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# Return and volatility dynamics among four African equity markets: A multivariate VAR-EGARCH analysis<sup>☆</sup>



Saint Kuttu<sup>1</sup>

Department of Finance and Statistics, Hanken School of Economics, P.O. Box 287, Vaasa, Finland

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## ABSTRACT

A multivariate VAR-EGARCH is used to examine the returns and volatility dynamics between thin-traded adjusted equity returns from Ghana, Kenya, Nigeria and South Africa. The findings suggest a reciprocal return spillover between Ghana and Kenya, and between Nigeria and South Africa. In addition, Nigeria appears to be the source of volatility innovations in Ghana, Kenya and South Africa. Own market volatility is pronounced, and volatility is highly persistent in all four markets with Ghana, Kenya and South Africa exhibiting volatility asymmetry.

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## 1. Introduction

The interdependence of international equity markets was reinforced by the 2008 global financial meltdown. In particular, the spasms of stock market volatility that spread from the U.S. equity market to equity markets overseas materialised due to advances in computer technology and the liberalisation of

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*E-mail address:* [saint.kuttu@hanken.fi](mailto:saint.kuttu@hanken.fi).

<sup>1</sup> Tel.: +358 403521758.

capital movements. Consequently, a clear understanding of the extent of stock markets linkage and interaction will continue to be an essential consideration for international investors and policy makers.

A growing number of studies have attempted to establish the nature and extent of interdependence among international equity markets by applying multivariate heteroskedastic models. For instance, [Canarella, Miller and Pollard \(forthcoming\)](#) studied the intra-American markets. [Rao \(2008\)](#) and [Worthington and Higgs \(2004\)](#) investigated the volatility dynamics in the Asian equity markets. [Booth, Martikainen, and Tse \(1997a\)](#) and [Koutmos \(1996\)](#) examined the volatility dynamics of markets in Europe.

Despite the increased study of market interdependencies in America, Asia and Europe, very few studies have been undertaken on equity markets in Africa. In particular, [Humavindu \(2006\)](#) used daily closing indices of the Namibian and South African equity markets from 4 January, 1999, to 20 March, 2003, and concluded, after applying a unit root test, cointegration analysis and an exponential generalised autoregressive conditional heteroskedasticity (EGARCH) model that evidence of linear relationships, significant volatility spillover and strong correlation between the two markets cannot be supported. Similarly, [Piesse and Hearn \(2005\)](#) found that the equity markets of South Africa and Nigeria transmit volatility to the equity markets of Botswana, Ghana, Kenya, Malawi, Mauritius, Namibia, Zambia and Zimbabwe when they applied an EGARCH model on a data set spanning January 1993 to January 2000.

Additionally [Adjasi and Biekpe \(2006\)](#), using a data set that included South Africa (large market) and Ghana (smaller market), reported that considerable cointegration relationships between the larger and smaller markets have significant feedback and causality that run both ways.

Likewise, [Wang, Yang, and Bessler \(2003\)](#) used cointegration and generalised impulse response functions on a data set that included the US as a global proxy. They found that regional integration between the stock markets of South Africa, Egypt, Morocco, Nigeria and Zimbabwe was weakened after the 1997–1998 crises, with South Africa exerting significant influence on the other markets after the crisis.

In addition, using Johansen cointegration and Granger Causality tests, [Piesse and Hearn \(2002\)](#) found that monthly stock indices of the equity markets of South Africa, Botswana and Namibia were cointegrated, with causality running from Namibia to South Africa and not vice versa.

From the forgoing, the analysis indicates that African market volatility dynamics have not been contemporaneously examined in a multivariate modelling framework, despite the superior qualities of the multivariate EGARCH methodology of allowing investigation of the asymmetric impact of past innovations on current volatility spillover ([Christofi & Pericli, 1999](#)).

Our goal in this paper is to contribute to the empirical literature on African market interdependencies by examining the return transmission and volatility spillover between the equity markets of Ghana, Kenya, Nigeria and South Africa in a multivariate vector autoregressive (MVAR-EGARCH) framework. We focus on these countries due to the cross-listed stocks on these exchanges.

Pervasive thin-trading has been documented on the equity exchanges by [Appiah-Kusi and Menyah \(2003\)](#) and [Mlambo and Biekpe \(2005\)](#). [Lo and MacKinlay \(1990\)](#) have argued that thin-trading causes return series that are otherwise independent to exhibit dependence, and failure to adjust for thin-trading introduces serious bias in empirical work. Prior studies that examined the equity markets of Ghana, Kenya, Nigeria and South Africa in an autoregressive framework did not adjust for thin-trading. However, we adjust for thin-trading to eliminate potential bias in empirical work.

In our analysis, we find a reciprocal return spillover between Ghana and Kenya, and between Nigeria and South Africa. Kenya is also influenced by past return innovations from Nigeria and South Africa. In terms of volatility, Nigeria appears to be the source of volatility stimuli to Ghana, Kenya and South Africa. The findings also show that, compared to cross-market volatility spillover, own market volatility innovations appear to be important in the Ghanaian, Nigerian and South African equity markets. Only the Nigerian equity market does not exhibit volatility asymmetry. Additionally, we find that our modelling methodology could not support market linkages in the presence of thin trading in the first and second moments.

This paper extends the literature on African market interdependencies in several directions. First, unlike previous studies on African market linkages, we account for thin trading and in so doing, eliminate potential biases associated with empirical work on thin trading. Second, contrary to previous studies on African market linkages which use univariate models to model the first and second moments, we examine the return and volatility dynamics contemporaneously on African stock exchanges in the MVAR-EGARCH framework developed by [Nelson \(1991\)](#) and used by [Koutmos \(1996\)](#), and [Antoniu, Pescetto, and Violaris \(2003\)](#).

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