

Expected Return and Portfolio Rebalancing

Marcus Davidsson

Newcastle University Business School

Citywall, Citygate, St James Boulevard, Newcastle upon Tyne, NE1 4JH

E-mail: davidsson_marcus@hotmail.com

Received: November 18, 2010

Accepted: November 30, 2010

doi:10.5539/ijef.v3n3p15

Abstract

The purpose of this study is to discuss portfolio theory. More specifically how an investor can maximize a portfolio's expected return while at the same time trying to minimize portfolio risk. This will be done by looking at both international and Kuwaiti stock market data. One important question that will be answered in this study is: How often does a portfolio need to be rebalanced in order to minimize portfolio risk i.e. changes in expected return?

Keywords: Portfolio theory, Investment risk management

1. Portfolio Theory

Portfolio theory was introduced to the world in two steps: first by the work by Markowitz (1959) and later by the work by Sharpe (1964). Markowitz mainly looks at diversification from an asset class perspective where an investor that spreads his risk between different asset classes will achieve a greater "diversification" and hence a smoother equity curve due to the low or negative cross correlation that exist between the return of such asset classes. However, the same idea can also be applied to highly positive correlated stock return portfolio by artificially creating negative cross correlation in return by short selling. The later work by Sharpe points out that market risk also plays an important role for the smoothness of the equity curve. A portfolio with a large beta (i.e. highly sensitive to changes in market returns) will have more risk than a portfolio with a zero beta. An investor can reduce such market risk by balancing long and short positions. Market risk plays an important role when it comes to investing in financial markets because market returns accounts for a large fraction of stock returns. The impact of a market risk should not be underestimated. Taleb (2007) explains that in general people tend to overprice equity and under price options due to the abundance of volatility in financial markets. It is also important to note that one reason why portfolio theory has gained such a worldwide acceptance might have to do with the fact that portfolio theory in general is based upon well documented empirical observations. Conrad & Kaul (1988) have found that conditional expected return is positive serial correlated and Engle (1982) has found that conditional return volatility is positive serial correlated. Conditional expected return also known as greed and conditional return volatility also known as fear are heavily used in portfolio theory i.e. the Sharpe ratio.

2. The Random Walk Model

One cornerstone in financial economics is the unit-root aka the random walk model. The equation for a random walk is given by $S(t) = a + b * S(t-1) + R$ where R is an independent and identically distributed (i.i.d) random variable drawn from a normal distribution with mean μ and standard deviation σ , b is the unit-root coefficient that takes a value of 1 and a is the drift coefficient i.e. expected return which can be either positive, negative or zero i.e. a pure unit root. Such a theoretical stock price model can easily be simulated in any mathematical software. Now the return for such a random walk model is given by $S(t) - S(t-1) = a + R(t)$ which means that the return for a random walk has two components; expected return a and random return noise $R(t)$. The random return noise $R(t)$ represents the fluctuations around the expected return a . It is important to note that without the drift component a the returns would be completely random $R(t)$. The objective for most investors is to eliminate such random return noise $R(t)$ element. This is done through diversification. For a highly diversified portfolio the random return noise $R(t)$ is canceled out hence return becomes expected return a . For such a highly diversified portfolio the only objective for the investor is to determine the trend direction i.e. expected return. Now the weakness of the random walk model is the fact that the expected return and volatility of return is assumed to be constant which is very unrealistic. Such constraining assumption means that we do not have any uncertainty. Nicholas Taleb calls such a risk parameterization the "ludic fallacy" (ludic is Latin for game). The only place where such a process can be found in its purest form is in a casino (Taleb, 2007). However, that does not mean that such a model cannot be used as a good starting point when it comes

to discussing stock markets. In fact it represent a very good starting point since it communicates expected return and return volatility in a very pragmatic fashion even though we have to be aware of its obvious limitations.

3. Portfolio Risk and Change in Expected Return

Many people when they hear about portfolio risk minimization think of portfolio diversification. The main objective for portfolio diversification is to minimize portfolio variance. Portfolio variance is a function of the return volatility for each security in the portfolio and the cross correlation of returns. Since cross correlation can be negative return variance can be canceled out. Portfolio variance is the amount of return noise around the portfolio's expected return. Diversification can to a large extent eliminate such return noise as seen in Exhibit-1. Fundamental factor models such as Fama & French (1993) claim to reduce such return noise even further. The problem with focusing too much on portfolio diversification has to do with the fact that a lot of risk comes from changes in expected returns i.e. when the Sharpe or Treynor ratio becomes negative the investor need to rebalance the portfolio. This is further illustrated in exhibit-2 and exhibit-3. Covel (2004), Davidsson (2010) and Kelly (1956) point out that change in expected return as a source of portfolio risk should not be overlooked. The importance of a Bayesian non-buy-and-hold perspective is also supported by Powers (2010). The importance of managing changes in expected return in order to minimize risk has lead to that the financial community has started to think about diversifying trends instead of returns (Fabozzi & Focardi, 2010). Applying such an idea might be easier than it first appears since expected returns will have a larger impact on returns over a long time period i.e. monthly or yearly return than over shorter time periods i.e. daily returns. Hence, portfolio diversification based upon monthly data might be more appropriate than diversification on daily data. Changes in expected return can arise both from firm specific risk and market risk. Market risk is managed by balancing long-and-short positions in the Capital Asset Pricing Model (CAPM) and in more traditional portfolio theory market risk is managed by engaging in frequent portfolio rebalancing. You can also manage changes in expected return by for example using a trailing stop loss. Frequently portfolio rebalancing becomes highly important to minimize portfolio risk since Value at Risk (VaR) is both a function of expected return and portfolio variance. The investor basically has to options either he rebalance the portfolio on a regular basis i.e. monthly or rebalance the portfolio when the conditional expected return becomes negative. The amount of data used to calculate the expected return also becomes highly important. You don't want to have too much return data since then it becomes difficult to detect changes in conditional expected return but on the same time a small amount of data will give you too much return noise. Such contradicting forces must be managed effectively. It is also interesting to note that portfolio risk is sometime measured differently in different communities i.e. portfolio volatility vs. portfolio drawdown. Seykota (2001) calls portfolio drawdown portfolio "heat". Portfolio heat answers the question: If all my stops were triggered at the same time what would my maximum loss be? When the trailing stop loss is set correctly it will capture changes in expected return very effectively. Return variance will have little impact on whether the stop will be triggered or not.

4. What is a Price Trend and what is the relationship to expected return?

At this stage it is also important to have a clear definition of what a price trend is. A uptrend can be represented by an increasing sequence i.e. 1,2,3,4,5,6,7,8 etc and a downtrend can be represented by a decreasing sequence i.e. 10,9,8,7,6,5,4,3 etc. Any price trend has two components and that is expected return and return volatility. The larger the expected return is the more "drift" such a trend has. The larger the return volatility is the more fluctuations i.e. random return noise we will have around our trend. Also in order to be defined as a price trend the absolute value of the expected return need to be large and the return volatility need to be small. It is also important to note that a trend in some specified direction is only a trend as long as it is intact i.e. no change in expected return and the trend does not end at the trend peak nor does the trend start at the trend bottom. This is further illustrated in exhibit-4.

5. Buy-and-Hold and Behavioural Finance

Portfolio rebalancing represents a fascinating topic. The arguments can be reduced to trend following vs. buy-and-hold. Education plays an important role here because the investor wants to make sure that he select the appropriate strategy and that he remains true to such a strategy over time. This may seem very easy but behavioral finance has shown over and over again that this is not necessarily the case. People in stressful situations tend to base their decisions on emotions rather than logical and scientific arguments. Take the sunk cost error for example. The sunk cost error is the notion that people tend to be unwilling to abandon a trade where money has been invested. A person might start as a trend following investor and all of a sudden the sunk cost error takes hold and such a person is turned in to a buy-and-hold-investor. The same goes for a buy-and-hold investor. When the price of an asset goes up a buy-and-hold investor essentially becomes a trend following investor. Exhibit-5 illustrates the emotional rollercoaster an undisciplined investor might go through. It is however difficult to completely dismiss the buy-and-hold strategy. It is worth pointing out that if an investor is going to pursue such a strategy he needs to have a very long investment horizon i.e. 20+ years otherwise it is very hard to find supporting evidence why any investor

should hold an asset with negative expected return. In 2000 the SP-500 Index was trading around 1400 and ten years later in 2010 the same index is trading around 1000. That is ten years of lost returns. If we look at markets from an even longer perspective we can see that they are trending upwards which is good news for a buy-and-hold-investor however significant returns are lost due to long period of drawdowns.

6. The Empirical Evidence

Now the objective for any investor is to diversify and maximize expected return. Exhibit-6 illustrates a comparatively diversified portfolio. The more bonds you buy the smoother the return index i.e. equity curve becomes. The bond return is simply assumed to be 2% per annum or 0.167 % per month. It is interesting to note that the bond returns in general tend to be the only return that will not become negative during a market crash (Ramchand & Susmel, 1998) hence bonds provides a good source of diversification even though the return on “risk free” government bonds has steadily been declining for the last 40 years. In exhibit-7 we can see a portfolio where the objective is to maximize expected return for a universe of 23 global stock market indices. i) Identify the market with the highest return in absolute terms for the last month. ii) If such a market had negative (positive) return for the last month then you take a short (long) position in the next month. In exhibit-8 we can see the performance of a two month risk adjusted return strategy aka trend following. Another important question to answer is: how often does a portfolio need to be rebalanced in order to make sure that an expected return remains positive. I plan to answer such question from a Kuwait perspective i.e. by looking at closing prices for companies at the Kuwait Stock Exchange (KSE). We can see in the first chart in exhibit-9 the daily percentage return index for a sample of 20 stocks trading on the KSE. We can also see the daily expected percentage return for a sample of stocks. We can see that a buy and hold investor would have struggled if such an investor would have selected a portfolio containing those randomly selected stocks. No stock has performed very well. We can see a sudden drop around 2008/2009 which can be explained by the global recession. It is also interesting to note that emerging markets tends to have higher beta than more saturated economies i.e. they are more sensitive to changes in the global economy. We can see in the second chart in exhibit-9, which is based upon a much bigger sample that some stocks have had a positive expected return but many stocks have also had a negative expected return. Over the complete sample, which includes 139 stocks trading on the KSE, 56 stocks had a positive expected return and 83 stocks had a negative expected return. We can also in exhibit-10 see how often changes in expected return have occurred for stocks trading on the KSE for different moving averages. A 60 day moving average should be dynamic enough to capture changes in expected return. We can see that for such a dynamic window expected return changes on average 60 times per stock over a time period of six years hence portfolio rebalancing becomes highly important.

7. Final Discussion

We have in this paper discussed portfolio theory. More specifically changes in expected return and the importance of portfolio rebalancing. Portfolio rebalancing is mainly a tool to make sure that an investor's expected returns are maximized and remain positive over time. An "optimal allocation" is only optimal as long as the numerator of the Sharpe Ratio is positive. We have also looked at empirical data from the KSE and analyzed how often changes in expected return took place for different rolling expected returns. We have discussed the general objective of an investor which is diversification and maximize expected return. For an institutional investor, with sophisticated software, maximizing both diversification and expected return is comparatively easy. For a small time investor such sophisticated optimization over a very large universe might be very difficult due to computational complexity. Hence, a more pragmatic approach for a small time investor would be to select trending securities from a diversify universe of i.e. bonds, stocks, commodities, real estate and then manage changes in expected return by engaging in frequently rebalancing. Our simple monthly rebalancing strategy consisting of 50% bond (diversification) and 50% momentum (expected return) produced very attractive returns even though the universe was limited to only 23 global index funds. Such a strategy will have low risk because i) it is comparatively diversified (even though that further asset class diversification is possible). ii) changes in expected return are actively managed. The purpose of this paper has been to show that even a small time investor can harvest the fruits of portfolio theory even if they can't afford to buy high end portfolio optimization softwares. The positive return produced by momentum investing has also been confirmed by other studies (Jegadeesh & Titman, 1993). Finally, the return index produced by the trend following strategy was not that attractive. One reason might be the limited universe such a strategy was run over. A trailing stop loss could also have been used as an exit strategy.

References

- Conrad, J & Kaul, G. (1988). Time-Variation in Expected Returns, *Journal of Business*, Vol. 61, No. 4, pp. 409-425.
- Covel, M. (2004). *Trend Following: How Great Traders Make Millions in Up or Down Markets*, Pearson Education Inc.
- Davidsson, M. (2010). Risk Management in a Pure Unit Root, *Journal of Risk Finance*, Vol 11, Issue 2, pp 224-234.

Engle, R. (1982). ARCH with Estimates of Variance of United Kingdom Inflation, *Econometrica*, 50:987-1008.

Fabozzi, F & Focardi, M. (2010). Diversification: Should We Be Diversifying Trends? *The Journal of Portfolio Management*, Vol. 36, No. 4: pp. 1-4.

Fama, E & French, K. (1993). Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics* 33 (1): 3-56.

Jegadeesh, N & Titman, S. (1993). Returns to buying winners and selling losers, *Journal of Finance* 48, 65-91.

Kelly, J. (1956). A New Interpretation of Information Rate, *Bell System Technical Journal*, vol 35, pp 917-926.

Markowitz, H. (1959). *Portfolio Selection: Efficient Diversification of Investment*, New York: John Wiley & Sons

Powers, M. (2010). Presbyter Takes Knight, *Journal of Risk Finance*, vol. 11, issue 1.

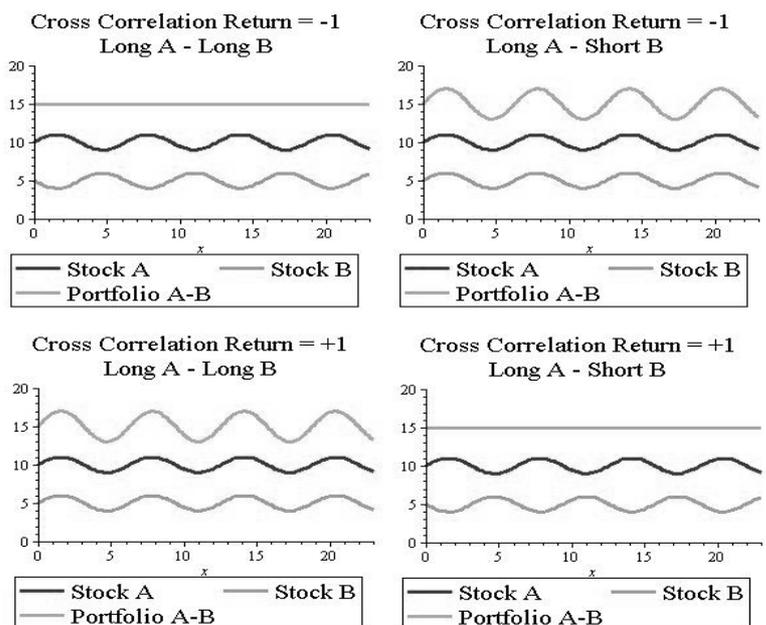
Ramchand, L & Susmel, R. (1998). Volatility and Cross Correlation across Major Stock Markets, *Journal of Empirical Finance*, vol 5, issue 4, pp 397-416.

Seykota, E. (2001). Determining Optimal Risk, *Technical Analysis of Stocks & Commodities Magazine*.

Sharpe, W. (1964). Capital Asset Prices - A Theory of Market Equilibrium under Conditions of Risk, *Journal of Finance*, vol 19, issue 3, pp 425-442.

Taleb, N. (2007). *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets*, Thomson Texere London.

Exhibit-1. Diversification and Return Noise Cancellation



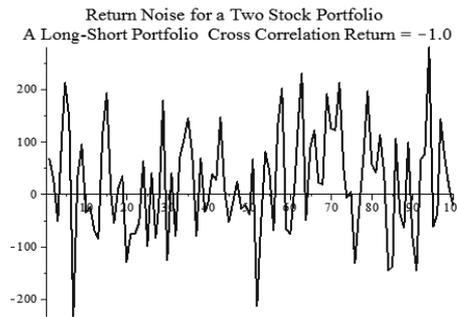
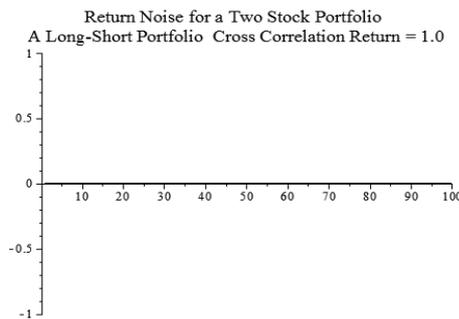
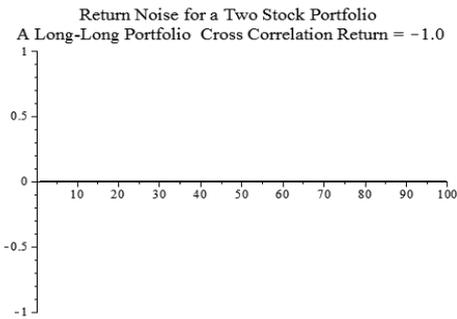
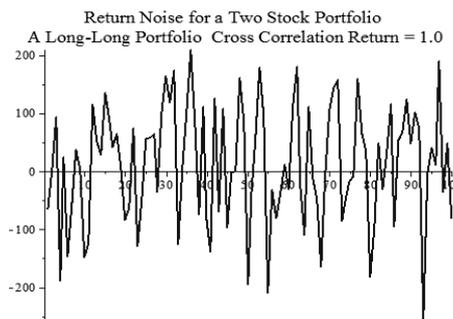
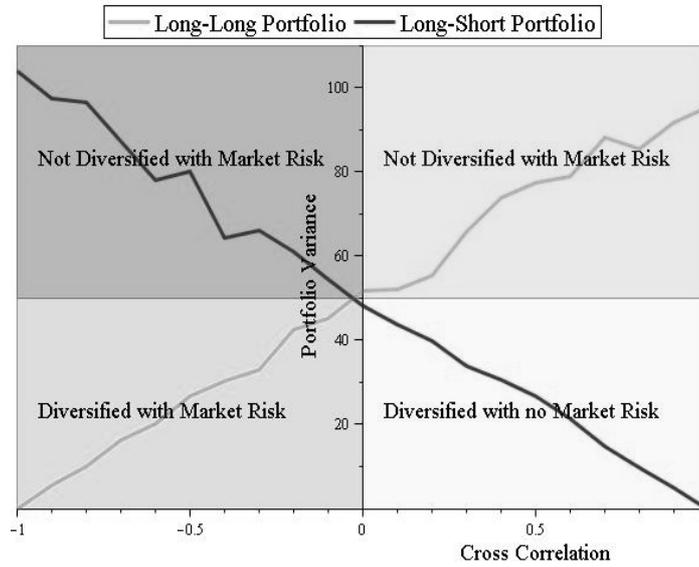


Exhibit-2. Trend Following and Expected Return

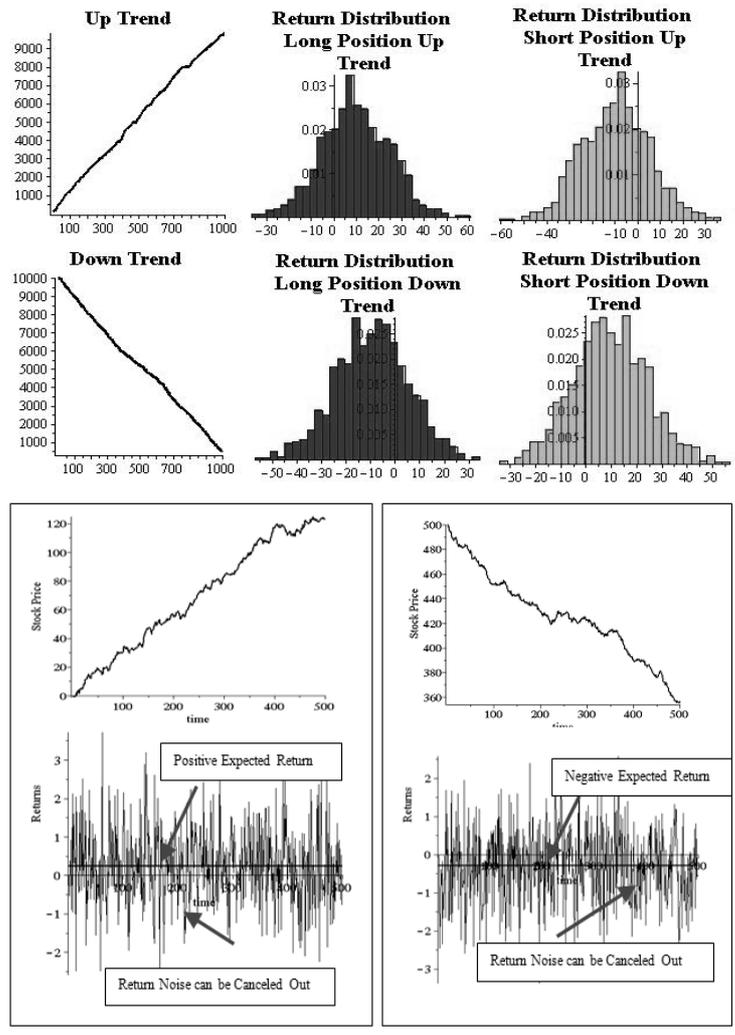


Exhibit-3. Rebalancing and Expected Return

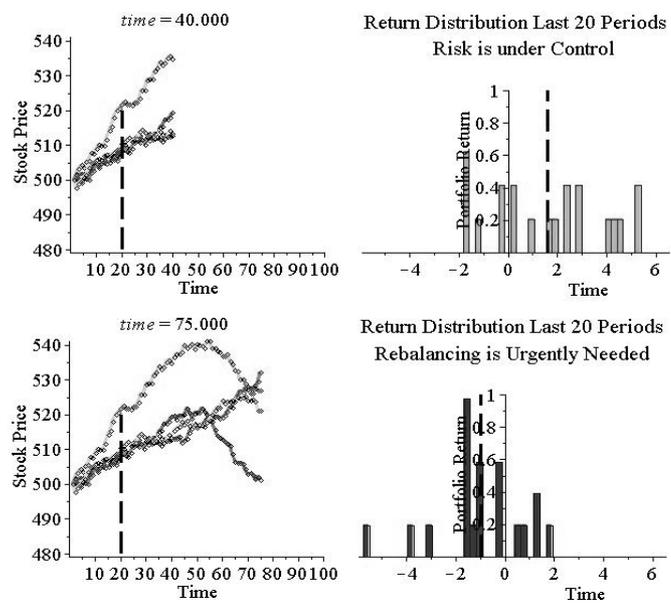


Exhibit-4. Price Trends and Expected Return

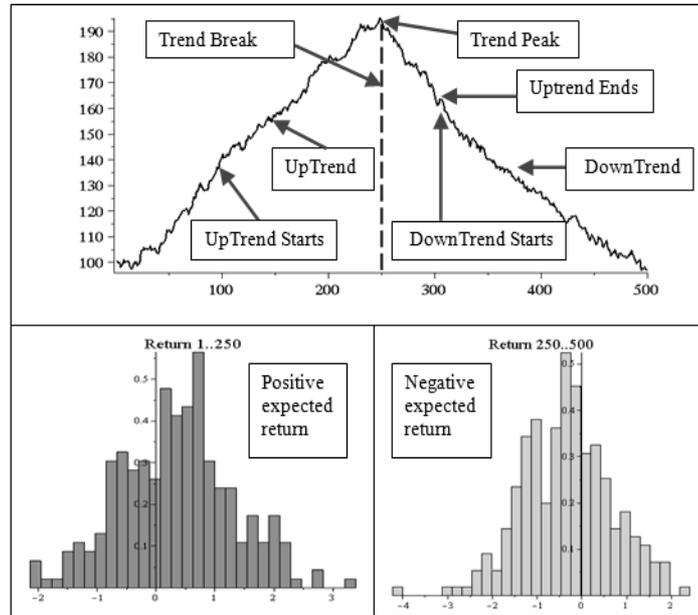


Exhibit-5. Trend Following and Behavioral Biases

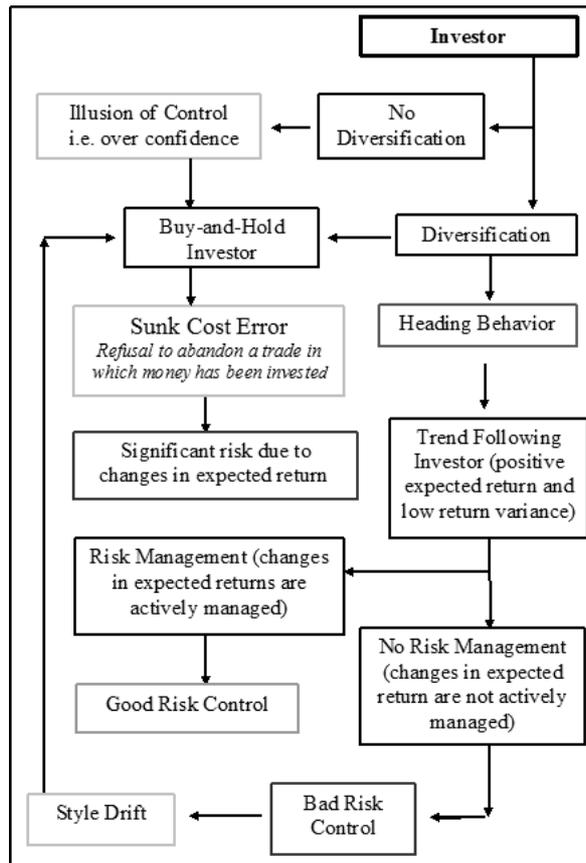


Exhibit-6. Diversified Portfolio

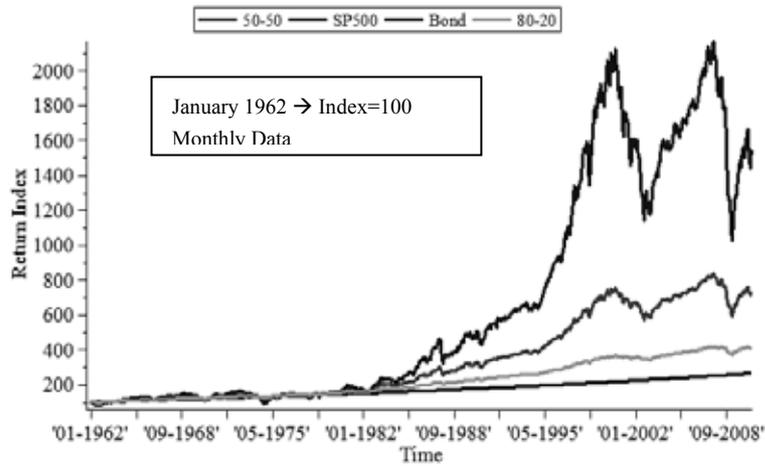
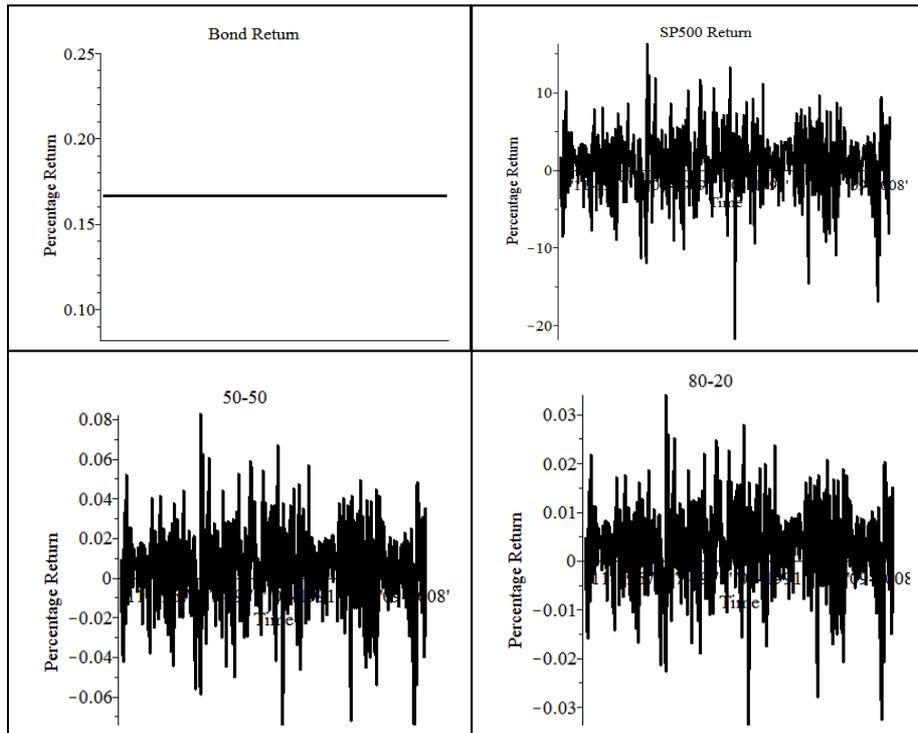


Exhibit-7. Global Portfolio and Expected Return (Momentum Portfolio)

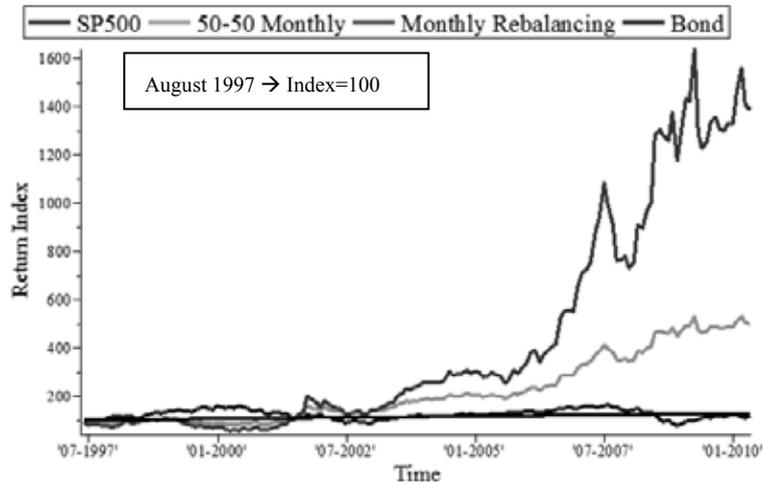
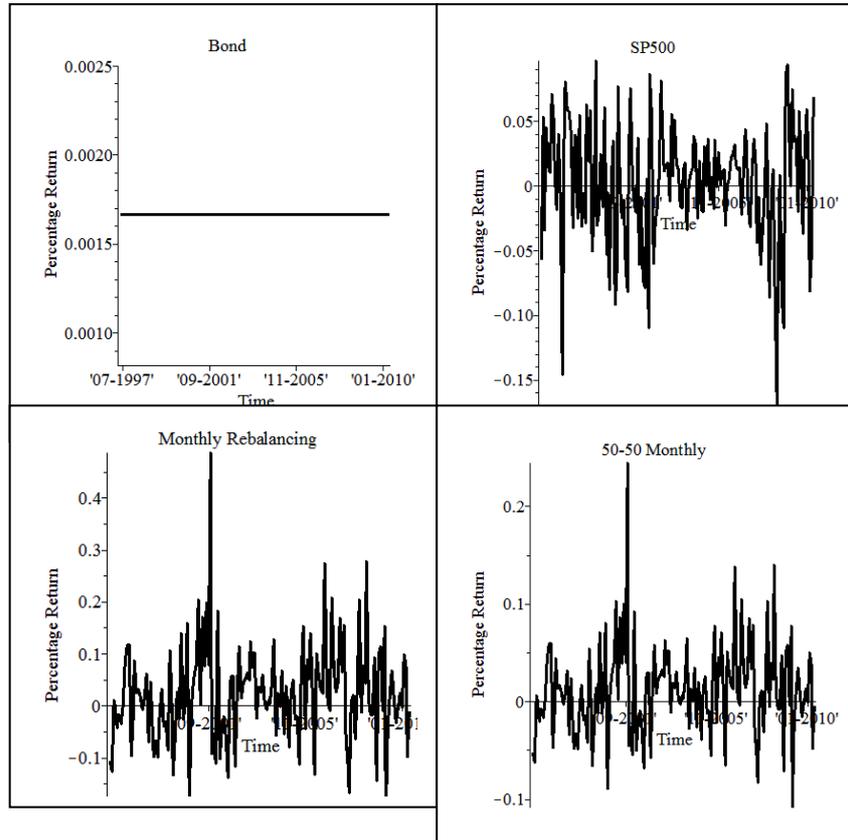


Exhibit-8. Global Portfolio and Trend Following (risk adjusted conditional expected return)

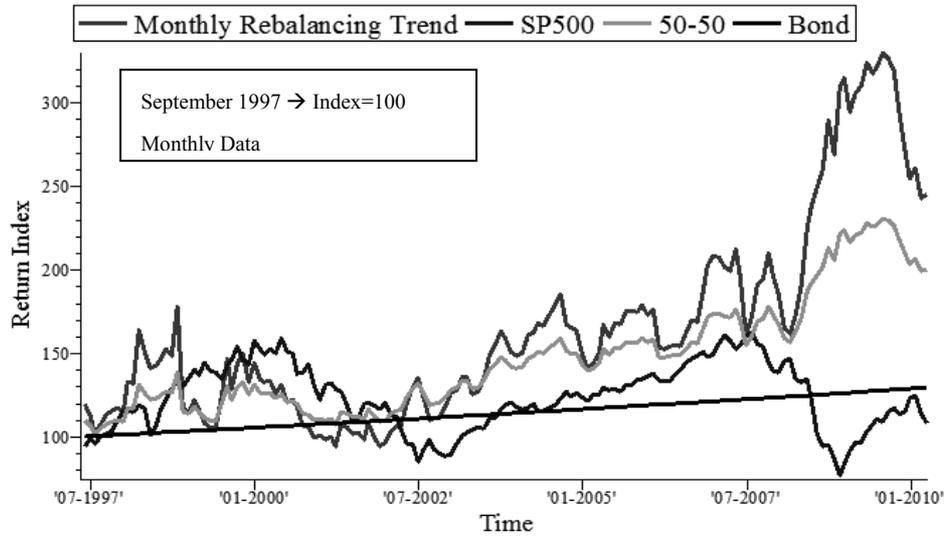
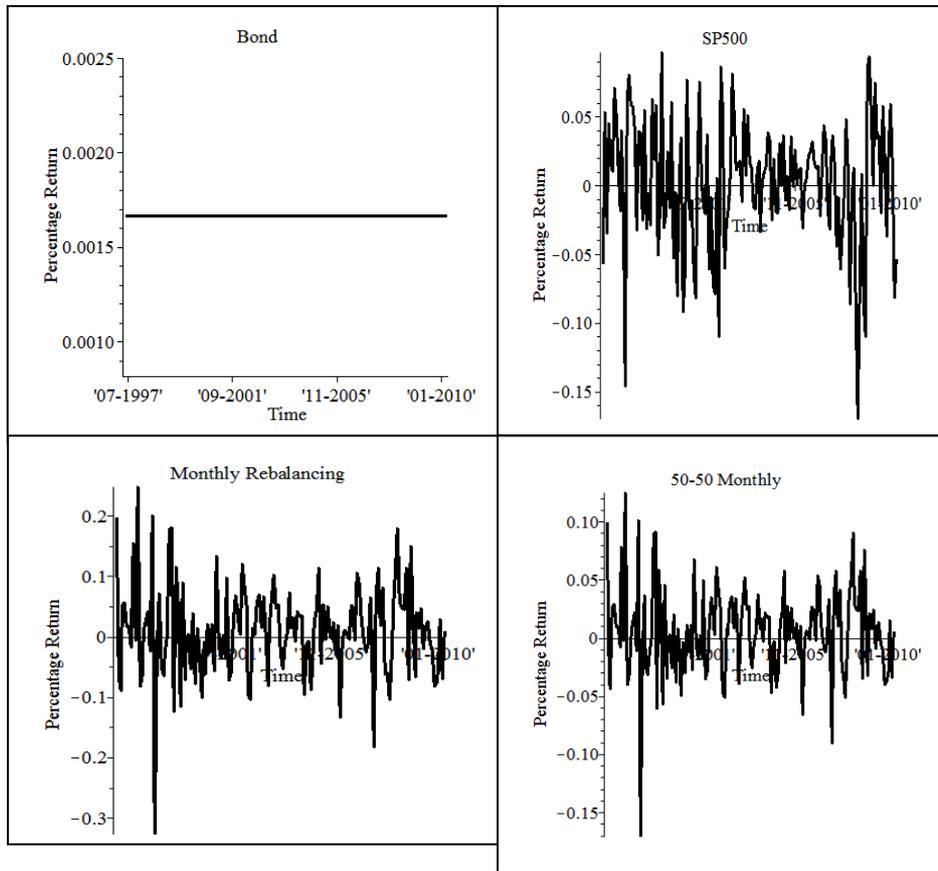


Exhibit-9. Kuwait Stock Market Data

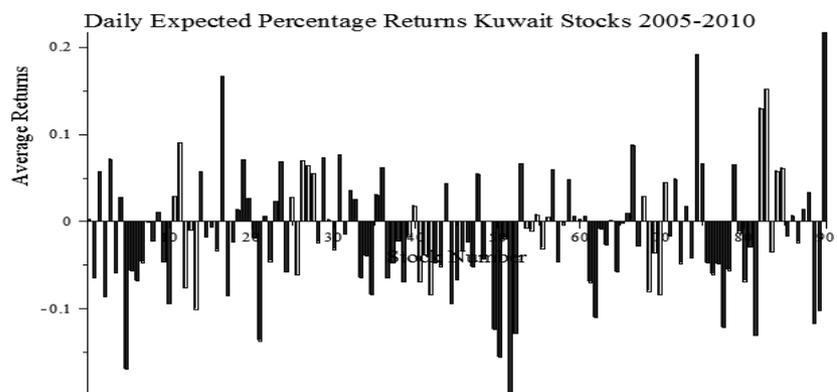
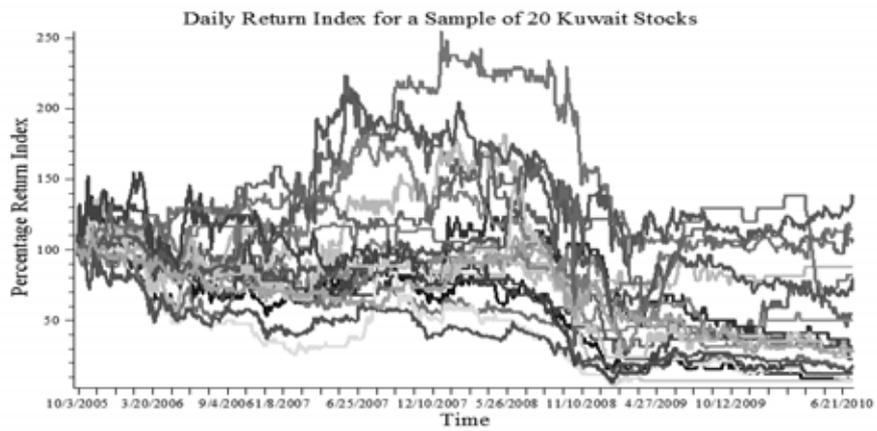


Exhibit-10. Expected Return and Kuwait Stocks

