STOCK (MIS) PRICING AND DIVERSIFICATION IN AFRICA: EVIDENCE FROM SELECTED AFRICAN EXCHANGES

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Abstract - This paper ascertains the extent of mispricing in equity portfolios, mispricing-under-investment relation and the role of African equities as risk diversification strategies during commodity markets turbulence. Following Baur and Lucey (2010), one identifies arbitrary commodity market crisis to be 1%, 5% and 10% declining moments in returns. However, their approach is extended by using African equities as a safe haven against gold. A risk-augmented CAPM is specified to estimate the mispricing in equity portfolios while the risk diversification model follows Baur and Lucey (2010). For all the estimations, the regressions are run on daily data from 5th January, 2010 to 30th December, 2015. First, the results show the presence of transient mispricing in the portfolios returns of African equities regardless of the firms' liquidity and volatility levels. More so, stronger mispricing is observed using an alternative specification. Second, mispricing causes significant divestment in big size portfolios. The conclusion is that mispricing in a portfolio of equity returns is due to low frequency of trading and that Africa's equity markets are risk diversifiers and safe havens for commodities.

Index Terms - Africa's Equity Markets, Diversification, Mispricing, and Safe haven.

I. INTRODUCTION

Prior to the 2008 global financial crisis, Africa received enormous private capital flows (PCFs) such that the value of the inflow to sub-Saharan African countries increased by over 300% between 2000 and 2007 (see IMF/World Bank World Economic and Financial Surveys, 2008). The advent of the 2008 global financial crisis has resulted in the decline of portfolio investment to Africa (Macias and Massa, 2009; World Bank Report, 2009; Osakwe, 2010 and UNCTAD Report, 2010), and consequently, ample number of African stock markets did not only suffer from the contagious effect but also faced huge decline in value of investments and capital flow reversal (IMF Report, 2009). The former has been attributed to the over-valuation of stock prices while the latter has been attributed to increased uncertainty on expected returns (AfDB Report, 2009; IMF Report, 2009; and Beck, Maimbo, Faye and Triki, 2011). Studies have established that an over-valued stock price is sensitive downward to negative stock market shocks, as price adjusts quickly to its intrinsic (or true) value and thus, reduces the value of stock investment (Ledoit and Wolf, 2003; Mohammed, 2006; Kan and Zhou, 2009; and Yan and Garcia 2014). For instance, after the 2008 global financial crisis, African stocks that are over-valued have prices decline tremendously and that have direct negative impact on the value of investors' portfolios, as value of a portfolio is the product of investment in stocks and share prices. Within six months, African stock investors experienced an average loss of more than half the wealth invested at the end of July 2008 (AfDB Report, 2009). Losses recorded in most of the African stock markets are higher than those of United States, Hong Kong and French markets (see Table 1). Although the American, French and Hong Kong markets were adversely affected by the crisis, most of these markets have fully recovered (see Table 1). The post-crisis stock market performances showed the significant effect of over-valuation of equity portfolios and prices before the financial crisis in most of the sampled African countries: Morocco, Egypt and Nigeria in particular (see Table 1 and Figure 1.1). On this note, the over-valuation (herein called positive mispricing) of investors' equity portfolios before the crisis, had heightened the effects of the financial crisis on the value of investors' equity portfolio in Africa. Shortly after the financial crisis, there is rising susceptibility of equity markets to various forms of economic shocks which have led to the resurgence of investors' appetite for alternative means to diversifying and downside market risk. In the last decade, investors have considered commodities as highly liquid financial assets (Buar and Lucey, 2010; Vivian and Wohar, 2012). A 2008 report by the US Commodities Futures Trading Commission (CFTC) showed that investment inflows to various commodity futures markets rose to US$200 billion in 2008 (CFTC Market Report, 2008). This value further increased by US$10 billion at the end of 2012. Similarly, significant number of commodities across the energy, metal, and agricultural sectors saw consistent boom just around the global financial crisis in 2008-2009 (Cheng and Xiong, 2014). The huge inflow is premised on the fact that investors potential to diversify can be improved with the inclusion of commodity futures in portfolios since commodities show equity-like returns and low

correlation with traditional assets (Gorton and Rouwenhorst, 2006).

The recent substantial declining moments in commodity markets in 2014 and 2015 (see Figure 1.2) has offered investors new impetus to diversify their investment portfolios across economies. For Africa equity markets to identify and benefit from the possible international cross-border portfolio investment flows and diversification opportunities, it requires appropriate pricing of equity portfolios and understanding of the correlations between its financial assets and global commodities. For these reasons, this paper raises three main questions: First, are African equity portfolio returns properly priced and if so, what is the extent of mispricing? Second, did the mispricing cause decline in value of investment in stocks on the exchange? Third, are African equities viable enough to proffer 'safe haven' during varying periods of global commodity market crashes? Answers to these require studies on mispricing of equity portfolio returns which is virtually non-existent for most African countries, and evidences for the third question for African equities remain scanty for post-financial crisis daily data. The concept of mispricing of equity portfolios has long been a major issue in the literature. Fama, for instance, reveals that tests of classical asset pricing models such as CAPM, CCAPM and ICAPM implicitly rely on an assumption of market efficiency, which permits the substitution of realized returns for expected returns. There is increasing evidence that common stocks are mispriced relative to these models. The reasons for these mispricing vary across equity markets and therefore, remain inconclusive in the literature. Jegadeesh and Titman (1993) and Brennan and Wang (2006) , for instance find positive correlation of individual stock returns at the 6-12 month horizon, which is consistent with the slow adjustment to firm specific news documented in a large number of studies. Jegadeesh et al. (1995) finds evidence that stock prices tend to over-react to firm specific information. Some studies found that stock returns co-vary with the state of stock market liquidity (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005 and Sadka, 2006) while studies that show that unanticipated increase in market illiquidity and sentiment affect the level of equity prices include Lee and Swaminathan (1991), Swaminathan (1996) and Amihud (2002). More studies affirm that investors consider commodities as highly liquid financial assets through hedging and risk management (see Vivian and Wohar, 2012). The increased interest of investors is premised on the assumption that potential to diversify can best be enhanced with the inclusion of commodity futures in portfolios since commodities show equity-like returns and low correlation with traditional assets (Gorton and Rouwenhorst, 2006). Earlier studies by Bodie and Rosansky (1980) and Anson (1998) buttressed this claim. Conversely, recent reports show that even though commodities can slightly reduce risk in portfolios, this effect becomes negligible in a balance portfolio (Yan and Garcia, 2014). Other studies have also explained the cross-market correlations. Olson, Vivian and Wohar (2014) reports that cross-market correlations between commodities and equities during crisis increases while equity-commodity correlations may be driven by herd behaviour (see Demirer, Lee and Lien, 2015). All the evidences above show that mispricing of portfolio returns has remained contentious in developed markets and less researched in African equity markets. There is also, a major research gap in African literature on investors taking positions in commodities and seeking diversification of portfolio risks during crises using African equities. Studies conducted in this area have often focused on developed markets with the perception of investors holding positions in commodities to act as a safe hub for equities. Meanwhile, studies on African equity markets remain limited. Therefore, the objective of this paper is to examine the presence of mispricing in equity portfolios and demonstrate the possibility of African stocks for diversifying risk and act as safe havens during the global commodity market crash. In this regard, this paper will focus on four African Exchanges – Johannesburg Stock Exchange (JSE), Nigerian Stock Exchange (NSE), Egyptian Stock Exchange (ESE) and Casablanca Stock Exchange (CSE). The paper is in five sections. The first is introductory; the second reviews relevant literature; the third provides the methodology and data requirements while estimation results, implications and discussions come up in the fourth and the fifth offers conclusions and policy recommendations.

II. METHODOLOGY

There are extant models of mispricing in the literature. They include models assuming that mispricing is independent of fundamentals, and follows a simple first-order autoregressive model (see Poterba and Summers, 1988). Models that assume that mispricing is due to slow adjustment of market prices to new information (Ball and Brown, 1968; Dimson, 1979; Brennan, Jegadeesh and Swaminathan, 1993, and Brennan and Wang, 2006), and models demonstrating that mispricing is associated with a market wide mispricing factor (Fama and French, 1993; and Brennan et al., 2006). The models that assume mispricing is associated with market-wide mispricing factor are also called the model of systematic mispricing. One major focus of the paper is to ascertain the presence of mispricing in portfolios of equities in African markets. Therefore, it will be quite appropriate to consider market factors driving mispricing and generating market wide mispricing factor. Essentially, this paper adopts 'systematic

mispricing approach' to examine the existence of mispricing in portfolios of equities in selected African markets: JSE, NSE, ESE and CSE. Empirical evidences show that most prominent market factors driving mispricing in stocks are liquidity and volatility (Lee et al., 2000; and Acharya et al., 2005). According to Archarya et al. (2005), these factors have caused mispricing relative to a given rational pricing model. Again, studies have revealed that stocks are mispriced relative to the classical asset pricing models. These evidences enables the study to specify a 'risk-augmented CAPM' to validate the presence of mispricing in the portfolio of selected African equities. The factors considered for the augmentation are average firms' liquidity and volatility. The principal regression model is therefore, specified in equation (1) as follows:

$$R^{P}_{i,j,t} = \alpha_{i,j,0} + \beta_{1i,j,t} R_{mkt,t} + \beta_{2,i,j,t} liq_t + \beta_{3,i,j,t} vol_t + \varepsilon_{i,j,t} \qquad (1)$$

Where $R^{P}, R_{mkt}, liq\ and\ vol$ are excess portfolio returns, market returns, liquidity measure (proxy with daily average change in volume of firm's transactions) and average firms' systematic volatility. $\alpha, \beta's\ and\ \varepsilon$ are intercepts, sensitivities and error terms. Signs $i, j\ and\ t$ represent selected stock markets, portfolios and time dimension. Equation (1) is estimated through the multivariate least square technique. For easier estimation, stocks are sorted into three different portfolios based on their sizes (average firm's capitalization) and firm's volatility (standard deviation of daily stock prices). The market mispricing factor is the variance ratio of the risk-augmented CAPM residual which is measured by $VR(m) \equiv \left(\frac{\text{var}(e^m)/m}{\text{var}(e^1)} \right)$; this is line with Andersen, Bollerslev and Das (2001); Brennan and Wang (2006); Li and Liu (2012); and Hong, Linton and Zhang (2015). Where e^m is the cumulative residual return over m-days. In the presence of short-lived mispricing, the residual of risk-augmented CAPM will be less than unity, so that $VR(m)\ \pi 1$. If the mispricing factor is very low, then the stronger is the mean reversion in mispricing; more so, when the mispricing factor is unity, there is absence of mispricing (see Brennan, Jegadeesh and Swaminathan, 1993; and Brennan et al., 2006).

To analyse the second question, the study follows the works of Fahir and Panageas (2004) and Mohammed (2006). Previous studies have examined the relation between mispricing and investment with interest in undervalued firms (Baker, Stein and Wurgler, 2003) while the studies of Panageas (2003) and Gilchrist, Himmelberg and Huberman (2004) considered overvaluation.. Studies by Polk and Sapienza (2002), Fahir et al. (2004) and Mohammed (2006) consider both over and under-valued firms. However, Polk et al. (2002) model did not separate the type of mispricing and investment to verify the relationship between mispricing and form of investment (under and over-investments). The model adopted in this study is in line with Mohammed (2006), but modified by classifying stocks into different portfolios and including for effect of past mispricing. The model estimated is specified in equation (2a-c).

$$\left(\Delta I_t / I_{t-1}\right)_{i,t} = a_1 + a_2 P_{(mis)i,t} + a_3 P^{+}_{(mis)i,t} + \xi_{(a)i,t} \qquad (2a)$$

$$\left({}^{+}\Delta I_t / I_{t-1}\right)_{i,t} = a_1 + a_2 P_{(mis)i,t} + a_3 P^{+}_{(mis)i,t} + \xi_{(b)i,t} \qquad (2b)$$

$$\left({}^{-}\Delta I_t / I_{t-1}\right)_{i,t} = a_1 + a_2 P_{(mis)i,t} + a_3 P^{+}_{(mis)i,t} + \xi_{(c)i,t} \qquad (2c)$$

Where the variables on the left $\left(\Delta I / I_{t-1}\right), \left({}^{+}\Delta I / I_{t-1}\right) and \left({}^{-}\Delta I / I_{t-1}\right)$ are defined as total change in investment in stock portfolio size,over-investment in stock portfolio size and under-investment in stock portfolio size. The investment in listed stock is proxy by daily average value of stocks traded. Actual investment is the daily average change in the value of stocks traded. Over and under-investment is measured by the positive (negative) daily average change in the value of listed stocks. The variables on the right consist of stock mispricing variable $P_{(mis)}$ and lags. The paper also controlled for over-valuation in stock portfolios, as earlier studies had demonstrated that the relatively high impact of financial crisis felt by stock markets in Africa is due to over-valuation (AfDB Report, 2009; IMF Report, 2009; and Beck, Maimbo, Faye and Triki, 2011). The control was done by leaving the value of positive mispricing at any time period it occurs $P^{+}_{(mis)}$ and zero otherwise. 'i' and 't' are portfolio classes (Big, Medium and Small) and time periods, respectively. Models specified are estimated through the least square estimation technique. The stock mispricing series remain the residual of the risk adjusted CAPM model $\left[residual = R^{P}_{i,j,t} - \hat{R}^{P}_{i,j,t} \right]$ this is in line with Brennan et. al (2006); Mohammed (2006); and Wang, Zhao and Wang (2013). The third question of providing insights on whether African equities can offer safe-havens to commodities during varying periods of market crashes was also addressed. In tackling this issue, the study adopted the hedge-safe haven model of Baur and Lucey (2010). Their model shows that the returns of a commodity (gold) depends on returns of other financial instruments such as stocks and bonds alongside varying declining moments in stocks and bonds. It is assumed that returns of gold would be uncorrelated with returns of stocks and bonds on the average for gold to be a safe haven for both financial instruments. In their specification, they examined commodities such as gold as safe havens for stocks and bonds.

Paradoxically, in this paper, the reverse is the case because African stocks are considered as safe haven for investors holding positions in global commodities. The models used for the analyses are specified in equations (3) and (4). The paper separated the safe-haven and hedge parameters for clarity, and moreover the study is more interested in the safe haven parameters in equation (4), as it remains its focus in addressing the question.

$$R_{i,t} = \eta_{i,0} + \sum_{k=1}^{4} \eta_{i,k} R_{k,t} + \upsilon_{i,t} \quad (3)$$

$$R_{i,t} = \gamma_{i,0} + \sum_{k=1}^{4} \gamma_{1k} dumm\left(R_{k(q=1\%),t}\right) + \sum_{k-1}^{4} \gamma_{2k} dumm\left(R_{k(q=5\%),t}\right) + \sum_{k=1}^{4} \gamma_{3k} dumm\left(R_{k(q=10\%),t}\right) \quad (4)$$

Where $R_{i,t}$ *and* $R_{k,t}$ represent the returns of selected African equity markets and commodities at time t, respectively. η_0 *and* υ_t are intercept and error term at time t. In equation (3), the structure of the model assumes that African equity prices cannot drive prices of selected commodities because of the safe haven rule. As stated earlier, equation (4) remains the focus of the estimation. In this model, the intercept γ_0 measures the average effect of the regressors on the regressand and can be used as hedging indicator. γ_1, γ_2 *and* γ_3 are coefficients of the dummy variables and relevant to the safe haven analysis. The dummy variables $dumm(...)$ measure the extreme return behaviour of the selected commodities and assign zero (0) value when the commodities returns varies within the defined thresholds 1%, 5% and 10% and one (1) otherwise. This is how the series for the quartiles (various declining moments of commodity markets) are generated. The series are the regressors in equation (4). The γs are interpreted accordingly, following Baur et al. (2010) and Ciner et al. (2012). If the coefficients in equation (4) $\gamma's$ are zero or negative, it is offered that, selected African equities are, on the average, a safe-haven for selected commodities. γ_0 is a hedge parameter which suggests that investors can use African equity market as a hedge if it is significantly negative or zero and, if not, as a diversifier. The subscripts 'k' and 'i' denote the selected commodities (oil, Gold, cocoa and platinum) and African stock markets (South Africa, Nigeria, Egypt and Morocco). Models are estimated through least square technique. We specified the univariate GARCH (1,1) model to capture for heteroscedasticity in the data as shown in equation (5).

$$\sigma_{i,t} = \theta_i + \alpha_{i,1} \upsilon_{i,t-1}^2 + \beta_{i,1} \sigma_{i,t-1}^2 \quad (5)$$

III. ESTIMATION RESULTS, IMPLICATIONS AND DISCUSSION

The mispricing analysis is based on the variance ratio using various numbers of days (5, 10, 15 and 20 days). The results in Panel A of Table 2a contain estimates of two countries (Egypt and Morocco). The mispricing in the big-size portfolio declines drastically as the frequency of trading days rise in Egypt stocks. In fact, the mispricing attenuated when the portfolios are traded every five days, and reported as 0.925 in the cell. A similar trend was observed for small-size portfolio, whereas, the medium-size portfolio shows a different pattern with increased mispricing. This implies that investors taking positions in the Egyptian stock market may order portfolio with more of big and small-size stocks to minimise the impact of mispricing on equity portfolio returns. In the Casablanca stock market, the big and medium-size portfolio yielded better results compared to a small-size portfolio. Holders of big-size portfolio, should not bother about mispricing in their portfolios as long as they trade this portfolio on a regular basis of, at least, 5 days interval on the average. Results for Nigeria and South Africa are documented in Panel B. In Nigeria, holders of medium and small-size portfolios that are frequently traded should not be scared of mispricing effects. The results of these two portfolios show that portfolio mispricing is transient on high frequency trading (the coefficients for both medium and small-size portfolios are 0.904 and 0.873, respectively). The big-size portfolio has low coefficients of the variance ratio compared to other portfolios and needs to be traded more frequently, especially on daily basis. For Nigeria, these results come as no surprise because of poor rating system and the usual habit of buy and hold strategy of speculative investors. The situation differs in the South African market because the results of the big-size portfolio indicate absence of mispricing. Here, mispricing in the portfolio disappears very quickly, even for speculative investors adopting a buy and hold strategy. Although for this portfolio, there is mispricing if trading delays for three weeks, however this mispricing is short-lived and the effect is trivial on expected portfolio returns. Investors taking position in medium-size may have their portfolio returns unaffected by mispricing (see Table 2a). The medium-size portfolio show transient mispricing in all periods. There is an absence of mispricing if the portfolio is traded at less than 5 days intervals. For small-size portfolio, the mispricing result is not different from the medium-size. These findings suggest that it is possible for the mispricing in portfolio to become negligible as long as the portfolio is traded on a daily basis. The mispricing behaviour in South Africa shows that the Johannesburg Stock Exchange is likely to be more efficient to price

discovery compared to other stock markets considered in the study.

CONCLUSION

This paper affirms the presence and extent of mispricing in portfolios of equities. The mispricing-divestment relation and establish that African equities can act as diversifiers and safe havens to commodities during market crises. A safe haven asset is differentiated from a hedge and a diversifier asset which on the average provides diversification benefits for investors. The empirical findings show some instructive and interesting highlights:

1. Mispricing of portfolio returns in Africa's equities, are caused by low trading frequency of stocks. This is due to the 'buy' and 'hold' strategy used by speculative investors and increased ignorance to trade in equities among individual investors which constitute a large proportion of total investors in equities.
2. In frequently traded stock portfolios, it was seen that mispricing is short-lived. Therefore, it has been concluded that mispricing in Africa's equity portfolios regardless of the size and volatility effects remain a 'low trading frequency phenomenon'.
3. The transient mispricing observed in stock portfolios cause divestment on the exchanges, especially in the big size portfolio stocks.
4. African equities can actually be used as safe-havens during global commodity market turmoil. South Africa, Egypt and Morocco Stock Exchanges can serve as safe havens for investors/traders in cocoa, platinum and oil markets, respectively.

I. recommendations

In line with the findings, the study recommends the following:

a. Speculative investors are encouraged to frequently trade their portfolio to improve liquidity and lessen the effect of mispricing on stock portfolio returns in the event of subsequent shocks.

b. Stock market authorities should provide strict regulations to guide against the buy and hold trading attitude of speculative investors.

c. Portfolio traders that intend to minimize the mispricing in a portfolio of equity returns should form the portfolio with equities that are frequently traded.

d. African countries should fast track the development of their commodity exchanges to improve performances in equities. They should encourage the establishment of regional and African commodity exchanges to achieve the desired inclusive growth.

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