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Investment Intensity Risk, Investor Irrationality and Stock Returns in Kenya

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ABSTRACT: The purpose of this paper is to investigate the effect of investor irrationality on the relationship between investment intensity risk and stock returns in Kenya.The study utilized monthly time series data for 60 companies listed at the NSE over the recent 9 years from 2011-2019. The study employed time series regression using Auto-Regressive Distributed Lag (ARDL) cointegration approach and Error Correction (ECM) estimation techniques to examine whether the effect of investment intensity risk on stock returns will vary with level of investor irrationality. Consistent with theory, investment intensity variable had more positive loadings on small firms with conservative investment policy, implying they have high exposure to investment risk and tend to yield higher returns. The study did not find evidence to support investment intensity risk in Kenya. The Investor irrationality variable is however a significant source of systematic risk and can enhance the predictive power of asset pricing models. The interaction term between investor irrationality and investment intensity was insignificant suggesting lack of moderating effect.The shorter nine year period considered by the study could be a source of small sample bias in the estimation. Sample periods for studies in mature markets span for over decades. In this light, making comparison of the findings in this thesis with those of other related studies may not be feasible. This study is first of its kind to analyze the moderating effect of investor behavior on asset pricing for an emerging market. The paper contributes to portfolio management and asset pricing literature for an emerging market.Practical implication of the findings in this study is that investments at NSE will yield high returns in a bullish market and that portfolio managers can strategically build up their portfolios to allocate more funds in small firms following conservative investment policy to earn higher risk-adjusted returns.

KEY WORDS: Investment Intensity, Investor Irrationality, Stock Returns.

1. INTRODUCTION

In recent years, numerous empirical studies have advanced an argument that investment intensity may represent sensitivities to some risk factors in asset pricing models. A section of asset pricing literature attributes much variation in expected stock returns to investment growth factor (Aharoni, Grundy & Zeng, 2013, Njogo *et al*., 2008). Other studies conclude that adding investment factor to equilibrium models considerably worsens the Gibbons, Ross and Shanken (GRS) statistic suggesting that investment factor does not add predictive value to asset pricing (Chan, Chen & Lakonishok, 2008; Cooper *et al.,* 2008). Titman and Xie (2004) found that financing choices for US firms that are associated with increase in capital investments results in negative stock returns. Consequently, another set of asset pricing studies have emerged, which focus on the link between investor irrationality and asset returns (Bathia and Bredin, 2012; Dalika & Seetharam, 2015). These prior studies have focused their analysis in developed markets but the evidence for tiny emerging markets such as Kenya is limited. In this regard, further investigation on the link between investment and stock returns is necessary so as to offer solution to the conflicting results in prior literature.

Investment factor, commonly referred to as investment intensity anomaly (Yao, Yu, Zhang & Chen, 2017) is the persistent pattern in stock returns where corporate events associated with asset expansion (contraction) tend to be followed by periods of abnormally low (high) returns. According to the fundamental valuation theory, a higher expected growth in book equity (investment intensity) would imply a low expected return, holding book value of equity, current stock price and expected future earnings constant. Cooper *et al*., (2008) finding show that firms with low asset growth rate outperform those with high asset growth rate. These findings have elicited new interest among researchers to seek explanation for why asset growth effect on stock returns occurs. Constantinou, Karali and Papanastasopoulos (2017) argued that investment effect is due to either the risk that investors take on when they invest in a firm or to mispricing by investors during the investment-making process. Other premia held constant, an increase in the cost of capital is likely to result in low level of investment because high cost of capital is associated

with low accessibility to funding sources. A decrease in the cost of capital, on the other hand, tends to stimulate investment. It is therefore reasonable to conjecture an inverse relationship between a firm's expected return (cost of capital) and its level of investment.

2. INVESTOR IRRATIONALITY

Advancing their argument on investor irrationality, Baker and Wurgler (2007) held the view that investors are not fully rational and that stock prices may be affected by other factors apart from fundamentals. Schmeling & Shiller (2009) opined that investors have tendency to extrapolate previous experience into the future and thus make investment decisions based on their beliefs. When investors are pessimistic about stocks characterized by series of earnings lower than expected, they tend to avoid them and as a result, such stocks will command higher expected returns. Optimistic beliefs, on the other hand, drive investors to underestimate risk leading to low expected return. Thus, investor irrationality may induce systematic risk which could impact the formation of stock prices and overall trading decisions (Lee & Swaminathan, 2002). Bathia and Bredin (2012) showed that investor irrationality helps to explain risk-adjusted returns of individual stocks at the New York Stock Exchange (NYSE). Tran and Nguyen (2013) observed inverse relationship between investor behavoiour and stock returns in the Norwegian and Vietnamese stock markets in contrast with Chuang, Ouyang and Lo (2010) who observed a positive relationship. Regionally, In Africa, Dalika and Seetharam (2015) observed strong inverse relationship between investor sentiment and stock returns in South Africa on smaller, high volatility, growth and young stocks. This study sought to bridge research gap in asset pricing literature by analyzing the effect of investor irrationality on the relationship between investment intensity risk and stock returns in Kenya.

3. CONCEPTUAL FRAMEWORK

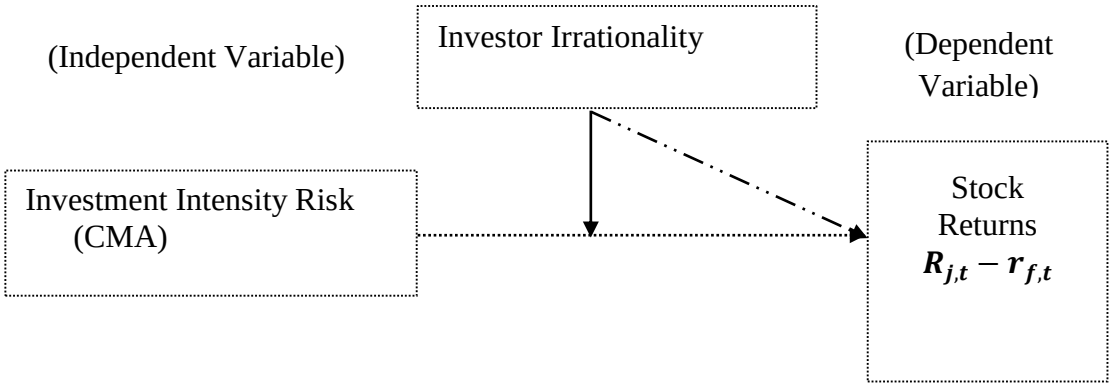

Figure 1

The network of associations in Figure 1 shows that investment intensity risk would predict returns because high cost of capital implies low net present values of new capital and low investment while and low cost of capital signifies high net present values of new capital and hence high investment. Tobin (1969) advanced the Tobin's Q theory as an alternative proposition for relating the market value of a stock and firm investment. Under this theory, Q is the ratio of the market value of an asset to cost of producing that asset. If this proposition holds, then the level of investment will be inversely related to cost of capital since a decrease in the cost funding tends to stimulate investment. Behaviourists argue that all investors do not hold similar belief about the fundamental price of a stock because of inherent behavioural biases. This could trigger shifts in demand induced by irrational speculations. It can then be reckoned that that investor optimism (or pessimism) may induce mispricings in the stock market thereby drive prices well above or below that warranted by the fundamental value. Thus, it is reasonable to assume that investor irrationality would influence the effect of investment intensity risk on stock returns.

To test the investment intensity effect, it was hypothesized that:

$H_0 1$: Investment intensity risk does not explain stock returns of firms listed at the NSE

$H_0 2$: The effect of investment intensity risk on stock returns is independent of investor irrationality at the NSE.

4. EMPIRICAL LITERATURE

The firm investment-return relationship has been investigated under different perspectives. Cooper, Gulen and Schill (2008) studied investment effect by using change in total assets as a measure for a firm's growth. Utilizing the US panel data, the study found that firms with low investment growth earn superior annualized risk-adjusted average returns (9.1% higher). The study further found evidence of asset growth effect in all firm sizes and that total asset growth dominates other determinants in the

predictive abilities of cross-sectional returns. A related study by Nyberg and Poyry (2010) show that investment effect is significant and strong explanatory factor for momentum returns in the US market.

Kilsgard and Wittorf (2011) examined the model that incorporates factors based on investment and profitability in addition to the market premium. The investment premium was constructed by computing excess returns on portfolio of firms with high investments over those with low investment. The authors argue that the investment variable has similar role as the Fama and French value premium in the sense that firms with low B/M equity have more growth opportunities, invest more and consequently earn lower expected returns than their high B/M counterparts. The investment premium was computed as the annual change in property, plant, and equipment (PPE) added to the annual change in inventories and divided by the lagged book value of total assets (TA). A total of 369 non-financial UK firms were studied from 2002-2011. Regression analysis was done using the monthly excess returns from 27 portfolios as the dependent variables. The study established that portfolios containing companies with either low or high investment ratio underestimates the returns at 5% level of significance.

Chen (2017) studied the relationship between investment and expected returns using non-financial firms listed on the Shanghai Stock Exchange over the period 1997-2015. The sample included firms with data for at least three years to reduce survivorship bias. Investment intensity was used to capture the cross-sectional average returns defined as simple year-to-year percentage change in total assets. The study established that investment factor is positive and significant implying that growth firms have more exposure to investment risk than their value counterparts. The study findings also indicated that portfolios with low investment level tend to have higher equity returns in the next one to three years and vice versa. It was also established that investment and expected returns exhibit a negative relationship after controlling for size and B/M ratio.

Bathia and Bredin (2012) examined whether incorporating conditioning information can help to capture the predictive ability of firm size, value, liqidity and momentum in explaining risk-adjusted returns of individual stocks at the New York Stock Exchange (NYSE). The study incorporated different investor sentiment measures in different asset pricing models to determine if it enhances the performance of these models. Results showed that investor sentiment augmented asset pricing models often contribute to capturing the predictive power of firm fundamental attributes. A similar study was undertaken in the Norwegian and Vietnamese markets from 1991 to 2013. Using ADR index and Consumer Confidence Index as additional components of the sentiment index, Tran and Nguyen (2013) concluded that the effect of investor reaction on stock returns is more pronounced in small, volatile, value and stocks that do not pay dividends. The results further revealed a negative association between sentiment and stock returns particularly for firms with negative returns in Norway and firms with volatile returns in Vietnam. These results are somewhat consistent with Baker and Wurgler (2007) in which study the sentiment effect was found to be more profound in stocks that are not easy to value and arbitrage. Dalika and Seetharam (2015) observed strong impact of investor sentiment equity shares in the South African market between 1999 and 2009. During low sentiment periods, subsequent returns were relatively high especially among low market cap, highly volatile, growth and start-up firms. These patterns, however, were seen to reverse when sentiment is high. The study was premised on the assumptions that mispricing is caused by both an uninformed demand shock and a limit to arbitrage.

5. RESEARCH GAPS

Whereas traditional finance theory assumes that investors are rational, the current study considers that asset pricing in emerging markets is more likely to be influenced either category of investors. Previous studies have often neglected the role of investor irrationality in explaining risk-adjusted returns (Lind & Sparre, 2016). To the best of the researcher's knowledge, this type of analysis has not yet been conducted using Kenyan data. Thus, the current study adds a new dimension in asset pricing studies by investigating if investor irrationality would moderate the effect of investment intensity risk on stock returns at the Kenyan equity market.

Prior studies estimate model parameters in time-series regression using ordinary least square (OLS) techniques. However Engle & Granger (1987) as cited in Narayan (2005) provide evidence against the employment of standard OLS techniques with findings that beta estimations are biased downwards for securities that trade less frequently and upwards for those traded more frequently. A significant contribution of this article therefore is the use of robust estimation method in analysis of variables. The Auto-Regressive Distributed Lag (ARDL) model was applied to analyze long-run relationship since variables were integrated of different order i.e. a mixture of *I*(0) and *I*(1) series. Further, the results of bounds test showed presence of co-integration and hence it became necessary to estimate the Error Correction Model (ECM) to infer short-run coefficients as well as long-run causal relationship among the variables (Engle & Granger, 1987).

6.0 DATA AND METHODOLOGY

The study population comprised all firms listed at the NSE but the final sample frame comprised 60 firms that met specification of selection criteria commonly used in asset pricing literature. The study utilized data from annual corporate reports, reports and publications of the central bank of Kenya, the Capital Markets Authority, the NSE annual investor handbook and daily equity price lists. The analysis period from January 2011 to December 2019 was dictated by availability of data on variables. At the end of December each year, stocks were distributed into two size groups and also independently allocated to two groups of value, asset growth and operating profitability using median breakpoints. The intersection of the independent 2x2 sorting yielded 12 porfolios which formed the dependent variables. The portfolios were ascribed initials relative to their location in the portfolio sorting matrix. For example, a portfolio at the intersection of small size and conservative investment (RSC), big size and conservative investment (RBC) and so on. Overall, small-aggressive firms had the highest average investment at 31.53% with a minimum rate of 4.53% and a maximum rate of 247.40%. Small conservative firms had the least average growth rate of -5.60% implying that firms in this portfolio mostly undertook corporate action to reduce their assets on annual basis over the sample period.

6.1 Descriptive Statistiscs and Diagnostic Tests

Table 6.1. Correlation Analysis (Pearson Corr. Coef)

	MKT	SMB	HML	RMW	INVI	IIRA
MKT	1.0000					
SMB	-0.2318**	1.0000				
HML	0.0037	-0.1206	1.0000			
RMW	0.0627	0.1697	0.2446**	1.0000		
INVI	-0.0942	-0.0431	0.0196	-0.2453**	1.0000	
IIRA	0.6582**	-0.0377	-0.0402	-0.0013	-0.0991	1.0000

**** Significant at 5% level**

Table 6.1 displays pairwise correlations of investment intensity risk, the main variable of interest and control variables. The table shows generally low and insignificant negative correlation between investment factor and other control variables, except INVI and HML which was positive (r = -0.0196, p>0.05). There was however significant but less than average correlation between INVI and RMW (r = -0.2453, p<0.05). The table further shows that market risk premium (MKT) and investor irrationality (IIRA) are positively correlated (r = 0.6582) implying that investor irrationality variable and market factor have a positive co-movement and that variation in investor irrationality may have an impact on estimation of market beta at the NSE.

6.2 Stationarity and Cointegration

This study utilized the ADF unit root test to examine the stationarity of the variables at 5% level of significance. Results of unit root test are shown in Table 6.2a and 6.2b.

Table 6.2a: Unit Root Test for Predictor Variables

Series	Augmented Dickey Fuller t-Stat	MacKinnon Crit. (5%)	p-Value
MKT	-9.5690	-2.8887	0.0000
SMB	-9.5690	-2.8895	0.0126
HML	-3.4143	-2.8895	0.0126
RMW	-11.2252	-2.8887	0.0000
INVI	-11.0085	-2.8887	0.0000
IIRA	-5.0304	-2.8889	0.0000
INVI*IIRA	-5.4939	-2.8887	0.0000

Table 6.2b: Unit Root Test for Dependent Variables

EX-RET	ADF Fisher Chi-Square t-Stat	MacKinnon Crit. (5%)	p-Value
Port. 1	-8.5160	-2.8887	0.0000
2	-4.0849	-2.8892	0.0016
3	-5.5349	-2.8889	0.0000
4	**-9.4924***	**-2.8898**	**0.0000**
5	-4.1382	-2.8892	0.0013

6	**-11.1917***	**-2.8898**	**0.0000**
7	-10.3239	-2.8887	0.0000
8	-5.4335	-2.8889	0.0000
9	-5.3925	-2.8889	0.0000
10	-11.7273	-2.8887	0.0000
11	-5.6378	-2.8889	0.0000
12	-4.4265	-2.8892	0.0005

***denotes variable stationary at 1st difference

From the results in Table 6.2(a), the null hypothesis of unit root is not supported for all variables and interacting terms at level. Further, results in Table 6.2(b) show that excess return on portfolio 4 (t = -9.4924, *p*-value = 0.0000) and portfolio 6 (t = -11.1917, *p*-value = 0.0000) were stationary at first difference on the ADF test. Narayan (2005) recommends performance of bounds test of co-integration in circumstances where variables display a combination of *I*(0) and *I*(1) series.

6.3 Cointegration

Table 6.3 F-Bounds Co-integration Test

Series	Test Stat.	Sig.	Lower Bound	Upper Bound *I*(1)	Null Hyp.
Port 1-12	F stat > *I*(1)	5%	2.45	3.61	Reject

Results in Table 6.3 show that all regressions on the twelve portfolios have F-statistic greater than the upper critical bounds value. It was concluded that there is co-integration. Consequently, we estimated both the ARDL and ECM model respectively for long-run and short-run relationship among the variables

6.4 Lag Length Selection

The need to select optimal number of lags for each model used in time series analysis is premised on the assumption that regressands will tend to respond to regressor variables with a lapse of time (Pesaran, Shin & Smith 2001). Adding lagged terms can eliminate the influence of uncontrollable factors thereby increasing the credibility of the regression results. Including too many lagged values in a model can however consume degrees of freedom and might introduce the likelihood of multicollinearity. In this study, optimal lag length was one (1) according to AIC, SIC and HQ criteria.

6.5 Residual Diagnostics

Multicollinearity assumption was assessed using the Variance Inflation Factor (VIF). All variables yielded VIF less than 10 suggesting absence of multicollinearity as recommendated in Field (2009). The null hypothesis of homoscedastic data was supported in all regressions on test portfolios using Breusch-Pagan Godfrey test and White's General Heteroscedasticity test at 5% level of significance. Autocorrelation assumption was tested using Breusch-Godfrey (BG) Lagrange Multiplier test since the models contain non-stochastic lagged values of the regressand (Gujarati, 2003). The BG LM test supported the null hypothesis of no serial correlation implying that the models were properly specified and that the OLS standard errors and statistics were reliable and consistent. Normality of residuals was tested using histogram and normal probability Q-Q plots following recommendations by (Nguyen, Ulku & Zhang, 2015). The plots of statandardized residuals against standardized predicted values were randomly and evenly dispersed throughout the plots which suggested normal residuals.

7.0 RESULTS

7.1 Investment Intensity Risk and Stock Returns

Table 7.1 reports the estimate of results of the time-series regression for main effects model conducted to establish whether investment intensity risk predicts the monthly equity returns at the NSE. The dependent variable in this regression was average monthly stock return on 12 equity portfolios for the nine year period (2011–2019). The Table illustrates the estimated intercepts and factor loadings.

Table 7.2: Error Correction Representation of the Selected ARDL Model (1,0,0,0,0,0)

Dependent Variable: Δ (AVRET)

Model Equation:

$$\Delta \mathrm{AVRET}_t = \alpha_0 + \sum \delta_i \Delta \mathrm{AVRET}_{t-i} + \sum \beta_i \Delta(\mathrm{MKT})_{t-i} + \sum s_i \Delta(\mathrm{SIZE})_{t-i} + \sum h_i \Delta(\mathrm{VALUE})_{t-i} + \sum r_i \Delta(\mathrm{OPROF})_{t-i} + \sum c_i \Delta(\mathrm{INVI})_{t-i} + \lambda \mathrm{ECT}_{t-1} + e_t \quad (4.6)$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.000134	0.001769	0.075714	0.9398
ΔAVRET(-1)	-0.913561	0.045520	-20.06961	0.0000
ΔMKT	0.797632	0.039679	20.10203	0.0000
ΔSIZE	0.203533	0.044970	4.525938	0.0000
ΔVALUE	0.017117	0.056114	0.305038	0.7610
ΔOPROF	-0.136768	0.036769	-3.719659	0.0003
ΔINVI	-0.044893	0.052693	-0.851982	0.3963
CointEq(-1)	-0.913561	0.031297	-29.18965	0.0000

R-squared	0.889355	Mean dependent var	-0.000242
Adjusted R-squared	0.889355	S.D. dependent var	0.052286
S.E. of regression	0.017392	Akaike info criterion	-5.256291
Sum squared resid	0.032064	Schwarz criterion	-5.231311
Log likelihood	282.2115	Hannan-Quinn criter.	-5.246164
Durbin-Watson stat	1.854543		

Results show that investment intensity effect on average stock returns is negative but insignificant at 5% level (*b* = -0.0449, *p-value* = 0.3963). This implies that holding other factors constant, a unit increase in investment intensity risk would lower return required by investors at the NSE by 0.0449 units though insignificantly. Thus, the null hypothesis of no significant effect of investment intensity risk on stock returns could not be rejected and thereby concluded that investment intensity risk is not a significant predictor of average stock returns in Kenya, holding constant other factors in the model. This implies that investors do not consider the company's total asset variation as an important factor for making investment decisions at the NSE. The results in the current study are somewhat consistent with conclusions by Cooper, Gulen and Schill (2008) that US firms with low asset growth earn superior annualized risk-adjusted average returns. Although Chen (2017) indicated that firm investment and expected returns tend to exhibit a negative relationship after controlling for size and B/M ratio, the relationship is however somewhat different when the FF5F model is considered. It should however be noted that the difference in the conclusions could be attributed to different measurement for INVI variable and methodology adopted by researchers for the analysis.

7.2 Investor Irrationality, Investment Intensity Risk and Stock Returns

Table 7.2 shows summary results of the ARDL time-series regression performed to establish if investor irrationality would influence the relationship between investment intensity risk and excess stock returns at the NSE. It was conceptualized that the influence could either be direct or through interaction, controlling for other risk factors in the model. The coefficients of the interaction model-2 were estimated by running the following ARDL error correction model equation:

$$\Delta(AVRET)_t = \alpha_0 + \delta_i \Delta(AVRET)_{t-i} + \beta_i \Delta(MKT)_{t-i} + s_i \Delta(INVI)_{t-i} + \xi_i \Delta(IIRA)_{t-i} + \gamma_i \Delta(INVI * IIRA)_{t-i} + CONTROLS_{t-i} + \varphi ECT_{t-1} + e_{4t}$$

The investor irrationality effect was established by assessing the change in adjusted R^2 and significance of the IIRA variable and its interaction with INVI in the interaction model. Table 7.2 further illustrates the estimated intercepts, the error correction term, factor loadings and their corresponding t-statistics and *p*-values.

Table 7.2: ARDL Error Correction Regression-Interaction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.0025	0.0015	1.6745	0.0972
AVRET(-1)	-0.9784	0.0387	-25.2995	0.0000
MKT	0.4601	0.0639	7.2018	0.0000
INVI	-0.0239	0.0436	-0.5483	0.5847
IIRA	0.0480	0.0073	6.5692	0.0000
INVI*IIRA	0.2346	0.1221	1.9207	0.0577
CointEq(-1)*	-0.9784	0.0268	-36.5068	0.0000

R-squared	0.9263	Mean dependent var	-0.0002
Adjusted R-squared	0.9263	S.D. dependent var	0.0523
S.E. of regression	0.0142	Akaike info criterion	-5.6629
Sum squared resid	0.0214	Schwarz criterion	-5.638
Log likelihood	303.9668	Hannan-Quinn criter.	-5.6528
Durbin-Watson stat	1.9287		

Results show that INVI is not statistically significant in explaining stock returns (s_i =-0.0239, *p*-value = 0.5847). The coefficient of IIRA variable is however positive and significant in explaining average stock returns (ξ_{i} =0.0480, *p*-value = 0.0000). This is interpreted to mean that sentiment has a strong influence on stock returns at the NSE. The coefficient of the interaction term is positive though not significant (γ = 0.2346, *p*-value = 0.0577). The results demonstrate that the effect of INVI on stock returns does not depend on the the level of investor irrationality at the Kenyan equity market. On the flipside, the effect of investor irrationality on stock returns does not depend on the INVI risk, meaning that the two variables ($\mathrm{INVI\ and\ IIRA}$) are independent and that investor irrationality does not moderate the effect of INVI risk premia on stock returns at the NSE.

7.4 Model Fit

The test results in lower panel of Table 7.2 show statistics for model performance of the interaction model involving investor irrationality and investment intensity risk. The intercept is indistinguishable from zero implying that the model completely captures the cross-section of returns efficiently. When IIRA and INVI*IIRA terms were introduced in the model, the adjusted R-square moved from 0.8894 to 0.9263 implying that the added variables are efficient. Thus INVI explains 92.63% of variations in stock returns in a model that incorporates IIRA and interaction term (INVI*IIRA). The ECT term is negative (-0.9784) and significant (*p*-value = 0.0000) in the error correction regression. The negative coefficient on ECT implies that there is evidence of long-run convergence/reversion to equilibrium and thus a long-run causal relationship can be inferred.

6 CONCLUSION

This study sought to establish whether investment intensity risk explains stock returns at the NSE. From the results of ARDL error correction regression, it was concluded investment intensity risk does not have significant pricing effect on stocks at the NSE, holding constant the effect of size, value and profitability factors. The study also found weak evidence for moderating effect of investor irrationality in the relationship between investment intensity risk and stock returns at the NSE. It therefore implies that investors do not necessarily consider a company's total asset variation as an important factor to consider when making decision on investment at the NSE. Thus, changes in value of assets either through acquisition or disposal does not communicate relevant information to investors regarding the risk position of listed firms at the NSE. The study however found significant direct effect of investor irrationality on stock returns in Kenya. This implies that the spread between bullish and bearish market condition is a significant proxy for systematic risk which should be augmented in asset pricing models for investment decisions.

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