Geopolitical risk, economic policy uncertainty, financial stress and stock returns nexus: evidence from African stock markets

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Abstract

Purpose – Despite the growing recognition of the complex interplay between macroeconomic shock indexes and stock market dynamics, there is a significant research gap concerning their interconnectedness and return spillovers in the context of the African stock market. This leaves much to be desired, given that the financial market in Africa is arguably one of the most preferred destinations for hedge and portfolio diversification (Alagidede, 2008; Anyikwa and Le Roux, 2020). Further, like other financial markets across the globe, the increased capital flow, coupled with declining information asymmetry in Africa, has deepened intra and inter-sectoral integration within and across national borders. This has, thus, increased the susceptibility of financial markets in Africa to spillover of shocks from other sectors and jurisdictions. Additionally, while previous studies have investigated these factors individually (Asafo-Adjei *et al.*, 2020), with much emphasis on developed markets, an all-encompassing examination of spillovers and the connectedness between the aforementioned macroeconomic shock indexes and stock market returns remains largely unexplored. This study happens to be the first to consider the impact of each of the indexes on stock returns in Africa, with evidence spanning from May 2007 to April 2023, covering notable global crisis episodes such as the Global Financial Crisis (GFC), the COVID-19 pandemic and the Russia–Ukraine war.

Design/methodology/approach – This study employs the novel quantile vector autoregression (QVAR) model, making it the first of its kind in literature. By applying the QVAR, the study captures the potential nonlinear and asymmetric relationship between stock returns and the factors of interest across different quantiles, i.e. bearish, normal and bullish market conditions. Thus, the approach allows for a more accurate and nuanced examination of the tail dependence and extreme events, providing insights into the behaviour of the variables under extreme events.

Findings – The study revealed that connectedness and spillovers intensified under bearish and bullish market conditions. It was also observed that, among the macroeconomic shock indicators, FSI exerted the highest influence on stock returns in Africa in both bullish and normal market conditions. Across the various market regimes, the Egyptian Exchange (EGX) and the Nairobi Stock Exchange (NSE) were net receiver of shocks.

Originality/value – This study happens to be the first to consider the impact of each of the indexes on stock returns in Africa, with evidence spanning from May 2007 to April 2023, covering notable global crisis episodes such as the GFC, the COVID-19 pandemic and the Russia–Ukraine war. On the methodology front, this study employs the novel QVAR model, making it one of the few studies in recent literature to apply the said method.

Keywords Stock markets, Financial stress, Economic policy uncertainty, Geopolitical risk, Risk spillovers

Paper type Research paper

Introduction

Over the past decades, the global economy has recorded many financial turmoil, notably the stock market crash of 1987, the 1997–1998 Asian financial crisis, the European debt crisis and

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the 2007–2009 Global Financial Crisis (GFC). These crises occasioned a near-collapse of the global financial sector, and culminated in many countries experiencing full-blown recession, evidenced by deteriorated macroeconomic indicators (Makin, 2019; Megaravalli and Sampagnaro, 2018).

In the same vein, the effects of the COVID-19 pandemic on international financial markets have been significant, as anticipated. Indeed, the global financial market was not spared of the ravaging impact of the pandemic. The very first half of 2020 saw the worldwide financial markets experience extreme volatility. Consequently, majority of central banks across the globe, particularly in Africa, were compelled to rollout accommodating monetary policies in a bid to reduce capital flight phenomenon.

Before economies could come out of the woods of the COVID-19 pandemic, Russia officially invaded Ukraine on 24th February, 2022. The so called "Special Operation" by the Russian government exacerbated the woes of many countries across the globe, wrecking a considerable havoc on almost every sector of emerging economies. In Africa, the war contributed to high rate of inflation, increased debt stocks, thus impeding post-pandemic recovery efforts (Bin-Nashwan *et al.*, 2022; Abu Hatab, 2022). Wiseman and Mchugh (2022) surmise that the devastations of the war are threatening global economy, intensifying uncertainty in the financial market and making life perilous for everyone worldwide.

From the foregoing, it can be argued that the global economy is inextricably linked, as postulated by Umar *et al.* (2022). Lehkonen (2015) simply describes integration as a "double-edged sword." This stems from the fact that despite the benefits of integration, such as creation of enabling environment for investment, it is widely acknowledged to be a major conduit for shock propagations, both within and across sectors (Demirer *et al.*, 2017).

It is pertinent to state that interest in inter-sectoral and intra-sectoral connectedness within and across countries among scholars and practitioners intensified in the aftermath of the 2007–2009 GFC, which purportedly shed more light on the significance of connectedness in shock propagation (Uluceviz and Yilmaz, 2020) and macroeconomic instability (Minoiu *et al.*, 2015). Claessens and Kose (2017) conclude that the near-crash of the global financial system and the deep contraction in the real sector in the heat of the crisis were mainly amplified by macro-financial linkages.

This notwithstanding, studies on macroeconomic and financial sector linkages have historically been constrained by data paucity, as earlier studies could not comprehensively capture the various shocks in the macroeconomy over absence of quantitative, reliable and continuous measure of macroeconomic shocks (Das *et al.*, 2019). Fortunately, the development of three USA-based newspapers indexes of macroeconomic shocks, namely geopolitical risk (GPR), economic policy uncertainty (EPU) and financial stress (FS) indexes have, to a very large extent, remedied the challenge (Das *et al.*, 2019). This is premised on the crucial influence the aforementioned indexes exert on financial markets and investor behaviour (Chiang and Chen, 2021; Uddin *et al.*, 2021). Su *et al.* (2019) corroborated this assertion, highlighting that heightened economic policy-related and financial market uncertainties, especially in the USA, and geopolitical tensions feed into stock market volatility.

Despite the growing recognition of the complex interplay between the said macroeconomic shock indexes and stock market dynamics, there is a significant research gap concerning their interconnectedness and returns spillovers in the context of African stock market. This leaves much to be desired given that the financial market in Africa is arguably one of the most preferred investment destinations (Alagidede, 2008; Anyikwa and Le Roux, 2020). Further, like other financial markets across the globe, the increased capital flow, coupled with declined information asymmetry in Africa has deepened intra and inter-sectoral integration, within and across national borders. This has, thus, increased the susceptibility of African markets to spillover of shocks from other sectors and jurisdictions. Additionally, while previous studies have investigated the three macroeconomic shock

indicators individually (Asafo-Adjei *et al.*, 2020), with much emphasis on developed markets, an all-encompassing examination of spillovers and connectedness between the stock market returns and the aforementioned shock indicators remains largely unexplored.

Against this backdrop, this study seeks to examine the impact of FS, EPU and GPR on stock market returns in Africa. This is primarily aimed at determining the index that exerts strongest influence on stock returns in Africa. Further, this study seeks to identify stock markets that are more resilient to macroeconomic shocks as well as those vulnerable uncertainties.

Employing the three macroeconomic shock indexes, with evidence spanning from May 2007 to April 2023, covering notable global crisis episodes such as the GFC, COVID-19 pandemic and the Russia–Ukraine war, makes this study the first of its kind in the literature. On the methodology front, we employed the novel QVAR model, making this paper one of the few studies in recent literature to apply this method. QVAR captures potential nonlinear and asymmetric relationships across different quantiles, i.e. bearish, normal and bullish market conditions, thereby allowing for a more accurate and nuanced examination of the tail dependence and extreme events.

The findings of this study would contribute to existing literature by providing a comprehensive understanding of interconnectedness and dynamics of GPR, FS and EPU and stock returns in the African stock market. Practically, the study proffers investors and policymakers with in-depth insight into dynamics and interdependencies of macroeconomic shocks and stock market returns. This would provide quintessential information on successful portfolio diversification, as investors could rely on the findings to make informed decisions by identifying and investing in markets that are more resilient to economic shocks. The rest of the paper highlights empirical literature review, methodology, findings and discussion of results, conclusion and recommendation for future studies.

Empirical review

In line with the objectives of this study, we thoroughly reviewed relevant and related studies on GPR, EPU, FS and stock market returns.

Indeed, geopolitical risks (hereinafter referred to as GPRs) have received much traction in recent times. Research interest in this area of study intensified, following the development of an index for GPRs by Caldara and Iacoviello (2018), and recent geopolitical tensions, notably Russia–Ukraine war. The GPR index has been widely employed by researchers because it encapsulates different geopolitical issues (Drakos, 2010; Kollias *et al.*, 2011) and their accompanying risky events. Caldara and Iacoviello (2022) broadly defined GPRs as "the risk associated with wars, terrorist acts, and tensions between states that affect the normal course of domestic politics and international relations". Chiang (2021) argued that GPRs trigger wild swings in the global economy, particularly financial markets, thereby rendering it a critical element for policy formulation, investment decisions and portfolio choices. Accordingly, the literature has attempted to examine the impact of GPRs on assets such as oil (Bouoiyour *et al.*, 2019), precious metals (Baur and Smales, 2020) and commodities in general (Ramiah *et al.*, 2019). Other strand of literature has also focused on the predictive capacity of GPRs in forecasting possible changes in stock prices, bitcoin returns (Bouri and Gupta, 2021), among others. Despite the plethora of studies on GPRs, literature on GPRs and stock market returns have largely been underexplored. Earlier studies by Balcilar *et al.* (2016, 2018), observed that GPRs trigger volatilities in stock prices and stock returns. However, these effects differ between nations and have an asymmetrical structure. A study by Balcilar *et al.* (2016), found a significant and negative relationship between GPRs and stock market returns and volatility in G7 nations, with Japan and the UK being the most vulnerable markets. For the

BRICS nations, Balcilar *et al.* (2018) used nonparametric causality-in-quantile tests to examine the impact of geopolitical risks on stock returns and volatility. The study discovered that GPRs have a stronger influence on stock market volatility than on stock market returns. A similar study by Rawat and Arif (2018), employing a quantile regression on a data spanning 1985–2017, found that among the BRIC nations, the Indian and Chinese stock markets were the most resilient to GPRs, while Brazilian and Russian stock markets were found to be most vulnerable. The researchers concluded that China and India may provide investors with a safe haven. In essence, GPRs tend to affect financial markets, making it one of the most carefully considered index among investors, analysts and researchers (Apergis *et al.*, 2018).

EPU is equally a key determinant of investment decisions. EPU stems from fears among investors over inability to form accurate expectations of conceived economic policy. EPU is mainly characterized by skepticisms in future dealings of government-induced policies, notably fiscal, monetary and regulatory policies amidst economic turmoil. This invariably compels individuals and firms to suspend investment, production and spending decisions (Mehrdoust and Samimi, 2020). On the stock market front, studies have concentrated on reaction of stock prices to changes in EPU. Notable among them is a study by Sum (2012), which delved into EPU and stock market performance in Asia from 1985 to 2012. The study established that high EPU lowers stock market returns in five ASEAN nations, and underscored that there is a direct link between EPU and stock market returns in Singapore and Malaysia. Pástor and Veronesi (2013) postulate that although EPU mostly has dire ramifications, it can have a positive impact on stock returns if the authorities in affected countries are able to roll out pragmatic measures to absorb the shocks. Alqahtani and Martinez (2020) also assessed the effect of EPU on stock markets of the Gulf Cooperation Countries and found that EPU had a long-term detrimental impact on stock prices in Bahrain and Kuwait. Research on EPU and stock market returns in Africa has received little attention. This notwithstanding, a study by Asafo-Adjei *et al.* (2020), one of the few studies in the context of Africa, employed Wavelet Coherence Analysis on daily data sourced from eight African markets, between December 2010 and December 2019, to examine EPU and stock returns co-movement. The results showed EPU co-move with stock market returns, at least in the long term and concluded that stock markets in Africa is a viable avenue for hedging against policy uncertainties, especially in the short to medium term.

The impact of FS on investment decisions cannot be overemphasized. FS index measures the stress level of financial system, assess the depth and duration of instability of financial markets and the efficiency of anti-crisis measures. Sandahl *et al.* (2011) postulate that FS is directly related to functioning of the financial market, while Louzis and Vouldis (2013) accentuate that FS is basically "systemic risk which has materialized."

The FS Index, which is developed by the Federal Reserve Bank, has over the years been widely deemed as the main parameter of financial stability across the globe. This is premised on the fact that historically, turbulence in the USA financial market unarguably influence the investment decision of foreign investors (Su *et al.*, 2019), resulting in heightened volatility. The attendant repercussion of GFC on financial sectors of economies globally underscores the need for an up-to-speed and accurate signals of FS to inform mitigating measures. Meanwhile, research in this area has focused on the construction of FS indexes for a specific country or a group of countries (Vermeulen *et al.*, 2015; Cevik *et al.*, 2016). More worrying, there is lack of extant literature on FS and stock market nexus, with notable exception by Sum (2012), Das *et al.* (2019), which found a negative relationship between FS and stock market returns. It is worth noting that these studies were conducted in developed markets, and thus the findings not necessarily be applicable to emerging markets, particularly Africa.

Theoretical review

This study mainly hinges on the decoupling theory. The proponent of this theory asserts that emerging markets are able to insulate themselves from global crisis. They argued that, managers of emerging economies are able to roll out policies, amidst global crisis that are capable of creating structural breaks in the degree of connectedness or interdependence. For instance, Dooley and Hutchison (2009) postulate that emerging markets exhibited high degree of immunity to shocks from advanced countries, citing the GFC. This has been confirmed by several studies, notably Boako and Alagidede (2016), Kose *et al.* (2008) and Levy-Yeyati and Sturzenegger (2009), postulating that emerging markets are seemingly insulated from shocks emanating from advanced markets.

However, this theory has become a bone of contention in the literature. The extent to which emerging markets are immune to economic shocks differs across countries, thus raising concerns over the reliability of the theory. Contrary to the assertions by decoupling theorists, Balcilar and Demirer (2015) observed that emerging markets, particularly Africa, cannot insulate themselves from the attendant repercussions of global shocks. The absence of convergence of findings reinforces the need for this study.

Methodology

In achieving the objective of this study, which seeks to examine the stock returns spillover contribution "to" and "from" various stock markets and macroeconomic shock indexes under consideration, we employ the QVAR model, advanced by Ando *et al.* (2018). The QVAR model is ideal for this study due to its ability to capture volatilities under different market conditions. The QVAR helps to ascertain how much of a shock (future error variance) associated with a market or variable, say "i" is attributable to shocks in "j" in extreme upper and lower quantiles and normal market conditions (bullish, bearish and normal market conditions).

In analyzing returns connectedness and spillovers, we first and foremost compute the continuous compounding returns for the stock markets and the macroeconomic shock indexes under consideration as follows:

$$y_t = ln\left[\frac{P_t}{P_{t-1}}\right] * 100 \tag{1}$$

where y_t denotes daily returns, P_t represents current price/current index of the respective shock indicators whereas P_{t-1} denotes previous day's price/index.

The QVAR model, developed from the VAR model framework, decomposes H-step ahead forecast-error variance for each variable of an N-dimensional VAR. This is based on the generalized forecast error variance decomposition (GFEVD) framework propounded by Koop *et al.* (1996) and Pesaran and Shin (1998).

Accordingly, the QVAR process p *th* order is given as:

$$y_t = c(\tau) + \sum_{i=1}^{\rho} \beta_i(\tau) y_{t-1} + e_t(\tau), t = 1, 2, \ldots..T \tag{2}$$

where y_t is the endogenous variable to be estimated; $c(\tau)$ is the constant parameter of the τth quantile; $\beta_i(\tau)$ and $e_t(\tau)$ are the coefficient of the lagged dependent variable of the τth quantile and idiosyncratic error, identically and independently distributed, respectively.

To put in proper perspective, returns on a particular stock market of the τth quantile can be represented by;

$$y_t = c(\tau) + \sum_{i=1}^{\rho} \beta_1(\tau) y_{t-1} + \beta_2(\tau) FSI_{t-1} + \beta_3(\tau) + EPU_{t-1} + \beta_4(\tau) GPR + e_t(\tau) \quad (3)$$

where y_t represents stock market returns at time t, $\beta_1(\tau)$ is the matrix of lagged coefficient of the returns on the various markets, whereas $\beta_2(\tau), \beta_3(\tau)$ and $\beta_4(\tau)$ represent the matrix of lagged coefficient of financial stress index (FSI), EPU and GPR, respectively.

The Moving Average (MV) representation of the QVAR (equation 2) is estimated by;

$$y_t = \mu(\tau) + \sum_{i=1}^{\infty} \varnothing_i(\varnothing) e_{t-i}(\tau) \, \mathrm{t} = 1, 2 \ldots\ldots\ldots\ldots\ldots\ldots \mathrm{T} \quad (4)$$

where; $\varnothing_i$ is the coefficient of the MV, recursively computed as;

$$\varnothing_i = \varphi_1 \varnothing_{i-1} + \varphi_2 \varnothing_{i-2} + \ldots + \varphi_p \varnothing_{i-p} \quad (5)$$

It is worth noting that the coefficient of the MV helps in the attribution of variance to individual variables in the system.

The GFEVD, accounting for the contributions of variable "j" to the H-step ahead forecast error variance of a given variable, say "i", is given as;

$$d_{ij}^{H} = \frac{\sigma_{jj}^{-1} \Sigma_{h=0}^{H-1} (e_i \varnothing_i(\tau) \sum e_j)^2}{\Sigma_{h=0}^{H-1} (e_i \varnothing_i(\tau) \sum e_i)} \quad (6)$$

where σ_{jj} is the jth diagonal component of the standard deviation and Σ is the covariance matrix of errors. For a given ith component, e_i is a selecting vector with ith element and zero otherwise.

Following Diebold and Yilmaz (2012), the study builds a connectedness table, to ascertain pairwise and net connectedness of the variables, i.e. stock market volatilities and macroeconomic shocks.

The population connectedness table (see Table 1).

Given that summation of the row is not equal to 1, the spillover index is calculated by normalizing the variance decomposition matrix by the row sum. Thus, the spillover index from "j" to "i" is given as follows:

$$SI_{ij}^{H} = \frac{d_{ij}^{H}}{\sum_{j=1} d_{ij}^{H}}, \text{where} \sum_{j=1}^{N} SI_{ij}^{H} = 1 \quad (7)$$

The net directional spillover between the markets is expressed as follows:

Variables	Y_1	Y_2	.....	Y_N	From others
Y_1	d_{11}^{H}	$[d_{12}^{H}$	.....	d_{1N}^{H}	$\sum_{j \neq 1} d_{1j}^{H}$
Y_2	d_{21}^{H}	d_{22}^{H}	.....	d_{2N}^{H}	$\sum_{j \neq 2} d_{2j}^{H}$
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
Y_N	d_{N1}^{H}	d_{N2}^{H}	.....	d_{NN}^{H}	$\sum_{j \neq N} d_{Nj}^{H}$
To others	$\sum_{i \neq 1} d_{i1}^{H}$	$\sum_{i \neq 2} d_{i2}^{H}$	.....	$\sum_{i \neq N} d_{iN}^{H}$	$\sum_{i \neq j} d_{ij}^{H}$

Table 1. Connectedness table schematic

Source(s): Table courtesy of Diebold and Yilmaz (2012)

$$NTS_{ij}^{H} = d_{j\leftarrow i}^{H} - d_{i\leftarrow j}^{H} \quad (8)$$

Data overview

The study makes use of seven exchanges from Africa, where at least one stock exchange is selected from each of the five geographical zones, namely North Africa, South Africa, East Africa, West African and Central Africa in order to get a fair representation from the continent. The Egyptian Exchange (Egypt) and the Bourse de Casablanca (Morocco) represent the North African region; whilst Johannesburg Stock Exchange (South Africa) and Botswana Stock Exchange (Botswana) represent the southern part of Africa. In East Africa, Nairobi Securities Exchange (Kenya) and Dar es Salaam Stock Exchange (Tanzania) were used as proxies, whiles the Ghana Stock Exchange (Ghana) and the Nigeria Stock Exchange represent the West of Africa. The data for the stock market are in monthly frequency, are gleaned from Bloomberg.

The macroeconomic shock indexes, namely GPR, FS and EPU are sourced from http://policyuncertainty.com, spanning from May 2007 to April 2023, with a monthly frequency.

Findings and analysis

Descriptive statistics

Table 2 presents the summary of the returns series of the stock markets under consideration, and the macroeconomic shock indicators (proxies), notably GPR, global economic policy uncertainty (GEPU) and FS indicator. The statistics comprise the mean, median, maximum return, minimum returns, standard deviation (Std. dev), skewness, kurtosis and observations (obs.).

Quantile dynamic spillovers and dependence analysis

In light of the primary objective of the study – to examine connectedness and spillovers of between stock markets in Africa and macroeconomic shocks – this section presents the quantile return spillovers and connectedness under different quantiles, i.e. normal ($\tau = 0.5$), bullish ($\tau = 0.95$) and bearish ($\tau = 0.05$), presented in Tables 3–5, respectively.

From Table 3 (bullish market), it can be observed that the total connectedness index (TCI) is 89.22%. This implies that 89.22% of shocks in the market could be attributed to the spillovers between the stock markets under consideration and the macroeconomic shock indexes. The high level of connectedness under this market condition is in line with previous studies (Jena *et al.*, 2022), which found evidence of increased connectedness under extreme market conditions.

Spillovers from the system to the respective stock markets (FROM) range from 88.12% to 91.33%. The JSE is the least receiver of shocks (88.12%), followed by CSE, recording 89.02%. Meanwhile the Egyptian Exchange (EGX) is the highest receiver of shocks (91.33%). Clearly, the volume of spillovers from the system to each of the markets highlights the extent of dependence between the markets and the various indexes in the bullish market. In relation to the macroeconomic shock indexes, it can be observed that GPR, GEPU and FSI received 90.34%, 88.68 and 86.11%, respectively, of shocks from the system.

Relatedly, shock transmission of the individual variables to the system ranges from 72.59% (EGX) to 99.27% (JSE), on the stock markets front and 80.3% (GPR) –112.37% (FSI) in relation to the macroeconomic indexes. From all indications, the FSI exerts very significant impact on the markets. Likewise, among the stock markets, the JSE exerts the highest level of shock, indicating the influence JSE wields on stock returns in Africa.

Table 2.
Descriptive statistics for log stock returns and macroeconomic shocks

		Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Obs
Africa equity markets									
Morocco	CSE	0	0	0.1	−0.23	0.04	−1.04	5.9	191
Egypt	EGX	0	0.01	0.29	−0.39	0.09	−0.5	2.31	191
South Africa	JSE	0.5	0.5	1.23	−0.07	0.08	−0.29	1.98	191
Kenya	NSE	−0.01	0	0.16	−0.32	0.06	−1.18	5.94	191
Nigeria	NGX	0	0	0.32	−0.37	0.07	−0.32	4.6	191
Tanzania	DSE	0	0	0.13	−0.15	0.03	−0.35	4.68	191
Ghana	GSE	0	0.01	0.18	−0.54	0.15	−1.75	13.87	191
Macro-economic shock indicators									
Geopolitical risk	GPR	0.02006	−0.0062	0.86350	−0.45127	0.20331	1.09157	5.49591	191
Economic policy uncertainty	GEPU	0.0271	−0.0042	0.86907	−0.39042	0.20532	1.38426	6.47493	191
Financial stress	FS	−0.519	−0.1105	16.1487	−15.148	3.024	0.3463	15.039	191

Source(s): Authors' own work

Table 3. Upper quantile directional return spillovers between equity markets in Africa and macroeconomic shock indexes (GPR, GEPU and FSI) ($\tau = 0.95$), May 2007–April 2023

	CSE	EGX	JSE	NSE	NGX	DSE	GSE	GPR	GEPU	FSI	FROM
CSE	*10.98*	8.14	11.1	9.13	9.88	9.95	8.47	8.64	11.14	12.53	89.02
EGX	10.26	*8.67*	10.9	9.39	9.67	10.2	8.75	9.18	10.88	12.09	91.33
JSE	9.77	8.15	*11.9*	9.36	9.71	10.1	9.01	8.78	10.92	12.36	88.12
NSE	9.93	8.31	11.3	*10.2*	9.94	9.94	8.22	8.81	10.75	12.54	89.77
NGX	10.45	7.69	10.6	9.52	*10.36*	10.1	8.69	9.24	10.81	12.54	89.64
DSE	9.88	8.12	10.8	9.43	9.57	*10.4*	8.83	9.01	11.05	12.97	89.65
GSE	10.78	7.8	10.6	8.96	9.75	10.2	*10.44*	9.11	10.43	11.95	89.56
GPR	10.07	8.26	11.2	8.81	8.96	10.5	9.08	*9.66*	10.86	12.62	90.34
GEPU	9.76	8.15	11.5	9.29	9.45	10.3	8.69	8.78	*11.32*	12.78	88.68
FSI	10.05	7.97	11.2	9.2	9.22	10.3	8.72	8.75	10.79	*13.89*	86.11
TO	90.95	72.6	99.3	83.1	86.15	91.4	78.47	80.3	97.64	112.4	892.22
NET	1.93	−19	11.2	−6.7	−3.5	1.77	−11.1	−10	8.96	26.26	*TCI* = 89.22

Source(s): Authors' own work

Table 4.
Normal quantile directional return spillovers between equity markets in Africa and macroeconomic shock indexes (GPR, GEPU and FSI) ($\tau = 0.5$), May 2007–April 2023

	CSE	EGX	JSE	NSE	NGX	DSE	GSE	GPR	GEPU	FSI	FROM
CSE	*21.27*	5.93	8.41	8.4	10.88	10.31	6.97	8.6	8.54	10.69	78.73
EGX	9.34	*15.62*	8.75	9.17	9.17	10.92	7.94	9	9.63	10.46	84.38
JSE	8.41	5.78	*22.96*	8.28	9.41	10.32	8.24	9.05	7.9	9.64	77.04
NSE	8.92	5.49	8.87	*19.88*	9.34	11.34	7.49	9.39	8.83	10.45	80.12
NGX	9.56	6.44	8.57	8.99	*22.66*	9.83	6.96	9.3	8.4	9.3	77.34
DSE	9.54	5.44	8.36	9.45	8.23	*24.3*	7.04	8.6	8.69	10.35	75.7
GSE	7.59	4.96	9.71	7.79	7.74	8.05	*28.09*	9.87	7.52	8.68	71.91
GPR	8	5.95	8.38	7.75	10.04	8.32	9.23	*24.66*	9.25	8.43	75.34
GEPU	8.64	5.97	8.56	8.43	9.15	9.07	7.68	9.6	*21.81*	11.11	78.19
FSI	9.01	5.15	10.02	8.2	8.69	10.89	7.48	8.78	9.15	*22.62*	77.38
TO	79	51.11	79.64	76.46	82.65	89.05	69.03	82.18	77.89	89.11	776.13
NET	0.27	−33.2	2.6	−3.67	5.3	13.36	−2.88	6.84	−0.3	11.73	$TCI = 77.61$

Source(s): Authors' own work

Table 5. Lower quantile directional return spillovers between equity markets in Africa and macroeconomic shock indexes (GPR, GEPU and FSI) ($\tau = 0.05$), May 2007–April 2023

	CSE	EGX	JSE	NSE	NGX	DSE	GSE	GPR	GEPU	FSI	FROM
CSE	*11.99*	8.05	11.32	10.04	9.85	10.81	10.12	10.77	8.7	8.34	88.01
EGX	10.12	*9.78*	11.04	9.64	9.14	10.82	10.33	11.06	8.91	9.16	90.22
JSE	10.26	8.34	*13.84*	9.59	9.69	10.25	10.15	10.84	8.59	8.45	86.16
NSE	10	7.8	10.83	*11.92*	9.71	11.21	10.07	10.9	8.9	8.66	88.08
NGX	10.62	8.05	10.49	9.67	*11.95*	10.85	10.01	10.72	8.87	8.78	88.05
DSE	10.2	7.83	11.01	9.79	9.79	*13.29*	10.08	10.92	8.43	8.67	86.71
GSE	9.97	8.5	11.16	9.76	9.33	10.87	*12.53*	10.63	8.58	8.67	87.47
GPR	9.76	8.02	11.01	10.09	9.57	10.92	10.43	*12.9*	8.52	8.77	87.1
GEPU	10.29	7.91	11.14	9.39	9.78	10.72	10.03	10.07	*11.44*	9.24	88.56
FSI	9.97	8.01	11.47	9.48	9.27	10.55	9.91	10.83	9.16	*11.36*	88.64
TO	91.19	72.51	99.47	87.45	86.13	96.99	91.14	96.72	78.67	78.74	879.02
NET	3.17	−17.7	13.32	−0.63	−1.92	10.28	3.67	9.62	−9.9	−9.9	*TCI* = 87.90

Source(s): Authors' own work

In relation to net return spillovers, the study found EGX (−18.74%), GSE (−11.09%), NGX (−3.5%) and the NSE (−6.7%) are net receivers of shocks. On the contrary, CSE (1.93%), JSE (11.15%) and DSE (1.77%) are net transmitter of shocks. The results somewhat contradict the assertions by Balcilar and Demirer (2015) that emerging markets are immune to shocks. Noticeably, shocks emanating from other jurisdiction spillover to markets in Africa, thus raising concerns over the veracity of the decoupling hypothesis. Surprisingly, the result shows that GPR tends to be net receiver of shocks in bullish market condition, implying that the impact of GPR on stock market returns and by extension the system is minimal.

The diagonal figures present the own share of return spillovers, that is, return shocks in a particular market that is attributable to events in the market. We observe that the own shocks contribution is quite low, ranging from 8.67% (JSE) to 13.89% (FSI). Evidently, returns on the market are largely influenced by external factors rather than inherent price movements and other internal market conditions. This reinforces the fact the interdependence and spillovers deepen under extreme market conditions, as revealed by the TCI of 89.22%.

In relation to bidirectional spillovers between the macroeconomic shock indexes and returns on the market, we observed that FSI appears to be highly connected to the stock markets under consideration, with percentage contribution to the respective markets ranging from 11.95% (GSE) to 12.97% (DSE). This supports the argument by Püttmann (2018) that FSI index provides a more vivid assessment of the financial system. This is followed by GEPU, with percentage spillovers ranging from 10.43% (GSE) to 11.14% (CSE). The results show that return on the GSE is relatively more immune to macroeconomic shocks or less integrated with the said indexes than the rest of the equity markets under bullish market condition. Again, the JSE and NSE recorded the highest bidirectional connectedness, followed by CSE and EGX. The prevailing high returns connectedness could be attributed to the creation of a unified platform for trading securities among the aforementioned markets.

Moving on to Table 4 (normal market condition), it is observed that the level of TCI is has reduced from 89.22%, in the bullish market, to 77.61%. The TCI reveals that about 77.61% of the possible total forecast error variance is accounted for by the markets and macroeconomic shocks under consideration. This supports earlier findings that the overall connectedness becomes weaker in normal market conditions, or in a period of moderate returns. In comparison with the bullish market condition, evidence from Table 4 suggests that shocks from stock market returns and the macroeconomic shock indicators (FROM) to each of the variables have largely reduced, with percentage contributions ranging from 71.91% (GSE) to 84.38% (EGX). Regarding the shock transmission to other markets (TO), we observed that the CSE and NGX transmitted the highest volume of shocks of 89.05 and 82.65%, respectively, underscoring the influence the two markets wield under normal market condition.

Akin to the results in Table 4, the EGX (−33.26%), NSE (−3.67%) and the GSE (−2.88%) are net receiver of shocks. The NGX which happens to be a net receiver of shocks in the extreme market regime (bullish market), is a net transmitter of shocks in the prevailing market condition. Consistent with the results in Table 3, we observed that FSI exerts the highest spillovers to the stock markets than GEPU and GPRI, with percentage contribution to the various stock markets ranging from 8.68% (GSE) to 10.69% (CSE). It is pertinent to state that, among the markets, GSE received the lowest shock from GEPU, confirming that, relatively, macroeconomic shock indexes have little impact on stock returns on the GSE.

Further, the figures in the diagonal cells, which is the percentage of own shock spillovers, ranges from 15.62% (EGX) to 28.09% (GSE). The increase in own shock spillovers in normal market condition vis-à-vis the bullish market condition sheds light on earlier findings that suggest dependence and spillovers in normal periods are minimal (Urom *et al.*, 2022), and that shocks in the stock market could be traced to inherent price movements.

In relation to bidirectional connectedness, the DSE and NSE recorded the highest dependence of 11.34% (DSE to NSE) and 9.45% (NSE to DSE). Arguably, this stems from the regional economic integration in East Africa (Eberhard-Ruiz and Moradi, 2019), and cross-listing of 7 out of 21 companies on the DSE predominantly on the NSE (Munisi, 2019). The CSE and NGX recorded the next highest connectedness of 10.88% (NGX to CSE) and 9.56% (CSE to NGX), confirming a finding by Zaimi (2022) that NGX and CSE are highly interrelated. GSE and NGX exhibit the lowest bidirectional connectedness. This reaffirms an earlier finding by Agyapong (2014) that the GSE and NGX are poorly interconnected. Taking into consideration the three macroeconomic shock indexes, we found that FSI and GEPU are highly connected, given that 11.11% of variations in the latter are attributable to the former and 9.15% of shocks in FSI is traceable to GEPU.

Concentrating on Table 5, we observe that the TCI is 87.9% under bearish market condition, indicating that 87.9% of the forecast error variance of return shocks could be traced to the stock markets and macroeconomic shock indexes in the system. Similar to the high TCI (89.22%) under the bullish market condition, the TCI figure in Table 5 signifies high interconnectedness in periods of extremely low or negative returns.

Shocks from other markets and indexes to each market or index are quite high, and are in the range of 86.16%–90.22%. This range is close to what was recorded in Table 3, suggesting similarities in connectedness and spillovers in extreme market conditions (bullish and bearish market conditions). It can also be observed that the percentage of shocks emanating from within a particular market (own shock), indicated in the highlighted diagonal figures, have reduced, in comparison with own shocks in the normal market. The implication is that markets become increasingly interdependent under bad market conditions, as rational investors endeavor to take mitigating measures to safeguard their investments against losses, including investing in more shock-resilient markets.

The own shock figures under the bearish market condition are relatively higher than what is recorded under bullish market conditions, possibly, owing to the need to diversify assets under bearish conditions (Shahzad *et al.*, 2020). The JSE happens to be the most independent market under the bearish market condition with own shock figure of 13.84%, indicating 13.84% of returns shocks in the market emanated from within. On the contrary, the EGX is the least independent market in bearish market condition, with own shock spillover of 9.78%, an indication that EGX is relatively more vulnerable to spillover shocks from other markets.

In terms of bidirectional spillovers, it is evident from Table 5 that CSE and NGX display strong interconnectedness, with 10.62% of shocks in NGX emanating from CSE, while 9.85% of shocks in CSE could be attributed to NGX. This supports the finding by Obalade and Muzindutsi (2019) that suggests NGX and CSE, arguably the leading equity markets in Africa, display strong interconnectedness under bearish market conditions. This is followed closely by the strong relationship between GSE and the EGX.

Moving to the return spillovers from the macroeconomic shock variables (GPR, GEPU and FSI), it can be observed that, GPR index exercises comparatively higher influence on the market system than the other indexes, with connectedness index ranging from 10.63% (GSE) to 11.06% (EGX). Indeed, GPR triggers uncertainties in financial markets, thus it unsurprising that FSI follows as the next index that gravely exert high volume of returns shock on the stock markets, recording spillover index from 8.34% (CSE) to 9.16% (EGX).

Finally, we notice that the EGX, NSE and NGX are net receivers of shocks, just as recorded in the bullish market, whereas the remaining markets are net transmitters of shocks, with the JSE leading with 13.32% shock transmission. The implication is that, generally, the CSE, JSE, DSE and GSE are more resilient to shocks emanating from GEPU, FSI and GPRI, and by extension from the stock market, during so called bad times.

Net return connectedness network analysis

The network plot presented in Figure 1 below provides a graphical representation/visualization of the extent of connectedness, the net receivers and transmitters of shocks as well as the direction and intensity of the spillovers between the stock markets and indexes under consideration.

To begin with, the size of the node represents the magnitude of shocks transmitted or received by a market, where as the colour depicts whether a variable is a net receiver of shocks (yellow) or a net transmitter of shocks/spillovers (blue). The arrows signify the direction of the spillovers. The deeper the colour of the arrow, the greater the magnitude of shock received or transmitted.

From Figure 1(a), we observe that the FSI is the largest shock transmitter, as depicted by the size of the node. This is in line with the findings in Table 3 it can be observed that the greater percentage of returns shock spillovers from FSI is transmitted to the Kenya (NSE), Nigeria (NGX) and Egypt (EGX). GEPU follows as a net transmitter of macroeconomic shocks under bullish market condition, transmitting greater percentage of its shocks to the Egyptian Exchange, as revealed by the direction and the relatively deeper colour of the arrow. It can also be observed that Tanzania (DSE), JSE and MOROC (CSE) are net transmitter of shocks, while Egypt (EGX), Nigeria (NGX), Ghana (GSE) and Kenya (NSE) are net recipient of shocks in the market. The EGX, as revealed from the plot, receives the highest volume of shocks in the extreme upper quantile.

Figure 1(b) showcase the significant influence GPR possess on stock market returns in Africa during bearish market condition. From the plot, it is evident that GPR is the only net shock transmitter among the macroeconomic shock indexes, transmitting significant levels of shocks to EGX. This notwithstanding, it can be observed that the other indexes exerted

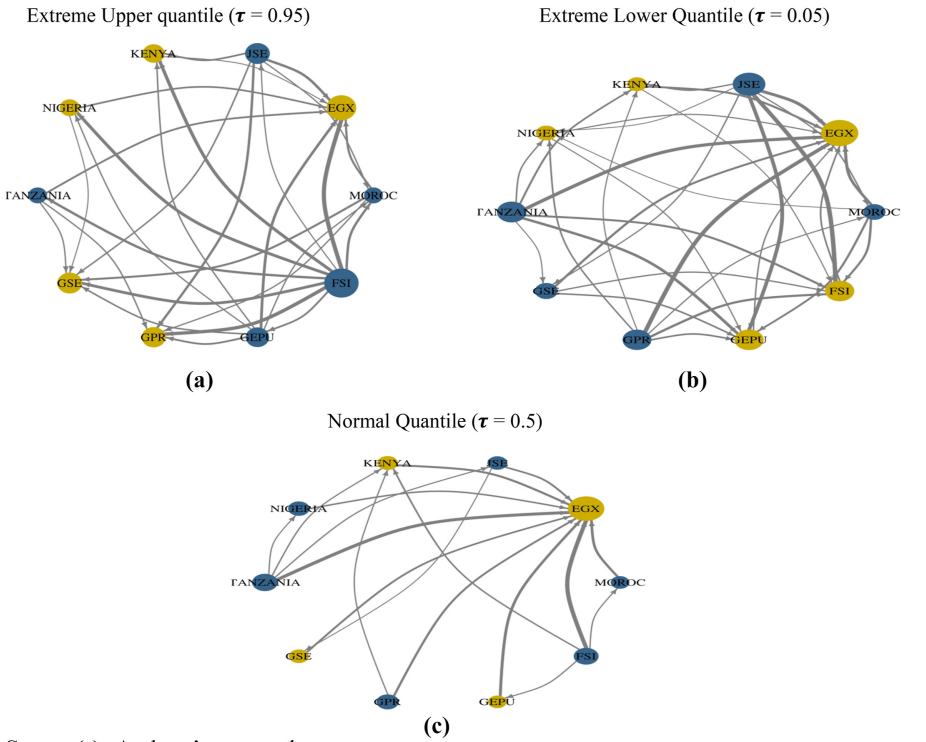

Figure 1.
Returns connectedness network plot

Source(s): Authors' own work

some influence on the stock markets, albeit minimal magnitudes. JSE, CSE, DSE and GSE proved to be relatively more resilient to shocks from other markets and the macroeconomic shock indexes. This validates the finding by Boako and Alagidede (2016) that majority of stock markets in Africa are able to decouple themselves from global shocks in bad times. The EGX, Nigerian Exchange (NGX) and Kenya (NSE) received more shocks than they could transfer, implying that investments in these markets are susceptible to shocks, particularly under bearish market condition. Investors are, therefore, urged to exercise some level of caution in investing in those markets in turbulent times.

Finally, Figure 1(c) shows that the FSI and GPR are quite influential in shock propagations to the various stock markets under normal market conditions, transferring high magnitude of shocks to Egypt (EGX). The plot shows that although GEPU transmit shocks to some markets, the impact is negligible. A critical assessment of the plot reveals that Kenya (NSE) and Egypt (EGX) appear to be highly connected FSI, GEPU and GPR, and thus receive substantial levels of shocks from same. The GSE, Kenya (NSE) and Egypt (EGX) are net receivers of returns shocks whereas Tanzania (DSE), Nigeria (NGX), JSE and Moroc (CSE) are net transmitters of shocks, signified by their respective blue-coloured nodes. It can therefore be inferred that investors who seek to mitigate their risks can invest in DSE, NGX, JSE and CSE under normal market condition as the said market are relatively more resilient to shocks under such condition.

Conclusion

We observed evidence of connectedness and spillovers between stock market returns and GPR, FS and GEPU, which intensified in extreme market conditions (bearish and bullish market conditions). This suggests that events on the stock markets in Africa are largely influenced by external shocks, emphasizing the need for investors and policymakers to account for external threats when making investment decisions and formulating risk management strategies.

Further, it has been established from the study that some markets in Africa are more resilient to shocks than others. Typically, the GSE, NSE and the EGX proved to be extremely susceptible to shocks, while JSE, DSE and CSE are relatively more robust, demonstrating strong resilience to shocks. This provides quintessential information for investors who intend minimize exposure to GPR, FS and GEPU risks.

Recommendation for future studies

We recommend that future studies may expand the geographical scope of the study to include other regions or global markets. Comparing the findings from the African stock market with those from other regions can provide insights into the uniqueness or commonalities of the relationships studied. Further, future studies may delve into how interconnectedness between stock markets in Africa and the macroeconomic indexes employed in the study could provide early warning signal for impeding crisis.

Policy makers, on the other hand, should adapt their regulatory frameworks to be flexible and adaptable to changing market conditions, particularly during periods of heightened GPR and EPU. This will help ensure that markets remain resilient and continue to function efficiently even in the face of external shocks.

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