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# NEXUS BETWEEN PORTFOLIO REBALANCING AND RETURNS OF EQUITY INVESTMENTS LISTED AT THE NAIROBI SECURITIES EXCHANGE

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**Abstract**

The nexus between portfolio rebalancing and returns of equity investments listed at the Nairobi Securities Exchange is examined in this study. The study used longitudinal research design. The target population was all equity investments listed at the Nairobi Boer. Secondary data which included equity investments daily returns and annual reports for the period 2014 to 2019 was used to calculate the standard deviation, compound annual growth rate using the geometric average rate of return and risk reward (Sharpe ratio) associated with equity investments. Over the study period, the finding was that the terminal portfolio balance at the end of December 2019 was $45.65 million for 20% daily rebalancing. The cumulative growth (geometric mean) was 7.67% annually. Daily, quarterly, and annually rebalancing strategies outperform the 2nd and 3rd - yearly rebalancing and buy-and-hold strategies for all rebalancing bands. When asset allocation of 60% stock/ 40% bonds is considered, daily rebalancing strategy at 10% rebalancing band recorded the highest standard deviation (10.54%) while the lowest standard deviation was recorded on 3rd-Yearly rebalancing strategy (9.96%) at 15% rebalancing band. When asset allocation of 40% stock/60% bonds is considered, the study found out that daily rebalancing strategy at 10% rebalancing band recorded the highest standard deviation of 8.27 while annual rebalancing strategy with a 15% rebalancing band recorded the lowest standard deviation of 7.72%. The study concluded that time and threshold rebalancing strategies have an effect on the return of equity investments listed at the Nairobi Securities Exchange. The study recommended that equity investors should consider both time and threshold rebalancing strategies when selecting portfolio rebalancing strategies that have an effect on portfolio return.

***Key Words:*** Portfolio rebalancing, returns, rebalancing bands, equity investments

## 1. INTRODUCTION

Across international markets, global investors allocate their portfolio by balancing the expected risk and return of assets. When price shocks cause the portfolio

weights to deviate from their optimal risk-return maximizing values investors are supposed to rebalance there portfolios (Daryanani, 2008). Rebalancing helps the portfolio increase diversification and reduces the risk of over-exposure (Walsh, 2012). Investors can sell some of the best performing assets and use the proceeds to purchase under-performing assets which the investors are holding or to buy other assets which investors think they are under-valued. According to Jackson (2006), stabilizing dynamics are induced using portfolio rebalancing also known as negative feedback trading or contrarian investment. Investors usually start with a specific weight in each asset when investing in assets. As time passes-by these weights change due to fluctuations in price. Investors rebalance their portfolio to bring assets back in-line, and maintain the initial risk and return characteristics.

Each time an asset deviates from the initial weight, some investors rebalance their portfolio (Fischer, Greminger & Grisse, 2017). Rebalancing the portfolio could be accomplished by acquiring more of the best performing asset class at the expense of the lesser performing classes or by rebalancing back to the initial portfolio mix (Daryanani, 2008). It is undertaken by institutional investors like insurance or pension funds and retail investor's who indirectly hold bulk institutional investors assets (Ameriks & Zeldes, 2004; Brunnermeier & Nagel, 2008). It is also undertaken because investors are passively exposed to greater market risk when realized return on financial assets result in mechanical variations in portfolio allocation. This risk is managed by actively rebalancing his or her portfolio when asset returns change over time.

Portfolio rebalancing often involves taking profit from outperforming assets so as to avoid overweighting and buying underperforming assets. It refers to the process of buying and selling portions of your portfolio in order to set the weight of each asset class back to its original state (Fischer, *et al.,* 2017). Portfolio rebalancing is adopted when an investor's investment strategy or tolerance for risk has changed. The investor can then use rebalancing to readjust the weightings of each security or asset class in the portfolio to fulfill a newly devised asset allocation. Frequent rebalancing results in selling profitable investments too soon and thereby missing on big prospective gains (Daryanani, 2008; Lim, 2013). It also results in to higher transactions costs and low return to the investors (Bertsimas & Pachamanova, 2008). It is normal for investors to buy assets that are going up which they assume will go up in future but portfolio rebalancing is often counter intuitive (Lam, 2014).

Behavioural biases such as status quo bias usually prevents investors from rebalancing their portfolios. Other behavioural biases include stock market

avoidance which relates to the tendency to avoid risky assets like stocks, insufficient diversification which is mainly attributed to home bias and using rules of thumb for allocation decisions, insufficient trading which is attributed to overconfidence of investors. The behavioral bias and emotions driven investing has negative consequences on the long-term wealth of investors (Lam, 2014). Besides existence of this behavioural biases, O'Brien (2006) posits that portfolio rebalancing is an option for investors to consider that should override behavioural biases because it helps investors achieve their investment goals and avoid the common investment mistake. In that sense, we are looking at the issue of rebalancing of an existing portfolio, where one can hold an asset in both the current and rebalanced portfolio weights.

Portfolio rebalancing can either be calendar rebalancing which refers to when portfolios are reset to their target allocations on a fixed schedule such as biweekly, monthly, semi-annually, annually among others (Ameriks, & Zeldes, 2004). It can also be range rebalancing to band; this one is undertaken if there is any asset class drifts outside the rebalance bands, it will be brought back to the nearest edge of the bands. Range rebalancing to portfolio benchmark is adopted if any asset class drifts outside the rebalance bands, it will be brought back to the target allocation (Lim, 2013). Range rebalancing to tolerance band is undertaken if any asset class drifts outside the rebalance band, then it will be brought back within the tolerance band while volatility-based rebalancing strategy is adopted when volatility rises above a certain predetermined threshold. Higher-volatility asset classes are sold and lower-volatility asset classes are purchased (Brunnermeier & Nagel, 2008).

Tactical rebalancing strategy relates to a sitiation when the investors have freedom to make the decision when they think it is a good time to rebalance and the target allocation of assets could be adjusted all the time while non-rebalancing strategy is adopted when the portfolios drifts along with the market. In some scenarios, these rebalancing strategies can be combined (Walsh, 2012). Therefore the current study sought to determine the nexus between portfolio rebalancing and returns of equity investments listed at the Nairobi Securities Exchange.

## 2. LITERATURE REVIEW

### 2.1. How rebalancing works in a portfolio - Hypothetical Example

The investor starts to invest Sh. 50,000 portfolio and allocates 60% for asset x (Sh. 30,000), 30% for asset y (Sh. 15,000), and 10% for asset z (Sh. 5,000). Over

time, asset (x) earns a return of 5% (Sh. 31,500), asset (y) earns a return of 1% (Sh. 15,150), and asset (z) earns a return of -13% (Sh. 4,350). The total value of portfolio at this time is Sh. 10,200. In order to maintain their allocations, the investor will sell Sh. 180 of asset (x) and use the proceeds to purchase Sh. 30 for asset (y) and Sh. 150 for asset (z).

**Table 1: How rebalancing works in a portfolio - Hypothetical Example**

| *Allocations* | *Beginning* | *Drifting* | *Before Rebalancing* | *Rebalancing* | *After Rebalancing* |
|---|---|---|---|---|---|
| X | Sh. 30,000 | +5% | Sh. 31,500 | -Sh. 180 | Sh. 31,320 |
| Y | Sh. 15,000 | +1% | Sh. 15,150 | +Sh. 30 | Sh. 15,180 |
| Z | Sh. 5,000 | -13% | Sh. 4,350 | +Sh. 150 | Sh. 4, 500 |
| Total | Sh. 50,000 | | Sh. 51,000 | | Sh. 51, 000 |

## 2.2. Empirical Review

### *2.2.1. Calender rebalancing strategy*

It is also known as Time rebalancing strategy. It refers to when portfolios are reset to the predetermined allocation on a regular schedule such as monthly, quarterly, annually, etc. The overweighed assets are usually sold and underweighted assets are purchased until the original target is reached. Portfolios are rebalanced based on a predetermined schedule regardless of market direction or expectation for the market. Amott and Lovell (1992) researched on the risk and reward for calendar rebalancing strategies from 1968 to 1991. At the beginning of the investment, the scholar's allocated stock or bond mix of 50/50. The scholars held the assumption that there was 1% trading cost. The study results were a return of 9.10% and a standard deviation of 11.47% for monthly rebalancing, a return of 9.08% and a standard deviation of 11.44% for quarterly rebalancing, a return of 9.06% and a standard deviation of 11.49% for annually rebalancing. In a nutshell, the study findings revealed that there is a meagre difference between return and the risk of each strategy. Monthly rebalancing had the highest return of 9.1, 0% on average, but the quarterly rebalancing recorded the lowest standard deviation of 11.44%. Annual rebalancing recorded the lowest return of 9.06% and the highest standard deviation of 11.49%. To wrap up it up all, the study found that periodic rebalancing that is done more frequently is far much better than that which is done less frequently.

### 2.2.2. Threshold Rebalancing Strategies

#### *2.2.2.1. Range Rebalancing Strategy*

It is also known as range rebalancing to band. It is adopted when any asset class is outside the rebalance band. It is usually brought back to the nearest band, not the target allocation. For example, a portfolio has a 20% target for smallcap stocks with 10% rebalance band. If the asset class drifts outside the rebalance range of [18%-22%], it will be brought back to the nearest band either 18% or 22% allocation. Amott and Lovell (1992) examined the risk and reward for calendar rebalancing strategies. The study period was between 1968 and 1991. The scholars allocated 50/50 stock or bond mix at the beginning of the investment. The authors held the assumption that there was a trading cost of 1%. The study found out that there was a return of 9.08% and a standard deviation of 11.45% for [48-52%] range rebalancing, a return of 9.08% and a standard deviation of 11.46% for [49-51%] range rebalancing, a return of 9.07% and a standard deviation of 11.46% for [45-55%] range rebalancing. The study found out that there is a meagre difference between return and the risk of each strategy. Both ranges [48-52%] and [49-51%] got the same average return of 9.08%, but the range [48-52%] has lowest standard deviation of 11.45%. On the other hand, the range [45-55%] is 9.07% and had the standard deviation of 11.46% which was the same with the standard deviation of range [49-51%].

#### *2.2.2.2. Threshold rebalancing strategy/Range rebalancing to portfolio benchmark*

It refers to a situation where if any asset class is outside the rebalance band, then it will be brought back to the target allocation. In an example where a portfolio has a 20% target for smallcap stocks with 10% rebalance band, these small-caps will be sold until they come back to 20% allocation. Amott and Lovell (1992) researched on the risk and reward for calendar rebalancing strategies. The study period was between 1968 and 1991. At the beginning of the investment, the researchers allocated 50/50 stock/bond mix. The authors held the assumption that there was a trading cost of 1%. The study found out that there was a return of 9.09% and a standard deviation of 11.45% for +/-5% threshold rebalancing, a return of 9.07% and a standard deviation of 11.46% for +1-2% threshold rebalancing, a return of 9.04% and a standard deviation of 11.47% for +/-1% threshold rebalancing. On the basis of these findings, the study further revealed that there is a meagre difference between return and the risk of each strategy. The +1-5% threshold rebalancing gets the highest

return of 9.09% and lowest standard deviation of 11.45%. On the other hand, the +/-1% threshold rebalancing gets the lowest return of 9.04% and highest standard deviation of 11.47%. The results reveal that more threshold rebalancing is better than less threshold rebalancing.

#### *2.2.2.3. Range Rebalancing to Tolerance Band*

It refers to a situation where if an asset class drifts outside the rebalance band, then it will be brought back within the tolerance band. For example, a portfolio has a 20% target for smallcap stocks with 5% tolerance band. If the asset class drifts outside the rebalance range of [18% - 22%], it will be brought back within the tolerance band of [19% - 21%] allocation. Daryanani (2008) examined the rebalancing strategies with portfolios of 25% U.S. large (S&P 500 Total Return), 20% U.S. small (Russell 2000 Total Return), 10% real estate investment trusts (Dow Jones REIT Total Return), 5% commodities (Dow Jones AIG Total Return), and 40% bonds (Bloomberg 7-10 Total Return). The study period was between January 1992 and December 2004. The scholars used rebalancing bands of 0%, 5%, 10%, 15%, 20%, and 25%. The scholars focused on daily, weekly, biweekly, monthly, quarterly, semiannually, and annually in a bid to establish if any asset was out of rebalance band. In the event that any asset was out of the rebalancing band, the author rebalanced it to the tolerance band which was assumed to be 50% of the rebalance band. The study assumed a $20 flat trading cost per trade regardless of the size of the trade. The optimal strategy on 12-month average return was rebalancing daily with a rebalancing band of 20% while buy-and-hold strategy did not perform well in the period under consideration.

## 3. METHODOLOGY

Hypothetical portfolios of 60/40 and 40/60 (stocks/bonds) were created. Daily stock prices (indices) were used to compare the performance of various rebalancing strategies vis-a-vis buy-and-hold strategy. The study was based on historical data of stocks and bonds for 5 years (2014-2019). Portfolios were created by FTSE NSE indices which comprise of FTSE NSE Kenya 15 index, FTSE NSE Kenya 25 index and FTSE NSE Kenya government bond index. The study used longitudinal research design. The design is preferred for time series data as it aids in collection of data on the same objects in different times. The target population was all equity investments listed at the Nairobi Boer. Secondary data which included equity investments daily returns and annual

reports for the period 2014 to 2019 was used to calculate the standard deviation, compound annual growth rate using the geometric average rate of return and risk reward (Sharpe ratio) associated with equity investments.

Measurement of financial variables:

(a) Standard deviation = $\delta = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{x})^2}$

Where:

$\delta$ = standard deviation of portfolio
$n$ = number of years in the portfolio
$x$ = the observed values of portfolio
$\overline{x}$ = the mean value of portfolio

(b) Compound Annual Growth Rate: Geometric Average Rate of Return

i) Arithmetic Return

$$T_{arith} = \frac{v_f - v_i}{v_1}$$

Where:

$T_{arith}$ = arithmetic return
$V_i$ = The initial value of an investment
$V_f$ = The final value of an investment

(ii) Geometric Average Rate of Return (Annualized Return)

$$\breve{T}_{geometric} = n\sqrt{\prod_{i=1}^{n}(1+r_{arith,i})} - 1 = n\sqrt{(1+r_1)(1+r_2)(1+r_3)...(1+r_n)} - 1$$

Where:

$\breve{T}_{geometric}$ = geometric average rate of return
$r$ = arithmetic return
$n$ = number of years

(iii) Risk Reward (Sharpe ratio)

$$RVAR = \frac{\overline{TR}_p - \overline{RF}}{\delta_p} = \frac{Excess\ return}{Risk}$$

Where:

RVAR = reward to variability ratio

$\overline{TR}_p$ = the average total return for portfolio p during some period of time

$\overline{RF}$ = the average risk free rate of return during the period

$\delta_p$ = the standard deviation of return for portfolio p during the period

$\overline{TR}_p - \overline{RF}$ = the excess return (risk premium) on portfolio p

## 4. RESULTS & DISCUSSIONS

### 4.1. Return performance of portfolio rebalancing in Kenya for 5 year period

#### *(a) Stock Fund - 60% stock/40% bonds*

Investing an initial amount of 20 million dollars at 60/40 (equity/bond) and providing a trading cost of $20 per trade. The terminal portfolio balance at the end of December 2019 was $45.65 million for 20% daily rebalancing as shown in Table 4.1.

**Table 4.1: Terminal Wealth (in millions) for Different Portfolio (60/40) Rebalancing Strategies (December 2014 - December 2019)**

| | *Rebalance bands* | | | | |
|---|---|---|---|---|---|
| | *0%* | *5%* | *10%* | *15%* | *20%* |
| Buy-and- hold | 41.16 | 41.16 | 41.16 | 41.16 | 41.16 |
| Daily | 44.11 | 43.63 | 43.76 | 44.41 | 45.65 |
| Monthly | 42.54 | 42.70 | 42.95 | 43.75 | 45.16 |
| Quarterly | 43.98 | 44.18 | 44.86 | 45.47 | 42.76 |
| Semi-annually | 42.92 | 43.48 | 43.50 | 42.89 | 42.63 |
| Annually | 44.10 | 43.86 | 44.07 | 43.65 | 42.90 |
| 2nd-Yearly | 44.52 | 43.97 | 44.31 | 42.90 | 42.90 |
| 3rd-Yearly | 42.63 | 41.29 | 41.29 | 41.87 | 42.48 |

The cumulative growth (geometric mean) was 7.67% annually as shown in Table 4.2, which is the highest return of our portfolios as compared to other strategies. In order to determine the 12 month average geometric returns as

summarized in Table 4.2, the study used both the initial investment and the investment amount at the end of periods. Table 4.2 reveals that the return of 20% daily which is higher than the returns of all the other strategies considered in this study at different bands. The results of the study are in-tandem with the findings of Daryanani (2008) that the highest return is at 20% daily. The results differ from the findings of Lam (2014) who found the highest return to be at 25% daily.

**Table 4.2: Return of Portfolio using Different (60/40) Rebalancing Bands (Geometric Mean) (December 2014 - December 2019)**

| | *Rebalance bands (%)* | | | | |
|---|---|---|---|---|---|
| | *0%* | *5%* | *10%* | *15%* | *20%* |
| Buy-and- hold | 5.59 | 5.59 | 5.59 | 5.59 | 5.59 |
| Daily | 6.14 | 6.40 | 5.28 | 6.39 | 7.67 |
| Monthly | 5.76 | 5.77 | 5.80 | 5.90 | 6.06 |
| Quartely | 5.93 | 5.95 | 6.03 | 6.10 | 5.78 |
| Semi-annually | 5.80 | 5.87 | 5.87 | 5.80 | 5.77 |
| Annually | 5.94 | 5.91 | 5.94 | 5.89 | 5.80 |
| 2nd- Yearly | 5.99 | 5.93 | 5.97 | 5.80 | 5.80 |
| 3rd-Yearly | 5.64 | 5.60 | 5.60 | 5.67 | 5.75 |

The study findings summarized in Table 4.1, 4.2, Figure 4.1 and 4.2 revealed that daily, quarterly, and annually rebalancing strategies outperform the 2nd and 3rd - yearly rebalancing and buy-and-hold strategies for all rebalancing bands. Quartely and 2nd- yearly rebalancing strategies are higher than the other rebalancing strategies in all rebalancing bands. Among all the rebalancing strategies considered in this study, 3rd - yearly rebalancing strategy underperforms all other strategies in all rebalancing bands. Likewise, buy-and-hold strategy underperforms all other strategies for all rebalancing bands.

Buy and hold strategy produced the least return (figure 4.1 and 4.2). Portfolio return is maximized when 20% daily rebalancing band is adopted over long period horizon.

### *(b) Bond Fund - 40% stock/60% bonds*

Considering an initial investment of 20 million dollars at 40/60 (equity/bond) and providing a trading cost of $20 per trade, the terminal portfolio balance at the end of December 2019 comes to $40.55 million for 20% daily rebalancing as shown in Table 4.3.

**Figure 4.1: Terminal asset values of Time Rebalancing**

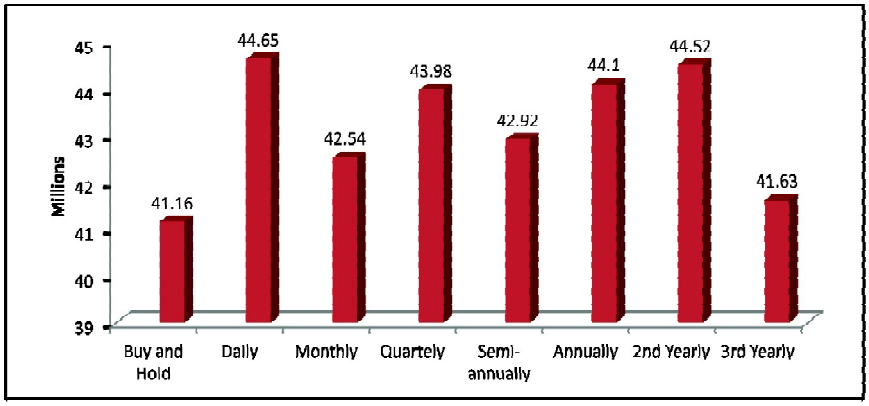



**Figure 4.2: Terminal Asset Values on Threshold Rebalancing for Different Portfolio (60/40) Rebalancing Strategies (December 2014 - December 2019)**

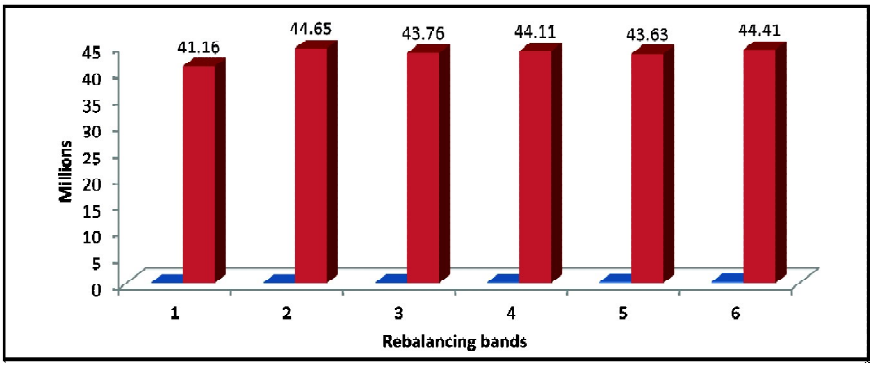



**Table 4.3: Terminal Wealth (in millions) for different Portfolio (40/60) Rebalancing Strategies (December 2014 - December 2019)**

| | *Rebalance bands* | | | | |
|---|---|---|---|---|---|
| | *0%* | *5%* | *10%* | *15%* | *20%* |
| Buy and Hold | 46.48 | 46.38 | 46.48 | 46.38 | 46.38 |
| Daily | 49.45 | 49.26 | 49.22 | 49.77 | 50.45 |
| Monthly | 48.06 | 48.38 | 48.79 | 49.17 | 48.84 |
| Quartely | 49.59 | 49.62 | 50.51 | 51.10 | 48.16 |
| Semi-annually | 48.42 | 49.06 | 49.04 | 48.31 | 48.00 |
| Annually | 49.63 | 49.40 | 49.66 | 50.90 | 48.29 |
| 2nd-Yearly | 49.94 | 49.38 | 49.79 | 50.02 | 48.29 |
| 3rd -Yearly | 47.06 | 46.67 | 46.67 | 47.26 | 47.88 |

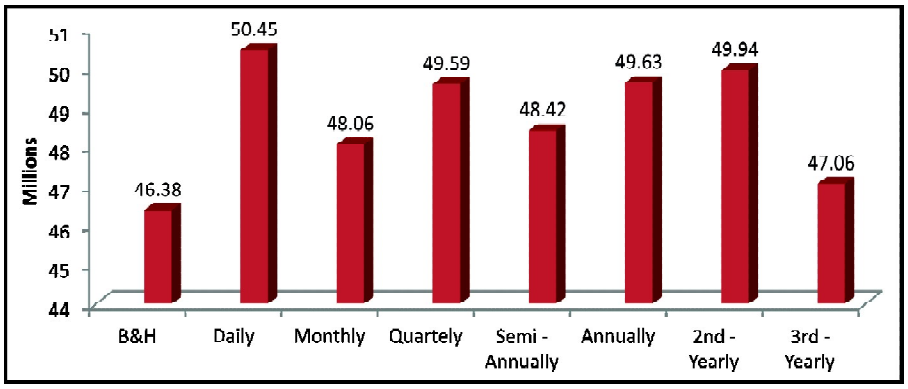
The geometric mean that represents the cumulative growth was 7.64% daily rebalancing at 20% rebalancing band as shown in Table 4.4.

**Table 4.4: Return (Geometric Mean) of Portfolio using different (40/60) Rebalancing Bands (December 2014 - December 2019)**

| | *Rebalance bands* | | | | |
|---|---|---|---|---|---|
| | *0%* | *5%* | *10%* | *15%* | *20%* |
| Buy and Hold | 6.20 | 6.20 | 6.20 | 6.20 | 6.20 |
| Daily | 6.54 | 6.57 | 6.51 | 6.52 | 7.64 |
| Monthly | 6.39 | 6.42 | 6.47 | 6.51 | 6.47 |
| Quarterly | 6.55 | 6.55 | 6.65 | 6.71 | 6.40 |
| Semi-annually | 6.43 | 6.49 | 6.49 | 6.41 | 6.38 |
| Annually | 6.55 | 6.53 | 6.56 | 6.69 | 6.41 |
| 2nd -Yearly | 6.59 | 6.53 | 6.57 | 6.59 | 6.41 |
| 3rd-Yearly | 6.28 | 6.23 | 6.23 | 6.30 | 6.37 |

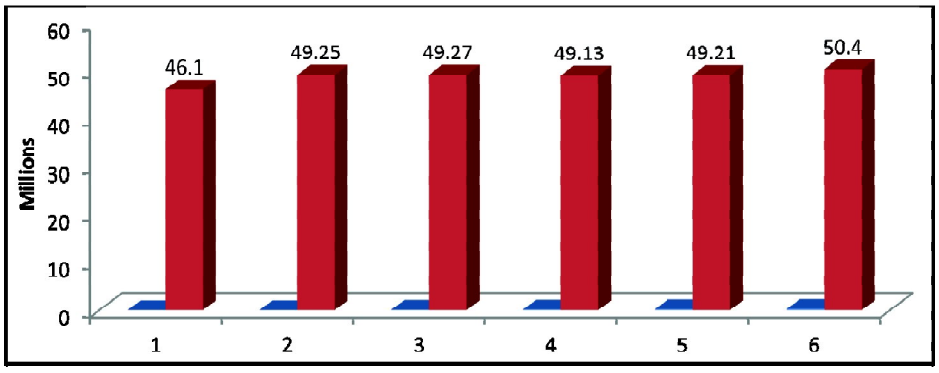
The results of Figure 4.3, reveals that daily rebalancing out-performs buy and hold strategy, monthly, quartely, semi-annually, annually, 2nd-annually and 3rd-annually. It is then followed by 2nd-yearly rebalancing, annually, quarterly, monthly, 3rd-yearly and buy and hold strategy.

**Figure 4.3: Terminal Asset Values on Time Rebalancing for Different Portfolio (40/60) Rebalancing Strategies (December 2014 - December 2019)**




In the Figure 4.4, (1) represents buy and hold, (2) represents 0%, (3) represents 5%, (4) represents 10%, (5) represents 15% while (6) represents 20%. It is evident that the highest return is recorded at 20% rebalancing band while buy and hold records the lowest return.

**Figure 4.4: Terminal Asset Values on Threshold Rebalancing for Different Portfolio (40/60) Rebalancing Strategies (December 2014 - December 2019)**




## 4.2. Risk

It is assessed using standard deviation of the portfolio return.

### *(a) Stock Fund - 60% stock/ 40% bonds*

The portfolio standard deviation results for both time and threshold rebalancing strategies for between December 2014 to December 2019 are summarized in Table 4.5. Daily rebalancing strategy at 10% rebalancing band recorded the highest standard deviation (10.54%), it was followed by monthly rebalancing strategy at 0% rebalancing band (10.53%), monthly rebalancing strategy at 5% rebalancing band (10.49%) while the lowest standard deviation was recorded on 3rd-Yearly rebalancing strategy (9.96%) at 15% rebalancing band.

**Table 4.5: 12-Month Average Standard Deviation of Portfolio (60/40) using Different Rebalancing Bands (December 2014 - December 2019)**

| | *Rebalance bands* | | | | |
|---|---|---|---|---|---|
| | *0%* | *5%* | *10%* | *15%* | *20%* |
| Buy and Hold | 10.35 | 10.35 | 10.35 | 10.35 | 10.35 |
| Daily | 10.38 | 10.38 | 10.54 | 10.47 | 10.35 |
| Monthly | 10.53 | 10.49 | 10.51 | 10.38 | 10.42 |
| Quartely | 10.38 | 10.30 | 10.27 | 10.08 | 10.15 |
| Semi-annually | 10.32 | 10.32 | 10.29 | 10.10 | 10.16 |
| Annually | 10.07 | 10.13 | 10.17 | 10.33 | 10.39 |
| 2nd -Yearly | 9.98 | 10.08 | 10.14 | 10.39 | 10.39 |
| 3rd -Yearly | 10.10 | 10.14 | 10.14 | 9.96 | 9.97 |

### *(b) Bond Fund - 40% stock/60% bonds*

The standard deviation of time & threshold strategies for December 31, 2014 to December 31, 2019 was summarized in Table 4.6. Daily rebalancing strategy at 10% rebalancing band recorded the highest standard deviation of 8.27. Monthly rebalancing strategy at 0% and 10% had a standard deviation of 8.24%, 8.24% respectively. Monthly rebalancing strategy at 5% rebalancing band came in fourth with a standard deviation of 8.23% while annual rebalancing strategy with a 15% rebalancing band recorded the lowest standard deviation of 7.72%.

**Table 4.6: 12-Month Average Standard Deviation of Portfolio (40/60) using Different Rebalancing Bands (December 2014 - December 2019)**

| | *Rebalance bands (%)* | | | | |
|---|---|---|---|---|---|
| | *0%* | *5%* | *10%* | *15%* | *20%* |
| Buy and Hold | 8.12 | 8.12 | 8.12 | 8.12 | 8.12 |
| Daily | 8.10 | 8.13 | 8.27 | 8.10 | 8.23 |
| Monthly | 8.24 | 8.23 | 8.24 | 8.13 | 8.05 |
| Quarterly | 8.12 | 8.06 | 8.04 | 7.91 | 7.89 |
| Semi-Annually | 8.05 | 8.04 | 8.03 | 7.85 | 7.89 |
| Annually | 7.84 | 7.88 | 7.91 | 7.72 | 8.12 |
| 2nd – Yearly | 7.79 | 7.87 | 7.93 | 7.82 | 8.12 |
| 3rd – Yearly | 7.93 | 7.96 | 7.96 | 7.86 | 7.92 |

The standard deviation of 3rd-Yearly was lower than that of buy and hold, daily and monthly rebalancing strategies. Lower standard deviations were recorded at 0%, 5%, 10% and 15% rebalancing bands respectively for annual and 2nd-Yearly rebalancing strategies. At 20%, the standard deviations were the same us that of buy and hold. For quarterly and semi-annual rebalancing strategies, the lowest standard deviation was recorded at 15% and 20% rebalancing bands.

## 4.3. Sharpe Ratio of Time Rebalancing

Financial assets' return-risk is described using the Sharpe's ratio. The ratio is used to evaluate the performance of a portfolio. The greater the portfolio's Sharpe ratio, the better the risk-adjusted performance. Table 4.7 reports the Sharpe ratio of periodic rebalancing of asset allocations of 60/40 and 40/60 respectively (equity/bond). For all portfolios, the highest Sharpe ratio was for 2nd-yearly rebalancing strategy.

**Table 4.7: Risk-adjusted performance of the period on time rebalancing (December 1992 - December 2012)**

| | *Sharpe Ratio* | |
|---|---|---|
| | *60/40* | *40/60* |
| Buy and Hold | 0.30 | 0.39 |
| Daily | 0.33 | 0.44 |
| Monthly | 0.31 | 0.41 |
| Quartely | 0.32 | 0.43 |
| Semi-annually | 0.31 | 0.42 |
| Annually | 0.33 | 0.45 |
| 2nd – Yearly | 0.34 | 0.47 |
| 3rd- Yearly | 0.31 | 0.38 |

The study also sought to determine how buy-and-hold strategy performs on threshold rebalancing as compared with other strategies (risk-return). The study found out that the Sharpe ratio was highest for 20% rebalancing band (0.23% and 0.35%) respectively. The results were summarized in Table 4.8:

**Table 4.8: Sharpe Ratio of Threshold Rebalancing (December 2014 - December 2019)**

| *Asset Allocation (Equity/Bond)* | *Sharpe Ratio* | | | | | |
|---|---|---|---|---|---|---|
| | *Buy and Hold* | *0%* | *5%* | *10%* | *15%* | *20%* |
| 60/40 | 0.17 | 0.21 | 0.19 | 0.19 | 0.19 | 0.23 |
| 40/60 | 0.28 | 0.32 | 0.31 | 0.31 | 0.33 | 0.35 |

## 5. CONCLUSIONS AND RECOMMENDATIONS

Time and threshold rebalancing strategies have an effect on the return of equity investments listed at the Nairobi Securities Exchange. Daily portfolio rebalancing strategy produces the highest return as compared to buy and hold, monthly, quarterly, semi-annual, annually, 2nd-Yearly and 3rd-Yearly rebalancing strategies. For all rebalancing bands, buy-and-hold strategy underperforms daily, monthly, quarterly, semi annually, annually, 2nd-Yearly and 3rd-Yearly rebalancing strategies. Daily rebalancing strategy records the highest standard deviation at different rebalancing bands. Annual rebalancing strategy records the lowest standard deviation at different rebalancing bands. Time and threshold rebalancing

strategies are of paramount importance in equity investments as they influence portfolio return. Equity investors should consider both time and threshold rebalancing strategies when selecting portfolio rebalancing strategies that have an effect on portfolio return.

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