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Moderating Effect of Illiquidity on The Relationship Between Momentum and Equity Returns in The Kenyan Capital Markets

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Abstract

This paper sought to examine the moderating effect of illiquidity on the relationship between momentum and equity returns in the Kenyan capital markets. Previous studies have shown that illiquidity has a time-varying effect on momentum strategies, but little is known whether illiquidity has a moderating effect on the relationship between momentum and equity returns in Kenyan capital markets. A longitudinal research design was used for this study to examine the causal inference. Data comprised of monthly transactions on the 20 equities used in the formulation of the NSE 20 share index over the period between Jan 2009 and up to March 2018 which formed 111 data points. ADF and PP results showed that Returns and momentum are stationary at levels while illiquidity was stationary at first difference. The error correction term was negative and statistically significant with or without the moderator. Results indicate that without a moderator percentage increase in momentum is linked to a 0.0000313% increase in returns in the short run. The study further shows that the effect of momentum on equity returns is moderated by illiquidity using a t-test. R2 changed from 0.427 to 0.4337 indicating a change of 0.006 at 0.05% significant level suggesting that illiquidity moderates the relationship between momentum and equity returns in the Kenyan capital markets.

Keywords: Illiquidity, Momentum, Equity Returns

Introduction

Globally capital markets play an important role in promoting economic activity worldwide by facilitating and diversifying firms' access to finance, (Association of Chartered Certified Accountants, 2012). In the period between 2009-2014, capital markets have experienced a period of unprecedented change primarily due to a wide-ranging post-crisis regulatory regime and a challenging macro-economic environment (Wyman, 2014).

Illiquidity refers to the inability to transact large quantities of assets and or securities due to a shortage of interested buyers, (Dalgaard, 2009). Illiquidity can also be defined as the degree of friction in a given exchange market, where there is a measurable extent of the cost of exchange, agents' price distortion, and movements (Amihud, Mendelson & Pedersen, 2005). Momentum on the other hand refers to the tendency of assets with good or bad recent performance to continue overperforming or underperforming in the near future, (Vayanos and Woodley 2013).

Momentum is the tendency of assets with good or bad recent performance to continue overperforming or underperforming in the near future, (Vayanos and Woodley 2013). Moskowitz, *et. al*, (2013), define momentum as the tendency of investments, in every market and asset class, to exhibit persistence in their relative performance for some time. One of the reasons for momentum is that higher returns are compensation for some unique risk associated with investments that have recently outperformed, (Moskowitz, *et. al* 2013). The second reason is the existence of momentum seems to challenge the efficient market hypothesis that past price behavior provides no information about future behavior. In other words, momentum is associated with some inefficiency in markets, perhaps due to investor behavior (Moskowitz, *et. al* 2013).

The empirical literature has provided evidence of returns attributed to momentum in international markets, (Fama and French, 2012; Choi, 2014; Muhairi, 2011; Norieka and Barauskas, 2010; Nguyen and Fraulo, 2010; Gutierrez *et.al*, 2004; Konokonglu, 2010; Nørregård, 2008; Gaunt and Schinider, 2012) except Japan (Fama and French, 2012). Choi, (2014) asserts that alternative strategies constructed by the physical momentum achieve expected better returns and reward–risk measures than those of the traditional contrarian strategy on a weekly scale. Winners on the other hand continue to outperform losers, with performance persistence continuing for periods of three to twelve months which indicates the occurrence of momentum in the short-run (Muhairi, 2011) and strongest around the 6–12-month mark (Gaunt and Schinider, 2012). Gutierrez *et.al*, 2004 posits that momentum profits increase as the lagged market return increases and at high levels of lagged market returns, the profits diminish but are not eliminated. In conclusion, Gutierrez *et.al* (2004) argue that momentum strategies depend critically on the state of the market and that momentum profits are reversed in the long run.

Capital markets play a vital role in Africa's future. The continent's financial markets have remained resilient and innovative amid slowing worldwide growth after the synchronized upturn of 2017. However, they remain fragmented and shallow compared to their equivalents in Latin America and Asia (Adesina, 2018). Kenyan equities were ranked the fourth-best performer as a group in 2013, according to the global indices of the US-based index provider *Morgan Stanley Capital International (MSCI)*. The MSCI Kenya Index increased 43.58% on the year, fourth-best among country indexes, after Bulgaria (91.55%), United Arab Emirates (UAE) (79.02%), and Argentina (68.97%). The performance declined in 2014, to 23.38%; 2015 (-18.34%); 2016(1.11%), increased in 2017 to 35.97% and a decline again in 2018 (-12.51%) and in 2019 the performance was 48.73% (MSCI Kenya Index, 2020) indicating a mixed performance of the equity market. Kenya's Market Capitalization accounted for 26.1 % of its Nominal GDP in Dec 2019, compared with a percentage of 23.6 % in the previous year. (CEIC, 2020) This is a dismal performance noting that a Stock market capitalization of about 50 percent of GDP and more is an indication of a well-developed stock market. Previous years also present performance below50%, for instance in 2009(29.1%), 2010(36.8%), 2011(23.4%), 2012(29.8%), 2013(40%), 2014(42.6%), 2015(32.6), 2016(27.5%) and 2017(30.8%) (World Bank, 2020).

According to the Capital Market Authority Kenya (CMA) 2018, in the quarter to June 2018, average quarterly equity market liquidity stood at 2.17 percent, compared to 1.83 percent registered in the quarter to March 2018, indicating a 0.34% decrease in turnover ratio in the equities market mainly attributable to a 22.91 decrease in turnover between Q1/2018 and Q2/2018, this shows how Kenya like other emerging market economies is characterized by a capital market with low liquidity levels averaging between seven percent and nine percent per annum between 2016 and 2018, this is also evident during the period 1993 to 2019 where the average period was 4.95% which is way below the global average of 26.20% (World Bank, 2020).

Empirical evidence has shown that the profitability of the momentum trading strategy strongly varies with the state of market illiquidity, consistent with behavioural models of investors' expectations. (Avramov *et.al*,2013; Aziz and Ansari, 2014; Orlov, 2016; Butt and Virk, 2017) it therefore would be interesting to further clarify whether illiquidity has a moderating effect on the relationship between momentum and equity returns in the Kenyan capital market.

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1. Hypothesis

The following hypothesis was tested

H_a, *illiquidity has no moderating effect on the relationship between momentum and equity returns.*

1.1. Review of Literature

One of the important characteristics of an efficient market is the ease with which financial assets can be traded (Lo and Khandani, 2009). Liquidity is related to the ease of trading security, several extensions of the neoclassical framework have been proposed to account for trading activity since the standard frictionless asset-pricing models cannot address the issue directly, (Lo and Khandani, 2009). For example, the seller of a hard-to-trade asset may incur an inventory cost that arises because a buyer may not be present at the time a seller needs to cash out, and the seller may be forced to enter into a transaction with a designated market maker. The market maker will charge the seller a fee by giving the seller an amount less than the fair price of the security to take on the risk of holding that security until a buyer is found, (Lo and Khandani, 2009).

According to Reilly and Brown, (2013) Illiquidity is a risk factor in determining returns. Risk factors are all the factors that contribute to a given degree to the returns of the stock, their effect is beta specific. The main risk factors in determining stock returns are business risk, financial risk (leverage), liquidity (Illiquidity) risk, exchange rate risk, and country (political risk). Amihud, Mendelson and Pederson, (2005) contends that liquidity as a concept is complex, and argues various sources of illiquidity; one of the sources of illiquidity is exogenous cost such as brokerage fees, order-processing costs, or transaction taxes. Every time security is traded, the buyer and/or seller incur a transaction cost; in addition, the buyer anticipates further costs upon a future sale, and so on, throughout the life of the security. Amihud, Mendelson and Pederson, (2005) further posits another source of illiquidity as demand pressure and inventory risk. Demand pressure arises because not all agents are present in the market at all times, which means that if an agent needs to sell a security quickly, then the natural buyers may not be immediately available. As a result, the seller may sell to a market maker who buys in anticipation of being able to later lay off the position. The market maker, being exposed to the risk of price changes while he holds the asset in inventory, must be compensated for this risk – a compensation that imposes a cost on the seller (Amihud, Mendelson, and Pederson, 2005).

Another source of illiquidity according to Amihud, Mendelson, and Pederson, (2005) is the difficulty of locating a counterparty who is willing to trade particular security, or a large quantity of a given security. Further, once a counterparty is located, the agents must negotiate the price in a less than

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perfectly competitive environment since alternative trading partners are not immediately available. This search friction is particularly relevant in over-the-counter (OTC) markets in which there is no central marketplace. Amihud, Mendelson and Pederson, (2005) conclude that trading security may be costly because the traders on the other side may have private information for example, the buyer of stock may worry that a potential seller has private information that the company is losing money, and the seller may be afraid that the buyer has private information that the company is about to take off. Then, trading with an informed counterparty will end up in a loss. Costs of illiquidity should affect securities prices if investors require compensation for bearing them and also liquidity varies over time, risk-averse investors may require compensation for being exposed to illiquidity and as such investors need to know them while designing their investment strategies and if liquidity costs and risks affect the required return by investors, they affect corporations' cost of capital and, hence, the allocation of the economy's real resources, (Amihud, Mendelson, and Pederson, 2005).

Various authors (Glosten and Milgrom (1985), Easley and O'Hara (1987), and Easley, Hvidkjaer, and O'Hara (2002), Amihud, Mendelson, and Pedersen (2005)) have developed the view of transaction cost causing illiquidity, moreover, the literature on the impact of illiquidity on asset prices seems to divide into two distinct perspectives; one approach posited by (Amihud and Mendelson (1986), Eleswarapu and Reinganum (1993), Eleswarapu (1997), and Aragon (2004)) argued that liquidity as just another deterministic characteristic of security such as a transaction cost, and because economic agents' preferences are based on an asset's net return, net of transaction costs, assets with higher costs must offer a higher gross expected return, ceteris paribus. Alternatively, Chacko (2005), argued that if trading costs exist but are not time-varying, the buyer or seller of security can incorporate these costs into his decision-making process, and such costs should have no first-order effects on asset prices in equilibrium, in line with this reasoning, Vayanos (1998) and Vayanos and Vila (1999) argued that illiquidity-related costs can only be a second-order determinant of asset prices since bid-offer spreads are so small relative to typical equilibrium risk premia. Further models by Pastor and Stambaugh (2003) and Acharya and Pedersen (2005) examined the systematic nature of illiquidity risk and posited that illiquidity should not matter in equilibrium because agents would simply reduce the impact of such costs by adjusting their portfolios less frequently. In conclusion, Hasbrouck (2005), noted that the extent to which agents do this is unclear since observed levels of trading volume are much higher than those predicted by standard equilibrium asset-pricing models. But if trading costs are time-varying and unknown in advance, then their impact on equilibrium

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asset prices can be more substantial because of the additional risks they impose on investors if such risks were not diversifiable or readily insurable.

Empirically, various authors find a significant positive effect of bid-ask spreads in explaining cross-sectional stock returns. However, there is limited literature on the moderating effect of illiquidity on the relationship between momentum and equity returns in the Kenyan Capital Market.

Momentum is one of the most debated yet the most popular factor influencing equity market returns, (Srivastava *et. al,*2019) Momentum as defined by Berger et.al (2009) is the tendency of investments, in every market and asset class, to exhibit persistence in their relative performance for some time. When applied to stock picking, momentum is about relative performance among stocks, and not about overall trends in the market. It works whether a market is in an upswing or downswing. Momentum can be used to identify securities likely to outperform, making it a powerful investment tool. It is also negatively correlated to value investing, making it an effective diversification component. Regardless of investment philosophy, virtually all investors can expect improved risk-adjusted returns by including momentum (Berger et.al 2009).

According to (Gosalia and Lefebvre, 2013) momentum is the rate of acceleration of a security's price or volume. The idea of momentum in securities is that their price is more likely to keep moving in the same direction than to change directions. In technical analysis, momentum is considered an oscillator and is used to help identify trend lines. Once a momentum trader sees acceleration in a stock's price, earnings or revenues, the trader will often take a long or short position in the stock in the hope that its momentum will continue in either an upward or downward direction. This strategy relies on short-term movements in a stock's price rather than fundamental value, and it is not recommended for novices. The existence of momentum leads to the momentum effect.

Jegadeesh and Titman (1993) presented evidence of momentum patterns in stock prices, which create an opportunity for investors to earn significant profits by buying past (winner stocks) that have performed relatively well (high returns) over the past three to twelve months and selling past (loser stocks) that have performed relatively poorly (low returns) over the past three to twelve months.

If stock prices either overreact or underreact to information, then profitable trading strategies that select stocks based on their past returns will exist. DeBondt and Thaler (1985) documented that past losers over three- to five-year periods outperform past winners over the subsequent three to five years. Jegadeesh (1990) and Lehmann (1990) found that losers over the past one week to one month outperform winners over the next one week to one month. These studies of very long-term and very short-term returns find

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profitable contrarian strategies and generally led to the conclusion that stock prices overreact to information. (Jagadeesh and Titman, 2011).

In international Markets, Chan, Hameed, and Tong (2000) found the momentum effect existed in the national stock market indices of 23 countries for the period 1980 to 1995. Nine are from the Asia-Pacific, eleven are from Europe, and two are from North America (Canada and the U.S.), where the difference between the returns of winner and loser portfolios is at least 0.25 percent per week. Bhojraj and Swaminathan (2001) further confirmed the qualitative results by Chan, Hameed, and Tong (2000) for their total sample of 38 countries over the period 1975 to 1999 result, where strong momentum is evident up to three quarters after the portfolio formation date, with winners outperforming losers significantly by 1.40% to 2.33% per quarter over the next 3 quarters. Bacmann, Dubois, and Isakov (2001) documented the profitability of momentum strategies in member countries of the G-7 i.e., USA, Canada, Japan, the UK, France, Germany, and Italy. While Griffin, Susan, and Martin (2003) find that momentum profits for Asia are decidedly weaker than those around the world, particularly for Europe. Momentum strategies exhibit a unique pattern of seasonality in January. Many of the well-known strategies such as long-horizon and short-horizon return reversals, the size effect, and the book-to-market effect are significantly stronger in January than in any other calendar month. In contrast, Jagadeesh and Titman found that the momentum strategy earns negative returns in January, but earns significantly positive returns in every calendar month outside of January.

A potential source of momentum profits is cross-sectional dispersion in expected returns. Intuitively, since realized returns contain a component related to expected returns, securities that experience relatively high returns in one period can be expected to have higher than average returns in the following period. Momentum strategies can also benefit from a positive serial correlation in factor returns. With a positive serial correlation, large factor realizations in one period will be followed by higher-than-average factor realizations in the next period. The momentum strategy will tilt towards high beta stocks following periods of large factor realizations, and hence it will benefit from the higher expected future factor realizations (Jegadeesh and Titman 2011).

Momentum profits can also potentially arise if stock prices react to common factors with some delay. Intuitively, if stock prices react with a delay to common information, investors will be able to anticipate future price movements based on current factor realizations and devise profitable trading strategies. Jegadeesh and Titman (1995) showed that in some situations such delayed reactions will result in profitable contrarian strategies, but in other situations, it will result in profitable momentum strategies. Momentum strategy with individual stocks is more profitable when the ranking period and

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holding period are not contiguous than when they are contiguous. When the holding period and the ranking period are contiguous, the profits to the momentum strategy are attenuated by the negative serial correlation in returns induced by the bid-ask spreads, and by the short-horizon return reversals. In contrast, industry momentum profits entirely disappear for the six-month ranking period when the ranking period and the holding period are not contiguous. The industry momentum seems to benefit from the positive first-order serial correlation in portfolio returns while the individual stock momentum is reduced by short-horizon return reversals (Jagadeesh and Titman, 2011).

1.2. Empirical literature

Avramov *et.al* (2013) studied time-varying momentum payoffs and illiquidity using data spanning from 1926 to 2011 for all common stocks listed on NYSE, AMEX, and NASDAQ obtained from the Centre for Research in Security Prices (CRSP). They found out that the profitability of the momentum trading strategy strongly varies with the state of market illiquidity, consistent with behavioural models of investor's expectations. Periods of high market illiquidity are often followed by low, and often massively negative, momentum payoffs. The predictive power of market illiquidity uniformly exceeds that of competing for state variables, including market states, market volatility, and investor sentiment, and is robust in both in- and out-of-sample experiments as well as among large-cap firms. Market illiquidity also captures the cross-sectional dispersion in momentum payoffs implemented among high versus low volatility stocks. Focusing on the most recent decade, while momentum profitability is non-existent unconditionally, it regains significance in periods of low market illiquidity, and market illiquidity similarly affects the profitability of the earnings momentum trading strategy.

Chen (2016) studied the semi-varying momentum payoffs and illiquidity. The researcher obtains raw data from Thomson DataStream of all stocks listed on the FTSE All-Share index. The sample spans the period 1990-2013. The author extracts datatype including daily market value (share price multiplied by the number of ordinary shares in issue); return index (a theoretical growth in value of a share-holding over a specified period); and unadjusted closing price. At the end of each month, the total number of shares outstanding, the return index, and the market value of each stock are obtained. Stocks are kept if they existed for at least three years before the year start. Chen (2016) found that periods of high market illiquidity are followed by low momentum profits, and very often negative returns. In the presence of aggregate illiquidity, the power of the competing state variables (for example, the down-market condition) disappears. The study also captures significant momentum crashes and the increase of liquidity risks during the financial crisis and concludes illiquidity shocks predict both momentum and value investment returns.

Aziz and Ansari (2014) studied momentum and illiquidity premium in the Indian stock market, using data from the Centre for monitoring the Indian Economy (CMIE). The sample consisted of daily and monthly data for S&P BSE500 stocks over the period April 2000 to March 2012. They found out that price momentum strategy could be enhanced by conditioning on past illiquidity. Illiquid winners outperform liquid winners by an average of 2.7% per month. Compared with momentum, the illiquidity effect is more pronounced. Further evidence presented a significant illiquidity premium in India for the period 2000-2012. A momentum strategy that buys previous six-month winners and sells losers earns substantial returns for the next six months. They conclude that exploring the alternate liquidity proxies and momentum strategy may shed light on the dynamic interaction between illiquidity and momentum.

Orlov (2016) empirically examined the effect of equity market illiquidity on the excess returns of currency momentum and carry trade strategies. The sample consists of end-of-month observations of spot exchange rates, one-month forward exchange rates, and corresponding bid-ask spreads for the period from January 1976 to January 2014. Results show that equity market illiquidity explains the evolution of currency momentum strategy payoffs, but not carry trade. Returns on currency momentum are low following months of high equity market illiquidity. However, in the recent decade, illiquidity positively predicts the associated payoffs. The findings withstand various robustness checks and are economically significant, approximating in value to one-third of average monthly profits.

Butt and Virk (2017) studied momentum profits and time-varying illiquidity effect, the collected data from daily and monthly files for all common stocks with share code 10 or 11 listed on NYSE, AMEX, and NASDAQ or the period of July 1963- December 2012. Their show that the contemporaneous effect of systematic illiquidity dominates the opposite prediction of lagged systematic illiquidity and retains its significance even if variables capturing the time-varying exposures of momentum returns to market risk are included in the analysis.

From the preceding studies on momentum and illiquidity, these studies conclude that illiquidity has a time-varying effect on momentum strategies, however, none of the study has looked at the moderating effect of illiquidity on momentum, and therefore this study seeks to fill this gap.

2. Methodology

Longitudinal research design was used for this study to examine the causal inference that can be made in certain cases by analyzing data collected over set time span which offers researchers the opportunity to gauge trends. Purposively, the study used monthly transactions on the 20 equities used in the formulation of the NSE 20 share index over the period between Jan 2009 and up to March 2018, which formed 111 data points. The stocks in the index were used because they represent a particular portion of the broader market and an index is imaginary portfolio of securities, furthermore they actively trade daily in the exchange, therefore, giving a true picture of the market. The period of 9 years and 3 months was selected and would capture milestones that affect the capital market, including the financial crisis of 2008, change of governance over this period, and the financial recession in 2009-2011.

This study adopted Amihud (2002) illiquidity model to measure illiquidity, which uses the average ratio of daily absolute stock return to its Shillings trading volume. This absolute price change against trading volume can be interpreted as the price impact flow.

$$ILLIQ_i = Monthly\ Average\ Daily\ Returns\left[\frac{Absolute\ value(Stock\ return)}{Shillings\ Volume}\right]$$

Momentum indicator the relative strength indicator (RSI) was used, developed by Welles Wilder (1978) It is a momentum indicator, or oscillator, that measures the relative internal strength of a stock or market against itself, instead of comparing one asset with another, or a stock with a market. The formula for the RSI is as follows:

$$RSI = 100 - \frac{[100]}{1 + RS} \dots\dots\dots\dots\dots 3.9$$

where RS = the average of x days' up closes divided by the average of x days down closes

2.1. Model specification

The following model was used

$$R_{i,t} = \gamma_t + \gamma_t \widehat{\beta_{P,t-1}} + \gamma_t Size_{i,t-1} + \gamma_t B/M_{i,t-1} + \gamma_t ILLIQ_{i,t-1} + \gamma_t MOMENT_{i,t-1} + \gamma_t ILLIQ.MOMENT_{i,t-1} + \varepsilon_{i,t}\ .$$

Where: -

$R_{i,t}$: denotes the excess return of stock i of month$t$.

$\widehat{\beta_{P,t-1}}$: denotes stock beta, which is the same for all stocks in the portfolio P using the data for the previous 12 months.

$Size_{i,t-1}$: is the log of market value of equity for month $t-1$.

$B/M_{i,t-1}$: is the book value over market value for month $t-1$.

$ILLIQ_{i,t-1}$: is the measure of illiquidity of the stock i of month$t-1$. Amihud Ratio was used for this measure.

$MOMENT_{i,t-1}$: is the measure of momentum of the stock i of month $t-1$ Relative Strength Index was used as a measure for momentum.

$\varepsilon_{i,t}$: is the error term where $\varepsilon_t \sim IId(0, \sigma_\varepsilon^2)$

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$\gamma_t ILLIQ.MOMENT_{i,t-1}$ is the Moderator Variable.

3. Results and Discussion

We present results first without the moderator and later after including the moderator to measure the change in R^2 to confirm the presence of moderation. The unit root test results are shown in table 4.1

Table 4.1 Unit Root Test Results Without Moderator

Variables	Augmented Dickey-Fuller (ADF) Test		Phillips Perron (PP)Test	
	At levels			
	Intercept	Intercept & Trend	Intercept	Intercept & Trend
	t-Statistic	t-Statistic	t-Statistic	t-Statistic
RETURNS	-4.7999** (0.0001)	-4.7768** (0.0009)	-8.1793** (0.0000)	-8.2914** (0.0000)
BETA	-1.5218 (0.5190)	-2.1997 (0.4847)	-1.564 (0.4975)	-2.2792 0.4413
SIZE	-0.8134 (0.8107)	-2.1307 (0.5221)	-2.0771 (0.2543)	-2.6242 (0.2707)
PRICE_BOOK	-1.6597 (0.4488)	-1.6527 (0.7654)	-1.6987 (0.4291)	-1.6918 (0.7485)
ILLIQ	-2.6921* (0.0787)	-2.971 0.1453	-8.4297** (0.0000)	-8.9247** (0.0000)
MOMEN	-5.5404** (0.0000)	-5.5241** 0.0001	-6.9163** (0.0000)	-7.0439** (0.0000)
	At first difference			
ΔBETA	-10.3554** (0.0000)	-10.3305** (0.0000)	-10.3554** (0.0000)	-10.3305** (0.0000)
ΔSIZE	-5.6554** (0.0000)	-5.4347** (0.0001)	-10.3988** (0.0000)	-10.3739** (0.0000)
ΔPRICE_BOOK	-10.3572** (0.0000)	-10.3096** (0.0000)	-10.3572** (0.0000)	-10.3096** (0.0000)
ΔILLIQ	-14.6094** (0.0000)	-14.5361** (0.0000)	-31.5872** (0.0001)	-31.3414** (0.0001)
ΔMOMEN	-8.1658** (0.0000)	-8.0981** (0.0000)	-21.304** (0.0000)	-21.1394** (0.0000)

Notes: - The Null hypothesis is that the series has a unit root. For ADF and PP the Probability based on MacKinnon (1996) one-sided p-values. Lag Length based on AIC. (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. The parenthesized values represent the probability while Δ denotes the first difference

Results in Table indicate based on the ADF and PP that not all the variables are stationary at levels, interestingly RETURNS and MOMEN are stationary at levels in both ADF and PP where their p-values at order zero are less than 0.05. Using the PP test the variable ILLIQ is stationary at *I(0)* leading

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to the rejection of the null hypothesis. For the other variables we accept the null hypothesis δ = 0, these variables have to be differenced that is integrated of order one *I(1)*to achieve stationarity. At the first difference, all the variables in both ADF and PP test have p values less than 0.05 confirming that they are stationary and therefore rejecting the null hypothesis (δ = 0) that there is a unit root in the variables.

To test whether there is a co-integration relationship between the variables, the Johansen cointegration test was used. Table 4.2 shows the results

Table 4.2 Johansen Cointegration test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.435847	187.0324	125.6154	0.0000
At most 1 *	0.419553	124.6376	95.75366	0.0001
At most 2	0.246221	65.34642	69.81889	0.1080
At most 3	0.162159	34.53693	47.85613	0.4727
At most 4	0.094233	15.25190	29.79707	0.7635
At most 5	0.030858	4.463782	15.49471	0.8628
At most 6	0.009562	1.047222	3.841466	0.3061

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.435847	62.39476	46.23142	0.0005
At most 1 *	0.419553	59.29122	40.07757	0.0001
At most 2	0.246221	30.80949	33.87687	0.1113
At most 3	0.162159	19.28503	27.58434	0.3928
At most 4	0.094233	10.78811	21.13162	0.6684
At most 5	0.030858	3.416560	14.26460	0.9152
At most 6	0.009562	1.047222	3.841466	0.3061

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4.3 Normalized cointegrating equation

RETURNS	BETA	SIZE	PRICE_BOOK	ILLIQ	MOMEN
1.000000	0.007835	0.000976	0.008866	4884.185	0.000117
	(0.00316)	(0.00339)	(0.00264)	(1876.09)	(6.0E-05)

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From Table 4.2 the null hypothesis of no cointegration (*r = 0*) against the alternative of presence of one or more cointegrating vector is rejected at the 5 % level of significance in both techniques (trace test and maximum eigenvalue). This implies there exist a long run relationship between RETURNS BETA SIZE PRICE_BOOK ILLIQ MOMEN. Based on this finding the study applied Vector Error Correction Model of RETURNS BETA SIZE PRICE_BOOK ILLIQ MOMEN. **Table 4.3** shows the normalized cointegrating equation results which implied that in the long run all the variables have a positive impact on the returns of equities in the Kenyan capital market.

3.1. Vector Error Correction Model (VECM)

Table 4.4 (see appendix I) shows results of Vector Error Correction estimates. The following equation was derived for error correction model

$\Delta Returns_t$= -0.464557ect_{t-1} – 0.218114$\Delta Returns_{t-1}$ – 0.005332$\Delta Beta_{t-1}$ +

(-5.49213) *(-1.51922)* *(1.02977)*

0.003129$\Delta Size_{t-1}$ - 0.007217$\Delta Pricetobook_{t-1}$ +

(0.56563) *(-1.59003)*

458.6135$\Delta Illiq_{t-1}$ + 0.0000313$\Delta Momen_{t-1}$+ 0.0000881. (4.4)

(0.61869) *(0.55459)*

Table 4.4 (see **Appendix I**) demonstrates that the variables are statistically insignificant at a 5% level apart from the error correction term as shown in equation 4.4 that represents the short-term relationship of the variables.

The coefficient of the Error Correction term is negative and statistically significant, indicating there is the convergence of short-run adjustment dynamics toward the long-run equilibrium. This further demonstrates that the previous year’s deviation from the long-run equilibrium is corrected in the current year at an adjustment speed of 46.7%. *Ceteris Paribus* a percentage increase in BETA is associated with 0.005332 percent decrease in RETURNS in the short run. A percentage increase in SIZE will lead to a 0.003129% increase in Returns in the short run, further a percentage increase in Price to Book Ratio is linked to a 0.007217% decrease in returns in the short-run. A percentage increase in ILLIQ is associated with a 458.61% increase in Returns in the short-run and in the case of MOMEN a percentage increase in MOMEN is linked to a 0.0000313% increase in returns in the short run.

Table 4.5. Least Square output for long run model

D(RETURNS) = C(1)*(RETURNS(-1) + 0.0078346283094*BETA(-1) + 0.000975898618098*SIZE(-1) + 0.00886559207795*PRICE_BOOK(-1) + 0.00937022076007*ASYM(-1) + 4884.18524418*ILLIQ(-1) + 0.000116792829385*MOMEN(-1) - 0.0507708888377) + C(2) *D(RETURNS(-1)) + C(3)*D(BETA(-1)) + C(4)*D(SIZE(-1)) + C(5) *D(PRICE_BOOK(-1)) + C(6)*D(ILLIQ(-1)) + C(7) *D(MOMEN(-1)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.464557	0.084586	-5.492134	0.0000
C(2)	-0.218114	0.143569	-1.519222	0.1319
C(3)	-0.005332	0.005178	-1.029766	0.3056
C(4)	0.003129	0.005533	0.565626	0.5729
C(5)	-0.007217	0.004539	-1.590028	0.1150
C(6)	458.6135	741.2629	0.618692	0.5375
C(7)	3.13E-05	5.65E-05	0.554591	0.5804
C(8)	8.81E-05	0.000261	0.337054	0.7368
R-squared	0.427175	Mean dependent var	0.000136	
Adjusted R-squared	0.381349	S.D. dependent var	0.003439	
S.E. of regression	0.002705	Akaike info criterion	-8.908354	
Sum squared resid	0.000732	Schwarz criterion	-8.686133	
Log likelihood	494.5053	Hannan-Quinn criter.	-8.818235	
F-statistic	9.321658	Durbin-Watson stat	1.979641	
Prob(F-statistic)	0.000000			

For Long-run coefficient the following equation was estimated.

$$ECT_{t-1} = 1.00000 Returns_{t-1} + \underset{(2.48029)}{0.007835 Beta_{t-1}} + \underset{(0.28803)}{0.000976 Size_{t-1}} + \underset{(3.36190)}{0.008866 PricetoBook_{t-1}} + \underset{(2.60338)}{4884.185 Illiq_{t-1}} + \underset{(1.95410)}{0.000117 Momen_{t-1}} - 0.050771 \quad (4.5)$$

Table 4.5 convey that the long-run coefficient C (1) is negative and significant which shows long-run causality between Returns and the independent variables (BETA, SIZE, PRICETOBOOK, ILLIQ and MOMEN). The adjusted R-squared is 0.381329, which means that 38.13% of the model is explained by the independent variables. Durbin Watson static is greater than the R^2 stipulating that the model is free from serial correlation hence not spurious.

To establish the moderating effect of illiquidity on the relationship between momentum and equity returns in the Kenyan Capital markets.

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The study carried out a unit root test to check for non-stationarity and cointegration tests to check for long-run relationship between the variables in the presence of a moderator variable.

3.2. Unit root Tests

The Augmented Dickey fuller tests and Phillips Perron tests were used to test for non-stationarity. **Table 4.6** shows the summary at levels and first difference.

Table 4.6 Unit Root Tests with Moderator

Variables	Augmented Dickey Fuller (ADF) Test	Phillips Perron (PP)Test
	Intercept	Intercept
	t-Statistic	t-Statistic
RETURNS	-4.7999** (0.0001)	-8.1793** (0.0000)
BETA	-1.5218 (0.5190)	-1.564 (0.4975)
SIZE	-0.8134 (0.8107)	-2.0771 (0.2543)
PRICE_BOOK	-1.6597 (0.4488)	-1.6987 (0.4291)
ILLIQ	-2.6921* (0.0787)	-8.4297** (0.0000)
MOMEN	-5.5404** (0.0000)	-6.9163** (0.0000)
ILLIQ.MOMEN	-2.7988 (0.0618)	-9.1934** (0.0000)
ΔRETURNS	-5.1919** (0.0000)	-21.8464** (0.0000)
ΔBETA	-10.3554** (0.0000)	-10.3554** (0.0000)
ΔSIZE	-5.6554** (0.0000)	-10.3988** (0.0000)
ΔPRICE_BOOK	-10.3572** (0.0000)	-10.3572** (0.0000)
ΔILLIQ	-14.6094** (0.0000)	-31.5872** (0.0001)
ΔMOMEN	-8.1658** (0.0000)	-21.304** (0.0000)
ΔILLIQ.MOMEN	-15.030** (0.0000)	-40.087** (0.0001)

Notes: - The Null hypothesis is that the series has a unit root. For ADF and PP the Probability based on MacKinnon (1996) one-sided p-values. Lag Length based on AIC. (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. The parenthesized values represent the probability while Δ denotes the first difference

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Table 4.6 shows that not all variables are stationary at levels with the exception of Returns and Momentum. However, at first difference all variables become stationary.

3.3. Johannsen Tests with Moderator

Johansen cointegration test was also performed, and the results are as shown below.

Table 4.7 Johannsen test with moderator Variable

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.542852	264.0296	159.5297	0.0000
At most 1 *	0.429688	178.7101	125.6154	0.0000
At most 2 *	0.383166	117.4987	95.75366	0.0007
At most 3	0.247039	64.83482	69.81889	0.1171
At most 4	0.158084	33.90700	47.85613	0.5069
At most 5	0.093213	15.15076	29.79707	0.7702
At most 6	0.030504	4.485342	15.49471	0.8608
At most 7	0.010119	1.108609	3.841466	0.2924

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.542852	85.31949	52.36261	0.0000
At most 1 *	0.429688	61.21141	46.23142	0.0007
At most 2 *	0.383166	52.66390	40.07757	0.0012
At most 3	0.247039	30.92781	33.87687	0.1081
At most 4	0.158084	18.75624	27.58434	0.4335
At most 5	0.093213	10.66542	21.13162	0.6806
At most 6	0.030504	3.376733	14.26460	0.9186
At most 7	0.010119	1.108609	3.841466	0.2924

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From Table 4.7 the results demonstrate at least one cointegrating equation and therefore the null hypothesis of no cointegration ($r = 0$) against the alternative of the presence of one or more cointegrating vectors is rejected at the 5 % level of significance in both techniques (trace test and maximum

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eigenvalue). Having confirmed the presence of a cointegrating equation, a vector error correction model was estimated this time including the moderator variable ILLIQ.MOMEN to examine the moderation effect. The change in R^2 was then used to assess moderation. A significant change in R^2 was adjudged to confirm moderation

Table 4.8 Least Square output for long run model with moderator

D(RETURNS) = C(1)*(RETURNS(-1) + 0.00281199974309*BETA(-1) + 0.00123778043701*SIZE(-1) + 0.000812860571612*PRICE_BOOK(-1)- 61863.4152791*ILLIQ(-1) - 0.000430629055031*MOMEN(-1) + 1196.59569215*ILLIQMOMEN(-1) + 0.0058897907757) + C(2)*D(RETURNS(-1)) + C(3)*D(BETA(-1)) + C(4)*D(SIZE(-1)) + C(5)*D(PRICE_BOOK(-1)) + C(6)*D(ILLIQ(-1)) + C(7)*D(MOMEN(-1)) + C(8)*D(ILLIQMOMEN(-1)) + C(9)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.850480	0.153815	-5.529232	0.0000
C(2)	-0.042726	0.153063	-0.279142	0.7807
C(3)	0.001656	0.005437	0.304592	0.7613
C(4)	0.002252	0.005515	0.408352	0.6839
C(5)	-0.000247	0.004689	-0.052780	0.9580
C(7)	-23189.56	7708.984	-3.008122	0.0033
C(8)	-0.000169	6.88E-05	-2.459382	0.0157
C(9)	437.9330	144.4993	3.030693	0.0031
C(10)	0.000154	0.000261	0.588000	0.5579

R-squared	0.433923	Mean dependent var	0.000136
Adjusted R-squared	0.382461	S.D. dependent var	0.003439
S.E. of regression	0.002703	Akaike info criterion	-8.901856
Sum squared resid	0.000723	Schwarz criterion	-8.654944
Log likelihood	495.1512	Hannan-Quinn criter.	-8.801724
F-statistic	8.431982	Durbin-Watson stat	1.990402
Prob(F-statistic)	0.000000		

Table 4.8 indicates the long-run model inclusive of the moderator ILLIQ.MOMEN the results demonstrate coefficient C(1) is negative and significant which shows long-run causality between Returns and the independent variables (BETA, SIZE, PRICETOBOOK, ILLIQ, MOMEN and ILLIQ.MOMEN). A *t*-test of the regression coefficient associated with the *ILLIQxMOMENT* interaction term is one way to determine if there is statistical moderation. The regression coefficient associated with the interactive effect of Illiquidity and Momentum on equity returns was significant at 0.05 level (γ_t= 1196, *t statistic* = 3.030693, *p* = 0.0031) The significant finding suggests that the effect of momentum on equity returns is affected by or *moderated by*, Illiquidity (i.e., there was significant moderation). The R- squared was 0.433923 indicating that 43.3% of the model

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is explained by independent variables. Further R^2 change of 0.006 i.e., 0.4339-0.427 was significant at a 0.05% level. Therefore, the null hypothesis that illiquidity moderates the relationship between momentum and equity returns were accepted. From the preceding results, the study confirmed that illiquidity moderates the effect of momentum on equity returns in that presence of illiquidity increases the effect of momentum on equity returns. This is consistent with a study by Chen (2016) who found that periods of high market illiquidity are followed by low momentum profits, and very often negative returns. This can be attributed to increased transaction costs which affect the probability of momentum strategy. The study is also consistent with (Orlov, 2016) who agreed that that equity market illiquidity explains the evolution of currency momentum strategy payoffs. Absalonsen and Vas (2014) attributed a stronger momentum effect in small stocks to due to illiquidity which means that their bid to spread is higher since they tend to be traded less which makes them harder to close position.

Conclusion

This paper examined the moderating effect of illiquidity on relationship between momentum and equity returns. First, the study established that momentum affects equity returns before and after including the moderator, the two variables are cointegrated, indicating that they move together in the long-run, while experiencing short-lived deviations from the long-run relationship. The Error Correction Model (ECT) is significant and negative indicating that although the relationship between momentum and equity returns experiences the short-run e ephemeral deviations, the system reverts to its long-run equilibrium position.

Secondly, the null hypothesis tested was accepted at a 0.05 %, p = 0.0031 significant level drawing inference that illiquidity moderates the relationship between momentum and equity returns in Kenyan Capital markets significantly. By conditioning past illiquidity an investor may be able to earn significant returns by applying momentum strategy, this goes to show the effect of illiquidity as a moderator variable on the relationship between momentum and returns.

Based on these findings fund managers while using momentum strategies in their portfolio construction should focus more on analysing the behaviour of illiquidity over the past year to maximize equity returns. The use of technology motivates the investor to identify the momentum opportunities that exist within the capital market therefore, further studies should be carried out to determine whether technology moderates or mediates the relationship between momentum and equity returns.

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APPENDIX

Table 4.4: Vector Error Correction Estimates

Cointegrating Eq:	CointEq1					
RETURNS(-1)	1.000000					
BETA(-1)	0.007835 (0.00316) [2.48029]					
SIZE(-1)	0.000976 (0.00339) [0.28803]					
PRICE_BOOK(-1)	0.008866 (0.00264) [3.36190]					
ILLIQ(-1)	4884.185 (1876.09) [2.60338]					
MOMEN(-1)	0.000117 (6.0E-05) [1.95410]					
C	-0.050771					
Error Correction:	D(RETURNS)	D(BETA)	D(SIZE)	D(PRICE_BOOK)	D(ILLIQ)	D(MOMEN)
CointEq1	-0.464557	0.854680	0.558914	-2.521559	-3.33E-05	-1095.149

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	(0.08459)	(2.16524)	(1.53667)	(2.46151)	(9.0E-06)	(231.064)
	[-5.49213]	[0.39473]	[0.36372]	[-1.02440]	[-3.69599]	[-4.73958]
D(RETURNS(-1))	-0.218114	-0.570376	-6.850325	1.297570	3.91E-05	937.3972
	(0.14357)	(3.67511)	(2.60823)	(4.17797)	(1.5E-05)	(392.191)
	[-1.51922]	[-0.15520]	[-2.62643]	[0.31057]	[2.55513]	[2.39016]
D(BETA(-1))	-0.005332	0.010541	-0.034713	-0.012713	1.50E-06	-22.65109
	(0.00518)	(0.13255)	(0.09407)	(0.15068)	(5.5E-07)	(14.1448)
	[-1.02977]	[0.07952]	[-0.36902]	[-0.08437]	[2.71696]	[-1.60138]
D(SIZE(-1))	0.003129	-0.010192	0.045127	0.026134	-9.59E-07	15.95879
	(0.00553)	(0.14163)	(0.10051)	(0.16101)	(5.9E-07)	(15.1137)
	[0.56563]	[-0.07196]	[0.44897]	[0.16232]	[-1.62588]	[1.05591]
D(PRICE_BOOK(-1))	-0.007217	0.001122	-0.003642	0.002831	9.30E-07	-23.02738
	(0.00454)	(0.11619)	(0.08246)	(0.13208)	(4.8E-07)	(12.3988)
	[-1.59003]	[0.00966]	[-0.04416]	[0.02144]	[1.92073]	[-1.85723]
D(ILLIQ(-1))	458.6135	-25081.06	6718.917	-417.5052	-0.484982	1377787.
	(741.263)	(18975.0)	(13466.5)	(21571.3)	(0.07904)	(2024919)
	[0.61869]	[-1.32180]	[0.49893]	[-0.01935]	[-6.13590]	[0.68042]
D(MOMEN(-1))	3.13E-05	0.000349	0.001974	-0.000245	-8.10E-09	-0.446504
	(5.6E-05)	(0.00145)	(0.00103)	(0.00164)	(6.0E-09)	(0.15434)
	[0.55459]	[0.24121]	[1.92339]	[-0.14905]	[-1.34409]	[-2.89301]
C	8.81E-05	-0.002241	0.003452	-0.002613	8.34E-09	0.258679
	(0.00026)	(0.00669)	(0.00475)	(0.00761)	(2.8E-08)	(0.71405)
	[0.33705]	[-0.33494]	[0.72701]	[-0.34357]	[0.29910]	[0.36227]
R-squared	0.427175	0.018193	0.096048	0.045380	0.454423	0.382425

Adj. R-squared	0.381349	-0.060352	0.023732	-0.030989	0.410777	0.333019
Sum sq. resids	0.000732	0.479514	0.241519	0.619715	8.32E-12	5460.789
S.E. equation	0.002705	0.069247	0.049145	0.078722	2.88E-07	7.389715
F-statistic	9.321658	0.231626	1.328170	0.594220	10.41153	7.740463
Log likelihood	494.5053	141.0707	178.4481	127.0922	1491.436	-367.9773
Akaike AIC	-8.908354	-2.423315	-3.109139	-2.166829	-27.20067	6.917015
Schwarz SC	-8.686133	-2.201094	-2.886918	-1.944608	-26.97844	7.139237
Mean dependent	0.000136	-0.002218	0.003597	-0.002752	1.32E-10	0.398411
S.D. dependent	0.003439	0.067247	0.049738	0.077530	3.76E-07	9.048384

Determinant resid covariance (dof adj.)	5.89E-27
Determinant resid covariance	3.22E-27
Log likelihood	2241.803
Akaike information criterion	-39.84960
Schwarz criterion	-38.12121

Standard errors in () & t-statistics in [ ]

Source: Research Data, 2019