SUSTAINABILITY PERFORMANCE COMMITMENT AND MARKET LIQUIDITY IN AFRICAN STOCK EXCHANGES:

An Event study analysis

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Abstract

This study investigates the impact of voluntary commitments to the Sustainable Stock Exchange Initiative (SSEI) on market liquidity within African Security Exchanges amid an increasing global focus on sustainability in capital markets. While adopting the event study methodology, the study utilised the Paired T-test and the two-way fixed effect panel model to analyse the short- and medium-term market liquidity effects of 13 Security Exchanges. As revealed by pre-trend and leveling off p values, the findings indicate significant short-term market liquidity improvements, which diminished over time. These results highlight the importance of policy recommendations that offer insights for security exchange policymakers as they adapt to sustainability dynamics and strive to enhance market performance. The study suggests that exchanges adopt concrete strategies to maintain market liquidity improvements, such as incentivisation schemes for listed companies to enhance their long-term sustainability performance and comprehensive measures addressing other underlying factors influencing market liquidity. Further, security exchanges should continue developing investor education programs on sustainability to enhance awareness and implement more sustainable initiatives to enhance investor confidence and meet the growing demand for responsible investment.

Keywords: *Sustainable Stock Exchange Initiative, market liquidity, Africa Security Exchanges, event study*

Introduction

Amidst an era characterized by heightened awareness of sustainability, the global financial landscape, including capital markets is witnessing a shift relating to global sustainability dynamics (Naidoo, 2020; Nykvist & Maltais, 2022). In light of this, capital markets policymakers increasingly recognise the need to engage in commitments that enhance sustainability performance to improve and align with global competitiveness (AlKaabi & Nobanee, 2020). African capital markets have been included in strategising to keep up with this trend. This is based on the understanding that integrating sustainability practices propels the positioning of African capital markets within the broader global financial system and augments investor willingness to invest (Lingnau et al., 2022).

Security exchange investors are willing to invest based on the 'magic triangle' comprising returns, the risk involved, and the liquidity power (Becker, 2011; Eichhorn & Towers, 2018). Liquidity power is vital because it generally indicates the ease of buying and selling. A market with poor liquidity is characterised by a limited investor base, resulting in low capital for the assets (Apergis et al., 2015). Liquidity plays a crucial role for listed firms as it contributes to a decrease in the cost of equity capital by lowering the trading costs for shareholders and minimizing the illiquidity premium (Nguyen, 2017). Furthermore, investors primarily seek to invest in liquid markets because markets with high liquidity tend to perform better when experiencing lower levels of volatility (Elliott, 2015).

Low levels of securities market liquidity are still one of the enormous challenges facing the African security exchanges (Ayadi & Williams, 2023; Matongela & Karodia, 2015). The challenge has been attributed to several factors, including economic instability in some countries that increases investor caution, impacting liquidity (Abdulkarim, 2023). Furthermore, limited participation, resulting from changes in investor sentiments, has contributed to illiquidity in several markets (Liu, 2015). Capital markets actively pursue initiatives to enhance their efficiency by improving liquidity, returns, and risk management.

The Sustainable Stock Exchanges Initiative (SSEI) is one of the initiatives founded by the United Nations in 2009 to enhance the environmental sustainability of stock exchanges (Ngwakwe, 2018). The initiative has garnered support from 133 stock exchanges dedicated to improving their performance by advancing sustainable investments, taking action on climate issues, and promoting ESG disclosures (*Sustainable Stock Exchanges*, n.d.). In Africa, 17 countries' stock exchanges out of 29 are SSE members, representing 58.62%.

Against the heightened discussions on sustainability in the financial sector and the essentiality for African capital markets to strengthen their liquidity, the study sought to examine the effect of voluntary commitments in SSEI on market liquidity within African Security Exchanges. The novelty of our research lies in employing the two-way fixed effects event study panel model and paired t-test to evaluate this effect. To our knowledge, no previous study has assessed the impact of the stock exchange's voluntary commitments on market liquidity.

Market liquidity

Determining the optimal market liquidity measure is challenging because various measures evaluate different but essential aspects of the securities market liquidity (Naik & Reddy, 2021). From the literature, three dimensions of security market liquidity can be examined, comprising width, depth, and resiliency (Kyle, 1985; Sarr & Lybek, 2002). Width, or tightness, is the ability to buy and sell an asset at roughly the same time and price (Olbrys & Mursztyn, 2019). Tightness is assessed using spread types, representing the price a trader must pay for a trade. On the other hand, market depth is the ability to accommodate large stock orders with minimal impact on stock price (Pham et al., 2020). Finally, market resiliency refers to the ability of the market to absorb and recover from disruptive events without causing significant disruption to the trading and liquidity of stocks (Broto & Lamas, 2020).

Liquidity measures of the three dimensions fall into three main categories: transaction costs, volume, and price impact (Sarr & Lybek, 2002). Transaction cost measurements are frequently utilised to evaluate the width aspect of the stock or market liquidity (Black et al., 2016). The bid-ask spread is the primary transaction cost and has received significant scholarly attention, for example, in the works of (Cobandag Guloglu & Ekinci, 2022; Eraker & Osterrieder, 2023; Ishfaq et al., 2022; Li et al., 2018). On the other hand, volume-based methods differentiate liquid marketplaces based on the relative and absolute transaction amounts to assess a market or stock depth. Trading volume, the total number of shares traded within a specific period, is considered the fundamental statistic in this category (Ametefe et al., 2016).

The third category of price impact metrics focuses on separating liquidity from external factors like current market conditions and new information that influence price changes (Stereńczak, 2020). The Market Efficiency Coefficient (MEC) price-based measure, introduced by Hasbrouck & Schwartz (1988), plays a role in distinguishing between short and long-term price shifts in financial markets. The measure capitalises on the idea that price changes are more consistent in liquid

markets even when new information affects prices. Through examining the variability of returns over periods, the MEC aids in identifying market characteristics like orderliness, resilience, and liquidity based on how price movement stabilises. Furthermore, by differentiating between short-term and long-term price adjustments, the MEC offers a framework for assessing how new information influences price equilibrium.

Given the study's focus on the security market adjustments to voluntary commitments and new information, the MEC price impact aspect measure of liquidity was utilised. Furthermore, it assessed voluntary commitments' short-term and medium-term impact on market liquidity. For this reason, the MEC is a valuable measure as it distinguishes between short-term and long-term price adjustments.

Materials and methods

The event study approach was used to identify voluntary commitment events and their effect on capital market liquidity. Event study methodology is advantageous because it is a simple and uncomplicated method considered the best measure for assessing a particular event. However, the process is faced with disadvantages, including that other unaccounted events could have an effect besides the event at hand, leading to misleading findings. It is also challenging to determine the ideal estimation and event periods (Kothari & Warner, 2007). To solve this issue, an estimation model that controls for both unobserved effects correlated with the event and those that are unrelated to the event was chosen.

The target population comprised all African security exchanges affiliated with the UN Sustainable Stock Exchange Initiative (SSE). The exchanges pledge to promote sustainable investing over the long term and expedite the improvement of listed companies' performance and disclosure of environmental, social, and governance (ESG) factors. According to SSE, this initiative includes 17 African nations represented by 18 exchanges (Appendix 1). A census study encompassing all 18 exchanges was conducted to account for their limited number. Due to insufficient data, five exchanges were excluded from the analysis.

The data collection process involved three steps. First, the event dates of the security exchanges' voluntary commitments to enhance sustainability performance were identified. These dates were picked from the commitment letters of each partner exchange available on the SSE website. The second step involved identifying the investigation timeframe to analyse the commitments' immediate short-run and medium-run effects on market liquidity.

The study's short-run examination period spanned 40 trading days, encompassing 20 trading days before the commitment and 20 days following the event. The medium-term impact was assessed by analysing a 120-trading day period, which included 60 days before the event and 60 trading days after the pledge. The timing of these events was determined based on studies conducted by (Armitage, 1995; Brown & Warner, 1985; El Ghoul et al., 2023; Oler et al., 2008). These periods were further in line with the conclusion by (Kothari & Warner, 2007), who highlighted that the event period range for an excellent event study is 21 to 121 days for daily reviews. These periods were deemed sufficient as liquidity effects were expected to have been felt by then.

The third step entailed obtaining the secondary data. The data was obtained from individual security exchange databases and investing.com internet databases. The collected data encompassed information regarding the leading market indices' daily closing prices, high and low prices, and

trading volume. Before analysis, the data for all the exchanges was combined in an Excel workbook and checked for completeness and accuracy.

The analysis process involved three steps. First, the pre-and post-voluntary commitment MECs were computed for each security exchange market index for short- and medium-run periods. The computation was in line with (Hasbrouck & Schwartz, 1988) study and depicted in the formula below:

$$MEC = \frac{long\ period \log return\ variance}{T * short\ period \log return\ variance}$$

- *The computation comprised 20 trading days as the long period and five days as the short period.*
- *The time (T) was 4, determined by the long period/ short period.*

Secondly, the STATA software was employed to compare the equality of means of the MEC across the 13 capital markets events. This was to determine whether there was significant variability across the exchanges in the short and medium run. Thirdly, the xtevent package developed by (Freyaldenhoven et al., 2023) was utilised to run the two-way fixed effects event study panel model (Equation 1) and estimate the overall effect of the commitment on market liquidity. The choice of the model over OLS was due to its ability to handle unobserved heterogeneity, thus reducing bias in estimates (Duxbury, 2021). Based on the model output results, visuals of the event study plots were generated to depict the effect of commitment on market liquidity.

$$Y_{it} = \sum_{K=-G-LG}^{M+LM-1} \delta_{k\Delta} Z_{i,t-k} + \delta_{M+LM} Z_{i,t-M-LM} + \delta_{-G-L_G-1}(-Z_{i,t} + G + L_G) + \alpha_i + \gamma_t + q'_{it}\psi + C_{it} + \varepsilon_{it} \quad \text{(Equation 1)}$$

Where:

- *Yit: MEC for security exchange i at time t.*
- *k: event time; G: pre-event period; M: Post event period; Z: Policy(voluntary commitment); LG: Lag of pre-event period; LM: Lag of post-event period*
- $\sum_{K=-G-LG}^{M+LM-1} \delta_{k\Delta} Z_{i,t-k} + \delta_{M+LM} Z_{i,t-M-LM} + \delta_{-G-L_G-1}(-Z_{i,t} + G + L_G)$: *cumulative dynamic effect of the policy at different horizons*
- *ai: Security exchange fixed effect*
- *γt: Time-fixed effect*
- $q'_{it}\psi$ *: Vector of controls with conformable coefficients.*
- *Cit: potentially unobserved variable correlated with the voluntary commitment*
- ε_{it}*: Unobserved shock uncorrelated with the voluntary commitment of a security exchange at time t*

Presentation of research findings

The study employed a paired t-test and a two-way fixed effects panel model analysis to assess the short-run and medium-run impact. The paired t-test was instrumental in comparing the mean liquidity measures before and after the exchange's commitment to the Sustainable Stock Exchanges initiative, providing a clear view of the immediate effects of this commitment. To complement these results, the two-way fixed effects panel model analysis offered a more in-depth investigation, controlling for unobservable variables that could skew the results.

Paired T-test results

A paired t-test statistical method is used to compare the means of a single group when data is collected at two different time points. This test is instrumental when the same individuals are measured at both time points, allowing for comparing the mean values over time (Ross & Willson, 2017).

Short-run paired T-test results.

The results of the short-run effect of the securities exchanges' voluntary commitment to sustainability performance event focused on comparing the MECs of the exchanges within a defined window of 20 days preceding and succeeding the commitment. The results presented in Table 1 offer empirical insights into the immediate changes in market liquidity following the exchanges' pledge to sustainability practices.

Table 1: The paired t-test results in the short run across the thirteen security exchanges

Null hypothesis(H0) : The MEC before voluntary commitment = MEC after voluntary commitment
Alternative hypothesis (H1) : The MEC before voluntary commitment != MEC after voluntary commitment

Variable	Obs	Mean	Std. errs.	Std. dev	[95% conf. interval]
MEC before voluntary commitment	260	6.14870	2.0587	33.1956	2.094777 10.20263
MEC after voluntary commitment	260	41.7894	11.8202	190.595	18.51351 65.06547
Difference	260	-35.6408	12.0750	194.7043	-59.4186 -11.8630

t = **-2.9516** Degrees of freedom = **259**

Pr(|T| > |t|) = **0.0035**

Source: Authors(2024) based on security exchanges and investing.com data

The null hypothesis was rejected at a 5% significance level since the p-value was significant (0.0035), concluding that the means differed significantly. The MEC liquidity measure average increased from 6.1487 in the pre-commitment period to 41.7894 post-commitment period. The interpretation was that from a general perspective, the African Security Exchanges that voluntarily committed to enhancing their sustainability performance through partnering with the Sustainable Stock Exchange Initiative experienced an improvement in their market liquidity, measured by the market efficient coefficient, in the short run.

Medium-run paired t-test results.

The results of the medium-run paired t-test, which compared the MECs of the security exchanges 60 days before the voluntary commitment and 60 days after the voluntary commitment, are presented in Table 2.

Table 2: The paired t-test results in the medium run across the thirteen security exchanges

Null hypothesis(H0) : The MEC before voluntary commitment = MEC after voluntary commitment
Alternative hypothesis (H1) : The MEC before voluntary commitment != MEC after voluntary commitment

Variable	Obs	Mean	Std. err.	Std. dev.	[95% conf.	interval]
MEC before voluntary commitment	780	6.1755	2.2298	62.27462	1.7984	10.5526
MEC after voluntary commitment	780	16.2971	4.0282	112.5032	8.3896	24.2047
Difference	**780**	**-10.12166**	**4.624618**	**129.1586**	**-19.1999**	**-1.04347**

t = **-2.1886** Degrees of freedom =**779** Pr(|T| > |t|) = **0.0289**

Source: Authors(2024) based on security exchanges and investing.com data

Similar to the short-run effect results, the p-value of the medium-run effect (0.0289) was significant at a 5% significance level. The null hypothesis was rejected, hence the conclusion that the pre-event mean differed from the post-event mean. The average MEC before voluntary commitment of 6.1755 grew to 16.2971, signifying an improvement in the market liquidity across 60 days after the voluntary commitment. The implication was that the security exchanges' commitment to sustainability yielded positive market performance based on the market liquidity in the medium run.

Two-way fixed effects panel regression model outputs visualization

To complement the t-test results, mitigate the bias of omitted variables, and analyse the dynamic relationships, the two-fixed effects panel regression model with the xtevent STATA package was performed. The visualizations derived from the analysis output using the xteventplot option are presented below.

Short-run two-way fixed effects regression output plot

Adhering to the methodological approach, Freyaldenhoven et al. (2023) in the xtevent package, the subsequent analysis examined the short-run impact exerted by the policy variable, the voluntary commitment, on the MECs. Using a fixed effects regression model, the changes in MECs over a timeframe, encompassing the days leading up to the event and the days following, were assessed and plotted in Figure 1. The analysis visualization shows the trend over a 15-day window around the event day(day 0).

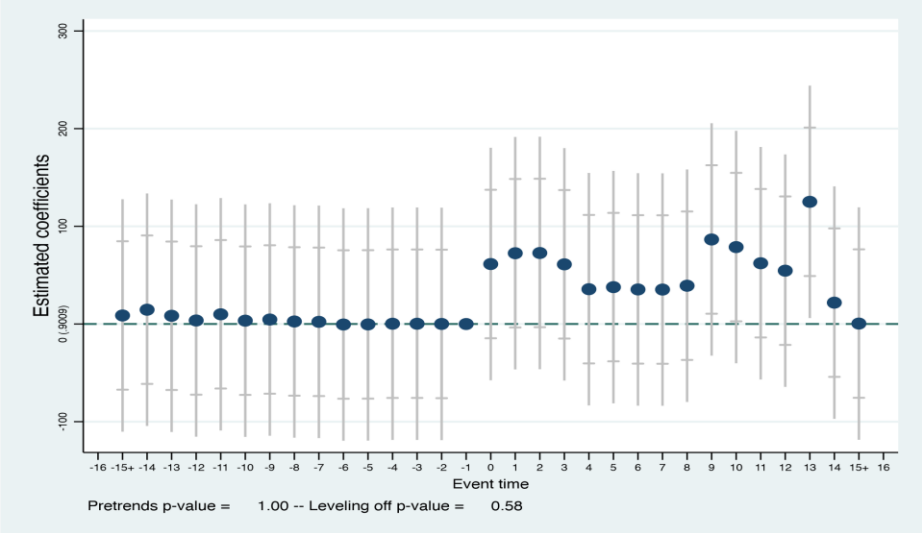

Figure 1: The Two-way Fixed Effect Regression Analysis plot of Voluntary Commitment's short-term effect

Source: Authors(2024) based on security exchanges and investing.com data

The pre-trend analysis from 15 days(-15) before the event to 1 day(-1) before the event shows if there was an existing trend before the event took place. The pre-trends p values are used to interpret this analysis and show if any changes after the event are a continuation of an existing trend or caused by the event itself. An insignificant pre-trend p-value indicates no existing pre-event trend. On the other hand, leveling off analysis from the event day (0) to day 15 shows if there was some smoothing out of coefficients after the event. An insignificant leveling-off p-value indicates that the coefficients did not smooth out after the event and, thus, the event had an impact on them.

Figure 1 shows that the pre-trend p-value(1.00) was highly statistically insignificant. This means that there was no statistical evidence to indicate pre-existing trends leading up to the security exchanges' voluntary commitment. The implication of the pre-trend p-value insignificance could be that the changes observed post-event were more likely to be attributed to the voluntary commitment rather than a continuation of an existing trend. The estimated coefficients indicate a change in trend from the event day(0) onwards, signifying positive changes in market liquidity. This was confirmed by the insignificant leveling off p-value (0.58) that signified that the coefficients did not level up post-event. However, the effect appears to peak immediately after the event and then gradually reduces and increases.

Medium-run two-way fixed effects regression output plot

The analysis in this section focused on understanding the effects of the voluntary commitment policy variable over a medium-term horizon on the MECs, using the xtevent package in STATA. The dataset encompasses 60 days before and after the policy event. Similar to the approach of the short-run analysis, the results are depicted through an xtevent plot. This graphical representation illuminates the trajectory of the estimated coefficients, capturing their trend from 6 days preceding the event to 40 days following it, thus providing a visual narrative of the policy's temporal impact on MECs.

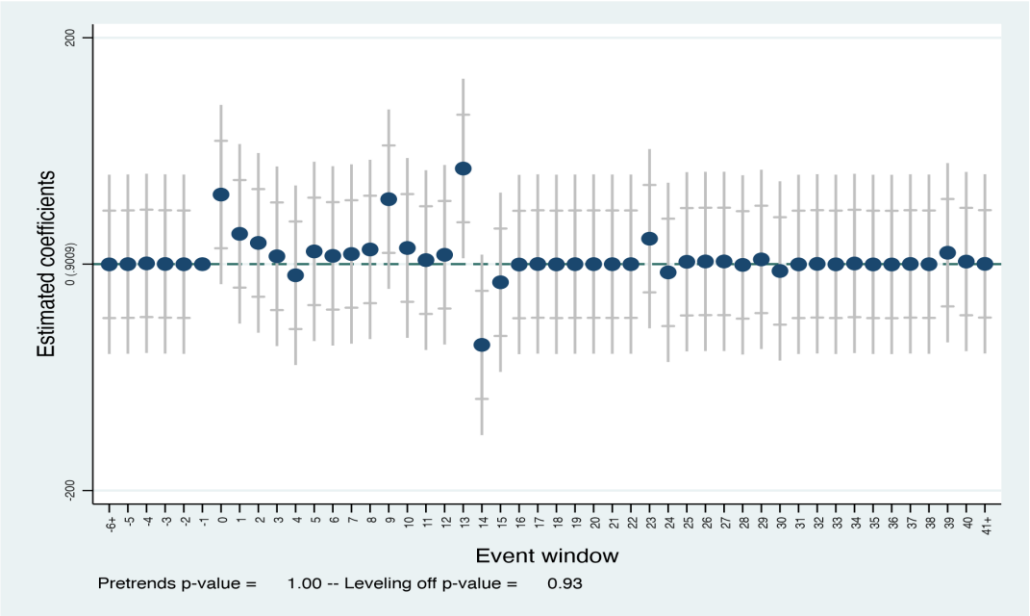

Figure 2: The Two-way Fixed Effect regression analysis plot of voluntary commitment's medium-term effect

Source: Authors(2024) based on security exchanges and investing.com data

Similar to the short-term analysis, the pre-event estimated coefficients and pre-trend p-value indicate a constant trend before the event. However, there are some significant variations after the event date. The significance of the results varies across the event window, with notable market liquidity changes identifiable on the event day and the subsequent 14 days. However, the coefficients from day 16 onwards level up and become relatively stable, indicating that the impact on market liquidity was there but, short-lived across the 13 security exchanges. Overall, the leveling-off p-value (0.93) was insignificant, implying that the post-event market liquidity trends did not level up indicating fluctuations in market liquidity.

Discussion, conclusion, and policy recommendations

The empirical results show that market liquidity in African securities exchanges significantly improved, especially in the near term, after their voluntary pledge to improve sustainability performance through collaboration with the Sustainable Stock Exchanges (SSE) project. The noteworthy enhancement implies that investors see the incorporation of sustainable practices into exchanges' operating frameworks favourably, which results in higher liquidity. The association also suggests that investors are beginning to view sustainability performance as a critical component in determining the feasibility of stock market investments in Africa.

Furthermore, the findings emphasise the value of securities exchange programmes supporting listed companies' sustainable investment strategies for improving market performance and liquidity. Several parameters, such as enhanced transparency and exchanges aligning with global sustainability goals, could be responsible for the increased liquidity. These elements all work together to raise investor confidence and market participation. This achievement helps Africa achieve its larger goal of sustainable economic growth by fostering a more robust trading environment for the listed companies.

However, the medium-term fixed effect panel model analysis reveals that the enhancements observed in market liquidity are potentially temporary, as evidenced by the trends depicted in the corresponding plot. This finding suggests that without structural changes, the initial boost in liquidity may dissipate as the market reverts to its equilibrium state.

Three policy recommendations for African security exchanges are highlighted in light of the research findings. First, the exchanges should implement policies that enhance sustained liquidity enhancements after the exchanges' voluntary commitment. Policymakers could consider implementing incentivisation schemes for listed companies to enhance their sustainability performance, thus improving investor confidence and transparency in the long run. Adopting comprehensive measures addressing the underlying factors influencing market liquidity can foster a more resilient and stable market environment where the benefits of increased liquidity are sustained over the long haul. This might involve revising regulatory frameworks, encouraging broader market participation, and enhancing efficiency in trading practices.

Secondly, exchanges may collaborate with regulatory bodies to develop educational programs to foster a deeper understanding of sustainability initiatives among investors and stakeholders. This approach aims to promote a market environment where sustainability is integrated into long-term investment strategies rather than being a driver for short-term liquidity fluctuations. Such educational efforts can equip market participants with the knowledge to embrace and incorporate such initiatives into their investment decisions.

Thirdly, African security exchanges should keep embracing and actively promoting a range of sustainability measures as they align themselves globally with the growing demand for responsible investment options. Security exchanges should integrate more sustainability activities into their operational and strategic frameworks to facilitate and support the longevity of these investor-valued initiatives. Given the empirical evidence of improved market performance, doing so will benefit the exchanges and further contribute to the broader global agenda of sustainable development, including climate action.

African security Exchanges Sustainability Stock Exchange Initiative partners

Name of Exchange	Country/Region	Index analysed
Botswana Stock Exchange	Botswana	BSE Domestic Company index
Bourse Regionale des Valeurs Mobilieres (BRVM)	West African Economic and Monetary Union countries: Benin, Burkina Faso, Ivory coast, Guinea-Bissau,Mali, Niger, Senegal and Togo	BRVM Composite (BRVMCI)
Egyptian Exchange	Egypt	EGX 30
Nairobi Securities Exchange	Nairobi	NASI
Stock Exchange of Mauritius	Mauritius	SEMDEX
Bourse de Casablanca	Morocco	MASI
Namibian Stock Exchange	Namibia	FTSE NSX
Nigerian Exchange (NGX)	Nigeria	NGX-AllShare
Rwanda stock Exchange	Rwanda	RSESI
Johannesburg Stock Exchange (JSE)	South Africa	JSE FTSE ALL Share Index
Dar es salaam Stock Exchange	Tanzania	DSEI
Bourse des Valeurs Mobilières de Tunis	Tunisia	TUNINDEX
Uganda Securities Exchange	Uganda	ALSIUG

Partners not included in analysis due to limited data availability		
Zimbabwe Stock Exchange	Zimbabwe	
Cape Town Stock Exchange (CTSE)	South Africa	
Somali Stock Exchange	Somalia	
MERJ Exchange	Seychelles	
Ghana Stock Exchange	Ghana	

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