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THE CAPPED AND SHAREHOLDER WEIGHTED INDICES

A QUANTITATIVE COMPARISON OF DIFFERENT
PENSION FUND EQUITY BENCHMARKS

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July ~ {2003}

{ Quantitative Research }

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{ EXECUTIVE SUMMARY }

The retirement fund industry in South Africa lacks a universally accepted objective benchmark for domestic equity portfolios. At the moment an assortment of benchmarks are in use, mostly with the Resources sector down-weighted relative to the All Share index (ALSI), along with the ALSI and peer mean benchmarks. In an attempt to address this deficiency, two new benchmark indices were recently introduced by the JSE – the Capped All Share index and the Shareholder Weighted All Share index. The Capped All Share index limits the weight of stocks on a quarterly basis such that no stock has a weight larger than 10%. The Shareholder Weighted All Share index adjusts the All Share index to reflect only the domestic free float for dual-listed shares.

This report considers these benchmarks from a quantitative perspective. An analysis of the various benchmarks revealed a number of important differentiating insights. In particular, we highlight the current sector breakdown of the benchmarks, concentration in large cap stocks, volatilities, tracking errors and betas. By comparing benchmarks in current use to the new benchmark indices, we conclude that the Capped All Share index is very similar to the All Share index, while the Shareholder Weighted index is closer to the current pension fund holdings.

Our report concludes by considering practical aspects of hedging with over-the-counter options on Capped Top 40 and Shareholder Weighted Top 40 indices as underlying instruments.

1. { INTRODUCTION }

There has been much debate surrounding an appropriate benchmark for retirement fund domestic equity mandates. The debate stems from a need in the pension fund industry for a generally accepted objective equity benchmark, reflecting the available domestic investible universe. One aspect of this debate reflects the need to comply with Regulation 28 of the Pension Fund Act. This regulation limits the weight assigned to companies with market capitalisation larger than R2 billion to 15%, and that of smaller companies to 10%. The second aspect considered is *availability* of stocks to investors on the JSE. The available free float and the impact of dual-listings on this have also emerged as important considerations. A third consideration is that our All Share index is widely regarded as an inappropriate benchmark for a balanced equity mandate because the large concentration of weights in a few large capitalisation stocks is found to be unacceptable for most portfolio managers' risk appetite.

To find a suitable solution to these issues, the FTSE/JSE Advisory Committee investigated the introduction of benchmark indices in consultation with members of the investment community. The results of their efforts culminated in the Capped All Share index (CAPI), and the Shareholder Weighted All Share index (S/W All Share, referred to as the PENI by some), both of which were introduced at 1 July 2003. The former index endeavours to comply with Regulation 28 of the Pension Fund Act and to ensure slightly less concentration by capping large shares to 10%. In the latter index, dual-listed shares are adjusted in an attempt to include only the domestic free float shares.

In this report the focus is on highlighting the characteristics of these indices from a quantitative perspective. Furthermore, we contrast the proposed indices to some commonly used domestic equity benchmarks. In Section 2, we explain the construction of each benchmark, and give some perspective on the motivation for their introduction.

In Section 3 we consider two constructed peer mean benchmarks, derived from Unit Trusts. These benchmarks are commonly used by market practitioners as proxies for holdings of pension funds. Section 4 is devoted to a quantitative comparison of the various benchmarks and indices, focussing on

- Construction
- Concentration
- Volatility
- Tracking error
- Correlation
- Beta against the All Share index
- Trading turnover

The benchmarks that will be considered are:

- All Share index (ALSI – J203)
- Capped All Share index
- Shareholder Weighted All Share index
- Half-weighted Mining Resources benchmark
- 80%:20% FINDI:RESI benchmark
- 68%:32% FINDI:RESI benchmark
- Peer mean benchmark derived from AA Prudential Unit Trust category
- Peer mean benchmark derived from General Equity Unit Trust category

In the final section of this report (Section 5) we discuss some aspects pertaining to the hedging of portfolios using derivatives which have the new indices as underlying instruments.

2. { THE VARIOUS PENSION FUND EQUITY BENCHMARKS }

In this section we introduce the two new benchmark indices, followed by some commonly used benchmarks.

2.a. Capped All Share index – “CAPI” (J303)

According to the JSE¹, “The index will follow the construction of the existing FTSE/JSE All Share index with regards to constituents, data and application of corporate actions. However, all companies/constituents whose weighting is larger than 10% in the index will be capped at a fixed level of 10%. Capping will be done on a quarterly basis and the weighting of constituents will thus vary intra-quarter. Capping is a mathematical process that follows the FTSE capping methodology.” The JSE also introduced a Top 40 version of the Capped All Share index, called the FTSE/JSE Capped Top 40 Index (J300).

¹ Reference: JSE Securities Exchange - “Capped and Shareholder Weighted Indices”, 20 March 2003

*Refer to the document
“Capped and
Shareholder Weighted
Indices” (20 March
2003) published by the
JSE Securities
Exchange for a
complete discussion of
the calculation of the
Capped All Share
index. This document
is available on the
website
<http://ftse.jse.co.za>*

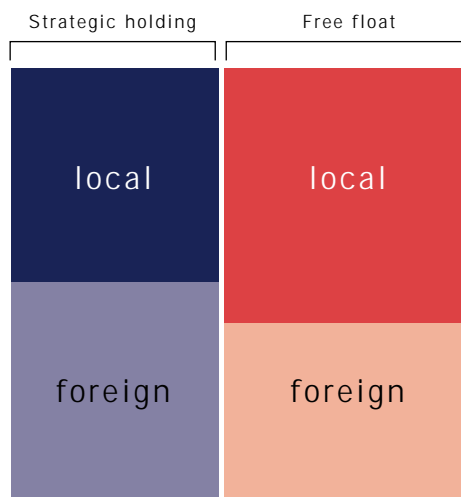
The capping procedure will be applied at a quarterly index review, at the close of business of the third Thursday of March, June, September, and December. All weights above 10% will be reduced to 10%, and the uncapped weights will be increased proportionally to keep the total index weight at 100%. A further or secondary capping will be applied to reduce any adjusted weights that might have increased above 10% during capping, which will be repeated until no weights are above 10%.

2.b. Shareholder Weighted All Share index – (J403)

According to the JSE¹, *“This index will follow the construction of the existing FTSE/JSE All Share index with regards to constituents, but additionally certain constituents’ weights will be further adjusted for non South African shareholdings. The goal is to eventually down-weight (exclude) all foreign free float holdings. Therefore the free float figure of a company in the index will be adjusted to reflect only the locally held free float. Due to the fact that this data on foreign free float holdings is not readily available, the shareholder weighting adjustment will commence with dual listed companies only. A dual listed company, in this context, is one which has a listing (secondary or primary) on any foreign index. The official FTSE/JSE free float will be used in all other cases.”* The JSE introduced a Top 40 version of the Shareholder Weighted All Share index, called the FTSE/JSE Shareholder Weighted Top 40 Index (J400).

Referring to Fig. 1, the strategic holdings and free float portions of a company’s shares can be subdivided into local and foreign holdings. The intention of the Shareholder Weighted All Share index is to include only the local free float component into the calculation.

Figure 1: Schematic diagram depicting the split between strategic holdings and free float shares for local and foreign share registers



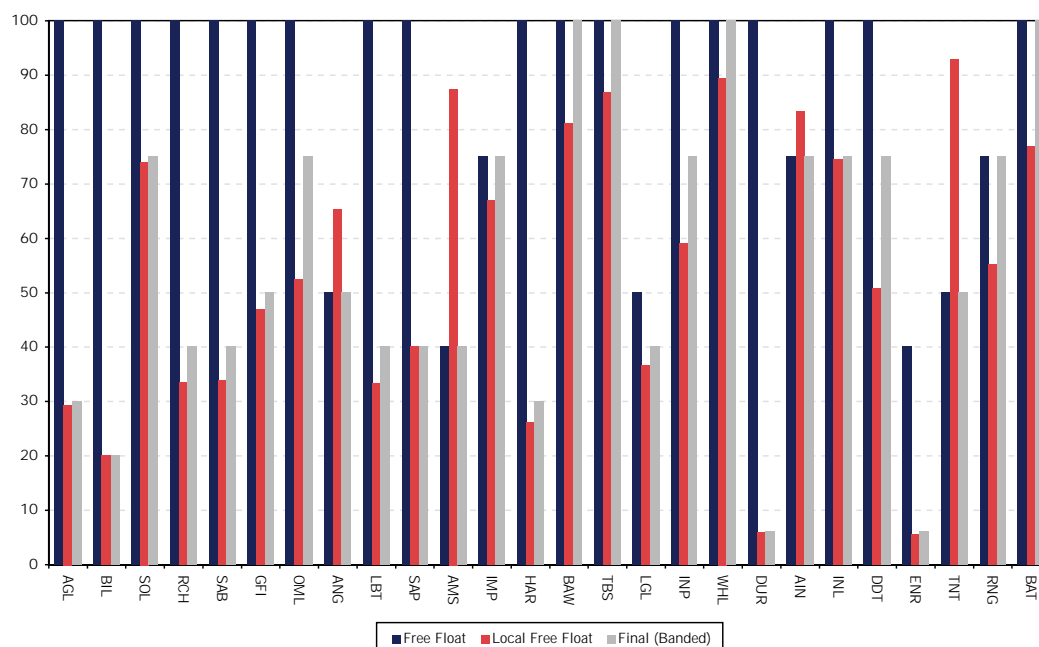
In practice, however, it is prohibitively difficult to determine the local free float exactly. The difficulty is that one cannot determine without complex investigation which portion of the STRATE register (local complement) relates to free float or strategic holdings. On the other hand, the available free float information does not reveal which of the free floating shares are local and which are foreign.

Instead the JSE suggests a practical estimation method to determine the local free float component (only for dual-listed stocks):

- Include paper based scrip in the estimation (assume it is local only)
- Exclude entire foreign register
- Analyse local register to determine nationality of holders, and include domestic beneficiaries
- Use resultant number to determine reduced weighting.

The resultant estimate would thereafter be compared to the free float factor, and the *smaller of the two (after being banded)* would be used to down-weight each dual-listed stock. This is illustrated in Fig. 2, where we show the original free float factors for a selection of dual listed stocks (blue), the result of the local registry investigation (red), and the final banded figure used in the S/W All Share index (grey).

Figure 2: Determination of weightings in the Shareholder Weighted All Share index



In the case of Anglo American plc (AGL), the normal free float is 100%, while the local free float determination is 29%. The smaller of the two numbers (29%) is then banded up to 30%. For Amplats (AMS), the free float is 40%, the local free float is 87%, and the smaller of the two numbers (banded up) is 40%.

For non dual-listed stocks the normal free float numbers will be used during the initial phase. The JSE will publish indicative shareholder weights at the quarterly index reviews, two weeks prior to the futures close-out, after which it will become effective.

2.c. Alexander Forbes Equity Index SA (AFEISA 150)

The AFEISA 150 was the first proposed benchmark index based on the universe of stocks applicable to domestic retirement funds, thus in spirit very similar to the S/W All Share index. The rationale was that with dual-listed companies, local based retirement funds would not be able to easily gain access to the

foreign listed shares of companies also listed in South Africa, due to domestic foreign exchange control regulations. This index is computed on the same basis as the FTSE/JSE indices, but it incorporates a number of adjustments. The most important deviations from the All Share index are:

- The free float factors are downward adjusted for International Control Accounts
- The index has a maximum of 150 stocks
- The free-float numbers are rounded to the nearest 5% (it was felt that the FTSE bands are too wide)

The index commenced in June 2002, and Alexander Forbes indicated that they will discontinue the index during 2003, once the new indices are introduced.

2.d. 68%:32% FINDI:RESI benchmark and similar benchmarks

There have been various attempts to down-weight the Resources component of the All Share index. One motivation is that Resources has underperformed the equity market for a long period during the 1990's, causing managers to reduce their Resources weighting on an almost permanent basis. A further motivation relates to the high concentration of risk in this market segment. These issues have led to a down-weighting of Resources in many of the benchmarks used to date. One variation has been to specify $x\%$ Resources and $(100 - x)\%$ Financial and Industrial companies. In this approach, the weight of the Resources component is initially set at $x\%$ (32% and 20% are commonly used) and the rest (Financials and Industrials) are set at the complement. These weightings are then reset every quarter to take account of market fluctuations which typically move the ratios away from the original setting.

2.e. Half-weighted Mining Resources ALSI benchmark

Another commonly used method to down-weight the Mining Resources component is to adjust the All Share index by reducing the allowed shares-in-issue of Mining Resources stocks that will be included in the index calculation. To further explain, we refer to the usual formula to calculate an index:

$$I = \frac{1}{b} \sum_i s_i f_i p_i$$

where s_i is the shares-in-issue for stock i ,

f_i is the free float factor ($0 < f_i \leq 1$),

p_i is the share price, and

b is a basing constant.

For the Half-weighted Resources ALSI, all the shares-in-issue are adjusted so that if a stock is a Mining Resources stock, we weight it by $s_i/2$ instead of the usual s_i . This reduces the Resources component without the need for frequent re-weights.

3. { CONSTRUCTED PEER MEAN PORTFOLIOS }

Although some managers are averse to actively measuring themselves against their peers, peer group benchmarking has become an established practice in the fund management industry. Surveys such as the Alexander Forbes Large Managers Watch and various Unit Trust surveys continue to reinforce this trend. It is therefore worthwhile to include some form of peer group benchmarking when discussing domestic equity mandates. In the absence of publicly available information of pension fund compositions, unit trust proxies are sought.

We consider two unit trust categories for benchmarking a retirement fund domestic equity benchmark:

3.a. Asset Allocation – Prudential Unit Trust Category:

- According to the Association of Collective Investments², *“These funds invest in a wide spectrum of investments in the equity, bond, money, or property markets. The underlying risk and return objectives of individual funds may vary as dictated by each fund’s mandate and stated investment objective and strategy. These funds conform to legislation governing retirement funds, (Regulation 28 of the Pension Funds Act) and are thus suitable as investment vehicles for retirement funds.”* We believe these funds could be representative of house views implemented by the various fund houses.

3.b. General Equity Unit Trust Category:

- According to the Association of Collective Investments², *“These funds invest in selected shares across all economic groups and industry sectors of the JSE Securities Exchange South Africa as well as across the range of large, mid and smaller cap shares. These funds do not subscribe to a particular theme or investment style. The funds in this category offer medium to long-term capital growth as their primary investment objective.”*

Because the unit trust compositions are made public quarterly, it is possible to explicitly construct peer mean funds. We constructed peer mean portfolios in the following manner:

We selected the funds belonging to the fund houses represented in the Alexander Forbes Top 10 Large Manager Watch. These fund houses represent the bulk of the domestic pension fund industry by funds under management. The weight of each stock in each fund is determined, and then divided by the number of valid funds in each group. The weights are then aggregated for each stock to arrive at that stocks’ weight in the peer group portfolio.

This is shown in the following formula of the weight w_k^{peer} of stock k in the peer group portfolio:

$$w_k^{peer} = \frac{1}{n} \sum_{j=1} w_{kj}$$

where w_{kj} is the weight of stock k in the *equity component* of fund j , and $n = 10$ because we used 10 funds. Due to the mandate of the AA Prudential Unit Trust category, we believe the AA Prudential peer mean is a good indicator of pension fund compositions.

² *Association of Collective Investments (previously known as Association of Unit Trusts)*

We equally weight the funds to construct the peer mean.

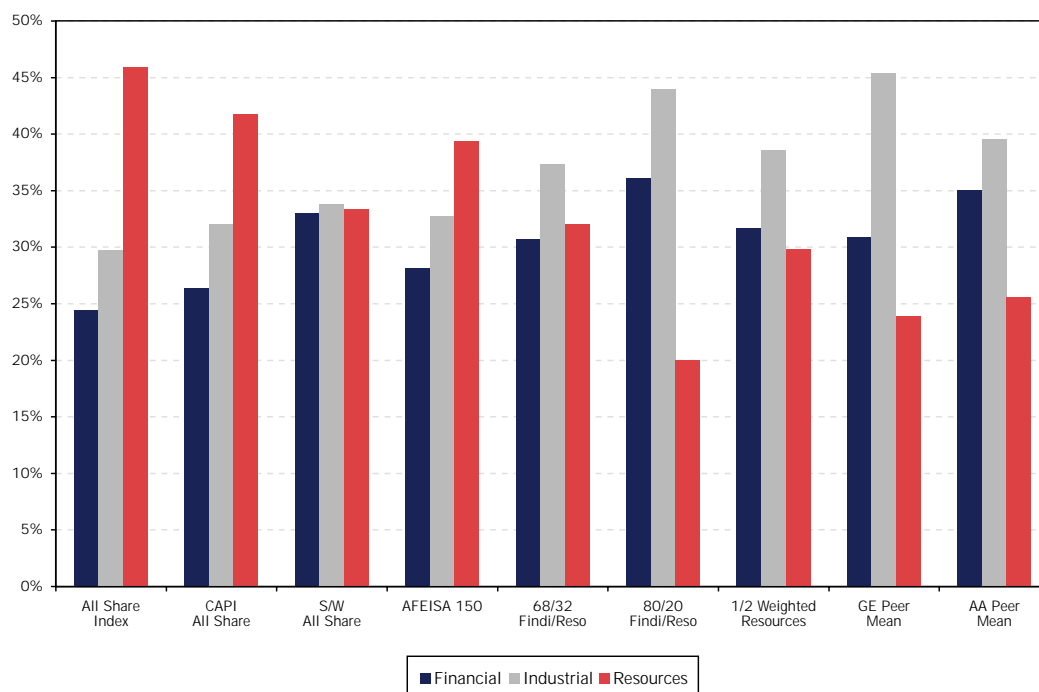
4. { QUANTITATIVE COMPARISON OF THE VARIOUS BENCHMARKS }

In this section various quantitative comparisons of the above benchmarks are considered. In our calculations we used recent (as at 31 March 2003) weights of the various benchmarks and indices, and a covariance matrix determined using monthly returns over the prior five years. To determine benchmark betas against the All Share index, we used our most recent (31 March 2003) estimation of individual stocks' betas against the All Share index.

4.a. Comparison by weight

Figure 3 shows the current (as at March 2003) major sector split of the various benchmarks. From Fig. 3 it is clear that the Capped All Share index is actually only an adjusted All Share index, with the Resources components slightly down-weighted (two Resources companies are capped) and the Financials and Industrials proportionally up-weighted. In contrast the Shareholder Weighted All Share index has a lower weight in Resources, due to the fact that many dual-listed companies are in fact Resources-based. If we assume that the AA Prudential Peer Mean is a good proxy for a pension fund peer mean, it seems that from a sector composition perspective the average pension fund would be benchmarked against the Half-weighted Resources down-weighted benchmark or the 80:20 FINDI:RESI benchmark.

Figure 3: Comparison of weights by major sectors



Although the Shareholder Weighted All Share index currently reflects the investment patterns of asset managers by its down-weight of Resources, it might differ markedly from the peer group in future, depending on foreign holdings of local stocks.

In the foreseeable future, the Resources component of the CAPI would be slightly reduced, while the size of the Resources component of the S/W All Share might vary appreciably from quarter to quarter.

4.b. Concentration of weights

One of the reasons that fund managers resist using the All Share index as a benchmark is due to its high concentration of the larger stocks. A useful diagram to investigate the concentration of stocks in an index or benchmark is a graph showing the cumulative weights of the stocks ranked by their weights (from largest to smallest). Fig. 3 clearly shows that the All Share index (ALSI) is highly concentrated in the larger (Resources) stocks. The first share (Anglo American plc) totals 16% of the ALSI; the first two shares comprise 25.5%, while the first 8 share total over 51% of the ALSI.

The Capped All Share index only alleviates this problem to a small extent, as the first two shares are capped at 10%. In contrast, the Shareholder Weighted All Share index is less concentrated, due to the reduction of weight of the large dual-listed shares. It is interesting to note that the Shareholder Weighted All Share index is closest to the AA Prudential peer mean (from a concentration perspective) in Fig. 3, which represents the current pension fund industry average. It is also clear from the graph that in the case of the General Equity peer mean, managers tend to take larger bets in smaller stocks.

Figure 4: Cumulative weights diagram for the various benchmarks

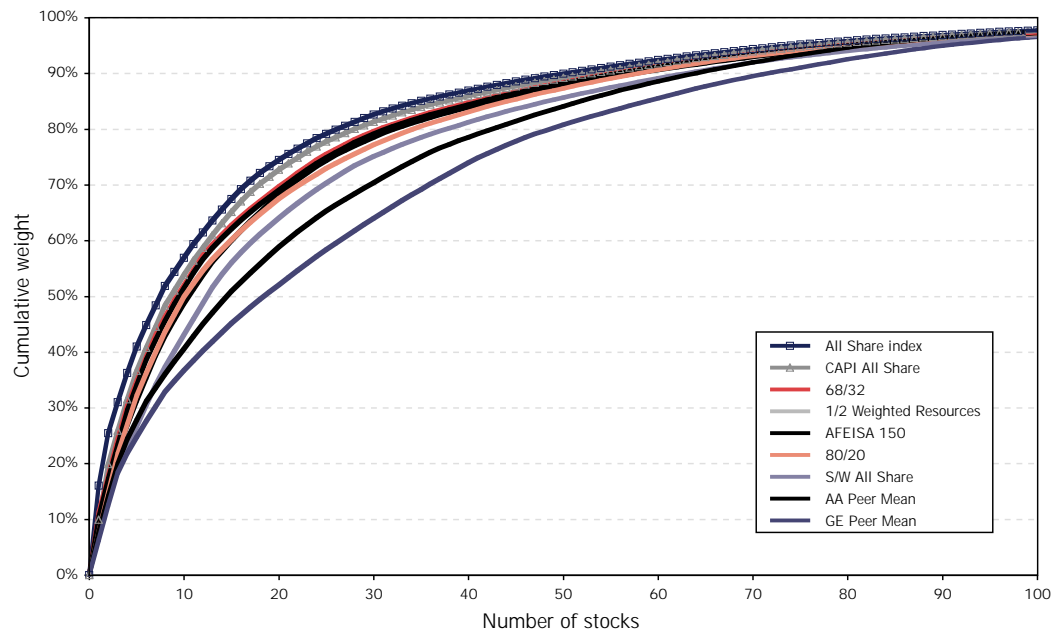


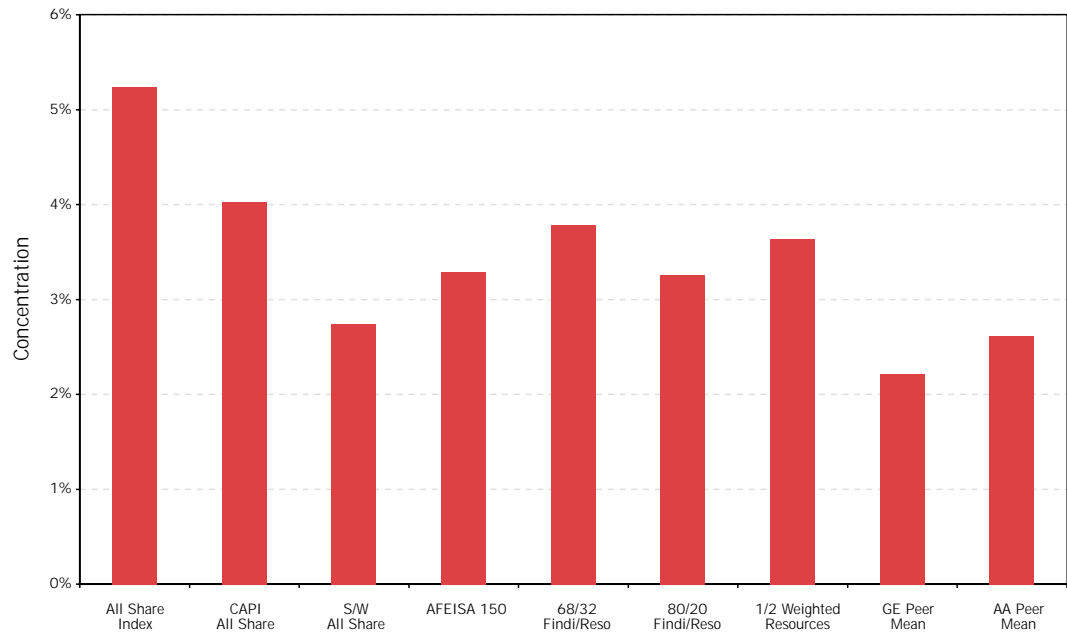
Fig. 5 is another representation of the concentration of the benchmarks, where we used the Herfindahl-Hirschman³ concentration measure defined as the sum of the square of the weights in the benchmark:

$$\phi = \sum_i w_i^2 = \mathbf{w}'\mathbf{w}$$

Clearly observable using this measure is the fact that the benchmarks follow the same order of most concentrated to least concentrated as given by Fig. 4.

³ *H. Hovenkamp, 1986, Antitrust, Minnesota, West Publishing*

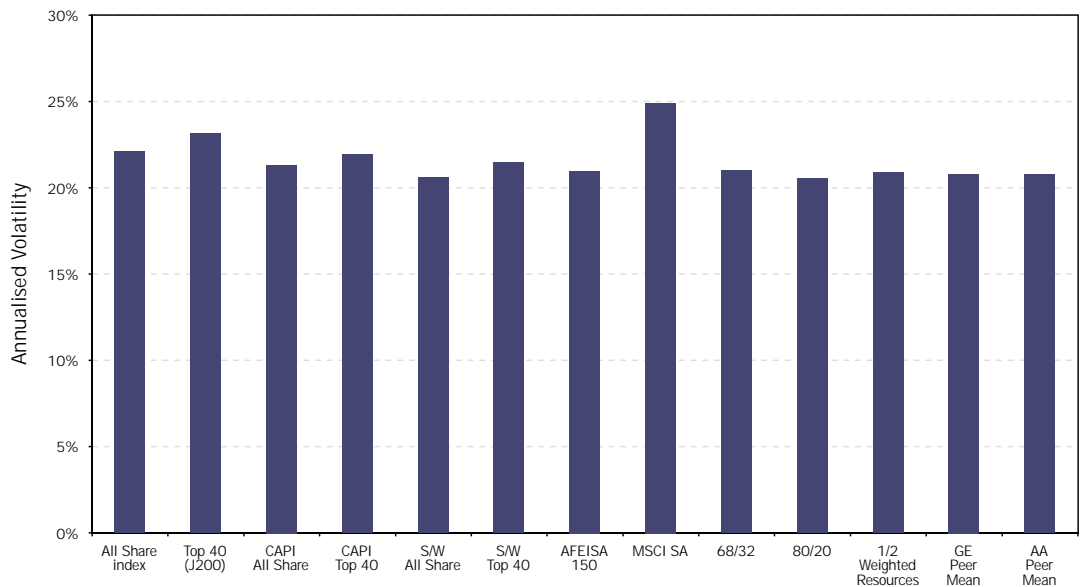
Figure 5: Herfindahl-Hirschman concentration measure of weights for the various benchmarks



4. c. Volatility/Total Risk

The annualised expected volatility is shown in Fig. 6. We note that current expected volatility of the All Share index is 22%. It is interesting to note that the Capped All Share index and the Shareholder Weighted index have very similar risks, and that it is in fact close to that of the peer mean portfolios. The volatility of these benchmarks are all in the range 20.5—22%, thus on the basis of absolute risk there is very little to choose from.

Figure 6: Volatility of the various benchmarks and indices



See Appendix A2 for a brief discussion of the methods employed to determine volatility.

4.d. Tracking Error

We determined the expected annualised tracking error using the current compositions of each benchmark or index and the covariance matrix mentioned earlier. The results are summarised in matrix form in Table 1. We start by noting that the Half-weighted Mining Resources ALSI benchmark and the 80:20 FINDI:RESI benchmark is closest to the AA Prudential peer mean in terms of tracking error. This confirms our observation in Section 4.a on the proximity of these benchmarks to the AA Prudential peer mean on the basis of major sector weights. Comparison of the new proposed indices to the Half-weighted Mining Resources benchmark and the 80:20 FINDI:RESI benchmark, reveals that the S/W All Share index is consistently closer to these two benchmarks in terms of tracking error (having a tracking error of only 3.4% to the 80:20 FINDI:RESI benchmark and 2.3% to the Half-weighted Mining Resources benchmark, as compared to 5.7% and 3.2% respectively). In contrast, in terms of tracking error, the CAPI is very close to the ALSI (having a tracking error of 1.7%).

Table 1: Tracking Error between the various benchmarks and indices

	All Share index	Top 40 (J200)	CAPI All Share	CAPI Top 40	S/W All Share	S/W Top 40	AFEISA 150	MSCI SA	68:32	80:20	1/2 Wght. Resources	GE Peer Mean	AA Peer Mean
All Share index	0.0												
Top 40 (J200)	2.1	0.0											
CAPI All Share	1.7	3.4	0.0										
CAPI Top 40	2.1	2.5	1.8	0.0									
S/W All Share	4.9	6.7	3.7	4.9	0.0								
S/W Top 40	4.0	5.2	3.2	3.4	2.5	0.0							
AFEISA 150	2.6	4.4	1.3	2.6	2.7	2.5	0.0						
MSCI SA	5.6	4.8	7.0	6.5	8.9	7.6	7.4	0.0					
68:32	3.7	5.5	2.7	4.0	2.4	3.2	2.1	8.4	0.0				
80:20	6.8	8.6	5.7	7.0	3.4	5.1	4.9	11.2	3.2	0.0			
1/2 Wght. Reso.	4.3	6.1	3.2	4.6	2.3	3.4	2.6	8.9	0.6	2.6	0.0		
GE Peer Mean	8.0	9.9	6.9	8.3	4.1	6.2	5.9	11.9	4.7	2.9	4.3	0.0	
AA Peer Mean	6.9	8.8	5.9	7.3	3.2	5.1	5.0	10.8	3.7	2.2	3.2	1.8	0.0

4.e. Correlation

The expected correlation is tabulated in matrix form in Table 2. We notice that all the correlations are fairly high (above 90%), which is to be expected considering the fair amount of overlap of stocks in these benchmarks and the positive correlation between the majority of the stocks.

From Table 2 it is evident that the benchmarks with high correlations ($\geq 98.5\%$) to the AA Prudential peer mean are noted as the 68:32-, the 80:20-FINDI:RESI, and the Half-weighted Mining Resources ALSI benchmarks. The Shareholder Weighted All Share index consistently has a higher expected correlation against each of these three benchmarks than that of the CAPI.

See Appendix A3 for a discussion of the method employed to determine expected tracking error.

Table 2: Correlation between the various benchmarks and indices

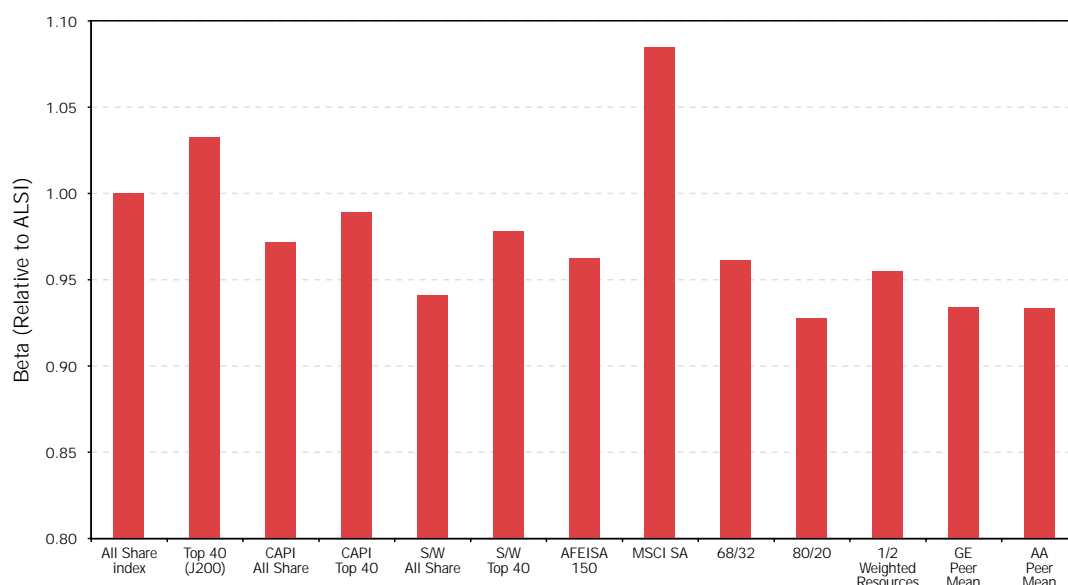
	All Share index	Top 40 (J200)	CAPI All Share	CAPI Top 40	S/W All Share	S/W Top 40	AFEISA 150	MSCI SA	68:32	80:20	1/2 Wght. Resources	GE Peer Mean	AA Peer Mean
All Share index	100.0												
Top 40 (J200)	99.7	100.0											
CAPI All Share	99.8	99.2	100.0										
CAPI Top 40	99.6	99.5	99.7	100.0									
S/W AllShare	97.6	96.0	98.5	97.5	100.0								
S/W Top 40	98.3	97.6	98.9	98.8	99.4	100.0							
AFEISA 150	99.4	98.5	99.8	99.4	99.2	99.3	100.0						
MSCI SA	97.9	98.2	96.7	97.0	94.1	95.8	96.2	100.0					
68:32	98.7	97.4	99.2	98.3	99.4	98.9	99.5	94.7	100.0				
80:20	95.1	92.9	96.4	94.8	98.7	97.1	97.2	89.5	98.9	100.0			
1/2 Wght. Reso.	98.2	96.7	98.9	97.8	99.4	98.8	99.2	93.9	100.0	99.2	100.0		
GE Peer Mean	93.2	90.4	94.6	92.5	98.1	95.7	96.0	88.0	97.4	99.0	97.9	100.0	
AA Peer Mean	94.9	92.6	96.1	94.3	98.8	97.1	97.1	90.3	98.5	99.4	98.8	99.6	100.0

4.f. Beta against FTSE/JSE All Share index

We determined the expected beta against the All Share index using the current compositions of each benchmark or index and our most recent (31 March 2003) estimation of individual stocks’ betas against the All Share index. Some background of the interpretation of beta and the method to determine benchmark betas is given in Appendix A5.

Figure 7 shows a bar chart of the betas of the various benchmarks and indices. The horizontal line indicates the beta of the AA Prudential peer mean, 0.933. Benchmarks that are most similar in terms of the beta value is the 80:20 FINDI:RESI benchmark (0.925), and the Shareholder Weighted All Share index (0.940). In contrast the beta of the Capped All Share index is relatively high, at 0.971.

Figure 7: Betas of the various benchmarks and indices against the All Share index



See Appendix A4 for a discussion of the method employed to determine expected correlation.

We should note that the correlation measure is not sufficient to ensure that returns are similar as it is possible to have two highly correlated funds where the first one's returns are double that of the second for each month. In such as case the correlation might be very close to 100%, yet their returns over a year might be very far apart.

Note: Beta is an important risk measure as departures in beta can translate in large differences in return.

4.g. Trading Turnover

The trading turnover is defined as the fraction of the benchmark which must be sold and consequently bought back to move from an initial benchmark to the final benchmark. Both the sold and the bought fraction are counted. The turnover gives an indication of the proximity between two benchmarks or indices, and it is directly related in the cost of restructuring from one benchmark to another. Table 3 shows the trading turnover between the various benchmarks and indices. Starting with the AA Prudential peer mean as a starting point, it is clear that the Shareholder Weighted index is much closer to the AA Prudential peer mean than the Capped All Share index.

From Table 3 it is evident that benchmarks with low trading turnover to the AA Prudential peer mean are the 68:32- and the 80:20-FINDI:RESI benchmarks, and the Half-weighted Mining Resources ALSI benchmark (having turnovers of only 56.6%, 52.5% and 55.1% respectively). When comparing the new proposed indices (CAPI and Shareholder Weighted) to these three benchmarks, no clear-cut decision can be made in terms of which index is closest to those three benchmarks.

Table 3: Trading turnover between the various benchmarks and indices

	All Share index	Top 40 (J200)	CAPI All Share	CAPI Top 40	S/W All Share	S/W Top 40	AFEISA 150	MSCI SA	68:32	80:20	1/2 Wght. Resources	GE Peer Mean	AA Peer Mean
All Share index	0.0												
Top 40 (J200)	27.2	0.0											
CAPI All Share	12.5	29.3	0.0										
CAPI Top 40	39.3	19.2	29.3	0.0									
S/W AllShare	46.8	61.4	38.8	52.2	0.0								
S/W Top 40	62.4	49.6	56.5	37.1	40.2	0.0							
AFEISA 150	24.8	39.7	17.7	35.8	33.0	49.7	0.0						
MSCI SA	83.4	73.5	89.4	79.0	79.6	70.8	86.1	0.0					
68:32	27.8	40.9	21.9	35.0	36.7	58.0	24.2	90.0	0.0				
80:20	51.8	64.1	43.4	50.7	31.4	59.7	41.8	97.6	24.0	0.0			
1/2 Wght. Reso.	32.2	45.2	24.8	34.3	35.6	57.3	26.5	91.1	4.4	19.6	0.0		
GE Peer Mean	75.0	91.2	69.4	86.0	49.1	73.7	60.5	108.3	65.1	60.1	64.0	0.0	
AA Peer Mean	66.6	80.5	61.1	73.6	41.0	57.6	52.2	98.0	56.6	52.5	55.1	34.4	0.0

5. { HEDGING WITH DERIVATIVES }

We expect there would be a need for option structures linked to the new Top 40-type indices. It is important to consider the hedging of the proposed pension fund benchmarks by using derivatives. Over-the-counter (OTC) option structures are frequently used to manage risks and enhance the performance of funds. The underlying entity for these options are usually the Top 40 index, but prompted by the introduction of the two new pension fund indices, SAFEX introduced CAPI Top 40 and Shareholder Weighted Top 40 futures contracts in July 2003.

A quick telephonic survey among the major banks (who typically price option contracts) revealed limited awareness of the new indices. Most respondents indicated that depending on demand they would make prices on OTC index options. However, we feel that there resides a difficulty in "flying blind" for 2½ months with the Shareholder Weighted Top 40. Only two weeks before futures close-out, when the updated weights for the

See Appendix A1 for a discussion of the method employed to determine trading turnover.

Delta hedging options on the Shareholder Weighted Top 40 index might be risky.

Shareholder Weighted Top 40 will be published, can the banks start to rebalance their hedging baskets.

This makes delta hedging risky for banks – resulting in a potential additional premium to be paid for the hedge. In contrast, the Capped Top 40 index is more transparent in construction, thus we anticipate banks would be more willing to make prices on these index options.

6. { CONCLUSION }

We conclude by summarising the important distinctions in our quantitative assessment.

The Capped All Share index is expected to cap at least one and perhaps no more than three stocks at 10%. At the moment and in the foreseeable future those stocks would be Resources companies.

In contrast, the Shareholder Weighted All Share index represents a marked deviation from the All Share index. Dual-listed shares are down-weighted according to a formula attempting to adjust for shares not readily available to the domestic investor. A possible factor that might detract from the usefulness of this index is that the foreign holding of some dual-listed stocks might fluctuate significantly from quarter to quarter, forcing funds to rebalance frequently. This aspect might also cause OTC options on the Shareholder Weighted Top 40 index to trade at a premium.

In summary:

- the two indices that will be introduced by the JSE Securities Exchanges differ markedly in terms of sector make-up
 - The CAPI is quite close to the ALSI, with only a slightly reduced Resources component.
 - Currently, the S/W All Share has roughly equal weightings for Resources, Financials and Industrials. However, this may change in future as foreign investors might change their South African holdings, thus impacting the domestic free float.
- The CAPI is a highly concentrated index, while the S/W All Share is significantly less concentrated.
- The volatility of the CAPI is expected to be higher than that of the S/W All Share.
- Tracking error calculations reveal that the S/W All Share index is much closer to current pension fund holdings, while the CAPI represents a significant departure from the status quo; it is in fact very similar to the ALSI.
- The CAPI has a higher beta than the pension fund peer mean and the S/W All Share index.
- We expect the market makers in OTC derivatives to be circumspect regarding price-making the instruments derived from the S/W All Share index, due to the lack of transparency in its construction, and the late announcement of information that would impact on quarterly rebalancing.

{ APPENDIX A }

A1. Turnover

We can calculate the total turnover required to move from the initial portfolio or benchmark to the target portfolio, provided the market remains stationary. We should bear in mind that:

- All under-weights should be bought back
- All over-weights should be sold
- Thus, we need to calculate the sum of the absolute weights of all the active weights

The turnover can then be expressed as

$$TO = \sum_{i=1}^n |w_{Pi} - w_{Ti}| = \sum_{i=1}^n |\omega_i|$$

where w_{Pi} is the weights for stock i in the initial portfolio P ,

w_{Ti} is the weights for stock i in the target portfolio T ,

and $\omega_i = w_{Pi} - w_{Ti}$ is the active weights.

A2. Volatility

The formula for the expected portfolio variance is

$$\sigma^2 = \mathbf{w}'\mathbf{\Omega}\mathbf{w}$$

where \mathbf{w} is the weights column vector, and $\mathbf{\Omega}$ is the covariance matrix. The annualised volatility is $\sqrt{12}\sigma$.

A3. Tracking error

We first determine the return R_P of the initial portfolio in terms of the returns of its constituent stocks and the constituent weights:

$$R_P = \sum_{i=1}^n w_{Pi} r_i$$

where R_P is the return of the initial portfolio P , w_{Pi} is the weight of stock i in portfolio P , and r_i is the return of stock i .

Similarly, we have for the return of the target portfolio T :

$$R_T = \sum_{i=1}^n w_{Ti} r_i$$

Tracking error is obtained by calculating the standard deviation of the relative returns between the initial portfolio and the target portfolio:

$$Stdev(R_P - R_T) = \sqrt{\text{var}(R_P - R_T)}$$

So we first calculate the variance of the relative returns:

$$\begin{aligned}\text{var}(R_P - R_T) &= \text{var} \left[\sum_{i=1}^n w_{P_i} r_i - \sum_{i=1}^n w_{T_i} r_i \right] \\ &= \text{var} \left[\sum_{i=1}^n (w_{P_i} - w_{T_i}) \cdot r_i \right]\end{aligned}$$

let $\omega_i = w_{P_i} - w_{T_i}$, then

$$\begin{aligned}\text{var}(R_P - R_T) &= \text{var} \left(\sum_{i=1}^n \omega_i r_i \right) \\ &= \text{cov} \left(\sum_{i=1}^n \omega_i r_i, \sum_{j=1}^n \omega_j r_j \right) \\ &= \sum_{i=1}^n \sum_{j=1}^n \omega_i \omega_j \text{cov}(r_i, r_j) \\ &= \sum_{i=1}^n \sum_{j=1}^n \omega_i \omega_j \sigma_{i,j} \\ &= \boldsymbol{\omega}' \boldsymbol{\Omega} \boldsymbol{\omega}\end{aligned}$$

where $\boldsymbol{\Omega}$ is the covariance matrix, and $\boldsymbol{\omega}$ is the column vector of active weights. The tracking error is usually annualised, thus if we used monthly returns to calculate the TEV, the tracking error (σ_{TE}) is

$$\sigma_{TE} = \sqrt{12 \cdot \text{var}(R_P - R_T)}$$

A4. Correlation and Covariance

The expected covariance between two portfolios can be as follows:

$$\begin{aligned}\sigma_{12}^2 &= \text{cov}(R_{1t}, R_{2t}) \\ &= \text{cov} \left[\sum_{i=1}^n w_{1i} r_i, \sum_{j=1}^n w_{2j} r_j \right] \\ &= \sum_{i=1}^n \sum_{j=1}^n w_{1i} w_{2j} \text{cov}(r_i, r_j) \\ &= \sum_{i=1}^n \sum_{j=1}^n w_{1i} w_{2j} \sigma_{ij} \\ &= \mathbf{w}_1' \boldsymbol{\Omega} \mathbf{w}_2\end{aligned}$$

Where R_{1t} is a series of returns for portfolio 1, r_i is a series of returns for stock i , $\boldsymbol{\Omega}$ is the covariance matrix and \mathbf{w} is the column vector of weights for portfolio 1.

Consequently the correlation would be

$$\rho_{12} = \frac{\sigma_{12}}{\sigma_1 \sigma_2}$$

A5. Beta

The expected beta of a portfolio or index against the ALSI was determined by multiplying the weights of the portfolio with the corresponding beta of that stock against the ALSI.

$$\beta_{index}^{ALSI} = \sum_i w_i \beta_i^{ALSI}$$

The beta of a stock against the All Share index is essentially the sensitivity of the return of the stock against a movement in the return of the All Share index, derived in statistical sense from the model equation⁴

$$R_s = \alpha + \beta R_I + e$$

where R_s is the return of a stock,

R_I is the return of the All Share index,

α and β are the intercept and slope coefficients to be estimated for the stock,

e is an error term, normally distributed around zero.

Usually, the standard error for this regression on JSE data is rather large, but when determining the beta for a benchmark against the All Share index, we expect small standard errors resulting in rather accurate estimates of beta.

The total risk (volatility) of a fund can be decomposed as follows:

$$\sigma^2 = \beta^2 \sigma_{bench}^2 + \sigma_{error}^2$$

The benchmark risk $\beta^2 \sigma_{bench}^2$ qualifies the component of the volatility of a fund that is attributable to the fund's exposure to the benchmark (or market). The more a fund is exposed to benchmark/market movements the more market risk it incurs. Market exposure is measured by the fund's beta relative to the benchmark. A fund's beta (and market exposure) increases with increasing investment in high beta stocks since a fund's beta is simply the weighted average of the betas of the underlying assets.⁵

Thus, when using the All Share index as a "benchmark" for the benchmarks, the larger the beta, the larger the market movements would attribute to the benchmark's total risk.

⁴ For information about the beta concept refer to our recent report "A practitioners guide to estimating beta & the role of beta" by Prof. Dave Bradfield (March 2003)

⁵ See our previous report "Interpreting the important concepts of risk", Dave Bradfield, Oct. 2002

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