Volatility Risk Pricing, Market Regulations and Cross Section of Stock Returns in Emerging Markets

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Abstract

Investors in Africa's equity markets are part of the economic agents as they tend to provide capital for investments and financial sector development. Studies have established that financial sector development propelled economic growth. In recent time, equity prices have declined tremendously in Africa owing to macroeconomic and market risks asforeign investors are pulling out their funds and domestic participation are more of dropping the stocks. The huge information deficits about the relationships between these risks and portfolio returns remain a vacuum that have resulted into loss of confidence. This paper provides information on the relationship between these risks and portfolio of returns using African equities. The results show that portfolio returns depend not only on the macro and market risks that is captured by a risk-augmented CAP Model, but also on the type of equity mispricing. Empirically, these risks induced return bias when estimated by volatility and variance ratio of residual returns. The findings also show that market regulations implemented during the study period impress positively on equity portfolio returns. Given these results, equity investors are encouraged to increase their stake in Africa markets to increase portfolio returns. Again, market regulators should focus more on regulations that will strengthen liquidity and protect investors' interest.

1. Introduction

Global equity markets is linkedwith numerous sources of risks. Noticeable among these risks are interest rate risk, exchange rate risk, inflationary risk, credit risk and market risk. Interest rate risk is perceived as a crucial source of uncertainty for investors. Indeed, financial theory postulates that changes in interest rates affect firm's expectations about future cash flows, the cost of capital to value that cash flow and ultimately, the equity price of firms on the exchange. Owing to this importance, the impact of interest rate risk on equity prices has received huge attention in the literature, although much of this research are done fordeveloped equity markets (Flannery and James, 1984; Staikouras, 2003 and 2006 and Hahm, 2004). Exchange rate risk is another risk that investors encountered. The fact that investors have their investment denominated in another country's currency expose them to this risk. Whatever happens to the home currency affects the value of their investment. Whilst, the market risk is the type of risk that affects all equities in the same manner and are caused by factors that cannot be controlled by diversification. Market risks include liquidity and volatility risks.

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Beginning from 2014, the prices of commodities such as oil, metals (defined here to includeiron ore, copper and platinum)and agricultural commodities fell substantially, and further in 2015. Thisdecline reflected weak global demand for raw materials from large developing countries including African countries, and resulted in continued slow growth, currency devaluation, and increased inflationary pressures. As a result of these rising risks, prospective investors are reluctant to invest in Africa equities and existing investors are pulling out their investments. Between 2014 and 2015, foreign investors participation declined and significant stock dropping in domestic participation (see Table 1). This has resulted in increased volatility of equity prices and illiquidity of the equity market.

African equity markets remained important to the continent as it ensure long-term commitments in real capital. In addition, studies have established a positive relationship between stock market development and economic growth (Mohtadi and Agarwal, 1997; Enisan and Olufisayo, 2009; Rahman and Salahuddin, 2010; Ikikii and Nzomoi, 2013 and Osamwonyi and Kasimu, 2013). For these reasons, the recent loss of investors' confidence that generates pulling of foreign investors and dropping the stocks by domestic ones is increasingly worrisome, as its attending effects have continued to loom on market risks (such as illiquidity of the market, rising volatility of equity prices, among others).The loss of confidence of investors may partly be due to theincreased exchange rate and inflation rate risks or due to inappropriate pricing of equities that have reduce the value of investors' portfolio and equity market risks.

For the former class of risks (exchange rate and inflation rate risks) several empirical works have been conducted on developed and Africa's equity markets. The most recent of these researches include Lustig, Roussanov and Verdelhan (2011); Kodongo and Ojah (2011);Aliyu (2011); Olowokere (2012); Cenedese, Payne, Sarno and Valente (2013) and Kodongo et al. (2012 and2014). Studies done on the mispricing of equities and equity market risks focused more on developed markets (Malkiel and Xu, 1997; Campbell, 2001; Goya and Santa Clara, 2003; Wei and Zhang, 2005; Ang, Hodrick, Xing, Zhang, 2006; and Lundblad, 2007). Studies on Africa's equity markets are very scanty (Samouilhan, 2007; Forgha, 2012 and Mustapha, 2015). Very instructive, none of these studies hasexamined the mispricing of equities, and whether stocks, especially the more traded ones are properly priced remains a question that is yet to be answered in the literature. Again, the relationship between market risks, specifically volatility risk and equity portfolios constructed with stocks across equity markets in Africa has not been clearly presented in the literature, in spite of the diversification of investors' portfolio across African equity markets. The question of whether this risk is also priced remained unanswered.

This paper seeks to provide answers to these questions by focusing on selected stocks that are most frequently traded on the four 'Big' African Exchanges. The study attempts the first question by showingthe disparity between the 'true-prices' of selected equities estimated through technical analyses and the market prices of these stocks. In case there are disparities in these prices, the study will further show that the mispricing persist in portfolio returns by sorting these stocks into different portfolios.This issue is to be examinedfrom the perspective of investors having portfolio containing stocks from a specific equity market. The second question is answered by establishing the relationship between volatility risk and cross section returns in Nigerian equities. If the study perceive significant relationship between volatility risk and cross section of investors' returns, then investors would like to price this risk and would demand for more premium in terms of the required rate of return on their equity investment in Africa. The market regulation issue is addressed by focusing on the Nigerian stock exchange.

The paper is arranged in five sections. The first section covers introduction and stylized facts on African Equity Exchanges, while the second section briefly review related literature. Third section provides the methodology and data required for estimation whereas the estimation results, implications and discussions are presented in the fourth section. The fifth section presents conclusions and policy recommendations.

1.1 African Equity Markets: Some Stylized Facts

Performances and Activeness

African Equity Markets (AEMs) has had a long history dated back to the establishment of the Egyptian Exchange in 1883. Up till 1987, Africa could only be proud of less than ten (10) equity exchanges, specifically eight (8) exchanges exist across the continent. The rapid development in the equity market in the continent was quiet amazing such that by 2012, the total number of equity exchange grew to twenty-nine (29) with Seychelles Equity Exchange as the latest, established in 2012 in Victoria.

Overtime, trading activities have shown that the largest Exchanges in Africa include Johannesburg Equity Exchange (JEE) South Africa, Egyptian Equity Exchange (EEE) Cairo, Nigerian Equity Exchange (NEE) Lagos and Casablanca Equity Exchange (CEE) Morocco. These Exchanges are the largest due to their size, breadth, width and skills. Box 1.1 shows the categorization of African Equity Markets followingSmith, Jefferis and Ryoo (2002). Smith et al (2002) categorizes African Equity Markets into four main groups based on their stage of development. Table 1.1 presents the characteristics of the ten largest Equity Markets in Africa. These countries are also members of the African Securities Exchange Association (ASEA) and their selection is based on the number of listed companies.

In Table 1.1 the JEE remains the most liquid among the top four exchanges over the period of five years these can be viewed from the perspective of the liquid ratio and value of traded shares. Between 2011 and 2015, South African equity exchange prove to be more liquid than other African Exchanges with the increasing trend of the liquid ratio. The value of shares traded slightly decline in 2014, which commensurate with what was observed in other selected equity markets. For South Africa, the decline was due to fall in confidence of domestic investors that was orchestrated by the depreciation of the rand against the US dollars and attractiveness of the money market instruments such as treasury bills. The Egyptian equity exchange is another big shot in terms of value and liquidity. The market shed some value in 2015 due to unfriendly macroeconomic environment and falling share prices of major market shares. However, in 2014 the market recorded an impressive performance, which is attributed to several market regulations such as the introduction of the block trading system, upgrade of the online trading platform, lower macroeconomic indices such as exchange rate appreciation and lower general price level, among others. In Nigeria, the NEE has provided assistance to corporations to raise capital either through issuance of equity or fixed income products (ASEA Annual Report, 2014). In 2014, the exchange witnessed bullish in its equity trading, the value of share traded rose to $7.19 billion from $6.53 billion. The liquidity indices also portrayed bright outlook for the market with an impressive increase of 430 basis points between 2013 and 2014. However, the indices nosedived in 2015 owing to several challenges, prominent of these challenges are transition in government, stagnant policy direction, rising exchange rate, and rising divestment by foreign investors. Between 2014 and 2015, foreign participation declined by 11.6%. Although these was compensated by increase in domestic participation but more of shorting the equity emanated from their transactions.

Box 1.1 Classification of African Equity Markets (AEMs)		
Category	**Characteristics**	**Equity Exchanges**
Cat I	More developed in terms of regulatory	South Africa
Frameworks, advanced Technical		
Infrastructure and others.		
Cat II	Medium-sized markets: developed regulatory	Egypt, Nigeria and Morocco
Frameworks, Technical Infrastructure		
and others.		
Cat III	Small-sized new markets, which have rapidly	Mauritius, Sudan, Ghana, Botswana
Grow in terms of regulatory Frameworks,		
Technical Infrastructure and others.		
Cat IV	Small-sized markets that are at their early	Swaziland, Zambia and Malawi etc.
Stage of development.		

Source: Smith et al (2002)

Table 1.1 Performance of Top Three African Equity Markets (2010 - 2015)

Countries	Year	Performance Indicators				Macroeconomic Risks			Liquidity Indicators			
		No. Shares Traded ($Mn)	ADT (P'Mn)	Rel. P (%)	Infl (%)	Exch Rate	Int. Rate (%)	CAP Ratio	Liquid Ratio	DP (%)	FP (%)
South Africa	2010	438,087.6	111.5	28.6	4.3	7.3	6.4	43.2	1,076.3	84.4	15.6
JSE/JEE	2011	402,299.5	118.9	30.9	5	7.3	5.5	46.2	990.8	85.6	14.4
	2012	408,628.9	102.3	31.5	5.6	8.2	5.3	40.9	1,021.5	84.6	15.4
	2013	413,053.9	93.6	29	5.7	9.7	5.1	55.2	1,070.1	83.8	16.2
	2014	405,004.4	88	30.1	6.1	10.8	5.8	35.2	1,109.6	80.8	19.2
	2015	575,518.4	120.7	NA	5	15.6	6.9	38.4	1,475.6	81	19
Egypt	2010	55360.5	164.5	27	11.7	5.8	12	42.9	261.1	78	22
ESE/EEE	2011	24571.4	118.8	19	11.8	5.9	12.1	32	115.3	64	36
	2012	23402.7	97.3	24	7.3	6.1	14.7	29	109.8	72	28
	2013	23331.2	94.8	21	9.7	7	14.2	21	110.1	73	27
	2014	40725.7	145.3	25	8.2	7.1	10.6	38	176.3	79	21
	2015	31975.3	145.6	27	10.4	7.7	11.7	32	152.9	NA	NA
Nigeria	2010	4989.4	15.7	15.2	13.8	148.3	6.8	10.1	28.3	51	49
NSE/NEE	2011	4181.9	24.3	17.4	10.9	151.8	11.9	9.7	22.2	19	81
	2012	4231.6	18.3	21.8	12	155.4	11.7	7.3	24.6	44	56
	2013	6531.2	19.7	18	8	159.7	13.2	7.9	34.5	49	51
	2014	**7192.9**	29.1	11.8	8	186.1	15.1	11.6	38.8	42	58
	2015	**4956.8**	24.7	10.2	9.8	196.9	14.5	8.7	56.3	53.6	46.4

Source: African Securities Exchange Association and Countries' Exchanges Websites. Note Average Daily Turnover (ADT) is the ratio of turnover to the average daily market capitalization. The average daily market capitalization is annual market capitalization divided by number of trading days, for this research a fixed number of trading days was adopted - 250 days (see Ferson and Harvey, 1994). The relative performance is generated using the ratio of annual market capitalization to the Gross Domestic Product (GDP) express in percentage. Whilst, the trend of the macroeconomic risks considered in the study were also presented alongside the market statistics, these variables are inflation, exchange rate and interest rate (proxy with the 3 months treasury bill rate), the * implies that data for the year were estimated. Capitalization ratio (CAP ratio) is the ratio of turnover and market capitalization while liquid ratio used in the study refers to the ratio of value of shares to the number of traded companies on the Exchange. Both DP and FP represent domestic and foreign participation, respectively. Market Activeness and economic growth rates of the largest four Africa's Equity Exchanges (Hereafter the 'Big Four') are presented in Annexure 1. The Initial Public Offers (IPOs) and Further Offers (FOs) are measures of market activeness in this study. As this portrays the attractiveness of the market to domestic and foreign investors to raise funds.

The growth of the Gross Domestic Product (GDP Growth rate) serves as a measure of economic growth. The African IPO and FO markets hit a five-year peak in 2015, with a record of 28 and 91listings, respectively. Again, 2015 showed a steady overall rise in Equity Markets activity. In terms of trading transactions, the AEMs earned 18% volume and 14% value compared to 2014. First half of the 2015 fiscal year, witnessed 72% IPO value and 54% IPO volume. This is a reflective of increased confidence in investors compared to the second half that recorded lower transactions.
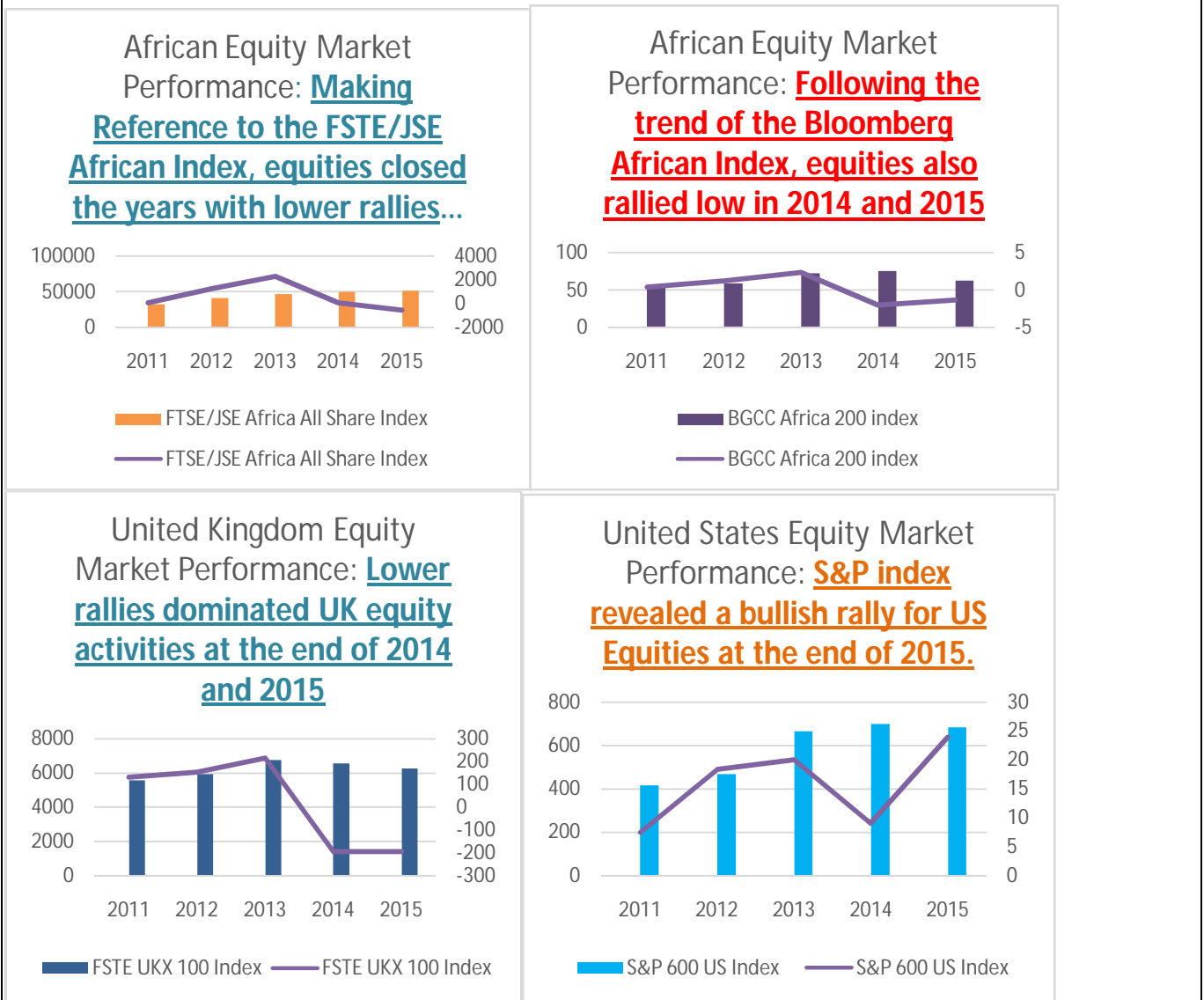
From 2011 to 2015, there have been 105 IPOs with a value of $6.085 billion and 336 FOs with a value of $35.222 billion, this shows that there is increased demand for funds in Africa. The number of IPOs and FOs initiated on African Exchanges continued to increase yearly such that the IPOs initiated between over the five years grew by 64.7% and FOs by 37.8%. These demands were placed by African companies on both African and foreign exchanges. Despite the rising volatility and policy inconsistencies that have increased macroeconomic risks in African countries, these market still attracted companies as demonstrated by the steady rise in 2015 listings as compared to 2014. Between 2014 and 2015, there has been an overall increase of 12% in the number of IPOs and 17.05% in the value of capital raised through this medium and 19.7% in the number of FOs and 13.02% in the value of capital raised. In 2015, the top four IPOs by proceeds involved companies and exchanges in North Africa. The listings were oversubscribed which implies healthy investors demand in the region. The companies that were listed include: Integrated Diagnostic Holding Plc, Emaar Misr for Development SAE, Edita Food Industries SAE, among others. Whilst, in 2014 investors demand was high in South West (Nigeria) and South Africa as the top two IPOs listing by proceeds were from Nigeria and South Africa Exchanges. The listed companies are SEPLAT Petroleum Development Co. Ltd and Alexander Forbes Group Holdings Ltd. In summary, Africa Equity Exchanges have the prospects of attracting more funds as demand pressure rises.

Among the 'Big Four' equity exchanges, the South Africa (JSE Limited) remains a reliable anchor of African Equity Markets activity with 35 IPOs (worth $2.709 billion) and 224 FOs (worth $30.013 billion) over the past five years (2011-2015). The market is also rank the second in the world for exchange regulations and the first for ease of raising debt or equity capital (World Economic Forum's Global Competitiveness Report 2015-2016). Between 2011 and 2015, the IPOs raised by companies on the JSE represented 45% of the total African IPO capital (33% of total volume), likewise, FOs capital raised was 82.6% of the total (66.6% of the volume). Other countries include: Nigeria with $0.751billion capital raised from IPOs and $1.519 billion raised from FOs; Egypt with $0.861 billion raised from IPOs and $1.158 billion capital raised from FOs; and Morocco with $0.376 billion raised from IPOs and $0.698 billion raised from FOs.

Equity Market Performance: Africa and selected developed Markets

Since 2011, FTSE/JSE Africa All Share Index and Bloomberg GCC Africa index performances have tracked similar course to the FTSE UKX 100 and S&P US 600 indices more closely until market gloom began to push the lower 2015, coupled with the exchange rate (against the US Dollar) crisis that paraded African countries. All indices presented in Box 1.2 share a clear rise in trading rally between 2011 and 2013. The increase however, got halted with the slower trading rallies that ended the 2014 and 2015 fiscal years.

Box 1.2: The performances of equities trailed similar patterns in Africa, the United Kingdom and the United States at the end of 2014. However in 2015, Africa's equity markets rally witnessed a different trend with the United States.

African Equity Market Performance: **Making Reference to the FSTE/JSE African Index, equities closed the years with lower rallies...**

FTSE/JSE Africa All Share Index
FTSE/JSE Africa All Share Index

African Equity Market Performance: **Following the trend of the Bloomberg African Index, equities also rallied low in 2014 and 2015**

BGCC Africa 200 index
BGCC Africa 200 index

United Kingdom Equity Market Performance: **Lower rallies dominated UK equity activities at the end of 2014 and 2015**

FSTE UKX 100 Index   FSTE UKX 100 Index

United States Equity Market Performance: **S&P index revealed a bullish rally for US Equities at the end of 2015.**

S&P 600 US Index   S&P 600 US Index

Source: Bloomberg. Note: the index value is the value at the last trading of the fiscal year, while the rate of change (measure of thickness in the trading rally at the end of the year) is an absolute change in the last trading day index value and its preceding day.

The intuition behind this is that the lower trading rally and slow performances of equities were not peculiar to the African Equity Exchanges, it also reflects in other developed equity exchanges, especially the London Equity Exchange. Therefore, domestic and foreign investors in Africa's Equities should hold this view and apprehend that slower performances of equities and its trading rally are global concerns.

From the stylized facts, the development in African Equity Exchanges was not significantly different from what can be obtained from other developed markets, however, in 2015 a slight divergence was noticed in the performance. With the level of activeness, pressing demand for funds by domestic and foreign companies, and the inclusive growth agenda that rampage the shore of Africa, coupled with technical advancement in these Exchanges, the divergence may short lived.

2. Literature Review

Investment risks are quiet enormous in all sphere, however there are two prominent ones that characterized all equity market be it developed or less developed. These risks are macroeconomic risk and volatility risk. In African Equity Markets, the risks from economic dynamics i.e. macroeconomic parameters such as: indices (exchange rate, inflation and interest rates), economic governance (political patterns, policy inconsistencies, war) and market governance (equity market regulations – Central banks and other regulatory bodies); and inherent market risk such as: market volatilities and equity price volatilities are inevitable for every investors as connections between some of these risks and returns in African Equity Markets have been extensively dealt with in previous studies (Senbet and Otchere, 2008; Olowe, 2009; Aliyu, 2011; Kodongo and Ojah, 2011; Kuttu, 2012; Kodongo and Ojah, 2014; and Mustapha, 2015).

Studies on macroeconomic risks and returns abound. Extant empirical research were largely based on the impact of these risks on stock returns using several models and estimation techniques. Conducted in varied markets, some adopt the single equation models while others followed the multi-equations models with varying parametric approaches. Studies that have adopted the parametric model found varied empirical results. Tests that found no effect of macroeconomic risks especially, exchange rate risk pricing are Loudon (1993) and Kodongo and Ojah (2011); meanwhile results of other studies are mixed and more importantly, inconclusive (Patro, Wald, and Wu, 2002; Jegadeesh, Kraussl and Pollet, 2009; and Bali, Brown and Caglayan, 2014). Others presented results that are consistent with theoretical notions (Forgba, 2012, Aliyu, 2011; and Mustapha, 2015). Ferson and Harvey (1994) used the multi-equation approach to establish the connection between risks and expected returns. Inability to resolve the divergence and ascertain the connection in the Africa context are not desirable from investors and corporate fund managers' perspectives. Again, none of these studies estimate the true price of equities through the impact assessment models presented.

The debate on the impact of volatility risks on equity returns has been around the corridor of research over the years. Notable ones have been done for developed equity markets (Malkiel and Xu, 1997; Campbell, 2001; Goya and Santa Clara, 2003; Wei and Zhang, 2005; Ang, Hodrick, Xing, Zhang, 2006; and Lundblad, 2007). Volatility risks can be classified into systematic and idiosyncratic volatility risks. Studies on both class of volatility risks have reported different results. For instance, studies that identify zero relationship between systematic volatility and weighted equity portfolio returns (Bali et al., 2006; Lundblad, 2007; Olowe 2009); for positive relationship, studies include Malkiel et al. (1997), Wei and Zhang (2005) and Mustapha (2015); meanwhile studies with negative relationship include the novel work of Ang et al. 2006 and 2009 and Mustapha (2015). Idiosyncratic volatility is theoretically believed to be diversified, however, the novel work presented by Ang et al (2006) have paved way for further research. Studies in the aspect include the works of Malkiel et al (2006), Bali and Cakici (2008), Brockman and Yan (2008), Fu (2009), Liu et al (2009), Bekaert et al (2010) and Mustapha (2015).

Between 2010 and 2015, there are several developments in terms of regulations. Market regulators strive to strengthen the market to attract more investors and enhance visibility across the continent and globally. These regulations influence the markets in either ways; to stimulate markets activities or to address certain challenges that confront investors and the market. For instance, in November 2014, the Nigerian Equity Exchange signed a capital market agreement with the London Stock Exchange Group to strengthen cooperation and promote mutual development between the two Exchanges. The agreement enables African companies that intend to be listed on the two Exchanges to do so. Hence, increase visibility as well as liquidity. The introduction of the Direct Market Access (DMA), admission into the World Federation of Exchanges and Corporate Governance Rating System are indication that the Exchange possess standard trading platform and renewed interest of the market to actually serve its clients. Likewise in Egypt, the Egyptian Equity Exchange increased investors' protection through frequent investor relations meetings, deepening the Legislative and regulatory infrastructure, block trading and facilitating capital increase procedure through the new online disclosure system. In all, studies relating to the impact of volatility of cross section of equity returns found mixed results, while none of the studies present the impact of market regulations and how it could change the overall effects of volatility on equity returns. Summarily, extensive studies have been presented in the purview of the relationships between macroeconomic/volatility risks and equity returns.

It is apparent from the literature that most of the extant studies focused on cross section of stocks; the few of the studies that estimate individual stocks did that to ascertain the presence of volatility clustering in prices (Campbell

et al., 2001; Olowe, 2009 and Aliyu, 2011). However, to estimate the 'true price' of equities through a system that uses parametric and non-parametric methods, and to incorporate country specific market regulations into factor loadingmodellingto provide more information to investors regarding fixing of mispricing in equity prices, especially for stocks that falls on the top of the trading bout have not been considered in the literature. A gap this study intends to fill.

3. Methodology and Data

The study stated two specific objectives to guide its estimations. These specific objectives are: first is to estimates the 'true price' of selected listed stocks on the four largest African Equity Exchanges, considering macroeconomic and volatility risks and second, to presents the extent to which financial/market regulations influence equity returns in Africa with sample from the four largest African Equity Exchanges. In order to estimate the 'true-price' of the selected equities, the paper adopted the market pricing multiple. We describe how the market pricing multiple approach is implemented by assuming that the daily current equity price of a firm is denoted with P_i, the true price of the equity is the product of the current price of equity and the pricing multiple (see equation 1). In the estimation, it is assumed that market prices are strictly positive $(P_i > 0)$ and impose that the expected value of the pricing multiple is stationary.

$$P_i^{TP} = P_i * P^M \approx \frac{P_i}{1 - \beta_{VolR}} \approx \frac{P_i}{1 - \hat{\beta}} \qquad (1a)$$

Where P_i^{TP} is the 'true price' of equity of firm I and P^M is the multiple pricing factoris the discounting factor and the risk parameter is the residuals from the first order autoregressive model specified in equation (1b). P_i remains the current price of firm I and β_{VolR} are factor loading of volatility risks.

$$P_{i,t} = \alpha_{i,t} + \beta_{1i,t} P_{t-1} + \varepsilon_t \qquad (1b)$$

Where $P_{i,t}$ is the daily stock price of firm i at time t; P_{t-1} represents one period lag value of stock price; EXR_t is the country specific exchange rate at time t. The differences between the true and the current equity prices informed investors on the nature of the mispricing in stocks, and the form of strategies to be adopted. A negative mispricing indicates that the intrinsic value of equity is over-priced and therefore price is expected to fall. Investors may go short (sell) on the stock to maximize equity portfolio and otherwise if positive mispricing prevails.

The robustness of the true price estimated is tested through the mispricing of equity portfolios. In the literature, there is a well-developed theory of rational equity pricing, however, there is no general canonical model of security mispricing. Therefore, in order to estimate the associated mispricing in equities, three models had been established. The first model is the one developed by Poterba and Summers (1988), which assumes that mispricing is independent of fundamentals, and follows a simple first order autoregressive AR(1) process. Studies have identified several variables that explained dynamics of equity prices, in the case of this paper this approach may not be appropriate as it intends to consider the effect of macroeconomic and volatility risks. The second model assumes that mispricing is due to slow adjustment of market prices to new information. This is apparently out of the scope of this study. The third model is the systematic mispricing that consider mispricing to be associated with a market wide mispricing factor (Archarya and Pedersen, 2005; Brennan and Wang, 2006).

In order to estimate the mispricing, the paper followed the systematic mispricing approach. All firms selected are sorted into three portfolios namely, high, medium and low portfolios. The equities are sorted based on the level of systematic volatilities, such that equities with low volatilities constituted the low portfolio, high volatilities constituted high portfolios and moderate volatilities instituted medium portfolio. The mispricing model in equation (2) apparently present the effects of systematic volatility and exchange rate risk.

The systematic mispricing approach makes use of the variance ratio and volatility of residual returns (see Kleidon, 1986; Jegadeesh and Titman, 1993; Brennan and Wang, 2006 and Lewellen et al. 2010). Where $R_{i,t}$ is the monthly average equity returns of firm I at time t and Rm_t is the monthly average of market returnat time t. EXR_t is

the computed average exchange rate at time t, and Vol_t is the systematic volatility generated at time t (the systematic volatility is the standard deviation of daily equity price and it is obtained on a monthly basis); the error term is ε_t which is assumed to be normally distributed with constant mean and variance. It also assumed that the risks betas will negatively impress equity returns; however the alpha and market beta have its signs varied. Equation 2 is the risk-augmented Capital Asset Pricing Model.

The variance ratio (VR) is defined for j-months as:

$$VR(j) = \left[\frac{\left(\text{var}(\varepsilon^j)/j \right)}{\text{var}(\varepsilon^T)} \right] \qquad (3)$$

Where ε^j is the cumulative residual return over j months, this paper consider j = 2 months. In the absence of mispricing, the variance ratio obtained through the residuals of the sorted portfolios estimated using the risk-augmented CAPM in equation (2) will be equal to unity (1), there exist transient mispricing when the variance ratio is closer to unity and remains stronger the farther to unity (Kleidon, 1986; Brennan and Wang, 2006; Tetlock and Alti, 2011).

The model to estimate empirically the extent to which portfolio of stock volatility is priced in equities is specified in equation (4), and estimated through the least square (OLS) technique.

$$R_{j,t} = \alpha_0 + \beta_1 Rm_t + \beta_2 EXR_t + \beta_3 Vol_t + \delta_i (SVol_{high} - SVol_{low}) + \varepsilon_t \qquad (4)$$

Where the definitions of $R_{j,t}$, Rm_t, EXR_t, Vol_t and β beta coefficients and $\varepsilon_{i,t}$ have been defined previously. $(SVol_{high} - SVol_{low})$ Represents the pricing factor following Drew, Naughton and Veeraraghavan (2004) and is the difference between values of high and low systematic volatility. Inequation (4), the decision rule to ascertain whether the systematic volatility is priced in equities is the nature of significance of the coefficient (δ_i) of the pricing factor $(SVol_{high} - SVol_{low})$. Positive sign of the coefficient implies gain from mispricing and the converse holds for negative sign. If δ_i is significantly different from zero with a positive sign, it then suggests that the systematic volatility is priced in the selected African equities.

To estimate the factor loading of market regulations on cross section equity returns, the paper used the categorized portfolios- high, medium and low. The equally weighted portfolios returns adopted is partly in line with Ang et al (2006). The market regulations are factored into the model estimated through dummies. Between 2010 and 2015, the selected African Exchange (Nigeria) had focused market regulations on the development of the over the counter (OTC) markets, enhancement of legislative and regulatory infrastructure of the market and augmentation of the technological infrastructure to support trading activities on their Exchanges (see ASEA 2009, 2010, 2012 and 2014 yearbooks; and equity exchange website). The general model estimated is presented in equation (5), the model is further separated into three models to capture the impact of each of the market regulations identified. The models are specified in equation (5a-c).

$$R_{it} = \alpha_{it} + \beta_{it} Rm_t + \sum_{l=1}^{3} \beta_{lit} MVrisks_t + \sum_{k=1}^{3} \beta_{kit} MR_t + \varepsilon_{it} \qquad (5)$$

$$R_{It} = \alpha_{It} + \beta_{1It} Rm_t + \beta_{2It} Inf_t + \beta_{3It} EXR_t + \beta_{4It} Vol_t + \beta_{5It} MR_{OTCt} + v_{It} \qquad (5a)$$

$$R_{IIt} = \alpha_{IIt} + \beta_{1IIt} Rm_t + \beta_{2IIt} Inf_t + \beta_{3IIt} EXR_t + \beta_{4IIt} Vol_t + \beta_{5IIt} MR_{LREGt} + v_{IIt} \qquad (5b)$$

$$R_{IIIt} = \alpha_{IIIt} + \beta_{1IIIt} Rm_t + \beta_{2IIIt} Inf_t + \beta_{3IIIt} EXR_t + \beta_{4IIIt} Vol_t + \beta_{5IIIt} MR_{TECHt} + v_{IIIt} \qquad (5c)$$

Where MR_{OTCt}, MR_{LREGt}, MR_{TECHt} are dummies that captures market regulations such as development of the over the counter (OTC) markets, enhancement of legislative and regulatory frameworks and augmentation of technological infrastructure. β_{5It}, β_{5IIt} and β_{5IIIt} are measures of the factor loadings.

It is more beneficial to investors if these betas are strictly greater than zero any values different from this more discourage investors. I, II, III represent the models of market regulations and k represents the each country's inflation rate differential. The estimation technique for all the specified models is the multivariate least square regression. Equity prices, volatilities and cross section of returns estimations require unbiased and consistent estimator as the estimations involved are high frequency observations, a basis for the use of the estimation technique.

Data

The data used for the estimation are monthly returns on selected eighty (80) stocks listed on the Egypt Stock Exchange, Johannesburg Stock Exchange, Nigerian Stock Exchange and Casablanca Stock Exchange. The four equity exchanges are considered based on the level of market development, inclusion of other markets may bias the estimation. Again, the selection of these equity exchanges was in line with the Smith et al (2002). The eighty equities were selected based on price continuity and informativeness that were driven by frequency of trade and capitalization; and to alleviate the potential influence of 'stale price'. Table 3.1 gives description of the data sets used, frequencies and sources, respectively. The exchange rate is defined as average currency price of the US dollar, a positive change stipulates currency depreciation in Africa. This approach is largely similar to what was adopted by kodongo and Ojah (2014). The basic differences are sample size and the use of real against the nominal. The duo considered 10 African Equity Markets at the aggregate level and used the real exchange rate while this paper used selected stocks listed on the 4 largest African Equity Markets and therefore, the nominal exchange rate is more appropriate to present the impact of exchange rate on individual stocks and cross section of equity returns.Changes in inflation rate differential is used as a measure of inflation risk. Inflation rate differential is the difference between inflation rate in one country and the inflation rate in another. The inflation rate differential for each country is included in the models. Most of the foreign investors in Africa equity markets have their funds in US dollars, therefore, the reference country used in this paper is the United States.

Table 3.1: Data Description and Sources

S/No	Data Sets	Source(s)	Frequency
1	Equity Prices, Volumes and Market Capitalization	• Egypt Stock Exchange website; • Nigerian Stock Exchange website; • Johannesburg Stock Exchange website; • Casablanca Stock Exchange website.	Daily Data: January 2010 to December 2015
2.	Exchange Rate, Inflation Rate and Interest Rate (90 days treasury bill rate)	• National statistical and Central Bank websites.	Monthly Data: January to December 2015
3.	Volatility: Systematic	It is computed by the Author. The systematic volatility is obtained as the standard deviation of daily equity prices.	Monthly Data: January to December 2015

Source: Author's Compilation; Website Addresses of Stock Exchanges are: http://www.casablanca-bourse.com/bourseweb/en/Negociation-History.aspx?Cat=24&IdLink=225; http://www.egx.com.eg/english/StocksData.aspx;http://www.nse.com.ng/market-data; https://www.jse.co.za /services/market-data; http://www.usinflationcalculator.com/inflation/current-inflation-rates/

Empirical Results and Analysis

Descriptive Statistics

In Annexure 2, Panel I presents a descriptive statistics of portfolio equity returns and the correlation of risk factors.

The assumption of normality appears to be violated in the distribution of portfolio returns characterized by high and medium systematic volatility while returns ofportfolio characterized by low systematic volatility shows that there is no evidence to reject the normality assumption.

The violation of the normality assumption is not amazing as the presence of non-normal in the distribution of returns suggests that investors are likely to request for more compensation to hold the portfolio and again, this

assumption are frequently violated in asset pricing returns (see Brooks et al., 1992). All the portfolio returns have first-order stationary levels. This is much expected because of the cross section approach used in generating the series. Panel II shows the correlation matrix for the risk factors. The correlation coefficients are low in all cases, the highest being 0.252 between systematic volatility and exchange rate.

More importantly, is that the correlation between systematic volatility and the returns of the market is negative which implies that systematic volatility reduces market returns. The observed low correlations among the risk factors are desired as it portends low cases of collinearity among explanatory factors.

Empirical Results

The true prices of equities and mispricing are presented in cases (see Figure 4.1). Case I and II show stocks that are positively mispriced (under-priced) while some stocks in Case III and all stocks in Case IV are negatively mispriced (over-priced). For positively mispriced equities, the intrinsic value of stock is more than the market value which indicates that adjustments to efficiency price requires increase in price. Therefore, investment strategy requires for these class of stocks is to go long (hold) on it, so as to benefit from price increase during the adjustments. Lafarge Holcim Maroc (LAFARG) led the class of stocks that was positively mispriced with about US$25.07. This implies that the stock should be retained by investors to maximize portfolio returns. This finding was complimented by growth of 10.2% recorded in the stock price between December 2015 and August 2016, and also the projection of financial times,of moderate rise in price of the stock by 2016 and 2017[3]. On the other hand, stocks of MTN Group Limited and TAQA Morocco were negatively mispriced. Investors should either be cautious in holding large volume of these stocks in their portfolio or go short on these stocks to minimize the portfolio risk.

The third model of mispricing assumes that mispricing for individual stocks responds to a common market wide factor such as liquidity and price dynamics (Brennan et al., 2006). In this model of mispricing return in increasing the responsiveness of mispricing to the risk factors, the paper used the market return as a proxy for market liquidity and systematic volatility to proxy price dynamics. Exchange rate risk was included in the model to represent macroeconomic risk. Previous studies have shown that, depending on the persistence of liquidity, the mispricing return bias could account for a significant portion of the return premium that has been found to be associated with liquidity betas (Drew et al., 2004and Brennan et al., 2006). In order to estimate the mispricing in portfolio returns. The three portfolio returns were regressed against the market return, exchange rate risk and systematic volatility (see Table 4.1).

In the result, the estimated high volatility portfolio return is found to negatively relate to market return, exchange rate and systematic volatility. Whilst, only exchange rate risk is found negative in the medium and low volatility portfolio return models. The positive value of systematic volatility risk in the last two models shows that investors should demand more for holding stocks characterized with medium and low volatility and if possible short stocks with high volatility as it reduces portfolio returns. The exchange rate risk that was significantly negative in all the three models indicates that exchange rate dynamics is harmful for the portfolio of investors that are extremely risk averse and neutral. Exchange rate risk threatens operations on the exchanges in Africa, as foreign investors funds tend to be worthless during exchange rate appreciation and investors' portfolio profit declines during the exchange depreciation. Therefore, a stable exchange rate is adorable to attract both domestic and foreign investors on African exchanges.

The mispricing indicators in Panel B are the robustness checks. Three portfolios based 2-month variance ratios from the risk-augmented CAP Model. Consistent with our hypothesis, it is found that the risk augmented portfolio return are significantly high on low volatility portfolio; and when the residual return volatility is included in the models as a factor, the effect of mispricing is more pronounced for the medium and low return volatility. This is consistent with the hypothesis that the variance ratio of residual returns is a good proxy for the first order

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[3]Financial Times forecast a 7% growth in Dividend of Lafarge Holcim Maroc in 2016 and 2017 and a positive market beta value of 1.966 as at September 23, 2016.

autocorrelation of mispricing and that the volatility of residual returns is a proxy for the volatility of mispricing (Kleidon, 1986 and Brennan et al., 2006).

However, the variance ratio results indicate weak evidences of mispricing in portfolios (high, medium and low volatility). Changes in mispricing was also low in all the portfolios as given by the results of the volatility of residual returns which implies that portfolio mispricing pattern may stay longer for stocks regardless of the volatility levels. The findings suggest that attempt to measure the effects on portfolio returns of variables such as systematic volatility and market return which may be good proxies for mispricing should be adopt with caution. Again, it is observe that the mispricing of portfolio returns is a high frequency phenomenon. The findings are in line with previous studies (see Farhi and Panageas, 2004; Brennan et al., 2006; Fassas, 2011 and Tetlock andAlth, 2011).

Figure 4.1: True prices of equities are estimated and depicted in cases. Case I consists of equities with more positive mispricing which suggest that these stocks are highly under-priced and will adjust to the market movement through increase in price. Case II constitutes of equities with lower positive waves of mispricing and require marginal price rise to adjust to the market. Case III stocks less negatively mispriced (over-priced) and will adjust to the market by slight decrease in price. Case IV stocks are characterized with large negative swings. These stocks will exhibit significant decline to adjust to the market.

CASE II:TRUE PRICES OF EQUITIES (IN US$)

MISPRICING OF EQUITIES (IN US$)

CASE III:TRUE PRICES OF EQUITIES (IN US$)

MISPRICING OF EQUITIES (IN US$)
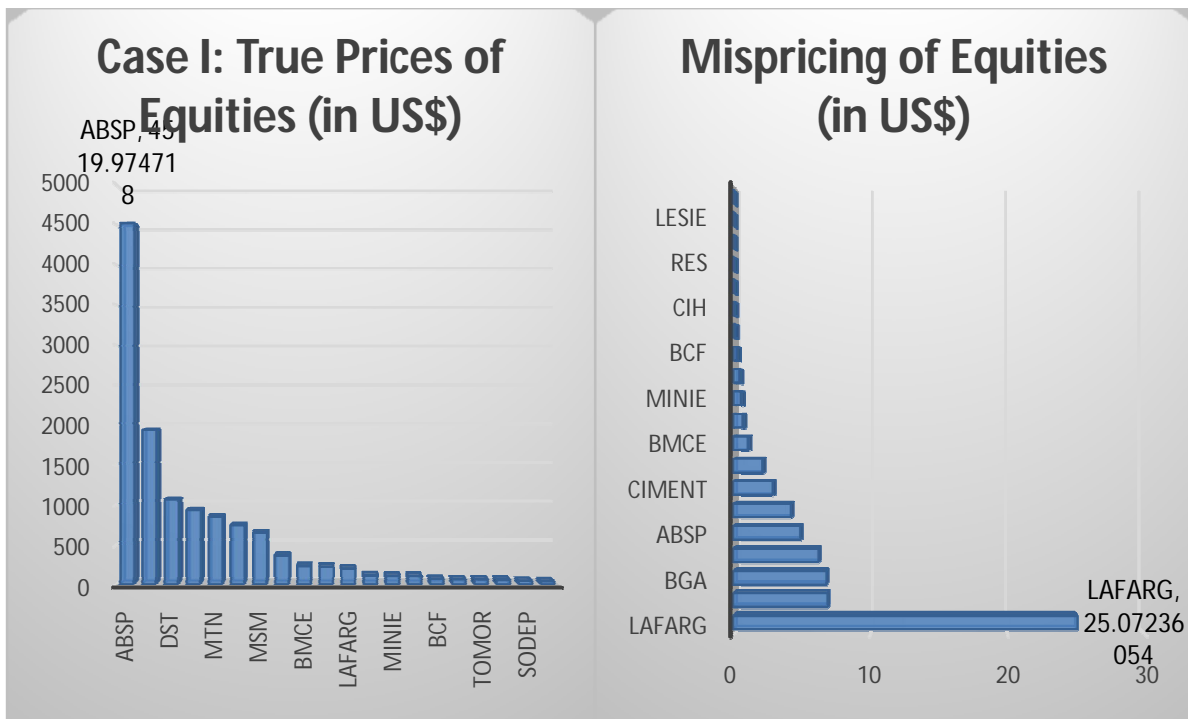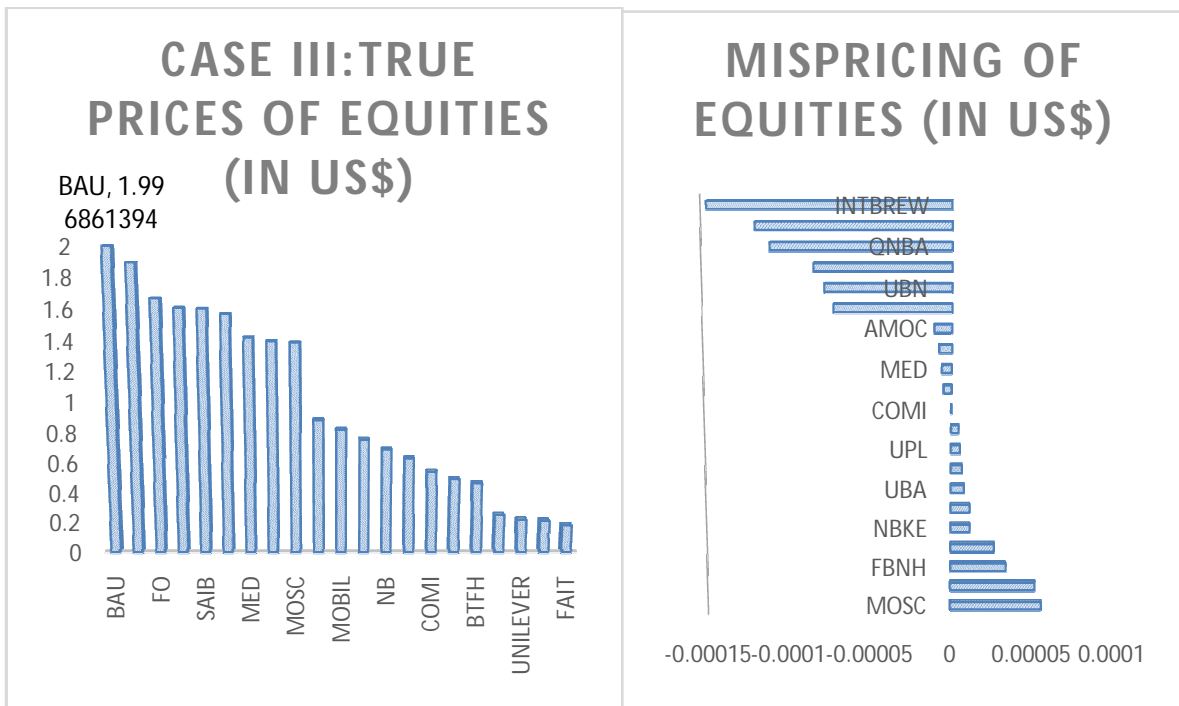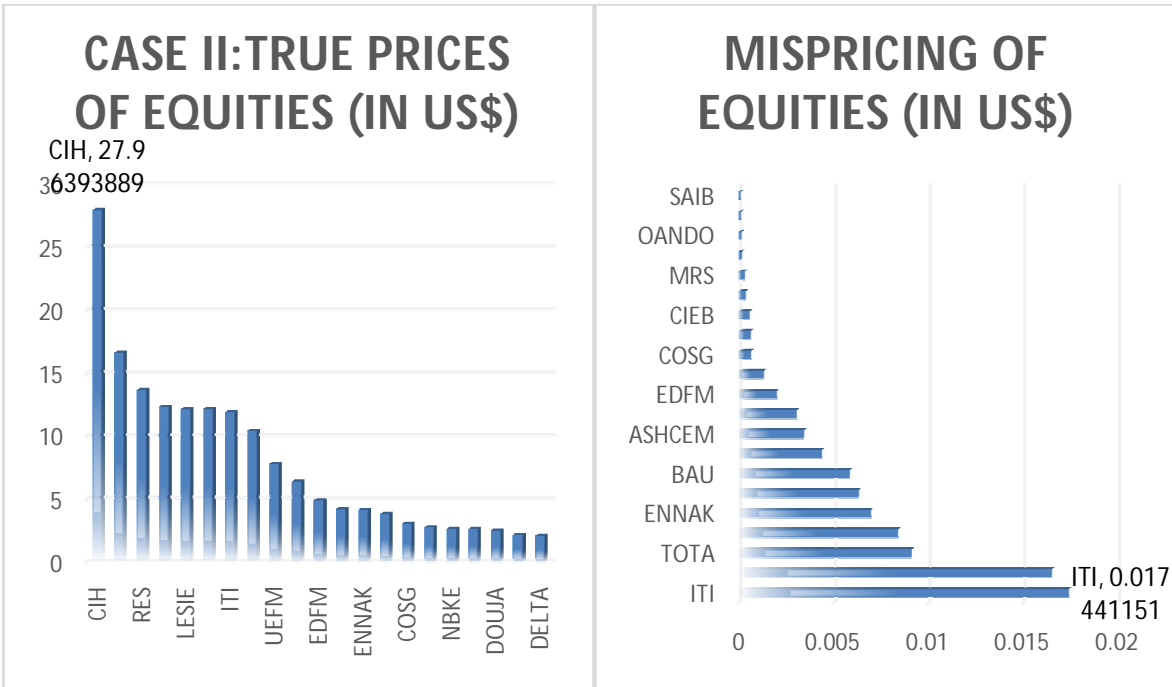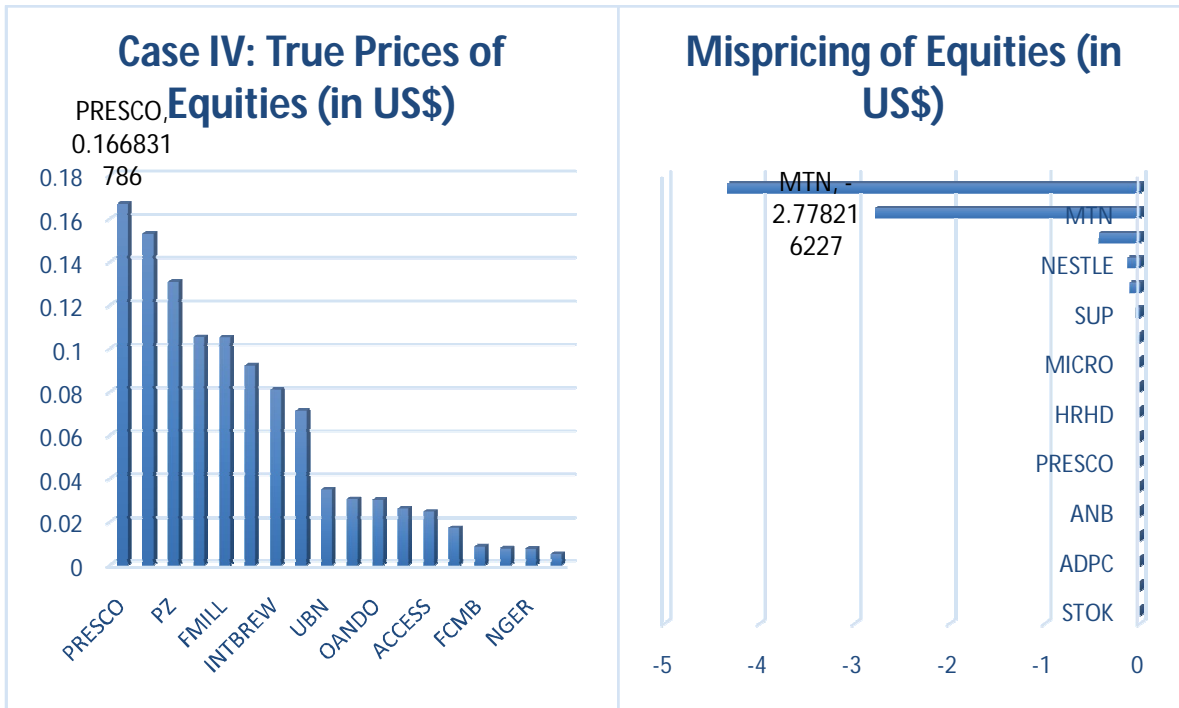
Source: Author's computation and compilation

The coefficients are the time series averages of the coefficients from cross-sectional regressions of equity mispricing return estimates on exchange rate risk and volatility. T-statistics are computed using the standard errors computed from the time series of the coefficients and take account of heteroscedasticity and autocorrelation using a Newey-West adjustment with two lags. The portfolios are sorted based on levels of systematic volatility of equities – high, medium and low levels.

Table 4.1: Robustness Test for Mispricing of Equities						
Panel A: Impact of Risks on Cross Section of Equity Returns						
	Portfolios and Portfolio Returns					
	High Volatility		Medium Volatility		Low Volatility	
	bi	t-stats	bi	t-stats	bi	t-stats
Constant term	-16.381	-1.846	-2.504	-2.389	1.554	0.318
Market Return	-0.094	-0.461	0.147	0.996	0.206	1.828
Exchange Rate	-2.194	2.13	-9.487	3.127	-6.153	-1.085
Systematic Volatility	-9.587	-1.912	2.056	3.374	1.359	3.252
Adj R-Squared	0.475		0.32		0.11	
Panel B: Mispricing Indicators						
VAR(2)	-1.967	-4.118	-0.803	-1.45	1.342	3.069
Vol	0.109	1.542	0.284	4.571	0.131	1.801

Source: Author's computation, underlying data are derived from several sources such as official websites of Exchanges, Reuters, and National Statistical OfficesSource: Author's computation, underlying data are derived from several sources such as official websites of Exchanges, Reuters, and National Statistical Offices.

In this section, the paper further tested for the robustness of the mispricing through pricing of volatility in equities. The four factor model in equation (4) was estimated and the results were reported in Table 4.2. The fourth factor is the difference between returns from high and low systematic volatility sorted portfolios. Therefore, this factor is the return of a zero investment factor that mirrors portfolios sorted with volatility (Drew et al., 2004). Panel A consists of the results of positively mispriced equities. In this panel, the result shows that, the coefficients of the pricing factor increases monotonically for low to high systematic volatility sorted portfolios.

The values are positive and significantly different from zero which implies that portfolios of positively mispriced equities are priced. The intuition behind these results is that, investors will demand for more compensation to hold these stocks in their portfolios. It is crucial to note that, a positively mispriced (under-priced) equities will experience price rise to equate its intrinsic value and investors should go long on all the portfolios. However, the monotonic increase in the coefficients across portfolios suggests that investors should demand for more compensation to hold equities as volatility risk threatens.

Similar results were observed for negatively mispriced equities (see Panel B). This implies that market risk (volatility) in equities are priced regardless of type of equity mispricing. Meanwhile, investors will earn more returns by holding equities with high and medium systematic volatility through 'gains from pricing'. Conversely, equities with low systematic volatility may neutralize portfolio return as the market will not be able to pay the compensation demanded by investors.

Table 4.2 Multifactor Pricing Model Based on Systematic Volatility Sorted Portfolios
Dependent Variable: Returns (Rt)

Panel A: Equities with Positive Mispricing						
	Coefficient			Probability		
	HVR	MVR	LVR	HVR	MVR	LVR
Intercept	-0.0055	-0.0138	-0.0107	0.1442	0.0017	0.0022
Market factor	0.6221	0.7403	0.7003	0.0044	0	0.0018
Exchange Risk factor	-0.4882	-0.1031	0.3303	0.0062	0.4405	0.0036
Volatility factor	0.0709	0.0635	0.0588	0.0144	0.0339	0.0002
High Minus Low factor	**0.5189**	**0.1774**	**-0.2106**	**0.0302**	**0.0411**	**0.0107**
Adjusted R-squared	0.8093	0.8527	0.7044			
BG-LM test				0.1278	0.0016	0.0309
ARCH test				0	0.0129	0.0005
Panel B: Equities with Negative Mispricing						
Intercept	0.0774	-0.0219	-0.0344	0.0288	0.0004	0.0219
Market factor	0.8137	0.5294	0.5466	0.0036	0	0.0002
Exchange Risk factor	0.3042	0.2348	0.3587	0.0014	0.0026	0.0099
Volatility factor	0.2807	0.1811	0.0773	0.0071	0.0004	0.0001
High Minus Low factor	**0.9445**	**0.5172**	**-0.0966**	**0.0044**	**0.0011**	**0.0009**
Adjusted R-squared	0.8185	0.7992	0.7033			
BG-LM test				0.1442	0.0321	0.1798
ARCH test				0.0012	0.0006	0.0042

Source: Author's computation, underlying output contains several regression results. The pricing estimations follow the method of Drew et al (2004). Stocks are categorized into positive and negative mispricing and each of the category are sorted into three portfolios (high, medium and low) based on systematic volatility. B-G LM stands for Breusch Godfrey serial correlation LM test prob. value; ARCH is the Autoregressive Conditional Heteroskedasticity test prob. value.

Impact of Market Regulations on Cross Section of Equity Returns

The empirical results for the estimates of the market regulation models is presented in Table 4.3. As explained earlier, each country had its inflation rate risk incorporated separately into the market regulation models. Results are also presented separately for each of the different specifications in Panels – Panel A, Panel B and Panel C. Inferences are based on the t-statistic of the estimators. In Panel A, outputs for the parameters specified in equation 4a are presented. These parameters convey information on the relative importance of each factor in influencing the expected returns of equities in Africa's equity markets. Most of the parameter estimates for risk factors yield interesting results. The alpha equity returns varies between 0.38% and 0.75% per month, which is actually reasonable for Africa's equity markets. The alpha is a reasonable estimate of the observed risk-free rates of returns and it indicates that investors can make excess return on investment made in Africa despite the risks.

The parameters are significant at varying levels and these findings support one of the criteria of Lewellen, Nagel and Shanken. (2010). The time varying of the market beta was significant at varying levels across portfolios. The parameter positively impress the returns of all portfoliosirrespective of their volatility patterns. Meanwhile, the impact level varies across classes of portfolios over the sample period. The factor appears to vary less to market movement as all the coefficients are less than unity. Portfolio equity with medium systematic volatility tends to have the highest coefficient, this is followed by portfolios with high and then low systematic volatilities. The intuition behind these findings is that the excess returns on investment is expected to underperform the market by 48.3% (high portfolio), 44.2% (medium portfolio) and 50.1% (low portfolio) in bullish period and outperform by the same magnitudes when the market is bearish. The positive results for medium and low market risks contradict the findings of Mustapha (2015) which considered only Nigeria.

The systematic risk of equities positively influencecross section of returns of both high and medium portfolios, however, the cross section returns portfolio with low volatility stocks are negatively affected. The positive influence suggests that portfolios of equities sorted with high and medium systematic volatilities give more returns to investors when OTC trading are more developed than portfolio sorted with low systematic volatility. More importantly, the positive relationship is supported by monotonic reduction in risk augmented beta of the volatility risk from high to low equity portfolios. The findings are consistent with traditional finance theory, which states that under-diversified high risk portfolios are expected to generate higher returns than low risk portfolios. It also buttress the empirical work f Goyal and Santa Clara (2003), Lundblad (2007) and Mustapha (2015). Meanwhile, it contrast with those of Blitz and Vliet (2007) which indicate that low volatility sorted portfolios outperform high volatility ones.

All the macroeconomic risks incorporated in the model influence cross section of equity returns inversely with varying levels of significance. The development of the over-the-counter market trading positively impress expected returns of equities as given by the parameter estimates, and also the positive impact was not influence by the scaling processes. The beta market regulation (MROTC-development of the OTC market) for the portfolio sorted by medium systematic volatility tends to highest value, 111.6% while high and low sorted portfolios have 80.1% and 40.6%, respectively. The results suggest important implications. First, foreign investors interested in diversifying their portfolios in the better performing African Equity Markets should do so by participating in the OTC market.

This should be done with the understanding that they can maximize returns on their portfolios regardless of the nature of volatility in stocks. Second, a risk averse investors that desire to reduce the portfolio risk should trade more of listed equities with low systematic volatility in the OTC markets as it portends to carry less impact on returns. A risk loving investors should trade more of the equities with high systematic volatility to maximize portfolio returns, while a risk neutral investors should mixed portfolio with equities characterized with the three classes of volatility. It is pertinent to note that while trading on the OTC market to maximize returns on equity investment, investors are expose to additional risks as the market is less transparent with less stringent regulations.

Table 4.3 Impact of Market Regulations on Cross section of Returns										
	Raw Return		Risk Augmented CAP Model							
			Risk Exposure							
	Mean	Std. Dev	β mkt	β MR	β Vol	β EXR	βInf_{Mor}	βInf_{Egyp}	βInf_{SA}	βInf_{Nig}
Panel A: Impact of Market Regulation with focus on the development of the OTC market										
High Volatility Portfolio	4.0874*	1.1306	0.517***	0.801***	0.053*	-1.669**	-0.004*	-0.176*	-0.071**	-0.262
	3.615		2.049	1.943	4.338	-2.097	-3.504	-3.228	-2.782	-1.352
Medium Volatility Portfolio	4.0684***	2.1491	0.558***	1.116**	0.025	-3.018*	-0.018*	-0.294	-0.044***	-0.38*
	1.893		2.237	2.075	0.218	-4.122	-4.212	-1.655	-1.902	-3.218
Low Volatility Portfolio	3.0104	2.5107	0.499*	0.406**	-0.013***	-1.997**	-0.206*	-0.617*	-0.057**	-0.741*
	1.199		4.452	2.718	1.842	-1.809	-5.882	-6.9	-2.003	-3.309
Panel B: Market Regulation with focus on the enhancement of Legislative and Regulatory Infrastructure										
High Volatility Portfolio	4.0874*	1.1306	0.525***	0.201**	0.049*	-1.648**	-0.011**	-0.108*	-0.083**	-0.284
	3.615		2.952	2.127	3.825	-2.181	-2.809	-3.059	-2.755	-1.401
Medium Volatility Portfolio	4.0684***	2.1491	0.553***	0.153	0.028	-3.014*	-0.029**	-0.442***	0.049**	-0.446**
	1.893		2.052	1.874	1.712	-3.302	-2.404	-1.807	-2.011	-3.017
Low Volatility Portfolio	3.0104	2.5107	0.516*	0.089**	-0.016	-2.015	-0.178*	-0.632*	-0.052**	-0.624*
	1.199		3.974	2.314	1.563	-1.794	-3.066	-5.355	-2.14	-3.835
Panel C: Market Regulation with focus on the augmentation of Technological Infrastructure										
High Volatility Portfolio	4.0874*	1.1306	0.516***	0.447*	0.051**	-1.501**	-0.015**	-0.113*	-0.085**	-0.256
	3.615		2.505	4.118	3.094	-2.117	-2.011	-3.725	-2.659	-1.459
Medium Volatility Portfolio	4.0684***	2.1491	0.568	0.787*	0.022**	-3.152**	-0.024**	-0.302	-0.047**	-0.402**
	1.893		1.657	3.882	2.055	-4.47	-2.411	-1.614	-2.028	-3.114
Low Volatility Portfolio	3.0104	2.5107	0.523***	0.229**	-0.014*	-2.004**	-0.191*	-0.618*	-0.049**	-0.688**
	1.199		3.002	1.906	1.882	-1.902	-3.839	-5.987	-2.987	-3.147

Source: Several Regression Estimates. The table reports Least Square estimates parameters, the high and medium volatility portfolios consist of 27 equities listed on the four Exchanges sampled, while low volatility portfolio has 26 stocks. The t-statistics reported are robust to heteroscedasticity and autocorrelation. The exchange rate used here is the computed average rate denominated in . *,** and *** indicate level of significance at 1%, 5% and 10%, respectively. The alpha coefficients are $\alpha_{High} = 0.75*$, $\alpha_{Med} = 0.38**$ and $\alpha_{Low} = 0.41*$

Panel B shows the results of the model that tested for the impact of market regulation on enhancement of legislative and regulatory infrastructure on cross section of equity returns. Positive relationships was documented between regulation on improve legislative and regulatory infrastructure and portfolio of equity returns heedlessly of its volatility. The positive relationships compliment enforcement of having legislative and regulatory infrastructure that of international standard in Africa's Equity Markets.The positive relationships buttressed the propositions of Murphy (2015) in his article who regulates whom and how? He researched the United States market regulatory policy for banking and securities markets. In our result, the impact increase monotonically from equity portfolio sorted by low systematic volatility to high systematic volatility, which indicates that high systematic volatility sorted portfolio benefited more from building international standard legislative and regulatory infrastructure in Africa's stock markets. Other portfolios (sorted by medium and low volatilities) also benefitted grossly from this development, however with less impact compare to the portfolio characterized by high systematic volatility[4]. Macroeconomic and volatility risks factor loadings have similar effects with the results in Panel A and therefore, interpretations are ignored to avoid repetition.

Results on amplification of technological infrastructure are presented in Panel C. Parameter estimates of this form of regulations remain significant, even after scaling for systematic volatility. The results show that increasing technological infrastructure to support trading activities on African equity exchange will increase investors' portfolio returns irrespective of the inherent volatility in equity prices. Portfolio characterized with medium systematic volatility yielded more returns about 78.7%, 44.7% for high systematic volatility and 22.9% for low systematic volatility sorted portfolios. Introducing advance technology to trading and trading platforms started as a revolution in Nigeria in 2000 and Morocco in 2001 which was later upgraded in 2008 to perform multiple functionalities, increased speed and foster transparency.

In summary, equity regulations in the Europe and United States emphasis on investors protection, fair and orderly markets, and price transparency and discovery (Boskovic, Cerruti and Noel, 2009). The empirical results had shown the importance of regulations to African equity exchanges, especially in the realm of enhancing liquidity and earning more portfolio returns regardless of the price volatility. Except the countries studied - Johannesburg Equity Exchange (JEE), Nigerian Equity Exchange (NEE), Egypt Equity Exchange (EEE) and Casablanca Equity Exchange (EEE) that have embraced these regulations and improving on it, other African exchanges, have unsophisticated OTC markets, weak regulatory and legislative infrastructure and poor technological infrastructure. These results have been able exhume the importance of these regulations and have further present it as medium of hedging investors exposure against several risk sources, especially macroeconomic and systematic volatility risks. In this regard, African Equity Markets regulatory authorities should intensify efforts to initiate and implement such rules so as to enhance competition, protect investors and maintain fair, orderly and more efficient markets.

Conclusion: Highlights and Policy Recommendations

Highlights

The paper has successfully shown that when equity market prices differ from fundamental prices because of stochastic pricing errors, a mispricing in both prices and portfolio returns emerged in African equities, regardless of the types of inherent risk in prices. In the first objective, the study adopted the first-order autoregressive and risk-augmented Capital Asset Pricing Models to estimate the 'true-prices' of, mispricing and pricing of selected equities while in addressing the second objective the risk-augmented CAPM induced by market regulation factors was used. To estimate the 'true-prices', the paper assumes that the log of relative mispricing follows an AR(1) process that is uncorrelated with fundamentals. Also, econometric literature have found the AR(1) process portends to be more robust in estimating equity prices compare to higher orders (Engel, 1982 and Engel and Patton, 2001).

The systematic mispricing model (risk-augmented CAPM) assumes that mispricing for individual stock responds to a common market-wide factor such as liquidity (capitalization) and volatility. Having estimated all these models to address the research objectives the following results emerged:

o   It was shown that, African equities exhibit mispricing and the mispricing depends on the persistence of liquidity (i.e. capitalization) in relation to the aggregate market and volatility types. For medium and low volatility sorted portfolios higher persistence in these variables resulted in more portfolio return bias.

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[4]See Table 4.3 for the coefficients and respective t-statistics.

Meanwhile, the high volatility sorted portfolio return is negatively mispriced with increased importunity of liquidity and volatility. In order to earn more portfolio returns, investors should hold more of high and medium volatility stocks in their portfolios as returns tend to increase as market gets more liquid and volatile to close the return bias. However, they should consider from medium to low volatility stocks in the case of a persistence illiquidity in the market.

o   Volatility is priced in the three sorted portfolios regardless of inherent risks in equity prices and types of mispricing. High and medium volatility sorted portfolios are positively priced indicating gains from risk pricing while the low volatility sorted portfolio is negatively priced. This suggests that investors that intend to earn more from volatile stocks should go 'long' on stocks with rising volatility and 'short' stocks with price discontinuity.

o   Market regulations embarked upon by the African exchanges are to protect investors' interest as our results show the successful implementation of these regulations translate to more returns for investors irrespective of the inherent risks in equity prices. A risk loving investor should invest more in equity especially on stocks that are highly volatile. Risk averse investor can create a portfolio with less volatile stocks however, with the intension of not benefitting from volatility as market liquidity strengthens.

Policy Recommendations

From the forgoing, the paper recommends that: first, it is more profitable for investors to increase their stakes in African equity markets now than ever. But in doing so, they should consider the benefits and cons from mispricing and volatility. Portfolios with high volatility is more profitable to hold than others. Second, our findings show that mispricing in stocks is a reoccurring decimal that never vanish. This shows that investors should embark more on trading their portfolio stocks oftentimes and disengage the attitude of 'buy' and 'hold' strategy as this is not currently healthy for their portfolios. Third, it was observed that the mispricing in portfolio return is primarily a 'high frequency' phenomenon, heedless of the volatility types. Technical analysts that desire to model portfolio return mispricing should do so with high frequency data.

Finally, as it has been established in this paper that previous regulations have helped African exchanges significantly in the past[5]. Therefore, market regulators should embark on regulations that will strengthen liquidity and enhance frequent trading of stocks on their platform. Such regulations may include encouraging 24/7 trading – use of mobile trading; intensify over-the-counter activities and ensure a more consistent and goal focusing market legislation.

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[5] In 2014, values of shares traded rose significantly for the four exchanges (South Africa, Egypt, Nigeria and Morocco) considered in the study.

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Annexures

Annexure 1: Africa Equity Markets' Activeness and Growth						
Africa						
		2011	**2012**	**2013**	**2014**	**2015**
IPO	Number	17	13	22	25	28
	Value ($'Mn)	1101	401	891	1701	1991
FO	Number	66	52	51	76	91
	Value ($'Mn)	4475	5455	5102	9478	10712
The Big Four AEMs						
South Africa JSE/JEE						
IPO	Number	5	5	4	9	12
	Value ($'Mn)	790	258	261	742	658
FO	Number	30	37	35	52	70
	Value ($'Mn)	2992	4828	4458	8156	9579
Nigeria NSE/NEE						
IPO	Number	0	0	1	1	1
	Value ($'Mn)	0	0	190	538	23
FO	Number	0	2	2	2	4
	Value ($'Mn)	0	224	424	359	512
Egypt ESE/EEE						
IPO	Number	0	0	0	1	4
	Value ($'Mn)	0	0	0	109	752
FO	Number	7	1	1	1	3
	Value ($'Mn)	346	3	88	522	199
Morocco CSE/CEE						
IPO	Number	3	1	1	1	1
	Value ($'Mn)	50	3	122	127	74
FO	Number	4	0	1	1	1
	Value	555	0	47	71	25
Growth: Annual GDP Growth Rates in Percent (%)						
World		3.13	2.48	2.4	2.63	2.47
SSA		4.3	3.65	4.74	4.63	2.98
South Africa		3.21	2.22	2.21	1.55	1.28
Egypt		1.82	2.19	2.11	2.23	4.2
Nigeria		4.89	4.28	5.39	6.31	2.65
Morocco		5.25	3.01	4.73	2.42	4.4

Source: Dealogic and World Bank Databank

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Annexure 2: Summary Statistics for Cross Section of Equity Returns and Risk Factors							
	Mean	Std. Dev	Skewness	Kurtosis	J-Bera	Stationarity Tests	
						t-test	I(d)
Panel I: Cross Section of Equity Returns							
HVR	4.454	6.191	-3.148	21.433	1138.37*	-9.644	I(1)
MVR	3.718	4.402	0.323	1.277	10.153*	-12.336	I(1)
LVR	2.685	3.553	-0.531	2.953	3.394	-9.874	I(1)
Panel II: Correlation of Risk Factors							
	MR	EXR	Svol				
MR	1	0.194	-0.291			-11.957	I(1)
EXR		1	0.252			-12.764	I(1)
Svol			1			-6.378	I(1)

Source: Author's computation. "Std. Dev" stands for standard deviation, HVR, MVR, LVR represent, respectively, portfolio return of high volatility stocks, portfolio return of medium volatility stocks and portfolio return of low volatility stocks. MR, EXR and Svol are market return, computed monthly average exchange rate risk and systematic volatility. All returns are in percent and they range from 2010:1 to 2015:12. The augmented Dickey-Fuller test statistic was reported for the hypothesis of a unit root. Critical values of the ADF statistic are -3.165, -3.475 and -4.094 at 10%, 5% and 1% levels, respectively.