POLICY BRIEF

Commodities Price Cycles and their Interdependence with Equity Markets in Africa

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Abstract

This study examined time-scale connectedness between returns on African stock markets and commodities across the energy, agriculture, metals, and beverage markets with wavelet-based coherency, wavelet multiple cross-correlation analysis, and wavelet-based Sharpe ratio and generalized Sharpe ratio diversification analysis. We find evidence of increased performance of risk-minimizing portfolios during crisis that are broadly narrowed to long-run fluctuations (shorter scales). Such higher performances at shorter scales suggest that, during crises, investors show some levels of risk-aversion towards African equity investments over long term horizons. This explains why some African

markets experienced first-round effect of the global financial crisis despite the theoretical view that African economies could potentially be decoupled from global economic shocks during crisis. Thus, although the decoupling phenomenon may hold for African markets during global financial crisis, if investors decide to balance their portfolios only for the short term, the portfolio reversals may cause serious effects to the continent. Further, of all the nine stock markets, it is only the Ivory Coast regional bourse that maximizes the multiple correlations against the linear combinations of the aggregate commodity indices. Lastly, the results confirm that having a combined portfolio of commodities and equities improves performance for different investment horizons.

Introduction

Broadly speaking, although commodities show equity-like characteristics, they tend to bear low to negative correlations with traditional assets classes like bonds and stocks. In the case of Africa, huge commodities endowment makes their economies highly dependent on commodities. At the same time, on account of their relatively less integrated nature, the continental economy has been deemed as partially segmented and therefore shows decorrelation with most global assets, including commodities. This is true for the continent's equity markets (Kodongo & Kalu, 2011). This provides hedging and diversification opportunities for global investors, a mechanism by which African countries can attract more investment capital.

Despite this common knowledge, there is always the need to regularly examine the evolution of the correlation pattern among related and unrelated asset classes, their contemporary patterns, and any noticeable dynamics for policy purposes. For example, to what extent does the dynamic relationship between African stocks and commodity prices hold discernible implications for equity-commodity investors seeking to diversify across uncorrelated assets?

This paper examined the time-scale connectedness and risk sharing behaviour between returns on African stock markets and commodities. Although empirical research has examined the relationship between African stock markets and commodities, the short-term, medium-term, and long-term sources of such relationships are overlooked. Such knowledge is needful to promote financial development in Africa and an expansion of African stock markets to attract more capital. Particularly, the story about the importance of financial markets and equity financing and stock markets in Africa as a tool for development cannot be complete without knowing specifically the details of how they might work in a portfolio and for which investor (hedgers, commodity dealers, food firms, etc.,) they are of interest – short-term, medium-term, or long-term. This also helps in the overall strategy and discourse of how to position African stocks as viable alternative vehicles in the global investments frontier.

Understanding the integration and connectedness among asset classes is central to research areas such as risk management, portfolio allocation, and business cycle analysis. Such studies do not just provide useful information to investors but also help policy makers to make sound decisions (Mensi et al., 2014). Knowing the correlation and risk sharing pattern of emerging stock markets with commodities is important because, primarily, the correlations between emerging stock markets and other asset classes constitute an important driver of the risk borne by international investors when deciding how to invest in a portfolio of dissimilar assets. The recommendations by Bekaert and Harvey (2014) are that contemporary studies seeking to examine the integration or correlation of equity markets must include other asset classes such as currencies, commodities, and bonds. This helps to provide useful information on the relative capacities of emerging equities in acting as viable alternatives to international investors seeking diversification away from global stocks.

Unlike the conventional correlation and multivariate GARCH analysis of African stock markets co-movements, this paper employs frequency-domain analysis using wavelet-based techniques; first to examine commodity-equity markets co-movements and second to investigate the significance of frequency domain analysis for portfolio and risk management through the estimation and comparison of frequency Sharpe Rations (SR) and generalized Sharpe Ratios (GSR) of commodity-equity portfolios.[1] The frequency dynamics is insightful for studying co-movements, as shocks with heterogeneous frequency responses create linkages with various degrees of persistence (Baruník & Krehlík, 2018). Such connections help in understanding possible sources of systemic risk that may remain hidden when aggregate measures are used. Using the time-scale measure helps to overcome such challenges; also partly because shocks to economic activity impact variables with different strengths and different frequencies. In financial markets, shocks arising from different investor expectations may exert impacts at different time scales. From the angle of portfolio investors seeking to hedge and diversify across different asset classes, day traders or hedge funds (short-term investors) are more concerned with co-movements at higher frequencies whereas big institutional investors (long-term investors) focus on the lower frequency. These differences in investment time horizons and resulting

1 The linear correlation and cointegration methods have, however, been criticized on many grounds that they may produce bias estimates due to the problems of heteroscedasticity, endogeneity, and omitted variable bias. Whilst there is great potential in the GARCH-type models in modelling asset returns behaviours, they also have the drawback of working with the assumption that return innovations are generally characterized by asymmetric multivariate normal or student-t distributions (Patton, 2006; Garcia & Tsafack, 2011). This assumption obviously is at odds with the empirics (Mensah & Alagidede, 2017) because the distribution of financial returns possesses fat-tails than those of the normal distributions and most financial returns exhibit non-linear dynamics and are usually asymmetric (Embrechts et al., 2002).

time objectives help them formulate and manage their investments strategies. It is therefore important to, not only cater for the correlations, but also the investment horizons.

We examine the multi-scale (short-, medium-, and long-run) structural relationships between stocks and commodities using the bivariate wavelet coherence and wavelet multiple cross-correlation methods. Wavelets possesses time-variant and time-frequency space features that are most suitable for exploring dynamic co-movement and interdependence among markets, through disintegration in the original series without any information losses. This then allows analysts to examine dominant channels of variability and to determine how those channels vary over time. It is instructive to note that this paper is not the first to apply wavelet techniques to the African stock market. Using the continuous Morlet wavelet transform, Boako and Alagidede (2017) establish that, the linkage between equity market returns in Africa on one hand and returns on commodities and exchange rates markets on the other hand are non-static and non-homogenous over time. In a related fashion, Omane-Adjepong and Dramani (2017) also apply wavelet to model the nature of regional and global connectedness of African stocks.

Although our paper is broadly related to Boako and Alagidede (2017) and Omane-Adjepong and Dramani (2017) for Africa, we extend the scope of these literatures by focusing on the time-scale behaviour across a broader set of commodities and African stocks and discuss how they influence the selection and allocation of assets for portfolios. The analysis also looks at portfolio diversification opportunities across the two asset classes and draws inferences based on investors' horizons. In this regard, we add to the contribution by Bekiros et al. (2016) and examine the portfolio performance of African stock markets with other commodities using wavelet-based diversified and undiversified portfolios. Here, we apply the wavelet test to calculate the scale-specific Sharpe ratios over different sub-periods in the sample to see how the risk-return characteristics of these different assets might have changed over time, rather than giving a one-shot look for the entire sample. This enables us to examine how risk-adjusted returns vary across these different periods. We believe analysis along these lines sets this paper apart from earlier works on Africa and contribute more significantly to the literature.

In addition, we use different indices in combination with the wavelet multiple cross-correlation (WMCC) measure to identify any potential group leaders that could influence the other variables in the group. The methodology estimates overall correlations and cross-correlation within the multivariate framework across different time scales, making interpretation of the results easier, and offer further information over time horizons for the measured relationships – thus, knowing if the considered variables are characterized by short-to-long-term linkages (Ftiti et al., 2016).

Methodology

On account of the shortfalls of the pair-wise correlation and other several GARCH models used as core metrics for measuring integration and interdependence across markets (Pukthuanthong & Roll, 2009; Alexopoulos, 2017, etc.), focus has now shifted to more robust methods such as wavelet multiple correlation and cross-correlation approaches, as proposed by Fernandez-Macho (2012).

A wavelet transform creates time-frequency analysis of signals, and thus, can estimate the spectral characteristics of signals as a function of time. Through wavelets, we generate both the power spectrum and phase difference spectrum necessary for coherence (local correlation) analysis. The method also possesses time-variant and time-frequency space features that are most suitable for exploring dynamic co-movement and interdependence among markets, through disintegration in the original series without any information losses. This then allows analysts to examine dominant channels of variability and to determine how those channels vary over time. Generally, the frequency-based approaches allow for the understanding of any permanent interdependence (linkages premised on fundamentals) and transient market interdependence (thus, spillovers resulting from excess linkages explained by shocks).

Conclusion and policy recommendations

Africa's economies have huge commodities endowment, which make most of them highly dependent on commodities. At the same time, these economies are relatively less integrated with most global asset markets, including the financial markets for commodities. To what extent does the dynamic relationship between African stocks and commodity prices hold discernible implications for equity-commodities investors seeking to diversify across uncorrelated assets? In this study, we examined the time-scale connectedness and risk-sharing behaviour between returns on African stock markets and commodities across the energy, agriculture, metals, and beverage commodities using data of monthly periodicity from 1996 to 2017.

First, we examined multi-scale (short-, medium-, and long-run) wavelet structural relationships between African stocks and commodities using the bivariate wavelet coherence. We established that, commodities and African stock returns co-move across multiple scales and co-integrate in the long run, albeit sparse, as evidenced by the high value of the wavelet multiple correlation coefficients (WMC) over increasing scales. Second, we found possible lead–lag relationship between the markets through a linear combination of all variables. We estimated wavelet multiple cross-correlation

(WMCC) values for all three series. From the wavelet multiple cross-correlation values, we found that of all the nine stock markets, it is only the Ivory Coast regional bourse that maximizes the multiple correlations against the linear combinations of the aggregate commodity indices. However, due to the symmetric nature of the cross-correlation plots, we could not arrive at a definitive conclusion as to whether the market leads others.

Finally, we analysed portfolio performances of African stock markets with other commodities using wavelet-based diversified and undiversified portfolios. Here, we applied the wavelet test in a translation-invariant manner, using both detail and smooth coefficients to calculate the scale-specific Sharpe ratios over different sub-periods in the sample to see how the risk-return characteristics of these different assets might have changed over time, rather than giving a one-shot look for the entire sample. This enabled us to examine how risk-adjusted returns vary across these different periods.

By analysing diversified portfolio paired performances, the results confirm that having a combined portfolio of commodities and equities improves performance for different investment horizons. Specifically, we observed that in non-crisis periods 2001-2006 (and 2011-2017) it is either the equally weighted or optimally weighted portfolios that show the greatest performances. However, as we enter into crisis zones such as the Asian crisis of 1997-2000 and the global financial crisis and Eurozone debt crisis periods the risk-aversion behaviour of investors become prominent as the risk-minimizing portfolios record the highest performances.

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Mission

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