1999	52.47	48.58	58.38	6.59	74.23	48.05	16
Congo, Rep.	2000	50.86	49.59	59.97	12.49	74.30	49.44	15
Congo, Rep.	2001	47.54	48.64	38.26	9.27	71.96	43.13	23
Congo, Rep.	2002	47.03	51.07	45.41	11.20	75.78	46.10	20
Congo, Rep.	2003	48.62	61.87	41.27	13.89	78.48	48.83	15
Congo, Rep.	2004	42.14	57.41	59.84	14.18	74.33	49.58	14
Congo, Rep.	2005	37.00	57.67	59.39	10.75	71.66	47.29	15
Congo, Rep.	2006	30.70	42.27	62.26	10.81	67.96	42.80	20
Congo, Rep.	2007	35.41	52.61	67.35	9.22	61.88	45.29	20
Congo, Rep.	2008	42.76	61.17	63.94	11.55	78.32	51.55	11
Congo, Rep.	2009	35.47	53.26	65.31	16.30	68.29	47.73	18
Congo, Rep.	2010	34.98	57.37	64.04	16.33	85.46	51.64	13
Congo, Rep.	2011	36.40	61.16	68.97	15.72	87.16	53.88	10
Congo, Rep.	2012	40.93	59.76	74.13	16.78	90.22	56.37	12
Congo, Rep.	2013	38.14	57.51	86.93	18.02	90.19	58.16	8
Congo, Rep.	2014	40.25	60.78	88.28	17.81	89.18	59.26	6
Congo, Rep.	2015	40.42	55.26	77.25	17.87	56.50	49.46	16
Congo, Rep.	2016	39.23	47.10	81.53	15.40	66.48	49.95	17
Congo, Rep.	2017	46.41	50.99	75.72	15.62	67.69	51.29	18
Congo, Rep.	2018	51.27	38.47	67.26	16.73	61.28	47.00	20
Congo, Rep.	2019	46.97	39.72	67.47	9.03	94.81	51.60	16
Congo, Rep.	2020	53.31	37.55	73.21	8.64	83.47	51.24	16
Congo, Rep.	2021	58.82	38.56	70.01	11.39	81.27	52.01	16
Cote d'Ivoire	1998	49.49	45.32	61.43	41.16	76.25	54.73	11
Cote d'Ivoire	1999	49.84	46.04	62.61	39.76	72.00	54.05	10
Cote d'Ivoire	2000	50.13	46.15	73.40	17.24	44.20	46.22	18
Cote d'Ivoire	2001	49.55	43.89	63.44	17.24	61.55	47.13	17
Cote d'Ivoire	2002	49.22	46.24	67.10	11.39	59.33	46.66	18
Cote d'Ivoire	2003	51.09	46.97	74.94	8.21	47.76	45.79	17
Cote d'Ivoire	2004	48.01	47.31	76.97	5.03	43.66	44.19	18
Cote d'Ivoire	2005	49.99	43.09	77.99	3.62	46.69	44.28	20
Cote d'Ivoire	2006	46.02	38.46	78.01	4.77	51.10	43.67	19
Cote d'Ivoire	2007	46.38	37.42	73.81	4.99	57.18	43.95	22
Cote d'Ivoire	2008	48.80	39.44	76.08	5.59	50.10	44.00	22
Cote d'Ivoire	2009	45.62	45.82	74.01	10.69	79.21	51.07	14
Cote d'Ivoire	2010	44.91	42.96	70.37	8.03	61.62	45.58	20
Cote d'Ivoire	2011	41.17	44.41	57.81	9.51	67.12	44.01	22
Cote d'Ivoire	2012	47.06	44.53	81.91	16.03	74.07	52.72	19
Cote d'Ivoire	2013	46.88	45.41	82.22	22.57	67.95	53.01	17
Cote d'Ivoire	2014	49.16	43.39	80.56	26.39	77.14	55.33	12
Cote d'Ivoire	2015	48.92	46.14	72.01	29.78	77.66	54.90	8
Cote d'Ivoire	2016	47.15	43.98	73.51	30.49	76.04	54.23	9

Cote d'Ivoire	2017	48.91	52.05	78.06	28.80	68.31	55.23	12
Cote d'Ivoire	2018	48.51	49.23	81.89	32.51	58.39	54.11	12
Cote d'Ivoire	2019	49.52	51.01	77.34	32.73	57.14	53.55	12
Cote d'Ivoire	2020	50.24	50.53	78.60	30.64	51.08	52.22	14
Cote d'Ivoire	2021	50.99	50.72	79.93	30.75	49.18	52.32	15
Ethiopia	1998	32.47	53.51	66.85	20.15	61.78	46.95	20
Ethiopia	1999	32.09	52.89	70.56	20.03	51.35	45.38	20
Ethiopia	2000	32.67	51.63	80.57	17.99	35.98	43.77	21
Ethiopia	2001	31.76	50.97	77.69	17.99	38.84	43.45	21
Ethiopia	2002	31.96	52.48	78.35	15.10	44.66	44.51	22
Ethiopia	2003	28.49	49.21	77.96	16.08	36.07	41.56	23
Ethiopia	2004	28.67	50.17	78.35	17.63	25.38	40.04	24
Ethiopia	2005	27.87	44.69	83.66	14.71	27.40	39.66	24
Ethiopia	2006	23.48	34.61	78.21	23.27	30.51	38.02	25
Ethiopia	2007	20.45	22.79	81.47	24.17	45.55	38.89	25
Ethiopia	2008	13.68	23.43	88.06	23.36	39.61	37.63	25
Ethiopia	2009	27.18	47.42	79.75	20.46	50.66	45.09	22
Ethiopia	2010	27.99	37.98	76.13	21.66	42.89	41.33	23
Ethiopia	2011	13.40	23.80	72.65	22.26	50.80	36.58	25
Ethiopia	2012	25.01	30.60	81.76	24.15	53.85	43.07	25
Ethiopia	2013	29.92	40.12	79.08	24.43	52.11	45.13	25
Ethiopia	2014	31.44	39.03	73.58	25.26	53.87	44.64	25
Ethiopia	2015	28.41	32.39	64.37	21.74	49.93	39.37	25
Ethiopia	2016	29.42	38.03	67.96	21.42	40.86	39.54	22
Ethiopia	2017	29.77	45.23	75.92	20.34	36.34	41.52	25
Ethiopia	2018	30.74	45.72	80.51	25.25	40.31	44.51	24
Ethiopia	2019	29.52	43.16	79.77	25.22	43.43	44.22	24
Ethiopia	2020	32.10	45.66	81.66	24.74	35.87	44.01	24
Ethiopia	2021	33.88	44.42	84.86	21.39	37.99	44.51	23
Gambia, The	1998	51.20	49.97	69.68	54.10	70.83	59.15	7
Gambia, The	1999	49.83	52.07	70.71	53.02	60.29	57.18	8
Gambia, The	2000	42.83	52.95	78.40	51.07	39.09	52.87	10
Gambia, The	2001	37.49	52.02	80.10	51.07	46.98	53.53	9
Gambia, The	2002	37.10	49.92	69.53	53.20	52.50	52.45	14
Gambia, The	2003	33.90	51.40	73.92	57.47	44.23	52.19	13
Gambia, The	2004	27.82	44.61	77.94	47.20	27.50	45.02	16
Gambia, The	2005	35.69	46.67	80.47	41.36	33.42	47.52	14
Gambia, The	2006	35.75	40.93	80.59	42.26	33.65	46.64	16
Gambia, The	2007	31.96	33.42	83.17	41.50	43.61	46.73	17
Gambia, The	2008	45.13	35.47	83.94	36.38	44.34	49.05	17
Gambia, The	2009	35.08	42.70	74.83	37.28	65.26	51.03	15
Gambia, The	2010	30.25	40.14	71.75	35.19	48.92	45.25	21

Gambia, The	2011	35.32	42.78	69.77	33.42	47.61	45.78	19
Gambia, The	2012	45.76	43.20	75.29	33.93	56.75	50.98	20
Gambia, The	2013	46.14	41.57	73.99	32.99	58.05	50.55	19
Gambia, The	2014	40.56	48.63	56.70	28.02	66.81	48.15	23
Gambia, The	2015	43.55	54.46	54.57	25.74	67.92	49.25	17
Gambia, The	2016	47.09	56.56	56.83	22.42	63.26	49.23	19
Gambia, The	2017	47.66	70.05	61.28	37.45	65.92	56.47	8
Gambia, The	2018	44.00	63.93	76.10	41.67	58.72	56.88	7
Gambia, The	2019	42.05	58.90	71.80	44.90	60.92	55.71	9
Gambia, The	2020	51.01	61.09	72.79	44.63	47.74	55.45	9
Gambia, The	2021	52.20	61.58	77.41	47.27	40.54	55.80	12
Gabon	1998	69.08	50.97	74.69	54.14	69.29	63.64	4
Gabon	1999	71.95	51.92	60.12	52.99	85.83	64.56	3
Gabon	2000	73.43	52.33	64.15	57.38	69.79	63.42	3
Gabon	2001	65.49	49.63	62.19	57.38	73.06	61.55	3
Gabon	2002	64.66	52.93	63.14	56.14	73.84	62.14	4
Gabon	2003	62.65	54.81	62.38	49.13	63.51	58.50	5
Gabon	2004	60.41	53.96	68.13	43.18	62.59	57.65	4
Gabon	2005	59.02	52.44	75.39	41.99	73.58	60.48	3
Gabon	2006	51.98	52.80	78.52	35.93	75.55	58.96	2
Gabon	2007	47.15	43.59	75.31	35.51	77.72	55.86	5
Gabon	2008	56.84	54.15	80.70	34.16	68.85	58.94	4
Gabon	2009	48.44	55.03	72.32	37.95	88.65	60.48	3
Gabon	2010	47.70	59.33	79.93	41.53	81.61	62.02	2
Gabon	2011	48.97	58.56	77.63	41.06	80.09	61.26	2
Gabon	2012	55.27	56.90	75.00	39.91	89.10	63.24	4
Gabon	2013	53.61	57.09	81.37	41.17	86.23	63.89	4
Gabon	2014	50.93	45.32	68.53	39.29	86.50	58.11	8
Gabon	2015	53.66	52.74	62.28	34.96	87.30	58.19	5
Gabon	2016	51.77	43.32	62.40	33.41	93.55	56.89	6
Ghana	2016	36.27	34.84	44.04	65.49	75.00	51.13	15
Gabon	2017	55.48	45.11	61.46	28.19	87.86	55.62	11
Gabon	2018	56.14	37.45	70.25	28.23	75.64	53.54	13
Gabon	2019	55.22	50.59	68.48	27.55	74.46	55.26	10
Gabon	2020	59.06	49.90	72.16	28.34	67.01	55.29	10
Gabon	2021	64.14	51.04	77.08	30.04	68.08	58.08	6
Ghana	1998	45.42	46.36	70.17	52.31	63.89	55.63	9
Ghana	1999	47.65	47.53	68.82	50.87	47.82	52.54	11
Ghana	2000	46.92	44.16	71.57	61.40	41.11	53.03	9
Ghana	2001	42.29	42.83	65.36	61.40	50.93	52.56	12
Ghana	2002	45.85	46.90	64.70	61.92	62.22	56.32	11
Ghana	2003	40.92	54.01	67.14	60.89	48.34	54.26	10

Ghana	2004	37.01	46.00	77.87	60.77	35.57	51.44	10
Ghana	2005	37.79	36.69	80.11	65.07	37.67	51.47	11
Ghana	2006	36.02	30.72	74.48	69.40	41.09	50.34	10
Ghana	2007	36.92	30.04	74.69	65.59	48.23	51.10	12
Ghana	2008	41.09	38.90	76.04	63.37	37.80	51.44	12
Ghana	2009	32.83	29.30	67.04	67.71	58.21	51.02	16
Ghana	2010	36.39	27.13	64.99	67.96	47.52	48.80	16
Ghana	2011	40.39	36.07	51.79	68.48	59.14	51.17	14
Ghana	2012	44.51	38.57	77.19	66.45	65.21	58.38	8
Ghana	2013	42.22	43.68	64.38	66.91	58.13	55.06	12
Ghana	2014	40.52	34.85	48.85	62.56	68.68	51.09	18
Ghana	2015	36.31	26.42	38.23	64.98	74.53	48.09	20
Ghana	2016	36.27	34.84	44.04	65.49	75.00	51.13	15
Ghana	2017	42.12	39.59	43.86	69.35	72.62	53.51	15
Ghana	2018	45.64	43.93	56.36	66.11	63.19	55.04	10
Ghana	2019	44.03	48.82	54.63	65.19	66.19	55.77	8
Ghana	2020	46.46	44.00	64.55	66.03	51.74	54.56	12
Ghana	2021	48.72	40.53	59.02	63.69	52.22	52.83	13
Guinea-Bissau	1998	50.41	61.98	59.93	7.81	67.54	49.53	17
Guinea-Bissau	1999	49.65	62.51	55.18	7.75	63.27	47.67	17
Guinea-Bissau	2000	54.78	61.54	48.75	26.45	41.88	46.68	17
Guinea-Bissau	2001	46.79	59.82	44.50	21.92	50.15	44.64	19
Guinea-Bissau	2002	45.78	60.75	46.51	22.49	56.31	46.37	19
Guinea-Bissau	2003	47.47	54.12	50.54	16.95	40.83	41.98	22
Guinea-Bissau	2004	45.67	59.85	51.73	17.88	36.80	42.39	21
Guinea-Bissau	2005	47.75	59.48	51.44	21.07	37.77	43.50	21
Guinea-Bissau	2006	45.41	42.04	52.21	21.36	31.68	38.54	23
Guinea-Bissau	2007	43.42	40.32	51.32	19.43	48.88	40.67	23
Guinea-Bissau	2008	53.24	37.69	47.00	17.18	42.17	39.46	24
Guinea-Bissau	2009	53.70	46.04	36.50	17.99	53.89	41.62	24
Guinea-Bissau	2010	52.00	41.46	52.42	18.31	43.85	41.61	22
Guinea-Bissau	2011	46.66	45.26	58.72	16.39	60.66	45.54	20
Guinea-Bissau	2012	55.58	44.93	72.37	7.74	56.23	47.37	24
Guinea-Bissau	2013	51.67	44.21	67.40	7.85	64.69	47.16	23
Guinea-Bissau	2014	51.16	44.81	53.04	13.18	74.25	47.29	24
Guinea-Bissau	2015	54.06	50.05	51.09	15.02	80.77	50.20	15
Guinea-Bissau	2016	51.46	40.63	62.09	15.71	85.54	51.09	16
Guinea-Bissau	2017	53.84	48.22	66.93	14.87	79.98	52.77	16
Guinea-Bissau	2018	53.67	46.91	77.80	15.34	65.44	51.83	16
Guinea-Bissau	2019	50.50	47.59	71.64	16.92	58.35	49.00	18
Guinea-Bissau	2020	47.58	47.30	79.40	15.94	53.46	48.74	18
Guinea-Bissau	2021	52.07	47.95	74.67	22.33	49.64	49.33	18

Kenya	1998	44.61	38.26	67.30	28.41	53.45	46.40	22
Kenya	1999	44.26	39.33	66.85	27.36	47.97	45.15	21
Kenya	2000	43.92	38.70	72.37	28.24	37.20	44.08	19
Kenya	2001	43.10	38.07	75.48	28.24	48.41	46.66	18
Kenya	2002	43.76	40.35	73.13	25.68	56.12	47.81	17
Kenya	2003	41.77	37.62	74.26	29.67	41.95	45.05	19
Kenya	2004	37.50	33.63	75.71	31.03	37.40	43.05	19
Kenya	2005	39.36	29.45	80.46	31.77	40.93	44.39	19
Kenya	2006	32.16	15.70	81.35	33.50	41.88	40.92	21
Kenya	2007	35.95	30.52	76.76	29.26	49.90	44.48	21
Kenya	2008	33.20	30.37	78.16	27.21	42.12	42.21	23
Kenya	2009	36.44	39.57	71.90	26.95	58.36	46.64	21
Kenya	2010	39.44	44.60	71.03	30.38	46.87	46.46	19
Kenya	2011	32.25	42.97	61.05	30.02	50.62	43.38	23
Kenya	2012	38.84	46.95	78.89	31.22	55.64	50.31	22
Kenya	2013	37.96	48.81	71.76	36.91	55.62	50.21	21
Kenya	2014	37.87	46.87	67.63	37.85	58.74	49.79	20
Kenya	2015	35.75	43.85	60.30	37.57	63.01	48.09	19
Kenya	2016	34.57	43.54	64.96	38.18	59.00	48.05	21
Kenya	2017	35.44	50.05	72.24	38.21	47.26	48.64	21
Kenya	2018	37.00	50.70	72.57	34.35	45.60	48.04	19
Kenya	2019	36.33	50.38	71.13	35.22	40.94	46.80	19
Kenya	2020	38.64	47.03	71.74	33.56	37.43	45.68	20
Kenya	2021	39.69	45.65	73.98	36.17	38.30	46.76	21
Lesotho	1998	59.35	42.87	89.38	57.07	56.51	61.04	6
Lesotho	1999	59.15	42.07	89.50	55.50	52.51	59.74	5
Lesotho	2000	58.81	42.69	74.09	60.00	40.09	55.14	7
Lesotho	2001	58.36	43.27	74.49	60.00	62.38	59.70	7
Lesotho	2002	51.02	39.04	76.08	65.64	71.22	60.60	6
Lesotho	2003	54.75	43.76	82.59	63.69	52.90	59.54	3
Lesotho	2004	48.79	39.81	77.91	59.08	50.43	55.20	5
Lesotho	2005	48.62	41.17	85.97	57.72	55.37	57.77	4
Lesotho	2006	42.90	31.85	81.57	55.77	64.02	55.22	6
Lesotho	2007	42.10	30.52	78.62	49.68	74.56	55.10	6
Lesotho	2008	48.66	36.49	83.39	50.01	74.10	58.53	5
Lesotho	2009	43.25	34.50	85.37	58.64	80.43	60.44	4
Lesotho	2010	36.01	38.57	84.76	58.58	58.14	55.21	5
Lesotho	2011	33.92	41.42	91.20	58.36	65.96	58.17	6
Lesotho	2012	42.22	43.79	77.06	58.58	65.99	57.53	10
Lesotho	2013	39.81	41.45	86.11	60.67	70.69	59.75	6
Lesotho	2014	39.28	40.54	76.64	48.60	76.76	56.36	9
Lesotho	2015	37.71	41.31	72.09	47.17	82.75	56.21	6

Lesotho	2016	35.80	43.25	87.63	45.76	86.05	59.70	5
Lesotho	2017	38.27	51.54	79.40	44.58	82.86	59.33	5
Lesotho	2018	41.91	51.27	88.35	43.63	74.09	59.85	5
Lesotho	2019	36.34	51.20	87.19	37.42	71.11	56.65	6
Lesotho	2020	40.35	53.83	79.39	38.77	67.19	55.91	8
Lesotho	2021	44.32	54.05	90.35	39.83	56.61	57.03	9
Mali	1998	38.80	41.83	78.45	48.08	65.59	54.55	13
Mali	1999	37.07	43.14	75.71	47.92	54.72	51.71	15
Mali	2000	39.30	43.45	79.73	49.51	34.54	49.30	16
Mali	2001	37.72	39.99	83.36	49.51	45.40	51.19	13
Mali	2002	45.70	43.12	86.01	59.21	55.10	57.83	9
Mali	2003	48.40	44.30	86.71	59.10	39.40	55.58	8
Mali	2004	41.78	45.34	90.37	58.16	29.25	52.98	9
Mali	2005	37.24	37.45	90.51	57.51	36.06	51.75	10
Mali	2006	38.51	36.31	76.79	58.48	45.86	51.19	8
Mali	2007	41.23	33.67	92.89	54.33	51.47	54.72	7
Mali	2008	46.24	33.61	92.43	50.98	42.25	53.10	9
Mali	2009	44.55	43.31	86.47	49.02	59.47	56.57	7
Mali	2010	44.98	41.20	86.53	47.71	46.99	53.48	8
Mali	2011	43.60	38.97	81.26	42.33	57.59	52.75	12
Mali	2012	51.13	38.48	85.62	23.31	66.25	52.96	18
Mali	2013	49.54	42.94	86.12	26.99	67.84	54.69	14
Mali	2014	48.47	38.99	81.98	26.22	71.32	53.40	15
Mali	2015	54.13	41.33	73.18	25.70	73.59	53.58	11
Mali	2016	51.38	42.95	78.16	24.93	76.09	54.70	8
Mali	2017	44.73	45.43	79.44	23.52	69.55	52.54	17
Mali	2018	51.72	44.29	86.05	20.44	63.88	53.28	14
Mali	2019	54.59	45.35	80.90	18.18	61.20	52.05	14
Mali	2020	47.02	44.70	83.71	13.88	62.79	50.42	17
Mali	2021	52.07	44.21	86.49	13.36	52.25	49.68	17
Mauritius	1998	61.48	50.49	65.12	95.63	88.55	72.26	2
Mauritius	1999	62.34	49.47	65.10	93.72	77.18	69.56	2
Mauritius	2000	62.19	49.99	70.76	94.13	50.70	65.55	2
Mauritius	2001	60.12	49.61	71.60	94.13	75.33	70.16	2
Mauritius	2002	60.29	53.57	69.64	96.37	77.65	71.50	2
Mauritius	2003	59.80	53.78	68.83	98.08	51.12	66.32	2
Mauritius	2004	56.87	50.69	71.53	99.00	41.71	63.96	2
Mauritius	2005	56.88	49.20	75.11	98.56	44.80	64.91	2
Mauritius	2006	51.41	37.36	76.34	95.55	33.96	58.93	3
Mauritius	2007	51.28	38.50	71.34	96.84	46.05	60.80	2
Mauritius	2008	59.32	48.89	72.25	94.49	36.68	62.33	2
Mauritius	2009	56.65	50.28	63.89	95.42	46.75	62.60	2

Mauritius	2010	54.31	50.70	61.92	94.16	36.00	59.42	4
Mauritius	2011	49.47	51.76	53.50	94.35	47.08	59.23	4
Mauritius	2012	58.45	55.08	65.65	96.42	52.15	65.55	2
Mauritius	2013	56.56	54.87	63.58	96.13	56.35	65.50	2
Mauritius	2014	57.50	53.23	47.95	94.02	58.88	62.32	3
Mauritius	2015	56.64	53.95	40.94	98.16	63.37	62.61	2
Mauritius	2016	56.26	53.70	44.84	99.00	70.96	64.95	1
Mauritius	2017	56.98	61.54	47.75	97.54	60.31	64.82	3
Mauritius	2018	57.80	59.83	57.96	97.80	51.33	64.95	2
Mauritius	2019	57.97	62.66	60.55	94.56	45.51	64.25	2
Mauritius	2020	58.63	64.35	63.71	95.87	36.85	63.88	2
Mauritius	2021	58.99	65.30	58.73	93.73	36.08	62.57	3
Malawi	1998	49.50	55.81	59.34	65.86	64.00	58.90	8
Malawi	1999	50.64	56.11	59.38	64.16	56.97	57.45	7
Malawi	2000	52.06	57.00	69.00	58.29	36.95	54.66	8
Malawi	2001	49.90	52.82	71.79	58.29	63.19	59.19	8
Malawi	2002	49.34	57.28	73.23	52.86	64.83	59.51	8
Malawi	2003	48.17	58.50	75.31	47.28	42.15	54.28	9
Malawi	2004	44.98	55.29	81.48	52.03	36.11	53.98	8
Malawi	2005	46.29	53.27	83.68	43.55	41.95	53.75	8
Malawi	2006	41.74	44.44	79.90	46.69	42.87	51.13	9
Malawi	2007	42.98	44.90	76.52	43.24	51.55	51.84	9
Malawi	2008	47.94	48.98	79.67	39.17	37.14	50.58	14
Malawi	2009	44.59	50.77	72.62	46.82	49.84	52.93	11
Malawi	2010	43.85	50.16	72.79	46.94	44.79	51.71	12
Malawi	2011	44.77	51.08	63.84	45.55	47.39	50.53	16
Malawi	2012	49.55	51.08	79.91	46.47	55.62	56.53	11
Malawi	2013	46.67	48.25	70.71	45.88	54.15	53.13	16
Malawi	2014	48.46	47.55	61.23	45.69	66.45	53.88	13
Malawi	2015	43.80	46.07	57.28	47.35	74.96	53.89	9
Malawi	2016	42.81	47.07	60.10	46.88	70.94	53.56	11
Malawi	2017	45.92	49.78	65.39	43.55	69.01	54.73	13
Malawi	2018	46.55	49.78	72.83	44.58	59.36	54.62	11
Malawi	2019	45.76	50.14	71.92	43.96	62.98	54.95	11
Malawi	2020	47.55	53.57	77.38	47.08	61.74	57.46	6
Malawi	2021	49.35	54.59	80.37	46.46	54.41	57.04	8
Mozambique	1998	40.31	54.11	69.76	48.71	60.61	54.70	12
Mozambique	1999	41.22	54.65	68.23	47.59	48.37	52.01	13
Mozambique	2000	40.60	55.01	77.02	45.78	31.86	50.05	14
Mozambique	2001	37.89	52.74	77.46	45.78	40.35	50.84	15
Mozambique	2002	39.24	58.44	81.57	50.93	42.78	54.59	12
Mozambique	2003	40.60	66.04	81.38	49.30	31.70	53.80	11

Mozambique	2004	37.62	63.78	83.10	47.78	24.35	51.32	11
Mozambique	2005	40.11	48.52	82.28	53.01	30.50	50.88	12
Mozambique	2006	30.88	32.60	86.26	51.15	31.26	46.43	17
Mozambique	2007	34.89	39.13	85.20	49.98	29.44	47.73	16
Mozambique	2008	36.99	44.12	85.08	48.63	32.38	49.44	15
Mozambique	2009	38.53	46.51	79.51	54.78	47.84	53.43	8
Mozambique	2010	30.88	34.65	78.37	51.18	43.58	47.73	17
Mozambique	2011	33.21	45.67	80.38	46.64	42.18	49.61	18
Mozambique	2012	40.91	54.02	85.26	47.63	42.69	54.10	16
Mozambique	2013	38.30	54.86	77.92	39.18	41.15	50.28	20
Mozambique	2014	39.43	48.86	73.76	32.62	51.83	49.30	22
Mozambique	2015	36.75	50.73	56.55	29.88	45.20	43.82	24
Mozambique	2016	29.17	44.04	46.23	21.47	37.88	35.76	25
Mozambique	2017	32.25	52.07	54.98	22.46	56.77	43.71	23
Mozambique	2018	37.09	54.43	67.53	21.41	41.25	44.34	25
Mozambique	2019	36.39	63.13	64.41	21.13	39.68	44.95	22
Mozambique	2020	37.09	62.88	70.85	18.82	34.34	44.80	22
Mozambique	2021	37.39	57.72	71.91	20.26	16.41	40.74	25
Namibia	1998	54.97	58.60	80.56	75.62	61.67	66.28	3
Namibia	1999	54.13	57.55	80.86	73.75	49.80	63.22	4
Namibia	2000	54.88	57.60	87.45	66.89	27.51	58.87	4
Namibia	2001	57.10	55.75	86.35	66.89	41.28	61.48	4
Namibia	2002	49.98	59.42	86.93	70.52	45.92	62.55	3
Namibia	2003	46.36	57.05	85.34	73.55	32.70	59.00	4
Namibia	2004	40.50	54.92	90.92	75.36	29.05	58.15	3
Namibia	2005	37.51	55.92	88.94	73.86	29.84	57.22	5
Namibia	2006	32.47	47.27	88.58	80.02	40.70	57.81	4
Namibia	2007	31.13	46.17	85.18	80.37	50.09	58.59	3
Namibia	2008	40.73	52.45	85.72	84.03	39.54	60.49	3
Namibia	2009	34.12	46.14	79.08	82.54	58.71	60.12	5
Namibia	2010	32.34	49.79	87.82	79.97	47.52	59.49	3
Namibia	2011	34.82	54.08	85.48	76.98	43.08	58.89	5
Namibia	2012	44.03	53.26	94.24	79.20	56.63	65.47	3
Namibia	2013	42.36	52.50	85.07	79.92	54.69	62.91	5
Namibia	2014	43.21	52.38	81.85	78.30	68.83	64.91	2
Namibia	2015	39.76	52.01	72.83	81.06	63.29	61.79	3
Namibia	2016	35.47	52.29	77.18	84.16	51.83	60.19	4
Namibia	2017	38.45	59.56	86.56	80.46	65.81	66.17	2
Namibia	2018	42.88	59.67	80.44	80.23	59.87	64.62	3
Namibia	2019	40.64	56.78	77.20	77.15	59.35	62.22	3
Namibia	2020	45.06	58.22	76.22	76.62	58.25	62.87	4
Namibia	2021	46.57	58.25	81.94	76.55	45.75	61.81	4

Nigeria	1998	61.78	59.18	52.70	17.34	49.03	48.00	18
Nigeria	1999	51.55	60.22	39.73	17.16	67.53	47.24	18
Nigeria	2000	53.89	60.28	48.81	21.06	75.82	51.97	11
Nigeria	2001	49.79	57.55	53.33	21.06	72.85	50.92	14
Nigeria	2002	49.02	58.96	47.80	15.38	70.93	48.42	16
Nigeria	2003	48.40	58.28	52.77	15.44	69.09	48.80	16
Nigeria	2004	45.74	50.15	48.06	12.34	74.39	46.14	15
Nigeria	2005	44.50	40.99	53.14	15.83	72.05	45.30	18
Nigeria	2006	50.95	39.94	56.97	16.87	71.65	47.28	15
Nigeria	2007	52.21	41.54	59.51	13.90	71.94	47.82	15
Nigeria	2008	55.28	49.84	56.35	15.89	69.38	49.35	16
Nigeria	2009	46.95	11.31	50.96	11.55	53.72	34.90	26
Nigeria	2010	45.85	4.56	54.83	12.30	56.27	34.76	25
Nigeria	2011	64.25	42.22	79.49	41.97	70.84	59.76	3
Nigeria	2012	52.61	62.52	52.02	48.72	79.47	59.07	6
Nigeria	2013	48.74	59.60	49.59	16.18	61.06	47.03	24
Nigeria	2014	62.62	51.14	48.07	58.17	60.13	56.03	10
Nigeria	2015	48.33	52.84	42.31	18.85	75.26	47.52	21
Nigeria	2016	44.59	40.30	40.63	18.29	51.49	39.06	23
Nigeria	2017	46.27	44.09	47.87	20.07	59.66	43.59	24
Nigeria	2018	50.51	47.38	49.45	17.20	63.78	45.66	23
Nigeria	2019	48.79	53.93	50.78	17.12	40.14	42.15	25
Nigeria	2020	51.29	55.74	52.63	16.87	51.32	45.57	21
Nigeria	2021	52.70	57.33	57.89	17.32	40.36	45.12	22
Rwanda	1998	37.64	53.04	74.76	7.69	63.86	47.40	19
Rwanda	1999	36.81	54.09	74.24	7.41	52.23	44.96	22
Rwanda	2000	41.47	53.70	80.07	6.92	32.69	42.97	22
Rwanda	2001	35.61	52.26	81.94	6.92	42.17	43.78	20
Rwanda	2002	41.42	53.95	78.72	7.50	45.34	45.38	21
Rwanda	2003	41.09	51.38	80.55	13.60	33.49	44.02	20
Rwanda	2004	42.40	47.65	78.09	18.49	27.56	42.84	20
Rwanda	2005	28.96	45.54	84.91	20.00	33.29	42.54	22
Rwanda	2006	26.52	38.59	90.50	32.40	36.22	44.85	18
Rwanda	2007	26.56	34.46	88.93	35.97	47.38	46.66	18
Rwanda	2008	30.98	37.16	90.26	36.05	37.72	46.44	19
Rwanda	2009	25.37	42.93	82.84	36.43	53.15	48.14	17
Rwanda	2010	34.12	51.66	86.77	41.30	43.31	51.43	15
Rwanda	2011	34.88	54.12	81.00	44.70	51.12	53.16	11
Rwanda	2012	35.84	49.26	88.33	43.71	51.88	53.81	17
Rwanda	2013	36.71	48.99	84.29	48.36	56.48	54.97	13
Rwanda	2014	37.57	49.50	82.86	48.38	61.76	56.01	11
Rwanda	2015	33.78	50.19	74.19	49.60	61.05	53.76	10

Rwanda	2016	35.68	45.91	73.06	51.86	59.29	53.16	14
Rwanda	2017	42.12	57.70	75.25	56.25	65.03	59.27	6
Rwanda	2018	52.50	62.43	80.52	56.00	56.26	61.54	4
Rwanda	2019	46.63	60.47	81.85	53.87	52.60	59.08	4
Rwanda	2020	48.03	61.59	85.40	54.12	47.75	59.38	5
Rwanda	2021	56.70	64.02	85.20	56.76	38.62	60.26	5
Sierra Leone	1998	39.89	47.50	48.71	6.41	51.59	38.82	24
Sierra Leone	1999	41.48	45.66	47.70	6.41	27.32	33.71	26
Sierra Leone	2000	42.25	42.74	58.60	6.77	13.72	32.82	26
Sierra Leone	2001	40.49	47.49	56.85	6.77	16.25	33.57	26
Sierra Leone	2002	41.69	47.79	58.25	17.71	44.23	41.94	25
Sierra Leone	2003	39.96	44.13	56.78	19.84	33.86	38.91	25
Sierra Leone	2004	35.31	40.24	57.97	25.21	26.46	37.04	25
Sierra Leone	2005	35.60	37.26	63.81	22.82	34.70	38.84	25
Sierra Leone	2006	31.37	27.22	69.03	27.72	37.09	38.49	24
Sierra Leone	2007	31.72	25.71	61.89	29.28	48.31	39.38	24
Sierra Leone	2008	41.14	37.75	75.17	29.55	40.24	44.77	21
Sierra Leone	2009	36.65	38.11	68.05	28.94	48.25	44.00	23
Sierra Leone	2010	35.59	33.71	66.06	29.94	37.95	40.65	24
Sierra Leone	2011	39.21	37.29	55.15	30.84	34.05	39.31	24
Sierra Leone	2012	42.88	38.98	74.16	29.50	54.97	48.10	23
Sierra Leone	2013	43.20	42.39	66.97	30.85	63.84	49.45	22
Sierra Leone	2014	41.98	40.68	62.59	29.59	72.15	49.40	21
Sierra Leone	2015	39.12	40.17	53.67	29.39	59.42	44.35	22
Sierra Leone	2016	35.92	42.92	60.79	32.03	77.20	49.77	18
Sierra Leone	2017	34.47	44.23	69.42	34.15	64.79	49.41	20
Sierra Leone	2018	38.40	43.78	66.59	32.52	53.29	46.92	21
Sierra Leone	2019	37.12	42.97	63.04	33.06	46.90	44.62	23
Sierra Leone	2020	40.39	47.53	68.71	31.28	49.23	47.43	19
Sierra Leone	2021	42.55	45.40	72.99	33.51	45.96	48.08	20
South Africa	1998	50.09	58.63	47.24	72.57	47.67	55.24	10
South Africa	1999	51.18	59.59	48.71	70.36	50.75	56.12	9
South Africa	2000	50.91	59.58	54.36	75.48	42.78	56.62	6
South Africa	2001	49.21	57.87	56.98	75.48	59.82	59.87	6
South Africa	2002	47.10	61.33	62.36	74.79	60.75	61.27	5
South Africa	2003	46.57	57.94	64.03	72.02	46.06	57.33	6
South Africa	2004	42.34	58.93	64.25	74.63	33.70	54.77	6
South Africa	2005	39.87	58.65	65.21	75.02	34.53	54.65	7
South Africa	2006	34.47	53.53	67.44	77.07	32.96	53.09	7
South Africa	2007	32.45	50.01	65.33	73.10	40.04	52.19	8
South Africa	2008	38.44	54.53	67.58	70.72	33.74	53.00	10
South Africa	2009	32.06	52.01	65.70	73.67	42.45	53.18	10

South Africa	2010	30.72	53.86	71.11	73.58	41.75	54.20	7
South Africa	2011	47.43	56.64	58.20	80.02	46.45	57.75	7
South Africa	2012	46.99	71.79	50.27	77.70	45.16	58.38	7
South Africa	2013	42.04	57.52	67.46	71.49	42.98	56.30	10
South Africa	2014	46.24	57.31	60.75	77.78	50.06	58.43	7
South Africa	2015	34.65	55.72	55.70	68.73	49.97	52.95	12
South Africa	2016	33.35	56.58	58.10	70.35	55.55	54.78	7
South Africa	2017	37.14	64.70	63.09	65.07	50.59	56.12	9
South Africa	2018	41.29	63.63	66.10	66.91	42.91	56.17	8
South Africa	2019	40.27	62.76	67.32	66.88	53.03	58.05	5
South Africa	2020	45.66	62.69	72.64	66.86	71.21	63.81	3
South Africa	2021	47.38	63.79	71.39	63.66	76.13	64.47	2
Sudan	1998	40.26	47.53	31.26	4.50	59.20	36.55	26
Sudan	1999	45.98	50.47	31.53	4.13	52.57	36.93	25
Sudan	2000	48.18	51.55	49.87	5.52	35.23	38.07	25
Sudan	2001	46.04	50.57	50.98	5.52	41.28	38.88	24
Sudan	2002	41.35	45.07	46.40	5.04	45.20	36.61	26
Sudan	2003	42.19	48.91	45.35	0.94	32.78	34.03	26
Sudan	2004	35.38	42.85	52.02	2.67	30.08	32.60	26
Sudan	2005	34.55	38.59	62.86	0.73	31.85	33.72	26
Sudan	2006	33.48	32.04	66.28	2.99	28.12	32.58	26
Sudan	2007	26.64	19.11	64.40	2.69	44.87	31.54	26
Sudan	2008	36.57	31.87	61.99	0.12	41.45	34.40	26
Sudan	2009	31.44	39.32	55.83	1.29	48.79	35.34	25
Sudan	2010	27.04	28.17	37.39	0.01	49.37	28.40	26
Sudan	2011	24.70	32.85	25.87	0.33	50.83	26.92	26
Sudan	2012	28.74	28.93	46.64	1.92	50.22	31.29	26
Sudan	2013	27.14	36.76	45.18	2.07	52.84	32.80	26
Sudan	2014	27.31	26.80	37.18	1.26	60.80	30.67	26
Sudan	2015	27.87	36.98	31.24	1.09	54.30	30.30	26
Sudan	2016	35.35	44.47	35.00	1.66	59.20	35.14	26
Sudan	2017	36.08	46.05	44.61	3.54	56.37	37.33	26
Sudan	2018	33.90	43.55	46.17	1.16	46.93	34.34	26
Sudan	2019	32.60	45.04	47.32	1.91	44.74	34.32	26
Sudan	2020	31.07	42.41	41.16	3.44	30.50	29.72	26
Sudan	2021	34.55	39.56	43.20	1.87	29.79	29.80	26
Tanzania	1998	46.72	49.84	71.15	42.96	58.41	53.82	15
Tanzania	1999	48.78	51.47	72.57	42.11	46.55	52.30	12
Tanzania	2000	49.22	51.73	81.03	40.54	34.15	51.33	12
Tanzania	2001	48.21	50.36	79.24	40.54	46.94	53.06	10
Tanzania	2002	49.56	50.52	77.54	48.53	56.01	56.43	10
Tanzania	2003	50.31	50.04	80.12	41.99	41.20	52.73	12

Tanzania	2004	47.79	48.12	81.72	39.42	32.98	50.01	13
Tanzania	2005	49.38	44.94	83.89	46.55	34.90	51.93	9
Tanzania	2006	45.39	35.51	80.13	47.74	42.85	50.32	11
Tanzania	2007	45.91	34.70	79.08	48.44	49.99	51.62	10
Tanzania	2008	49.59	39.42	79.94	45.60	39.66	50.84	13
Tanzania	2009	44.02	38.86	76.54	48.96	56.13	52.90	12
Tanzania	2010	46.79	40.47	78.86	47.45	45.24	51.76	11
Tanzania	2011	43.68	42.90	69.91	45.49	52.58	50.91	15
Tanzania	2012	48.48	40.88	81.15	44.66	57.86	54.61	15
Tanzania	2013	49.23	51.34	78.57	45.18	56.09	56.08	11
Tanzania	2014	50.68	44.15	69.29	38.07	63.51	53.14	16
Tanzania	2015	49.27	45.83	62.40	41.07	64.46	52.61	13
Tanzania	2016	46.45	46.80	63.43	41.57	69.14	53.47	12
Tanzania	2017	48.71	54.67	64.81	37.34	67.78	54.66	14
Tanzania	2018	49.84	49.97	74.03	32.32	55.24	52.28	15
Tanzania	2019	48.08	50.13	73.89	30.69	57.32	52.02	15
Tanzania	2020	49.90	51.29	74.51	29.99	50.51	51.24	15
Tanzania	2021	51.67	52.00	79.84	33.14	45.47	52.42	14
Zambia	1998	38.25	58.36	39.23	40.81	54.87	46.30	23
Zambia	1999	40.57	60.35	39.96	40.51	50.96	46.47	19
Zambia	2000	42.10	60.92	52.06	37.67	27.33	44.02	20
Zambia	2001	39.71	58.58	68.39	37.67	32.69	47.41	16
Zambia	2002	39.71	63.08	62.01	40.41	36.96	48.43	15
Zambia	2003	39.07	63.99	62.51	42.55	19.93	45.61	18
Zambia	2004	32.36	55.65	65.33	42.61	27.15	44.62	17
Zambia	2005	27.70	47.34	75.10	40.99	42.63	46.75	16
Zambia	2006	32.40	45.27	70.28	45.97	54.27	49.64	12
Zambia	2007	33.21	38.24	79.31	46.10	59.37	51.24	11
Zambia	2008	43.16	52.38	77.47	47.92	49.08	54.00	8
Zambia	2009	37.32	20.78	75.73	48.93	79.78	52.51	13
Zambia	2010	39.83	34.09	74.02	46.88	69.37	52.84	10
Zambia	2011	43.04	44.84	70.29	57.13	69.99	57.06	8
Zambia	2012	49.04	46.97	82.07	56.74	76.83	62.33	5
Zambia	2013	48.91	57.56	84.65	56.22	77.35	64.94	3
Zambia	2014	49.18	50.33	71.73	51.85	79.89	60.60	5
Zambia	2015	40.87	46.61	57.84	52.17	79.56	55.41	7
Zambia	2016	38.96	47.78	58.09	46.37	79.63	54.17	10
Zambia	2017	48.31	52.72	66.78	46.32	78.21	58.47	7
Zambia	2018	51.78	46.01	65.49	46.80	67.70	55.56	9
Zambia	2019	46.93	48.73	64.71	39.92	60.13	52.08	13
Zambia	2020	49.35	42.75	72.58	34.60	73.01	54.46	13
Zambia	2021	52.55	54.00	64.70	36.70	78.64	57.32	7