Multi Asset Portfolio: Back-testing Report

Report Prepared for the Hamilton Investment Fund

This analysis has been undertaken by Dr Paul Docherty to verify the performance and risk of the Multi Asset Portfolio investment strategy, by applying the strategy (on a notional basis) to historical market data over the past 20 years.

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The Portfolio

The Multi Asset Portfolio strategy allocates assets across several asset classes as follows:

Asset Class	Target Range %	Benchmark %
Cash and cash equivalents	9 to 11	10
Fixed income	22.5 to 27.5	25
Equities	13.5 to 16.5	15
Real estate	6.75 to 8.25	7.5
Natural resources	6.75 to 8.25	7.5
Swiss franc assets	9 to 11	10
Gold, silver & other precious metals	22.5 to 27.5	25
TOTAL		**100**

The Multi Asset Portfolio strategy takes a passive approach, with the relative proportion of capital invested in each asset class rebalanced quarterly.

The Benchmark

The Multi Asset Portfolio strategy aims to achieve returns over the medium to long term (5 to 7 years) which exceed the Australian inflation rate by 4% (the Benchmark).

This report also compares the risk-adjusted return of the Multi Asset Portfolio strategy to the Australian equity market index.

Data

To back-test the historic returns on the Multi Asset Portfolio's investment strategy, data was collected from Thomson Reuters Datastream. The following indices were used as proxies for each asset class:

Cash (10%)
UBS Bank Bill Index

Fixed income (25%)
UBS Composite Bond Index

Equities (15%)
S&P ASX300 Industrials Index

Real estate (7.5%)
S&P ASX300 A-REIT Index

Natural resources (7.5%)
S&P ASX300 Resources Index

Swiss franc assets (10%)
CHF denominated Swiss 10-year Government Bond Index

Gold, Silver & Metals (25%)
Perth Mint Gold $AUD (20%)
Perth Mint Silver $AUD (5%)

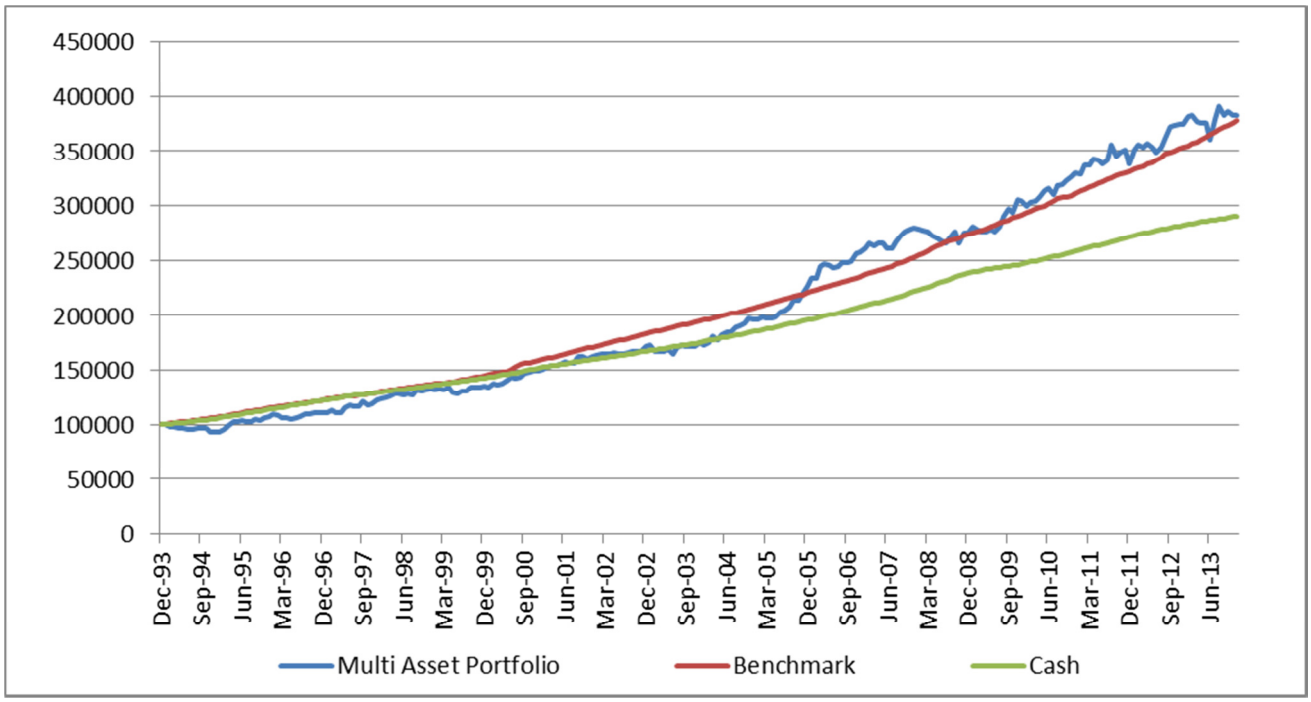
Equity Market (Benchmark)
S&P ASX300 Index

Inflation (Benchmark)
CPI excluding volatile items

Historical Performance – Back-testing Overview

Figure 1 compares the notional returns on $100,000 invested using the Multi Asset Portfolio strategy and the Benchmark across the 20-year period from 1994 to 2013. The notional returns for the Multi Asset Portfolio strategy are calculated after transaction costs and an allowance for fees of [1.5375%] per annum. The notional performance of the Multi Asset Portfolio strategy closely tracks the Benchmark across the entire period of evaluation. At the end of 2013, the initial investment of $100,000 using the Multi Asset Portfolio strategy gives a terminal value of $382,183 compared with $377,604 for the Benchmark. Across the same time period, a $100,000 investment in cash would have a terminal value of only $290,282.

Figure 1: Cumulative Returns on $100,000 Investment



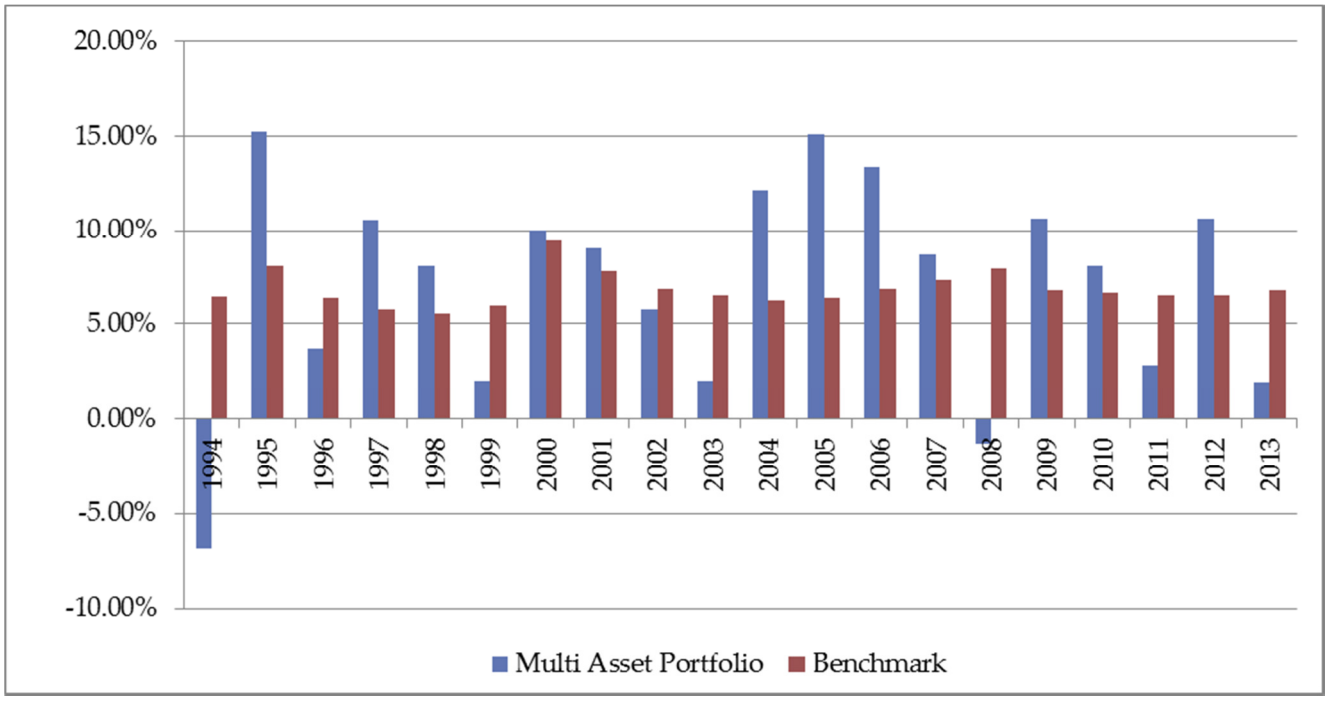
The notional returns using the Multi Asset Portfolio strategy and the Benchmark are compared in Table 1. As the Multi Asset Portfolio strategy aims to achieve the Benchmark return over the medium-to-long term, investment periods of the most recent 5, 10, 15 and 20 years are considered. The Multi Asset Portfolio strategy would have outperformed the Benchmark in each period.

Table 1: Medium-to-Long Term Historical Returns (p.a.)

	5yr	10yr	15yr	20yr
Multi Asset Portfolio strategy	6.76%	8.08%	7.15%	6.93%
Benchmark	6.68%	6.83%	7.00%	6.87%

The notional annual returns for the Multi Asset Portfolio strategy and the Benchmark are reported in Figure 2. The Multi Asset Portfolio strategy would have outperformed the Benchmark in 12 out of 20 years. There were only two years across the period from 1994 to 2013 when the return, using the Multi Asset Portfolio strategy, would have been negative. The strongest outperformance would have been during the bull markets of 1995 and from 2004 to 2006.

Figure 2: Annual Returns



Risk

The risk associated with using the Multi Asset Portfolio strategy compared with and equity-only portfolio is reported in Table 2. The standard deviation of monthly returns for the Multi Asset Portfolio strategy is less than half the standard deviation of monthly returns for the S&P ASX300 index, indicating that the former is much less risky.

The beta of the Multi Asset Portfolio strategy is only 0.19, indicating that returns using this strategy have a low correlation with equity market returns. Hence, the Multi Asset Portfolio strategy only exhibits a small amount of sensitivity to market-wide deviations.

Table 2: Standard Deviation and Beta

	Standard Deviation	Beta
Multi Asset Portfolio	1.60%	0.19
S&P ASX300	3.75%	1.00

Risk Measures

The standard deviation of returns (σ) is a statistical measure of the variation of historical returns from the average. The standard deviation is commonly accepted to be a reasonable measure of the total portfolio risk. Standard deviation is measured as follows:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{n}(R_i - \bar{R})^2}$$

The beta of returns (β) is a measure of the sensitivity of returns to general market movements. Beta is an appropriate measure of risk where an investment is one part of an investor's total wealth. Beta is measured as follows:

$$\beta = \frac{cov(R_i, R_m)}{\sigma_m^2}$$

See ***Glossary*** (back page) for explanation of variables in formulae.

Downside Risk

Conventional risk measures show the amount of deviation from the average, treating both negative and positive deviations the same. Investors are more concerned with negative deviations than positive ones. Downside risk resolves this problem by focusing of negative deviations.

One way to measure downside risk is by undertaking drawdown analysis, which examines the frequency and magnitude of negative return months. An investment portfolio with more frequent and/or larger drawdowns has a greater exposure to downside risk.

A more formal measure of downside risk is downside deviation (σ^-), which calculates the standard deviation of returns less than zero as follows:

$$\sigma^- = \sqrt{\frac{\sum_{i=1}^{n}[\min(0, R_i)^2]}{N^-}}$$

See ***Glossary*** (back page) for explanation of variables in formula.

Drawdown Risk Analysis

The downside risk of the Multi Asset Portfolio strategy and the S&P ASX300 Index across the period from 1994 to 2013 are compared in Table 3. The Multi Asset Portfolio strategy would have generated a negative return in a slightly larger proportion of months (90 compared with 86). However, the mean return in negative months would have been much more negative for the S&P ASX300 (-3.24%) compared with the Multi Asset Portfolio strategy (-0.95%). The downside deviation is also substantially higher for the S&P ASX300 compared with the Multi Asset Portfolio strategy.

The results in Table 3 indicate that the Multi Asset Portfolio strategy has a much lower exposure to downside risk compared with an equity-only portfolio.

Table 3: Drawdown Risk Analysis

	No. Negative Months	Mean Negative Return	Downside Deviation
Multi Asset Portfolio	90	-0.95%	0.96%
S&P ASX300 Index	86	-3.24%	2.71%

Risk-Adjusted Returns

Table 4 compares the risk-adjusted returns of the Multi Asset Portfolio strategy and the S&P ASX300 index. Using the Sharpe ratio to calculate risk-adjusted returns, the Multi Asset portfolio strategy is shown to have notionally outperformed the S&P ASX300 index across the past 10- and 15-year periods, but not in the most recent 5-year period or across the 20-year holding period. When the Treynor ratio is used to measure risk-adjusted returns, the Multi Asset Portfolio strategy is shown to have outperformed the S&P ASX300 index across all holding periods. When notional returns are adjusted for downside risk (Sortino ratio), the Multi Asset Portfolio strategy outperforms the S&P ASX300 across the last 20-, 15- and 10-year periods, but not in the most recent 5-year period.

When all three ratios are taken as a whole, the notional risk-adjusted returns generated by the Multi Asset Portfolio strategy compare favourably to an equity-only investment.

Table 4: Risk-Adjusted Returns

	5yr	10yr	15yr	20yr
Sharpe Ratio Multi Asset Portfolio	0.130	0.143*	0.111*	0.080
Sharpe Ratio S&P ASX300	0.185*	0.105	0.099	0.093*
Treynor Ratio Multi Asset Portfolio	0.016*	0.015*	0.012*	0.007*
Treynor Ratio S&P ASX300	0.007	0.004	0.004	0.004
Sortino Ratio Multi Asset Portfolio	0.212	0.237*	0.177*	0.131*
Sortino Ratio S&P ASX300	0.335*	0.136	0.135	0.126

* Represents the higher ratio for any given holding period.

Risk-Adjusted Returns Measures

Risk-adjusted returns are a measure of how much return an investment will provide given the level of risk associated with it, enabling the comparison of two investments that have different risk profiles.

The Sharpe ratio (S) measures the excess return per unit of standard deviation in returns. It is calculated as follow:

$$S = \frac{\bar{R} - R_f}{\sigma_{\bar{R}-R_f}}$$

The Treynor ratio (T) measures the excess return per unit of beta. It is calculated as follows:

$$T = \frac{\bar{R} - R_f}{\beta}$$

The Sortino ratio (So) measures the excess return per unit of downside deviation. It is calculated as follows:

$$So = \frac{\bar{R} - R_f}{\sigma^-}$$

See ***Glossary*** (back page) for explanation of variables in formulae.

Conclusion

The Multi Asset Portfolio strategy would have generated an after transaction costs and fees* return that slightly outperformed the stated benchmark of inflation plus 4% across the period from 1994 to 2013. This strategy has less risk and less downside risk compared with a portfolio that is fully invested in equities. The risk-adjusted returns that would have been generated by the Multi Asset Portfolio strategy compare favourably to the risk-adjusted returns of the S&P ASX300 index.

*Allowing for transaction costs and fees of [1.5375%] per annum.

Report Author:

Dr Paul Docherty
PhD (Finance), B Com (Hons 1), LLB, GCPTT.
Senior Lecturer in Finance – The University of Newcastle

Email: Paul.Docherty@newcastle.edu.au

Important Notice

The information in this report is not intended to, and does not, constitute financial, tax, legal, investment or professional advice.

This report has been prepared solely for informational purposes and is not a recommendation to participate in any particular investment strategy.

The analysis provided in this report applies the current investment strategy of the Multi Asset Portfolio to historical market data over the past 20 years. The returns used in this analysis are notional returns only, and not the actual historical returns of the Multi Asset Portfolio, any other fund or any financial product.

All investment returns fluctuate across time and the past performance of an investment strategy is no guarantee of the future performance of the same strategy.

Glossary

R_i	The return of a financial asset i in a particular period.
$\bar{R}$	The mean return of a financial asset across the entire sample.
$cov(R_i,R_m)$	The covariance between the returns of financial asset i and the market portfolio m.
σ_m^2	The variance of the returns of market portfolio m.
$min\ (0,R_i)$	The minimum of either zero or the return of financial asset i in a particular period.
N	The number of time periods in the entire sample.
N^-	The number of periods in the entire sample where the returns of financial asset i are negative.
R_f	The risk-free rate of return.
β	A measure of the sensitivity of returns to general market movements.
σ^-	The standard deviation of returns less than zero.
So	The Sortino ratio (So) measures the excess return per unit of downside deviation.
S	The Sharpe ratio (S) measures the excess return per unit of standard deviation in returns.
T	The Treynor ratio (T) measures the excess return per unit of beta.
σ	The standard deviation of returns (σ) is a statistical measure of the variation of returns from the average.
$\sum_{i=1}^{n}$	The sum of all observations across n time periods.