EFFICIENT ASSET ALLOCATION FOR INDIVIDUAL INVESTORS: IS SOUTH AFRICA DIFFERENT

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The asset allocation decision adds more to the return of a portfolio than selecting securities within the asset classes. The lack of knowledge of South African individual investors, and to a large extent international investors, prohibit them from making efficient asset allocation decisions. Due to the large number of different securities available to investors, it is unreasonable to expect that they will be able to select a well diversified portfolio with the limited resources available to them.

The aim of this research paper is to determine if there is a simplistic model to be used by individual investors for asset allocation decisions. With the emergence of unit trusts, index funds, and exchange traded funds in South Africa where investors can invest in a basket of securities, it has become easier to diversify portfolios. Proxies are used for the main asset classes, namely shares, bonds, and cash. By applying Markowitz portfolio theory, an efficient frontier is constructed with the asset classes as inputs. Risk-adjusted returns are then calculated for portfolios on the efficient frontier and combined with utility theory to determine the most efficient portfolio.

The allocations to the various asset classes are calculated and compared over time, as well as with selected foreign countries. Optimum intervals for portfolio rebalancing by individual investors in an emerging market are also explored.

JEL classification code: G11

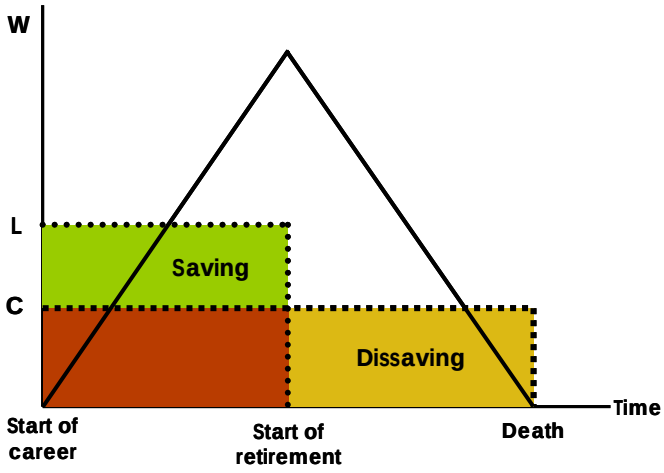
Introduction – Individual investors

The asset allocation of individual investors is often influenced by advice from financial advisors/planners, brokers, or bankers. An analysis of the individual's personal situation is important as basis for setting up a financial plan. Huber & Kaiser (2003) advise that recommendations are geared towards the individual's stage of life, risk tolerance, investment goals, and liquidity needs.

Figure 1 indicates the influence of consumption, saving, and dissaving on the wealth of an individual over his or her life-cycle. Consumption (C) is defined as a function of wealth of household (W), labour income of household (L), marginal propensity to consume from wealth (a) and

marginal propensity to consume from labour income (c)as follows: $C = aW + cL$

Figure1:
Consumption, Saving, and Dissaving According to the Life-Cycle Hypothesis



Source: Modigliane (1966: 166)

Malkiel (1996) advocates that two considerations are important in an individuals investment choices – the individuals capacity for risk, and his/her attitude toward risk.

Modern portfolio theory purports that diversification minimizes non-systematic or idiosyncratic risk. An investor can achieve the right balance between risk and reward by combining the use of a utility function with diversification (Chhabra, 2005).

As reported by Spero (2000), David Dreman summed up the rationality of the individual investor as follows:

> "Modern economic theory is based on the assumption that people are rational and on what economists call utility theory. Investors consider the trade-off between risk and return and then spend, save, and invest their money to increase their overall return. Any adviser who has been in the business more than three months knows this is not necessarily the way things work."

Individual investors do not define risk in the same way as investment managers. Individuals experience and define the following as risk (Kiefer, 2000):

- *Exclusion* – the risk of not being in the winning asset at the right time;
- *Loss* – clients focus on the risk of negative returns;

- *Regret* – may feel regret even though the investment decision was good;
- *Cash flow* – volatility in the income stream provided by the investment;
- *Goal shortfall* – risk of not reaching investment goal; and
- *Performance risk* – risk of not achieving client's expected return.

Chhabra (2005) also adds the following two components of personal risk:

- *Lifecycle stage* – person at peak of earning capacity may be able to take on more risk than someone close to retirement; and
- *Event risk* – protection against singular risks like loss of job, or macro events such as market crashes.

Brunel (2003) defines *decision risk* as the risk of changing strategy at the worst possible time. He argues that approaches geared toward reducing this risk be aimed at strategic asset allocation or tactical portfolio rebalancing.

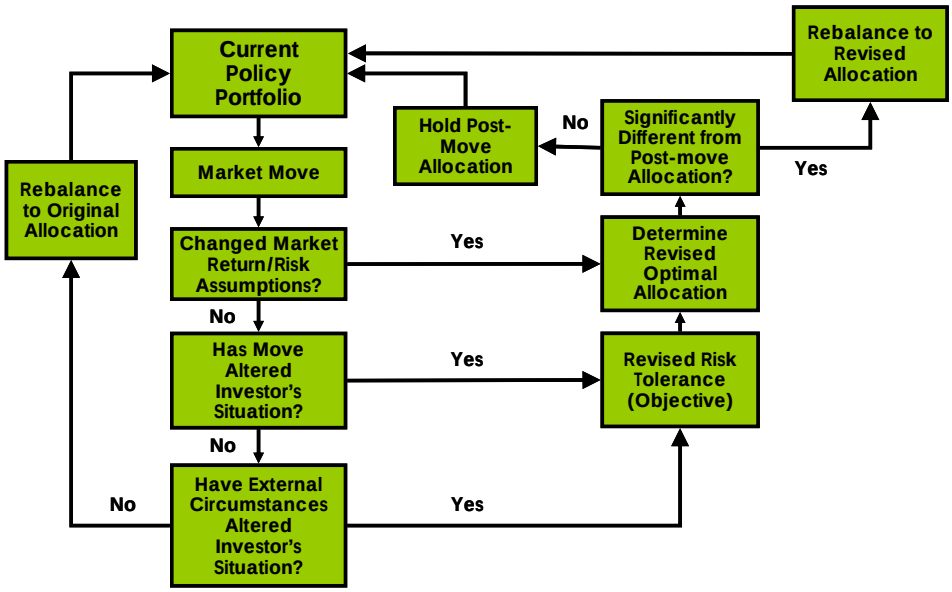
Brown (2003) and McCarthy (2004) point out that individual investors define risk in subjective terms (like losing money or investing in unfamiliar securities) and focus on absolute returns instead of relative returns. They add that individuals lack the ability to interpret portfolio risk measures, and that too much investment knowledge is assumed in risk profiling questionnaires leading to sub-optimal portfolio construction based thereon. McCarthy (2004) suggests that advisors determine risk tolerances and educate clients on the impact of portfolio volatility.

Spero (2000) insists that an investment policy statement should be drawn up for each client meeting the following main criteria:

- Confirm portfolio objectives;
- Protect the portfolio from ad-hoc changes;
- Maintain discipline for a long-term strategy; and
- Restrain manager/client from inappropriate short-term actions.

The policy statement should be reviewed at least annually to confirm goals and to evaluate allocation and methodology in light of the goals. An idealized portfolio revision process is depicted in Figure 2.

Figure 2:
An Idealized Portfolio Revision Process



Source: Leibowitz (2004)

Schooley (1999) found that the asset allocations of US individual investors are consistent with their time horizons and risk tolerances. Investors with time horizons of less that a year were not willing to take risk, and few investors with long time horizons of more that ten years were not willing to take risk. Equity holdings in portfolios confirmed the aforementioned, with higher allocation to equities for portfolios of individuals willing and able to accept more risk.

Markowitz mean-variance portfolio theory

In 1952 Harry Markowitz published an article on portfolio selection advocating the use of the expected (mean) return and variance of return of the portfolio as a whole, as criteria for portfolio selection (Markowitz, 1999). He proposed that the expected return on a portfolio is the weighted average of the expected returns of the securities of which the portfolio is comprised, and the variance of portfolio return is a function of the variances of, and covariances between, securities and their weights in the portfolio.

Comparing Markowitz's measure of portfolio risk, the standard deviation of returns, graphically with the expected return of the portfolio, an envelope curve can be constructed that contains the best possible combinations of risk and return called the efficient frontier(Reilly, 2003). Portfolios lying on the efficient frontier will dominate all other portfolios because they provide the maximum return for a given level of risk, or minimise risk for a given level or return.

Michaud (1989) recommends that optimization should be defined in terms of a benchmark, and that transaction and liquidity cost constraints should be included.

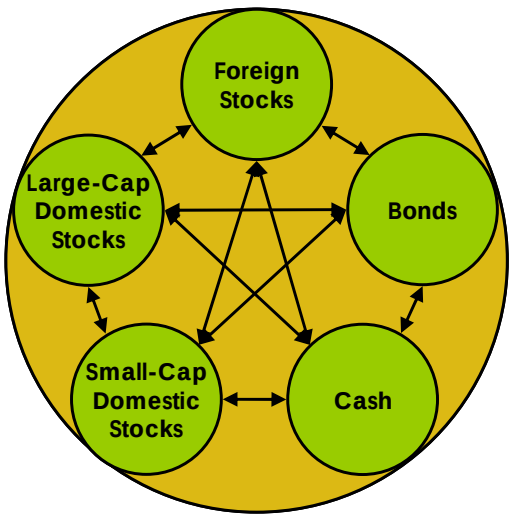
Altay-Salih (2002) tested the performance of the efficient frontier in an emerging market setting. He established that increasing foreign participation in an emerging market has a deteriorating effect on the performance of mean variance portfolio investing compared to passive strategies. The study also found that better results were obtained using shorter periods of past data, with two years being too long – better performance was achieved with one year of past data.

In his 1952 work, Markowitz also mentioned inclusion of consumer durables, nonportfolio sources of income, changing probability distributions, illiquidities, and taxes into formal portfolio analysis.

Mean-variance versus behavioural portfolio theory and diversification

Mean-variance-efficient portfolios, as described by Markowitz, depend on the expected return and standard deviation of return of each asset, as well as the correlation between the returns of each pair of assets Figure 3). Individual investors, however, build behavioural portfolios, ignoring correlation between assets (Statman, 1999). Behavioral portfolios are constructed as pyramids with layers of assets as can be seen in Figure 4. Correlations between assets are not taken into account, but portfolios are rather constructed in layers representing specific goals and attitudes toward risk. Bottom layers are designed to protect on the downside, and upper layers to get upside potential (Statman (2004).

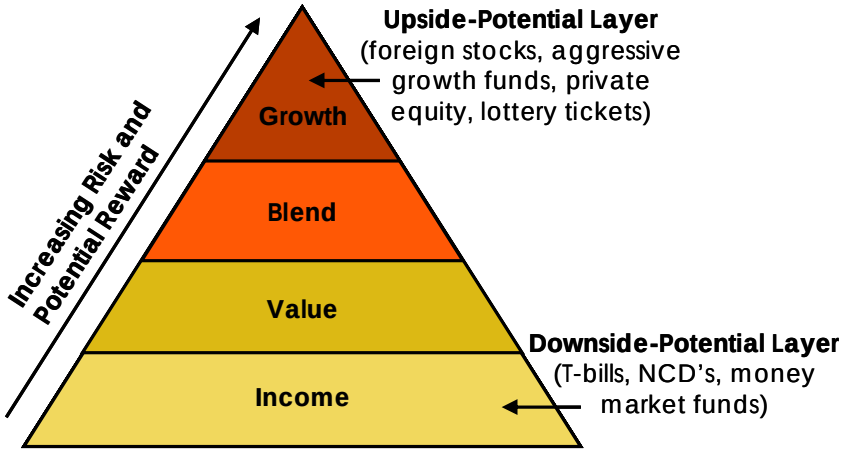
Figure 3:
Mean-Variance Portfolios



Source: Adapted from Statman (1999)

Figure 4 indicates how risk and potential reward increases as we move up the layers of the behavioural portfolio. The same investor will include Government securities and NCD's at the lowest level (downside protection level), but will also include foreign securities, IPO's and lottery tickets at the highest level (upside potential level). Statman (1999) contends that diversification is only desirable to reduce risk when looking at the future, not at the past. Looking at the past, the only thing relevant to investors is having been in the best performing asset class.

Figure 4:
Behavioural Portfolios (Layered Pyramids)



Source: Adapted from Statman (1999) and Statman (2004)

Reduction of risk is always seen as a benefit in mean-variance portfolio theory, but not always in behavioural portfolio theory. Statman (2004) describes undiversified investors as "mathematically challenged" in the same way as lottery players and say they are motivated by hope for riches, and not risk seeking. He states that diversification rules for behavioural portfolios might not be as precise as that of mean-variance portfolio theory, but there should be a balance between upside potential and downside protection.

In the 1960's a portfolio could be sufficiently diversified by including as little as 20 stocks (Malkiel, 2002). Statman (2004) argues that at least 300 stocks are necessary in todays market to get the same level of diversification. He also found that the average investor only holds 2 or 4 stocks, evidence that investors compile behavioral portfolios ignoring diversification.

Malkiel (2002) suggests that investors consider other asset classes, i.e. REITs (real estate investment trusts – property unit trusts (PUTs) in RSA), and Treasury Inflation-Indexed Securities (Inflation-linked bonds in RSA) for optimal diversification. Building a core portfolio consisting of index

funds (or exchange traded funds (ETFs)) will greatly enhance diversification. He found that, from a US perspective, international stocks did not add to diversification, and that indexing outperformed actively managed funds for US equity funds, international equity portfolios, as well as bond funds.

A study by O'Neal (1997) proved that investors can get diversification benefit by holding more than one mutual fund (unit trust). Although holding more mutual funds do not influence standard deviation much, he saw significant reduction in terminal wealth level dispersion. For long-term investors this is of great importance.

Siebenmorgen and Weber (2003) studied the asset allocation recommendations of investment advisors in Germany and found that the recommendations are more consistent with the behavioural model than mean-variance optimisation. They focused more on spreading investments evenly over asset classes than minimizing variance as Markowitz diversification requires.

Merton and Campbell-Viceira extends "old" Markowitz portfolio theory with the following (Ambachsheer, 2005), representing major advances in investment theory:

- Multiple investment horizons rather than a single horizon;
- Potential cash flows are more useful in assessing rewards of long-horizon investment strategies than future wealth prospects;
- Rewards from investments must be integrated with other risks and rewards, longevity, real property and education; and
- Strategic asset allocation should be dynamic due to predictive timevariant components of bond and equity returns.

Asset Allocation

According to Reilly (2003) and Brinson (1986), the design of a portfolio involves four decisions:

1. The asset classes to include in the portfolio;
2. The normal or policy weights to assign to each asset class;
3. Allowable allocation ranges based on policy weights; and
4. Selecting specific securities to buy for the portfolio.

Two studies by Brinson (1986)&(1991) and a study by Ibbotson (2000) all found that about 90 percent of a fund's return over time can be attributed to its asset allocation policy. Jahnke (1997) also remarked that "There is little doubt that asset allocation is an important determinant of portfolio performance." He, however, also raised questions regarding appropriate asset classes, fixed or dynamic asset

class weights, determination of asset allocation, as well as the cost of implementation.

The asset allocation process can be divided into the following three stages (Cahn, 1998):

1. Strategic asset allocation;
2. Tactical asset allocation; and
3. Portfolio Rebalancing.

All three stages need to be integrated to ensure effective asset allocation.

Portfolio Rebalancing

Rebalancing forms an important part of the asset allocation process in that it minimises the loss of efficiency resulting from deviations of the asset allocation that is undesireable (Chan, 1998).

Fenelli (2003) reports that rebalancing strategies "are almost universally recommended" as instrument of risk control in portfolio management. Because they eliminate emotional responses to adverse conditions, rebalancing strategies complement strategic asset allocation policies.

Tsai (2001) highlights the following commonly used rebalancing strategies:

- Never rebalance;
- Mandatory monthly rebalance;
- Mandatory quarterly rebalance;
- Rebalance if any asset class drifts by more than five percentage points at month-end; and
- Rebalance if any asset class drifts by more than five percentage points at quarter-end.

Results of a study published in Employee Benefit Plan Review (Anonymous, 1999) found that rebalancing produced better risk-adjusted rates of return compared to buy-and-hold strategies without any rebalancing. Rebalancing adds value to a portfolio, no matter which strategy is used (Tsai, 2001).

Annual rebalancing, in a study by Israelson (2002) proved to lower volatility and increase investor returns. According to Chan (1998), quarterly rebalancing produced the best enhancement to return of the calendar-period-based rebalancing rules with optimum results obtained with a wide rebalancing range such as +/- 10%. Using turning points in the monetary cycle as trigger points for rebalancing, Jensen

and Mercer (2003) achieved better in sample Markowitz efficiency than a buy-and-hold strategy or business cycle approach as applied by Brocato and Steed (as reported by Jensen, 2003).

Rebalancing, however, comes at a cost, and the benefits must always be weighed against transactions costs incurred during rebalancing. Optimal rebalancing can provide both higher returns and lower risk by implementing a no-trade region around desired asset allocations and only implementing trades if these boundaries are breached and only to bring it back to the boundary, not the target allocation (Donahue, 2003).

Assumptions

The study is subject to the following assumptions:

1. No taxes and transaction costs;
2. Individuals have access to limited information – calculations based on two-year historical data;
3. Only domestic investments considered;
4. Invest only in three main asset classes, i.e. equity, bonds, and cash;
5. Portfolios built for investor with average investment utility function;
6. The risk tolerance of the investor is static (objectives do not change);
7. Returns are calculated in local currencies; and
8. Constraints on portfolio: short selling is not allowed, but there are no further restrictions on the asset allocation – investors can invest from 0% to 100% in any asset class.

Methodology

Data used for the study was obtained from the I-Net Bridge database. Proxies were used to represent the three main asset classes – equity, bonds, and cash. For South Africa, the total return on the FTSE/JSE All Share Index and the BESA All Bond Index were used as proxies for equity and bonds respectively. The yield on 3-Month NCD's was used as a proxy for cash. For international comparisons, the JP Morgan Government Bond Indices, in local currencies, were used for bond proxies, and Call Deposit Rates for cash. For equity proxies we used the ASX All Ordinaries Index (Australia), the Toronto 300 Composite Index (Canada), the Nikkey 300 Index (Japan), the FTSE All Share Index (United Kingdom), and the S&P 500 Composite Index (United States of America).

Complete data was obtained for the period 01/01/1999 to 31/12/2004. Two-year historical information was used to determine mean-variance portfolios and the asset allocation was applied to the following year. The means and variances of returns were calculated over various periods and used to determine mean-variance portfolios. A two-year period was used for the study based on Atay-Salih's (2002) findings in an emerging market setting. Although he recommended periods shorter than two years, the authors felt that the South African market differs enough from the traditional emerging market to warrant a two-year period. Rebalancing of portfolios were done on an annual basis based on a constant proportion (50% equity, 40% bonds, 10% cash) as prescribed by Merril-Lynch for an average-risk investor, as well as based on the mean-variance portfolio during the past two years. Two different asset allocations were selected from each efficient set – one based on the best risk-adjusted return portfolio determined by the best Sharpe ratio, and one based on the portfolio that produced the highest utility for the average-risk investor. These asset allocations were then used to rebalance the portfolio on an annual basis and compared to the constant proportion portfolio and a buy-and-hold portfolio over various time periods starting on 01/01/2001.

Results

The results for a South African individual investor is given in Tables one to five. Table one represents performance over a one-year period starting in 2001. Mean variance portfolios were created based on the optimized portfolios over the previous two years (1999-2000). The results show that mean-variance portfolios outperformed a constant proportion portfolio, which in turn outperformed the buy-and-hold strategy.

Table 1:
Performance over one year (2001)

	Risk	Return	Utility	Sharpe
BEST PORTFOLIO EACH YEAR (UTILITY)	18.04%	23.36%	0.185	0.721
MEAN-VARIANCE PORTFOLIO (UTILITY)	18.04%	23.36%	0.185	0.721
BEST PORTFOLIO EACH YEAR (SHARPE)	16.49%	22.33%	0.183	0.727
MEAN-VARIANCE PORTFOLIO (SHARPE)	16.49%	22.33%	0.183	0.727
CONSTANT PROPORTION	16.01%	21.69%	0.178	0.709
BUY AND HOLD	16.01%	21.69%	0.178	0.709

Over a two-year period, superior results were obtained when rebalancing the portfolio to asset weights as indicated by the highest utility mean-variance portfolios in the previous two years respectively (Table 2). It is also again evident that rebalancing provides better results than the buy-and-hold strategy, and mean-variance rebalancing outperforming the constant proportion portfolio.

Table 2:
Performance over two years (2001-2002)

	Risk	Return	Utility	Sharpe
BEST PORTFOLIO EACH YEAR (UTILITY)	14.31%	18.55%	0.155	0.573
MEAN-VARIANCE PORTFOLIO (UTILITY)	13.06%	14.30%	0.117	0.304
BEST PORTFOLIO EACH YEAR (SHARPE)	15.45%	18.53%	0.149	0.530
MEAN-VARIANCE PORTFOLIO (SHARPE)	12.10%	13.47%	0.113	0.259
CONSTANT PROPORTION	8.83%	12.25%	0.111	0.216
BUY AND HOLD	12.64%	10.90%	0.085	0.045

As is evident from Table 3, similar results are achieved over a three-year period with only the utility of the constant portfolio marginally outperforming the mean-variance portfolio as compiled based on the best Sharpe ratios. The mean-variance portfolio according to the best utility function, however, still outperformed all other portfolios.

Table 3:
Performance over three years (2001-2003)

	Risk	Return	Utility	Sharpe
BEST PORTFOLIO EACH YEAR (UTILITY)	13.84%	17.67%	0.148	0.529
MEAN-VARIANCE PORTFOLIO (UTILITY)	13.26%	14.67%	0.120	0.327
BEST PORTFOLIO EACH YEAR (SHARPE)	14.60%	17.65%	0.145	0.501
MEAN-VARIANCE PORTFOLIO (SHARPE)	13.50%	14.48%	0.117	0.306
CONSTANT PROPORTION	9.48%	13.24%	0.119	0.305
BUY AND HOLD	11.05%	12.01%	0.102	0.151

Table 4 shows that, based on utility and the Sharpe ratio, the constant proportion rebalanced portfolio produced the best results over the four year period between 2001 and 2004. From an absolute return perspective, however, mean-variance portfolios outperformed. In all cases rebalancing outperformed the buy-and-hold potfolio.

Table 4:
Performance over four years (2001-2004)

	Risk	Return	Utility	Sharpe
BEST PORTFOLIO EACH YEAR (UTILITY)	12.94%	18.05%	0.155	0.595
MEAN-VARIANCE PORTFOLIO (UTILITY)	13.17%	14.31%	0.117	0.301
BEST PORTFOLIO EACH YEAR (SHARPE)	12.71%	17.65%	0.152	0.575
MEAN-VARIANCE PORTFOLIO (SHARPE)	13.61%	14.36%	0.116	0.295
CONSTANT PROPORTION	9.51%	13.86%	0.125	0.370
BUY AND HOLD	12.29%	13.05%	0.108	0.220

Table five ranks the various portfolios according to their performance based on returns in the various countries. From a pure return point-of-view, portfolios constructed and rebalanced using the mean-variance portfolios with the best Sharpe ratio produce the best results in four out of the six countries. In countries where this portfolio did not provide the best results, the constant proportion portfolio (Australia) and mean-

variance based on utility (USA) provided the best results. Over this period, 16 of the 18 rebalanced portfolios outperformed a buy-and-hold strategy with only the mean-variance portfolios based on utility being outperformed by all other portfolios in Canada and Japan.

Table 5:
International *Returns* over four years (2001-2004)

	AUS	CAN	JAP	RSA	UK	USA
Mean-variance (Sharpe)	1	3	1	1	1	2
Constant Proportion	3	1	2	3	3	3
Mean-variance (Utility)	2	4	4	2	2	1
Buy-and-Hold	4	2	3	4	4	4

It can be seen from Table 6 that, except for one case, the constant proportion rebalancing strategy proved to be the lowest risk strategy. The results for the other strategies are fairly mixed, but the buy-and-hold portfolio had the highest risk in four out of the six countries.

Table 6:
International *Risk* over four years (2001-2004)

	AUS	CAN	JAP	RSA	UK	USA
Mean-variance (Sharpe)	2	3	1	4	2	2
Constant Proportion	1	1	2	1	1	1
Mean-variance (Utility)	3	4	3	3	3	3
Buy-and-Hold	4	2	4	2	4	4

Based on risk-adjusted returns, results are fairly mixed, with mean-variance portfolio based on Sharpe outperforming in three countries (Australia, Japan, and the UK), constant proportion outperforming in two (Canada and South Africa) and mean-variance based on utility outperforming in the USA (Table 7). It is clear, however, that rebalancing strategies provide better results than the buy-and-hold portfolio in 89% of the cases.

Table 7:
International *Utility/Risk adjusted Returns*
over four years (2001-2004)

	AUS	CAN	JAP	RSA	UK	USA
Mean-variance (Sharpe)	1	3	1	3	1	2
Constant Proportion	3	1	2	1	3	3
Mean-variance (Utility)	2	4	4	2	2	1
Buy-and-Hold	4	2	3	4	4	4

Conclusion

The results of this study confirm the notion that portfolio rebalancing plays an important part within the context of portfolio construction. From the study it is clear that rebalancing is significant in an international as well as local context.

Apart from indicating that rebalancing tends to outperform a simple buy-and-hold strategy for most of the periods under review, the study found mixed results as far as the optimal rebalancing strategy was concerned. Whilst this doesn't limit the findings of the study in any way it may serve as an area for further research.

The results indicate that there is very little if any difference between the importance of rebalancing from a South African and an international perspective. Based on this it is recommended that South-African individual investors compile and rebalance their portfolios by making use of rebalancing techniques which are in line with their own risk tolerance and investment utility functions.

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