

Rebalancing strategies and the performance of balanced portfolios: 1925-2001

1. INTRODUCTION

" 'Tis the part of a wise man to keep for himself today for tomorrow, and not venture all his eggs in one basket."

Miguel de Cervantes, Don Quixote - 1605

For centuries investors have been exhorted to diversify their investments. So highly regarded is this principle for the proper management of risk that Pension Funds, Life Offices, General Insurers and Medical Schemes are required by law to diversify their assets across a number of different asset classes. The primary reason for the existence of asset regulations, known as prudential guidelines, is to reduce the risk of the investment portfolio through effective diversification. However, due to differential asset class performance, the portfolio weightings will, over time, move away from the set benchmark. This will require active intervention by the portfolio manager in order to rebalance the portfolio.

How should this rebalancing be done? This study simulates the returns (and the concomitant risks) which would have been earned on balanced portfolios in South Africa over the past century using a variety of rebalancing techniques.

2. ASSET ALLOCATION AND THE REBALANCING OF PORTFOLIOS

The activities that comprise the investment management process include setting an investment policy (usually referred to as the asset allocation decision), market timing (when to move in and out of asset classes) and security selection (which specific securities to buy/sell). Asset allocation can be defined as the allocation of an investor's portfolio among a number of "major" asset classes (Sharpe, 1992). The purpose of the asset allocation decision is to pre-define an acceptable level of risk for a portfolio, consistent with the goals and time horizon of the investor.

Chan (1998) divides the process of asset allocation into three distinct stages: strategic asset allocation, tactical asset allocation and portfolio rebalancing. Strategic asset allocation is the process of deriving an efficient long-term asset allocation mix for a portfolio. It seeks to determine a point on the efficient frontier that optimises the risk-adjusted return of a portfolio subject to the desired risk tolerance. It is commonly called the portfolio's strategic benchmark.

In tactical asset allocation, short-term deviations are made from the long-term strategic benchmark because of specific opportunities, which the portfolio manager wishes to exploit in the hope of achieving above expected returns.

The strategic asset allocation decision is a primary determinant of both the risk and the return of a portfolio. It is therefore one of the most important decisions that an investor makes. The landmark studies of Brinson, Hood and Beebower (1986) and of Brinson, Singer and Beebower (1991) indicated that, on average, over 90 percent of the total variation in portfolio performance was attributable to the asset allocation decision. The importance of asset allocation was confirmed by the UK study of Blake, Lehmann and Timmerman (1999) who concluded that "Strategic asset allocation accounts for most of the time series variation in portfolio returns, while market timing and asset selection appear to have been far less important".

Financial institutions such as pension funds, life offices, general insurers and indeed medical schemes are required by law to hold so-called prudential portfolios of assets. For example, pension funds and life offices are not permitted to hold more than 75 percent of their assets in equities and equity related instruments. Retirement funds and life offices may invest 25 percent of their funds in property. These institutions are thus required to make asset allocation decisions within a prescribed framework.

Even outside of the framework of prudential asset allocation requirements, portfolio managers set target allocations to meet the particular risk characteristics of their clients.

Due to the passage of time, portfolio asset allocations tend to drift from their strategic proportions as a consequence of the relative performances of the different asset classes. The portfolio manager has at least three alternatives: do nothing and accept the drift, buy more of the best performing asset class at the expense of the lesser performing classes, or rebalance back to the initial portfolio mix.

The first strategy may result in a rapid change in the desired risk/return characteristics of the portfolio. Goodsall and Plaxco (1996) observed that a drift strategy undermines the policy benchmark. They noted that "A drifting strategy will ensure a minimum position before a rally and a maximum position when a market falls, which will minimize gains and maximize losses". The second alternative implies making a judgement call

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on the continuance of a trend in the market, in other words a form of market timing.

Only the third - rebalancing - represents a logical strategy. The rebalancing takes place to meet the carefully designed policy, which was set independent of any judgement about the future direction of the market. The term portfolio rebalancing refers to the process of returning a portfolio to the desired asset allocation mix.

Rebalancing is therefore an important part of the asset allocation process. The integrity of the strategic benchmark can only be maintained if rebalancing does take place. Asset allocation is therefore not a once-off process; continual asset allocation cannot be avoided. Rebalancing to a policy benchmark is a simple yet powerful mechanism that brings discipline to the asset allocation process. This discipline ensures that a fund remains in line with a planned and desired long-term policy, rather than allowing the asset allocation to drift with the markets.

Arnott and Lovell (1993) suggested that three primary rebalancing methods could be considered. The first is calendar rebalancing, in which the asset mix is "normalized" at say monthly, quarterly, annual or at reporting period intervals. It has the benefit of extreme discipline, but also has a degree of arbitrariness as to the increment of time. At more volatile times, shorter rebalancing periods may be advisable.

The second is rebalancing to an allowed range. Maximum and minimum limits are set within which the asset class may drift. Once the limit is reached, rebalancing back to the limit is implemented. For example given a 60 percent normal equity mix with five percentage points of tolerance, a sale of one percent of the equity holding would be signalled when equity reaches 66 percent of assets.

The third method is known as threshold rebalancing. Here movement beyond the range limits described above results in rebalancing all the way back to the policy mix. In contrast a buy-and-hold strategy (which results in a pure drift portfolio) is a completely passive strategy where no rebalancing of the portfolio occurs (Perold and Sharpe 1988).

Wise (1993) found that annual rebalancing could not be regarded as approximately equivalent to maintaining a constant mix but felt that quarterly rebalancing might be an acceptable proxy. Over longer periods, the difference between passive drift strategies and rebalanced strategies can become significant. The choice of the rebalancing interval in practice depends on the expected relative price behaviour of the asset classes, in other words how the expected returns on the assets are likely to behave relative to each other.

The extent of rebalancing is also an active decision variable. Trigger rebalancing allows the asset allocation

to move freely within certain pre-defined ranges, until a trigger point is reached. Range rebalancing brings the asset mix just back within the imposed ranges while threshold rebalancing brings the asset mix fully back to the original policy mix. The trigger points can be monitored daily, monthly or even only yearly.

An alternate paradigm can be termed constraint-based rebalancing. Rebalancing could, for example, occur whenever yields reach a certain point or when the return differentials between asset classes achieve a certain spread.

Generally, in a low-volatility trending market, it might be expected that portfolios with frequent rebalancing will under perform those with infrequent or no rebalancing. This can be illustrated by considering a portfolio of two asset classes, treasury bills and equities. As share prices go down, rebalancing requires the purchase of shares, and vice versa. If share prices enter a sustained downtrend, rebalancing would accelerate portfolio capital losses by calling for repeated shifts of capital out of bills into shares. However, as share prices go up in a steady trend, rebalancing trades would slow or reduce the portfolio capital gain because they require repeated sales of shares as their prices appreciate.

By contrast, in a volatile, range-bound market environment, portfolios subject to frequent rebalancing tend to outperform those with infrequent or no rebalancing. Under such market conditions, rebalancing achieves the same effect as mean-reversion trades, i.e. "buy low and sell high". This could significantly enhance the portfolio return even if the market return over the period turns out to be flat.

Therefore, whether the chosen frequency for rebalancing would result in a gain or loss is critically dependent on market condition. Unfortunately, expected market behaviour is not an input into the mechanical rebalancing rules.

Whilst a number of market timing studies have been reported in the South African finance literature (for example Firer, Sandler, and Ward, 1992; Waksman, Sandler, Ward, and Firer, 1997), little if anything has been presented on the risk/return profiles of portfolios which are constrained (by law or by mandate) to maintain particular proportions of equity, bonds and cash. In this paper we report the performance of rebalanced portfolios containing a mix of equity, bonds and cash using different rebalancing techniques.

3. METHODOLOGY

Five asset classes were identified for study. The long-term South African data series for equities, bonds and cash presented in Firer and McLeod (1999) was updated using the INet-Bridge database to include returns up to December 2001. Monthly historical returns were calculated for these asset classes over the 77-year

period January 1925 through December 2001. In addition monthly returns for two US asset classes, large capitalization stocks and long-term government bonds, were sourced from Ibbotson Associates (2002).

A spreadsheet was developed to model the various rebalancing scenarios. Inputs included the monthly data for the three local and two foreign asset classes, rand/dollar exchange rates and inflation rates for South Africa.

Portfolio performance was calculated from a South African perspective. When investing in foreign assets, rands were converted into dollars at the prevailing spot rate. The foreign investment grows in nominal terms in the US and is then imported back into rand at the relevant spot rate at the end of the period. When

calculating real returns on foreign investments, South African inflation was used, not US inflation. This was necessary to achieve the true measure of real portfolio growth in South African terms.

Risk for the portfolios was measured using the historical variance of return, since it is the traditional measure of risk for portfolio evaluation and is reported by many other studies on historical investment performance.

Eleven portfolios were constructed, each with a different asset allocation mandate (Table 1). Portfolio A contains a 90 percent equity allocation, and represents what might be expected of an investment in the equity market, where a small allocation of funds are placed in bonds and cash perhaps for reasons of liquidity.

Table 1: Asset allocation in the eleven portfolios (%)

Portfolio	Equity			Bonds			Cash	Total Offshore
	SA	US	Total	SA	US	Total		
A	90	0	90	8	0	8	2	0
B	75	0	75	20	0	20	5	0
B ₁	60	15	75	20	0	20	5	15
B ₂	75	0	75	5	15	20	5	15
B ₃	70	5	75	10	10	20	5	15
C	65	0	65	30	0	30	5	0
D	45	0	45	25	0	25	30	0
D ₁	30	15	45	25	0	25	30	15
D ₂	45	0	45	10	15	25	30	15
D ₃	40	5	45	15	10	25	30	15
E	20	0	20	30	0	30	50	0

Portfolio B mimics the portfolios of pension funds and life offices where the maximum allowed asset allocation into the equity market (75 percent) is maintained. Other than a small cash component of five percent, the balance (20 percent) is placed in the bond market.

The inspiration for the asset allocations selected for the next three portfolios (C, D and E) came from a suite of unit trusts being marketed by a prominent unit trust management company. This suite was designed to match investors' life-cycle needs and offers a range of risk/return profiles.

Portfolio C approximates the profile suggested for "younger, aggressive investors with an horizon of greater than five years". It contains 65 percent equities, 30 percent bonds and five percent cash.

Portfolio D is defined as having a moderately conservative investment profile with a balance of growth and capital protection, being suitable for investors approaching retirement. It is made up of 45 percent in equities, 25 percent in bonds and 30 percent in cash.

Portfolio E is suggested for retired investors, those in need of capital preservation and those with a low risk tolerance. The composition is 20 percent in equities, 30 percent in bonds and 50 percent in cash

Portfolios B and D were chosen for further diversification (15 percent of the assets held in US investments) because they represented relatively heavy and light equity positions. Portfolio B₁ differed from B by having 15 percent of its equity allocation offshore. B₂ had 15 percent of its bond allocation offshore, and B₃ had five percent of its equity and 10 percent of its bonds invested offshore. Similar variations in the weights making up portfolio D led to the composition of the three final portfolios, D₁, D₂ and D₃.

A periodic rebalancing approach was used. The results of monthly, quarterly and annual rebalancing are reported. At each time interval, the portfolio was rebalanced using a constant-mix approach; in other words, the portfolio was returned to the original asset class proportions chosen at the outset.

Trigger rebalancing was also allowed for in the model. This allowed the portfolio to drift until a certain limit was

reached, and the portfolio was then rebalanced back to its mandate proportions. The limit was set as an allowable deviation from the mandate proportions, and was triggered by a change in total equity proportion in excess of this limit. The portfolio was automatically rebalanced when this limit was reached. In the results presented here, a five percent trigger was used.

In addition a "pure drift portfolio", in which investment was made into a specified asset allocation portfolio, but no further adjustments were made over the time horizon studied was used.

Portfolio proportions over time were graphed to show how the portfolio weights changed with time for each rebalancing method.

Since the database was made up of monthly returns, any changes occurring during a month were only accounted for at the end of the month. Thus small proportions in excess of the deviation limits can be expected. These could be reduced by the use of weekly or even daily data.

Transaction costs were not included in the model. Arnott and Lovell (1993) studied the risks and rewards for rebalanced portfolios using a 50/50 mix of equities and bonds over the period 1986-1991 and found that the highest turnover strategy required only a 10 percent annual turnover. They noted that portfolios generally do generate re-investible income. This income, coupled with new contributions and possible withdrawals from the

portfolio from time to time, makes much of the turnover costless. Managers can simply re-invest income and contributions into the underweight asset class and take withdrawals from the overweight asset class.

In any event, large institutions have negotiated down transactions costs to almost negligible levels. Typical figures would be 0,3 percent of trade value for equities and 0,003 percent for bonds. Transactions costs would thus in practice not be considered by financial institutions when making prudential portfolio rebalancing decisions.

4. RESULTS

The descriptive statistics (both nominal and real) for the individual asset classes are presented in Table 2 and for the 11 asset allocation portfolios in Tables 3, 4 and 5. Separate analyses were carried out for each of the three rebalancing periods, for a five percent trigger-rebalancing limit and for the pure drift portfolio.

Positive returns were found in 79 percent of the years using monthly rebalancing and portfolio A (Table 3). This increased monotonically as the equity component decreased. With portfolio E, 92 percent of the years showed positive returns. Generally, the four active rebalancing strategies gave a similar proportion of positive years. The pure drift portfolio showed the same proportion (75 percent) as that of the pure South African equity portfolio.

Table 2 : Descriptive statistics: pure asset classes

	Mean %	Std Dev %	Compound annual growth rates %	Cumulative value of a R1 investment R	Min %	Max %	Range %	Percentage years with +ve returns %	No of yrs +ve returns	No of yrs -ve returns
Nominal										
SA Equity	16,3	23,2	14,6	26 959	-26,4	93,7	120,1	75	58	19
SA Bonds	7,7	10,3	7,5	223	-9,1	35,9	45,0	81	62	15
SA Cash	6,6	6,5	6,6	122	0,0	21,8	21,8	100	77	0
SA Inflation	5,9	5,6	5,9	75	-5,0	18,5	23,5	87	67	10
US Equity	12,9	20,4	11,2	2 931	-43,3	54,1	97,4	71	55	22
US Bonds	5,4	9,6	5,2	44	-9,2	40,6	49,8	71	55	22
US Inflation	3,1	4,4	3,1	10	-10,3	18,1	28,4	88	68	9
Real										
SA Equity	9,8	21,2	8,2	361	-29,9	88,0	117,9	68	52	25
SA Bonds	1,9	9,7	1,5	3	-19,4	28,3	47,7	56	43	34
SA Cash	0,7	4,5	0,7	2	-9,3	13,0	22,3	60	46	31
US Equity	6,7	19,8	5,0	39	-40,8	50,5	91,3	61	47	30
US Bonds	2,6	10,9	2,1	5	-15,4	35,5	50,9	58	45	32

Table 3: Proportion of years with positive returns for asset allocation portfolios

	Portfolio	Monthly	Quarterly	Annually	Trigger	Drift
Nominal						
A	90:08:02	79	79	78	78	75
B	75:20:05	83	83	82	83	75
B1	(60+15):20:5	87	87	87	87	75
B2	75:(5+15):5	82	82	82	82	78
B3	(70+5):(10+10):5	83	84	83	86	78
C	65:30:05	84	84	84	84	75
D	45:25:30	88	88	88	90	77
D1	(30+15):25:30	88	90	88	91	79
D2	45:(10+15):30	88	88	87	88	79
D3	(40+5):(15+10):30	91	91	90	91	78
E	20:30:50	92	92	92	92	79
Real						
A	90:08:02	66	66	66	66	68
B	75:20:05	66	65	65	66	68
B1	(60+15):20:5	73	71	70	70	68
B2	75:(5+15):5	69	70	68	69	69
B3	(70+5):(10+10):5	70	70	70	69	68
C	65:30:05	66	66	64	65	68
D	45:25:30	71	71	69	69	69
D1	(30+15):25:30	71	71	73	73	69
D2	45:(10+15):30	74	73	73	74	69
D3	(40+5):(15+10):30	74	73	74	75	69
E	20:30:50	68	65	66	69	69

Table 4 Arithmetic mean returns for asset allocation portfolios

	Portfolio	Monthly	Quarterly	Annually	Trigger	Drift
Nominal						
A	90:08:02	15,36	15,39	15,39	15,53	16,05
B	75:20:05	14,01	14,08	14,08	14,23	15,69
B1	(60+15):20:5	13,54	13,67	13,57	13,73	15,48
B2	75:(5+15):5	13,62	13,71	13,73	13,84	15,25
B3	(70+5):(10+10):5	13,59	13,71	13,68	13,92	15,28
C	65:30:05	13,15	13,23	13,23	13,29	15,42
D	45:25:30	11,10	11,21	11,24	11,32	14,73
D1	30+15:25:30	10,65	10,79	10,74	10,80	14,30
D2	45:(10+15):30	10,49	10,62	10,66	10,68	13,91
D3	(40+5):(15+10):30	10,71	10,84	10,84	11,02	14,10
E	20:30:50	8,78	8,85	8,89	9,09	13,32
Real						
A	90:08:02	8,99	9,02	9,02	9,15	9,63
B	75:20:05	7,72	7,79	7,79	7,93	9,28
B1	(60+15):20:5	7,30	7,42	7,33	7,48	9,05
B2	75:(5+15):5	7,77	7,87	7,89	8,04	8,94
B3	(70+5):(10+10):5	7,62	7,72	7,70	7,93	8,95
C	65:30:05	6,92	7,00	7,00	7,05	9,01
D	45:25:30	4,98	5,08	5,12	5,19	8,35
D1	(30+15):25:30	4,57	4,70	4,65	4,71	7,88
D2	45:(10+15):30	5,06	5,17	5,22	5,33	7,88
D3	(40+5):(15+10):30	4,90	5,02	5,03	5,25	7,83
E	20:30:50	2,80	2,86	2,90	3,09	6,99

Table 5: Standard deviations of returns for asset allocation portfolios

	Portfolio	Monthly	Quarterly	Annually	Trigger	Drift
Nominal						
A	90:08:02	21,13	21,18	21,32	21,62	22,83
B	75:20:05	18,19	18,29	18,56	18,37	22,25
B1	(60+15):20:5	15,99	16,25	16,25	15,81	22,00
B2	75:(5+15):5	17,30	17,47	17,86	17,56	21,37
B3	(70+5):(10+10):5	16,79	17,00	17,26	16,94	21,49
C	65:30:05	16,48	16,59	16,89	16,74	21,86
D	45:25:30	11,94	12,11	12,45	12,09	20,93
D1	(30+15):25:30	10,13	10,35	10,43	10,14	20,39
D2	45:(10+15):30	10,78	11,01	11,39	10,93	19,26
D3	(40+5):(15+10):30	10,71	10,92	11,20	10,76	19,76
E	20:30:50	8,02	8,12	8,25	8,18	19,43
Real						
A	90:08:02	19,30	19,34	19,48	19,73	20,80
B	75:20:05	16,56	16,63	16,92	16,72	20,14
B1	(60+15):20:5	14,66	14,92	14,88	14,46	19,65
B2	75:(5+15):5	15,59	15,72	16,13	15,79	19,24
B3	(70+5):(10+10):5	15,20	15,38	15,64	15,34	19,31
C	65:30:05	14,98	15,07	15,39	15,23	19,69
D	45:25:30	10,54	10,67	11,08	10,71	18,59
D1	(30+15):25:30	9,02	9,25	9,31	8,96	17,60
D2	45:(10+15):30	9,66	9,83	10,30	9,89	17,30
D3	(40+5):(15+10):30	9,33	9,52	9,85	9,43	17,29
E	20:30:50	6,67	6,74	6,95	6,86	16,88

Introducing US equity in place of some of the South African equity (15 percent, portfolio B₁) resulted in an increase in positive years to 87 percent. Replacing local bonds with US bonds had a marginal effect. At the lower equity percentages found in portfolio D, the injection of US securities had a very limited effect on the proportion of positive years.

Surprisingly, unlike in the case of nominal data, the number of years with positive real returns did not increase as the proportion of equity in the portfolio decreased. For example using the quarterly rebalanced portfolio, the proportion of positive years ranged between 65 percent (for portfolios B and E) and 71 percent for portfolio D. This anomaly may be accounted for by the fact that bonds and cash gave negative real returns for 34 and 31 of the 77 years respectively.

From Table 4 we see that the average South African portfolio returns across the three calendar strategies differed at most by 14 basis points (Portfolio D), with annual rebalancing usually giving the highest return. This pattern reflects the fact that letting the portfolio remain unbalanced for longer periods of time is beneficial, as evidenced in the extreme by the performance of the pure drift portfolios. The small differences suggest that the final returns of the portfolios, prior to consideration of

transactions costs, are not strongly affected by the rebalancing period chosen.

Trigger rebalancing on portfolio A gave a 14/17 basis point advantage over annual/monthly rebalancing and somewhat less as the equity proportion in the portfolio fell. The patterns were similar for real returns, as shown in the second panel of Table 4.

In Table 5 the standard deviations of the annual returns of the portfolios are presented. Portfolio standard deviation increased as the rebalancing period increased. The extent of this increase was of the order of 19 to 51 basis points. The small improvements in return with increasing rebalancing period seem to be more than offset by somewhat higher levels of risk. However less frequent rebalancing will result in lower transactions costs. There is little to suggest that monthly rebalancing would have been a better strategy.

Including US equities in the portfolios resulted in lower standard deviations, probably reflecting the lower volatilities of the US compared to the South African equity market.

The range of returns across the rebalancing methods was very similar for the five portfolios, and showed no

difference whether real or nominal returns were being observed. The ranges of the drift portfolios closely approximated the range of the pure equity portfolio since these portfolios rapidly approached a very high equity component.

Of interest to managers of prudentially structured portfolios is the extent to which their portfolios may drift away from the mandated proportions between rebalancing periods. In Figure 1 shows the monthly time series of proportions of equity, bonds and cash invested in portfolio C over the 77-year period.

The first three graphs show the impact of rebalancing periods of a month, a quarter and a year, the next illustrates the impact of a five percent trigger rebalancing range and the fifth graph shows the drift in the proportions for an initially balanced portfolio that is never rebalanced.

The horizontal lines demarcate the target equity range of 65 percent plus or minus five percentage points - the chosen trigger rebalancing points. It is clear that the longer the rebalancing period, the more likely the portfolio was to fall outside of the target asset allocation percentages.

Focussing on the 10 years which showed the maximum deviations from the target equity position of 65 percent, it was observed that in eight of the cases, the year in question was one of the top 10 years on the JSE and in the other two cases, the prior year fell into the top 10 category. Thus in good years for equity, long rebalancing periods resulted in high portfolio drift, adding to the expected returns, but, as we saw in Table 5, at the expense of greater portfolio risk as measured by portfolio standard deviation.

The 10 years during which the equity proportion in the portfolio was lowest were largely years in which the equity market registered a negative nominal return. Market performance thus had a major influence on the extent to which balanced portfolios drift from their target asset allocation proportions.

It would be expected that the use of trigger rebalancing would ensure that the asset allocations always remained within the trigger proportions. However the trigger rebalancing graph shows minor deviations above and below the target range for equities. This is because the decision to rebalance was only made at the end of each month (the data used is monthly) and an asset return during a particular month may send an asset class allocation above its target.

The final graph of Figure 1 indicates the speed with which the drift portfolio composition approached an all-equity asset allocation. The strong out-performance of the equity market over the bond and cash markets during the 77 years of the study drove the equity proportion in portfolio C to over 90 percent by 1944, this despite the recession years 1929-1932 during which the equity market proportion fell from 77 percent to 70 percent. The 12 years following 1932 provided a compound annual equity growth rate of 18,5 percent, resulting in the pure drift portfolio moving strongly towards the 90 percent equity mark. By 1963 this was 95 percent and 99 percent by 1979. Thus for over half of the study period, the drift portfolio had risk characteristics not dissimilar from those of an all equity portfolio.

The range of actual equity holdings found in the five South African portfolios is shown in Table 6. The use of monthly compared to annual rebalancing resulted in a much tighter range of observed equity holdings. For example, in portfolio A, using monthly rebalancing, the largest deviations above and below the 90 percent target were 1,5 percent and 2,7 percent respectively. For annual rebalancing, these widened to 4,0 and 4,3 percent respectively. A similar pattern existed for the other four portfolios. Lowering the equity target holding resulted in a wider range of equity weightings through to portfolio D.

Other than for the highest equity holding, trigger rebalancing resulted in an intermediate range of equity holdings between those displayed by monthly and annual rebalancing.

The standard deviations of the equity holdings across time in each portfolio are also reported in Table 6. As might be expected, the longer the rebalancing period, the greater the observed standard deviation of returns. The risk of the trigger-rebalanced portfolios generally lay between that of the quarterly and the annually rebalanced portfolios. The increasing proportion of non-equity holdings from portfolios A to E was reflected in higher standard deviations.

Figure 2 shows the path of wealth accumulation between 1925 and the end of 2001 of a one rand investment in each of the following South African portfolios: pure equity, pure bonds, pure cash and portfolio C rebalanced monthly, five percent trigger rebalanced and not rebalanced at all (drift).

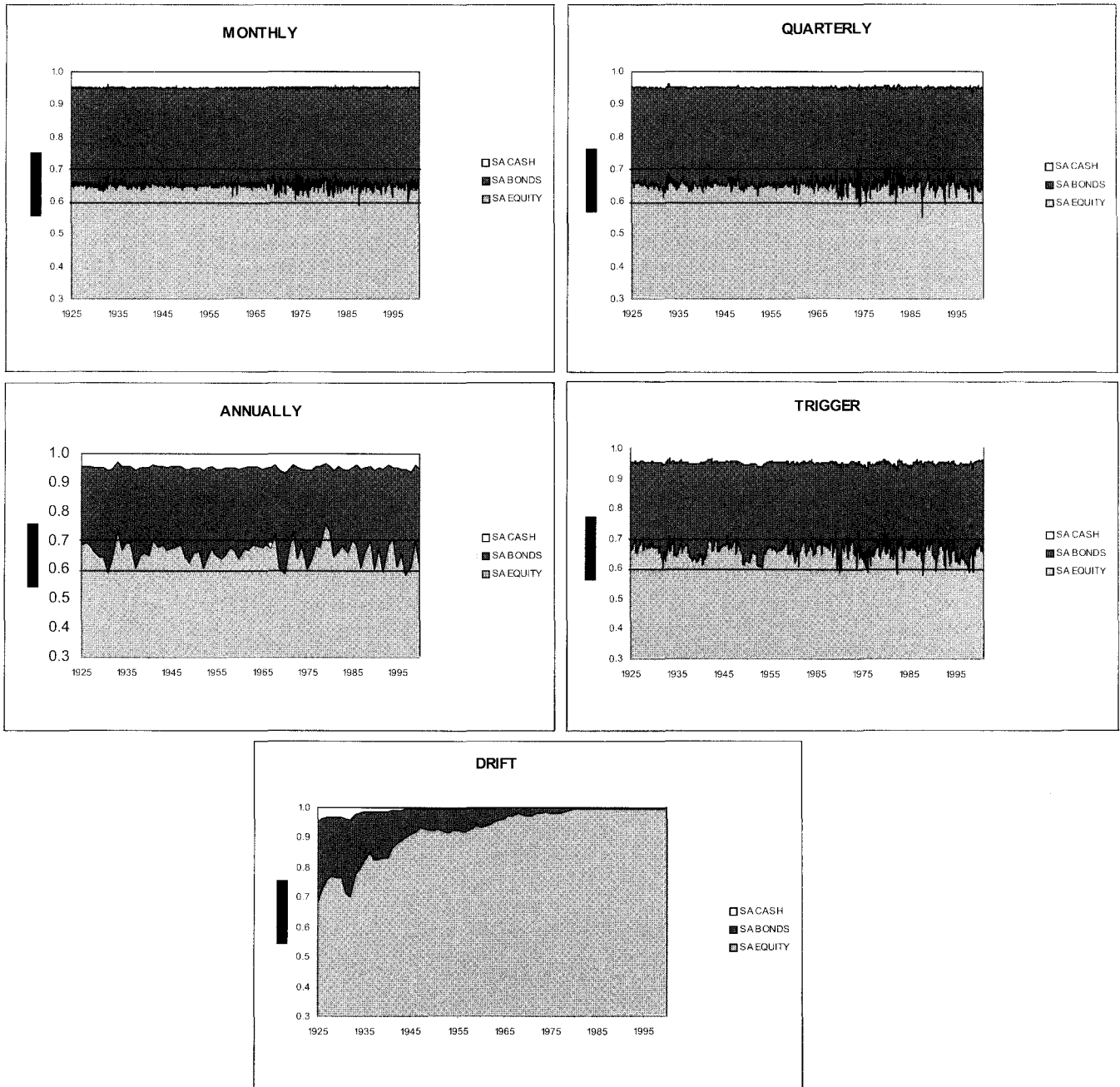


Figure 1: Portfolio C (65:30:05): Variation of asset class proportions over time for different rebalancing strategies

Table 6: The deviation of equity weightings from the target proportions for differing rebalancing periods

Portfolio	Rebalancing Frequency			Target
	Monthly	Quarterly	Annual	
A				
Upper deviation of equity from target	1,5	2,7	4,0	5,4
Lower deviation of equity from target	2,7	4,2	4,3	5,6
Standard deviation of equity %	0,44	0,65	1,08	1,61
B				
Max deviation of equity above target	3,3	6,0	8,9	6,7
Max deviation of equity below target	5,5	8,2	8,3	7,6
Standard deviation of equity %	0,91	1,35	2,27	2,39
C				
Max deviation of equity above target	4,1	7,6	11,2	7,4
Max deviation of equity below target	6,4	9,5	9,6	7,3
Standard deviation of equity %	1,10	1,63	2,76	2,54
D				
Max deviation of equity above target	4,5	8,6	14,1	7,8
Max deviation of equity below target	7,1	9,6	10,3	8,2
Standard deviation of equity %	1,21	1,81	3,17	2,68
E				
Max deviation of equity above target	3,1	6,2	10,8	6,6
Max deviation of equity below target	4,5	5,6	6,1	6,4
Standard deviation of equity %	0,78	1,18	2,15	2,46

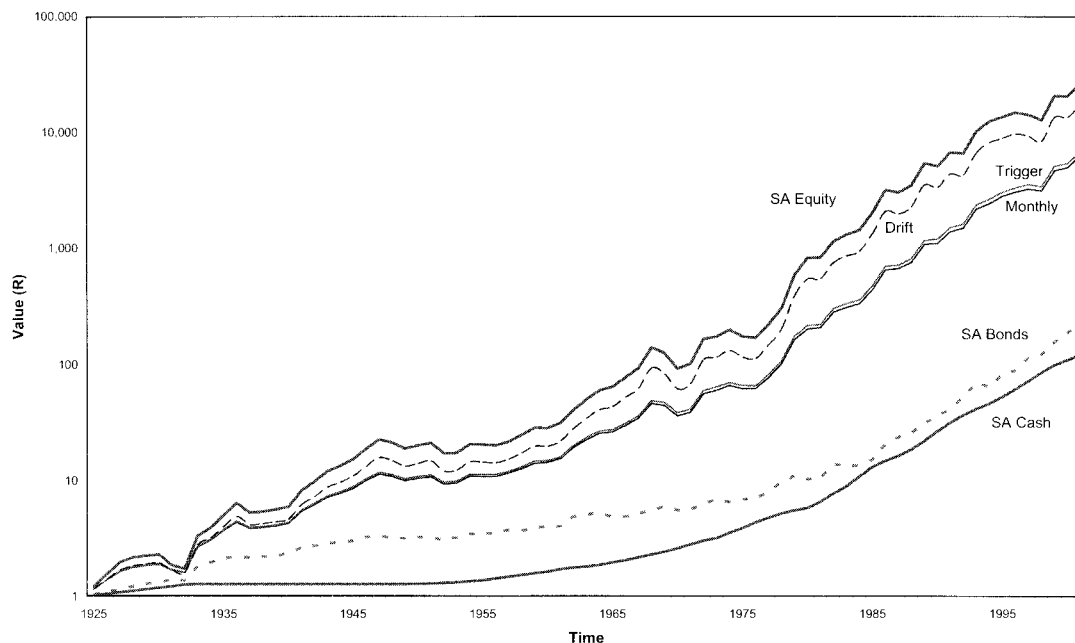


Figure 2: Wealth Paths for Equity, Bonds, Cash, Portfolio C rebalanced monthly, Portfolio C 5% trigger rebalanced, Portfolio C drift,

Over the period the pure equity investment provided the greatest accumulation of wealth (R26 959) with the pure drift portfolio in second place at R17 569. This was as a result of the increasing exposure of the drift portfolio to equity over time. The rebalanced portfolios do not have an extreme exposure to equities, so their accumulated wealth paths over the period were substantially lower than the equity portfolio and the pure-drift strategy. The final wealth values of the two were R6 343 for monthly rebalancing and R6 848 for trigger rebalancing.

In the Table 7, the performance of the asset allocation portfolios for the differing rebalancing methods is presented. The results for the pure asset class portfolios are shown for comparative purposes. Both terminal wealth and compound annual growth rates based on nominal and real data are reported.

As we observed in Figure 2, the equity portfolio outperformed all the others. This was followed by the drift portfolio. The superior performance of the equity asset class resulted in this portfolio drifting fairly rapidly towards an almost all equity position (after 20 of the 77 years had passed, the 65:30:05 initial allocation in portfolio C had become a 90:09:01 portfolio). Thus for much of their lives, the drift portfolios consisted of ever

increasing proportions of equities. This situation even pertained to portfolio E where after 30 years the equity component had grown from 20 percent to 70 percent and it reached 90 percent after 50 years.

The three time-rebalanced portfolios offered similar returns for each portfolio. Growth rates were not strongly influenced by the rebalancing period. For portfolio E, annual rebalancing led to the highest terminal value. In the case of portfolios A, B, C and D the quarterly rebalancing resulted in higher final portfolio values. Trigger rebalancing provided slightly higher compound annual growth rates and thus terminal values.

The overwhelmingly strong performance of equities relative to the other two asset classes should have resulted in the longer rebalancing periods providing higher terminal wealth values because of the generally longer over-exposure to equities that would have occurred. Perhaps the relatively poor performance of equities, combined with strong bond and cash returns in recent years, contributed to this outcome. Over the last five years, equities offered a compound annual return of 12,3 percent, compared to 20,1 and 14,5 percent for bonds and cash respectively. This illustrates a key motivation for the use of balanced portfolios.

Table 7: Nominal and real final portfolio values and compound average growth rates

Pure Asset Classes					
	Equity	Bonds	Cash	Inflation	
Final Portfolio Values					
	R 26,959	R 223	R 122	R 75	
	361	3	2		
Compound Annual Growth Rates					
	14,6	7,5	6,6	5,9	
	8,2	1,5	0,7		

Asset Allocation Portfolio					
	Monthly	Quarterly	Annual	Trigger	Drift
Final Portfolio Values					
A	R 18 290	R 18 650	R 18 418	R 19 551	R 24 283
	245	250	247	262	326
B	9 796	10 207	9 981	11 209	20 270
	131	137	134	150	272
C	6 343	6 665	6 491	6 838	17 596
	85	89	87	92	236
D	2 183	2 324	2 329	2 508	12 224
	29	31	31	34	164
E	533	557	569	658	5.519
	7	7	8	9	74
Compound Annual Growth Rates (%)					
A	14,0	14,0	14,0	14,1	14,4
	7,6	7,6	7,6	7,7	8,0
B	13,0	13,1	13,1	13,2	14,1
	6,7	6,8	6,7	6,9	7,8
C	12,4	12,5	12,4	12,5	13,9
	6,1	6,2	6,1	6,2	7,6
D	10,8	10,9	10,9	11,0	13,4
	4,6	4,7	4,7	4,8	7,0
E	8,7	8,8	8,8	9,0	12,2
	2,7	2,7	2,7	2,9	5,9

(Real portfolio values and compound growth rates are shown in italics)

5. CONCLUSIONS

In this paper the results of a study into the performance of balanced portfolios in South Africa over the last 77 years are presented. Five portfolios of widely varying composition were formed using South African equities, bonds and cash as asset classes. In addition six portfolios were created which contained a proportion of the equity and/or bond allocation in US securities.

The results clearly show the impact of the asset allocation decision on portfolio performance. Mean returns are directly related to the proportion of equity in the portfolios, as are portfolio standard deviations.

The compound annual returns of the portfolios were largely unaffected by the choice of rebalancing period – monthly, quarterly or annual. This is ascribed to the poor performance of equities over the past five years. Although transactions costs were not included in this study, it seems probable that they would play a role in the rebalancing frequency decision.

A very small increase in portfolio standard deviation was found as the rebalancing period increased. If frequency of rebalancing is the main determinant of the magnitude of transactions costs, it appears that an annual rebalancing strategy would have been the best choice, since transactions costs would have been minimised without a significant loss of returns or an acceptance of higher levels of risk.

The choice of rebalancing frequency will depend upon the portfolio manager's specific mandate or tolerance for deviations from the target asset allocation proportions. Annual rebalancing resulted in large deviations in the equity proportions during the rebalancing period, particularly for portfolios with low proportions of equity.

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