

An Investible South African Corporate Bond Index: Construction and Tracking

For Dibanisa Fund Managers
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Summary

- A previous Cadiz report highlighted the important role that corporate bonds have played in the out-performance of active bond fund managers.
- This report discusses the construction of an investible corporate bond index with the specific requirements of a tracking fund in mind.
- We formulate rules for an equally-weighted “buy-and-hold” index of fixed coupon corporate bonds.
- We propose a 50:50 blend of the corporate index and the GOVI index and compare the performance of this fund with the performance of the active fund managers over the last one, three and five years (focusing mainly on the five year results).
- We find that over all three time frames the blended index produced similar returns to the peer mean of the active fund managers.
- However this was with significantly lower return volatility.
- Thus the risk-adjusted characteristics of the blended fund were significantly better than those of the peer mean.
- This risk-adjusted out-performance was achieved consistently over each of the individual one year periods in the analysis. By contrast, individual active managers displayed a degree of inconsistency, with many moving from top to bottom quartile over the five year period.
- We performed a regression analysis and fitted the Cadiz PCA model to all fund returns.
- We concluded that portfolio yield was the most important factor in determining fund performance, with yield curve shifts and active timing decisions forming a much smaller contributor to returns.
- We conclude with some recommendations regarding the practical implementation of a corporate bond index tracking fund.

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Introduction

The South African corporate bond market has experienced rapid growth over the last ten years, but unfortunately trade in the secondary market remains highly illiquid. The credit indices published by the Bond Exchange of South Africa (BESA) are not investible and are not suitable as the basis of an index tracking fund. The main reason is that the indices consist of almost all listed corporate bonds, most of which rarely trade in the secondary market.

An earlier Cadiz report¹ highlighted the important role that corporate bonds have played in generating out-performance by active bond funds over their benchmarks. The report suggests that a passive strategy consisting of a blend of both government and corporate bond index tracking funds may show an improved risk-adjusted return relative to the peer mean of active fund managers.

In this report we describe the construction of a corporate bond index that is more liquid than the published credit indices, with the specific requirements of an index tracker in mind. We construct a time series of historical returns and then compare the index's return and risk characteristics with:

- the ALBI
- the GOVI
- the major active bond funds
- a 50:50 blend of the corporate index and the GOVI index.

Thereafter the report focuses on the practical issues related to the creation of a corporate bond index tracker.

Data

An analysis of this kind requires a significant amount of data, some of which is not that easy to find. The major data vendors often do not record traded volume data for the smaller bond issues, forcing us to extract (and clean) raw data from the exchange.

Our main data sources were as follows:

- Corporate bond data was sourced from the Bond Exchange of South Africa (BESA). We have compiled a database of all trades reported in the BESA "Trade by Trade" email that is disseminated to subscribers on a daily basis.
- Bond static data (maturity dates, coupon rates, etc.) was obtained from the monthly "Bond Data" emails published by BESA.
- Mark-to-market yield data was sourced from I-Net Bridge.
- Active fund data was provided by Alexander Forbes.

The analysis is based on the last five years of monthly returns, ending 30 September 2009 and all return data in this report is presented before management fees.

¹ "An Analysis of Bond Fund Performance", Brett Dugmore, Cadiz Securities, June 2009.

Corporate Index Construction

Our goal is to create a corporate bond index that is as liquid as possible, while retaining some of the characteristics of credit in active bond funds. We were prompted by the previous Cadiz report which suggested that at least half the observed alpha of active funds was due to the credit spreads of corporate bonds held in these portfolios.

This indicates that a passive portfolio consisting of a mix of corporate and government bonds may have achieved improved risk-adjusted performance relative to the average active fund manager. The challenge is to find rules for the construction of a corporate bond index that retains as much liquidity as possible without eliminating too many higher yielding corporate bonds.

Eligible bonds

We have chosen to follow the “dual ranking” approach used in the construction of the BEASSA indices². The advantage of this approach is that it takes both market capitalisation and liquidity into account in selecting index constituents.

We then form an equally-weighted index using the constituents chosen from the dual ranking. We have chosen equal weights over market-capitalisation weights since this reduces the concentration in low-yielding government guaranteed bonds. Our weighting scheme includes a “buy-and-hold” condition that is described in more detail below.

The Cadiz corporate bond database consists of 471 corporate bonds. These were reduced to a smaller universe of 292 eligible bonds according to the following filters:

- The bond must be listed on BESA.
- The BESA “pricing class” must be “V”, indicating that they follow standard bond pricing rules (although they may be callable), and can be treated as “vanilla” bonds.
- The bond must pay a fixed coupon.
- The bond must have a minimum outstanding nominal of R1bn.
- The bond must trade on yield, not price.

We do not assume a minimum term to maturity since we intend to hold bonds to maturity as far as possible.

These rules exclude floating rate notes, amortising instruments and convertible bonds. A possible direction for future research is to include these instruments in the index. In some cases it may make sense to construct a separate index, for example for floating rate notes.

The corporate bond index that we propose differs from the “Credit Fixed” corporate bond index published by BESA in the following respects:

² “BEASSA Total Return Indices”, Bond Exchange of South Africa and Actuarial Society of South Africa, 2000. The report is currently available at the web URL:
http://www.bondexchange.co.za/besa/action/media/downloadFile?media_fileid=3925

- The BESA index includes all listed fixed-coupon bonds with outstanding nominal of R100m or more, whereas our index has a minimum requirement of R1bn.
- The BESA indices consider all bonds regardless of their pricing class, while we only consider those classified as “V”.
- The indices are weighted by market capitalisation, while we use an equal weighting scheme.
- Our index has a liquidity screen as determined by the dual ranking process described below.

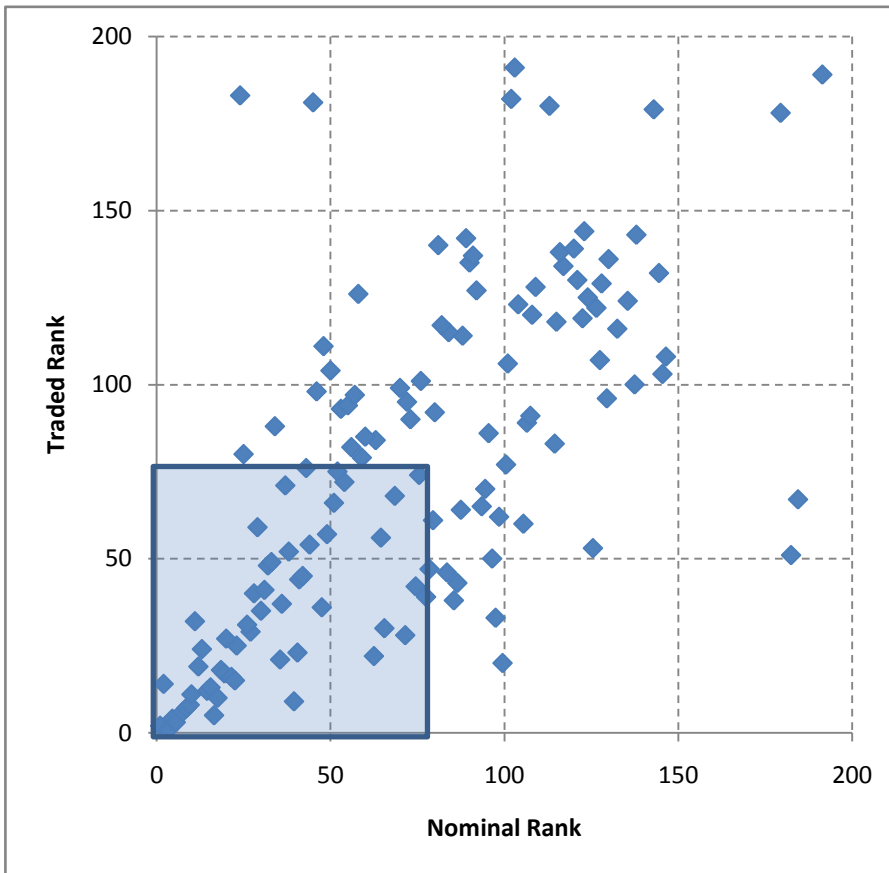
Dual ranking

Once the list of eligible bonds has been found according to the rules described above, we rank them according to their size and liquidity. Following the method used for the ALBI, GOVI and other BEASSA indices, each bond is assigned a rank according to a dual ranking system as follows:

- The bonds are ranked according to their current outstanding nominal.
- The bonds are ranked according to their total secondary market trade over the last twelve months.
- The dual rank is calculated as the maximum of the two ranks calculated above. Ties are broken by adding 0.5 onto the nominal rank.

The dual ranking system can be easily visualized by plotting, for each bond, its nominal rank on the horizontal axis of a graph and its trade rank on the vertical axis. The smallest square (with its bottom left corner at the origin) that encloses the desired number of bonds determines the bonds to be included in the index. This is illustrated in Figure 1 below.

Figure 1: Dual ranking



We choose to include the top 50 ranked bonds, and the blue square encloses the eligible bonds based on the dual ranking system described above.

The choice of 50 bonds is somewhat arbitrary, but our simulations indicate that the results are not significantly improved by increasing the number of eligible bonds. Conversely, a smaller choice of bonds, such as 25, also produces similar results. We feel that 50 bonds provides sufficient diversification without unduly straining the liquidity characteristics of the index. In a later section we analyse the liquidity of the index in some detail.

By definition, the dual ranking system automatically excludes participation in initial issues via auction or private placement, because the new bond would not have any secondary market trade to measure its trading rank. An area for further research is to modify the index construction rules to allow for participation in new issues, auctions and placements. Since the index is intended to buy-and-hold as far as possible, it may make sense to relax the restriction on secondary market turnover in these instances. Alternatively, in a core-satellite or active-tracker blend, initial issues would be subscribed to through the active allocation.

Weighting scheme

Once the 50 constituents have been selected, the index construction process ensures that the index consists of approximately an equal weighting in each eligible bond, according to the following rules:

- At inception the index holds each eligible bond in equal weights according to percentage value.
- A bond only leaves the index at maturity.
- After inception, at each rebalancing date, if the number of new bonds in the index equals the number of bonds leaving the index, then the proceeds of the bond sales are used to purchase equal amounts of the bond entering the index. The remaining bonds remain unaffected. This is not likely to occur unless a bond matures on a rebalancing date.
- If the number of bonds entering the index is not equal to the number of bonds leaving the index, then the whole index is rebalanced such that all bonds are held in equal weights after rebalancing.

The purpose of the weighting scheme is to minimise transaction costs by eliminating small or unnecessary rebalancing trades.

Rebalancing frequency and cash flow reinvestment

The BEASSA indices are rebalanced monthly, but from an index tracker perspective it may be desirable to rebalance less frequently to reduce trading costs. The corporate index presented in this document is rebalanced at the end of each calendar quarter. We investigated the differences in returns for different rebalancing frequencies and found that the effect was marginal.

When coupons are paid or bonds mature, the proceeds are re-invested in the index proportionately across all remaining bonds in the index. This is assumed to take place on the trade date whose settlement date is on the cash flow date.

Credit risk

Most of the larger South African corporate bond issues have a credit rating assigned by one of three major rating agencies, namely S&P, Moodys, or Fitch. Active fund managers that invest in non-government bonds have a credit process that determines:

- The allowable allocation to each credit rating.
- A fair value credit spread at which the asset manager is happy to purchase the bond.
- Conditions under which a corporate bond will be sold, e.g. concerns regarding the strength of the underlying corporate.

A corporate bond index needs to specify any rules relating to the credit quality of its constituents. There are a few possible approaches:

- **No credit restrictions.** This is the approach followed by the BESA credit indices. Any listed corporate bond with more than R100m nominal outstanding is included regardless of the credit rating.
- **A minimum credit rating.** It is possible to specify a minimum credit rating for a bond to be eligible for inclusion. The problem in South Africa is that many of the corporate bonds are unrated, so this would severely restrict the number of eligible instruments.
- **A credit committee.** A more subjective approach would be to form a credit committee that decides on the eligibility of each bond on a case by case basis. This would allow for customised credit decisions, and takes on some of the functions of an active bond fund manager.

For the purposes of this report we have assumed no credit restrictions. In a later section we discuss the credit quality of the corporate bond market and the corporate index in particular.

Historical Performance of the Index

Having specified the index construction rules for the corporate index, we now turn our attention to the historical performance of the index over the last one, three and five years. Using our historical database of trading statistics and outstanding nominals we reconstructed the index and calculated monthly returns.

We compare the historical return characteristics of:

- the corporate bond index
- a 50:50 blend of the corporate index and the GOVI index
- a selection of active bond funds
- the peer mean of these funds
- the ALBI
- the GOVI.

The time series cover the period 30 September 2004 to 30 September 2009. All returns are presented pre-fees.

Index characteristics

Table 1 below summarises some of the index characteristics:

Table 1: Index characteristics

Average # of bonds	26
Max # of bonds	43
Min # of bonds	12
Average % turnover per month (including coupon and principal reinvestment)	3.24%
Current AAA holding	29%
Current # of bonds	43

The current number of bonds is representative of the minimum index size going forward. In the early stages of the back-testing the corporate bond market was less developed and hence there were fewer eligible bonds. It seems likely that in the future this market will grow and the universe of eligible bonds will increase.

Comparative return analysis

We now turn to an analysis of the return and risk characteristics of the corporate bond index over the last one, three and five years. To put the return figures into context we begin by looking at the changes in the yield curve over these three time periods.

The bond market experienced significant volatility over the last five years due to the economy passing through a full interest rate cycle and the additional volatility caused by the global financial crisis. Figure 2 below shows the current government par³ curve (purple) together with the curve at the start of each of the time frames considered in our analysis.

Figure 2: Historical par curves

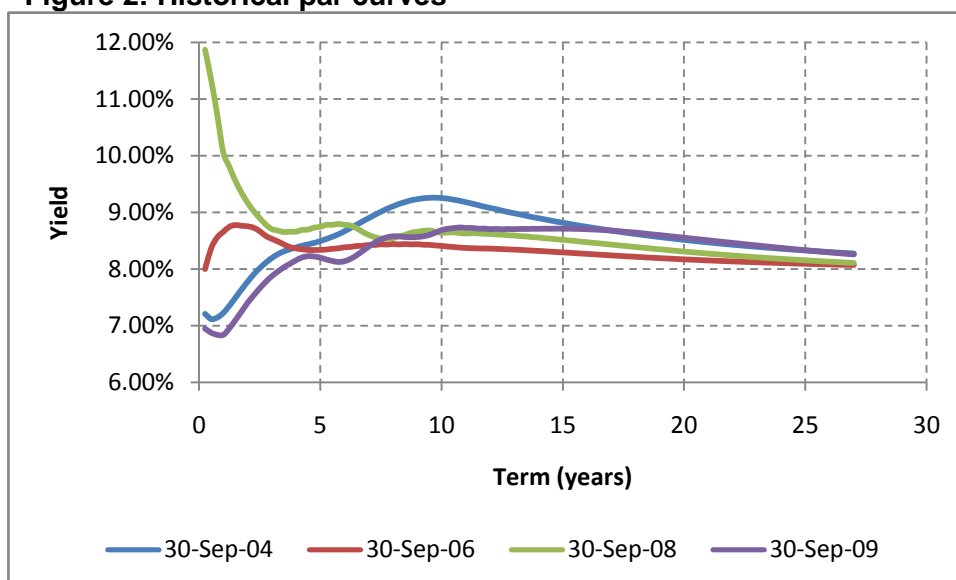


Figure 2 highlights the following points:

- It is evident that the short end of the curve experienced significant volatility due to the changes in the repo rate over the period.
- Interestingly the most recent yield curve is not very different from that of September 2004. This means that the net effect of yield curve shifts (and the resulting capital gains or losses in bond valuations) is not very significant compared to the interest accrued over the last five years.

³ These are perfect fit par curves constructed from zero curves published by BESA. The zero curves are constructed from the main government bonds, together with a collection of money market instruments in the short end. A full explanation of their construction can be found in “The BEASSA Zero Coupon Yield Curves: Technical Specifications”, Bond Exchange of South Africa, November 2003. This document can be found at the web URL http://www.bondexchange.co.za/besa/action/media/downloadFile?media_fileid=3784

- The rise in long-dated yields over the last three years resulted in the ALBI underperforming cash over the period.
- The yield curve is currently steeper than it was at any of the prior four dates. This most likely an indication that we are nearing the bottom of the current interest rate cycle. It is the steepening that occurred over the last three years that has caused the ALBI to underperform cash for the period,

Table 2 below gives comparative returns on the major asset classes over the three time periods.

Table 2: Comparative asset class returns

	Cash	Equities	ALBI
1 year	10.03%	7.70%	9.07%
3 year	10.47%	6.66%	8.02%
5 year	9.19%	19.53%	8.48%

From Table 2 we observe:

- The ALBI has under-performed cash over one, three and five years (after a period of significant out-performance during the early years of this decade).
- Over one and three years equities have under-performed both bonds and cash. This is evidence of the unusual economic environment of the last few years.
- For this reason we should be cautious when interpreting our risk – returns statistics. In particular, with bond returns fairly close that of cash, the Sharpe ratio is a less useful measure as it becomes very sensitive to the exact level of performance⁴.

Tables 3 - 5 below show the average annualised return, standard deviation and Sharpe ratio for each of the funds over each of the three time horizons. The number in brackets shows the fund's rank on that characteristic. For ease of reference we have highlighted the corporate bond index, the 50:50 blend of corporate and GOVI, the peer mean and the ALBI benchmark.

⁴ For example, a fund that slightly out-performed cash will always have a higher Sharpe ratio than one that under-performed, regardless of the comparative return volatility of the two funds. So a fund that out-performed cash by one basis point, but with very high volatility would appear more attractive than one that under-performed by one basis point, but with extremely low volatility.

Table 3: Comparative returns (last 5 years)

Name	Return	Risk	Sharpe
Corporate	10.02% (1)	5.18% (23)	16.04% (1)
Prescient Bond QuantPlus	10.02% (2)	5.44% (22)	15.18% (2)
Stanlib Core Bond (Pooled)	9.94% (3)	7.48% (1)	10.03% (3)
Futuregrowth Yield Enhanced	9.65% (4)	6.81% (13)	6.74% (4)
RMBAM Bond Portfolio	9.61% (5)	6.84% (12)	6.13% (5)
Advantage Moderate Bond FOF	9.54% (6)	6.29% (19)	5.58% (7)
SYmmETRY Bond Portfolio	9.53% (7)	5.69% (21)	5.94% (6)
Stanlib Core Bond	9.37% (8)	7.45% (2)	2.45% (8)
Cadiz Core Bond	9.32% (9)	6.88% (11)	1.91% (10)
Investment Solutions Pure Fixed Interst Portfolio	9.32% (10)	6.51% (17)	1.94% (9)
Prudential Yield Enhanced Portfolio	9.29% (11)	7.31% (5)	1.36% (12)
50:50 Blend	9.28% (12)	6.17% (20)	1.41% (11)
Investec Dynamic Bond Portfolio	9.25% (13)	7.25% (6)	0.74% (13)
Mean	9.23% (14)	6.75% (15)	0.58% (14)
Coronation Active Bond Composite	9.23% (15)	6.81% (14)	0.57% (15)
SIM Duration Bond Fund	9.18% (16)	7.39% (3)	-0.20% (16)
Prescient Bond Quant	9.11% (17)	6.66% (16)	-1.20% (17)
Pan Africa AM Segregated Domestic Bond	9.08% (18)	6.9% (10)	-1.69% (18)
OMIGSA Fixed Income Investments Bond Portfolio	9.05% (19)	7.11% (9)	-2.02% (19)
Metropolitan Managed Gilt Portfolio	8.94% (20)	7.14% (8)	-3.46% (20)
GOVI	8.53% (21)	7.18% (7)	-9.27% (21)
ALBI	8.48% (22)	7.34% (4)	-9.67% (22)
ABSA Bond Fund	8.41% (23)	6.49% (18)	-12.07% (23)

We make the following observations:

- Over this time frame the corporate index was the top performing portfolio.
- It had the lowest return volatility.
- Thus the corporate bond index had the highest Sharpe ratio.
- The 50:50 blend slightly out-performed the peer mean.
- All funds except one outperformed the ALBI.
- The range of returns was 1.61% between the best and worst performing portfolio.

Table 4: Comparative returns (last 3 years)

Name	3 year		
	Return	Risk	Sharpe
Prescient Bond QuantPlus	9.83% (1)	5.87% (25)	-10.89% (1)
Advantage Moderate Bond FOF	9.67% (2)	6.92% (21)	-11.49% (2)
Futuregrowth Yield Enhanced	9.45% (3)	7.75% (15)	-13.08% (3)
RMBAM Bond Portfolio	9.42% (4)	7.72% (16)	-13.6% (4)
Corporate	9.35% (5)	5.76% (26)	-19.36% (6)
Coronation Active Bond Composite	8.94% (6)	7.99% (8)	-19.11% (5)
Pan Africa AM Segregated Domestic Bond	8.92% (7)	7.81% (14)	-19.8% (8)
Investment Solutions Pure Fixed Interst Portfolio	8.86% (8)	7.3% (19)	-21.98% (9)
Investec Dynamic Bond Portfolio	8.84% (9)	8.34% (1)	-19.56% (7)
SYmmETRY Bond Portfolio	8.83% (10)	6.13% (24)	-26.67% (20)
Mean	8.79% (11)	7.61% (17)	-22.08% (10)
Prescient Bond Quant	8.76% (12)	7.31% (18)	-23.42% (14)
50:50 Blend	8.75% (13)	6.84% (22)	-25.07% (18)
Cadiz Core Bond	8.64% (14)	7.96% (10)	-22.99% (12)
Prudential Yield Enhanced Portfolio	8.58% (15)	8.29% (3)	-22.77% (11)
SIM Duration Bond Fund	8.55% (16)	8.24% (5)	-23.23% (13)
OMIGSA Fixed Income Investments Bond Portfolio	8.52% (17)	7.95% (12)	-24.49% (16)
Stanlib Core Bond (Pooled)	8.48% (18)	8.32% (2)	-23.9% (15)
Metropolitan Managed Gilt Portfolio	8.46% (19)	8.1% (7)	-24.74% (17)
Stanlib Core Bond	8.32% (20)	8.17% (6)	-26.29% (19)
Trident Capital- PQ Active Bond	8.15% (21)	7.84% (13)	-29.58% (22)
GOVI	8.14% (22)	7.95% (11)	-29.25% (21)
ALBI	8.02% (23)	8.24% (4)	-29.71% (23)
JM Busha BondPlus	7.92% (24)	6.16% (23)	-41.31% (25)
Argon Domestic Core Bond	7.87% (25)	7.99% (9)	-32.51% (24)
ABSA Bond Fund	7.44% (26)	7.08% (20)	-42.74% (26)

From Table 4 we observe:

- All funds under-performed cash for the period, as can be seen from the negative Sharpe ratios.
- The corporate bond index performed well, with returns in the top quartile.
- The 50:50 blend under-performed the peer mean marginally.
- Again, most active funds managed to beat the ALBI.
- The range of returns between the best and worst portfolio was 2.39%.

Table 5: Comparative returns (last 1 year)

Name	1 year		
	Return	Risk	Sharpe
Advantage Moderate Bond FOF	12.49% (1)	9.16% (13)	26.86% (2)
Prescient Bond QuantPlus	11.82% (2)	6.36% (27)	28.17% (1)
Corporate	11.5% (3)	6.57% (26)	22.35% (3)
RMBAM Bond Portfolio	11.5% (4)	8.83% (19)	16.62% (4)
Coronation Active Bond Composite	10.61% (6)	9.48% (5)	6.1% (6)
Pan Africa AM Segregated Domestic Bond	10.5% (7)	9.03% (16)	5.17% (8)
Prescient Bond Quant	10.48% (8)	8.43% (23)	5.41% (7)
Investment Solutions Pure Fixed Interest Portfolio	10.43% (9)	8.52% (22)	4.74% (9)
Futuregrowth Yield Enhanced	10.29% (10)	8.68% (20)	2.95% (10)
Investec Triple Alpha	10.24% (11)	9.15% (14)	2.31% (12)
50:50 Blend	10.23% (12)	7.78% (24)	2.57% (11)
Mean	10.18% (14)	8.85% (18)	1.65% (13)
OMIGSA Fixed Income Investments Bond Portfolio	10.18% (13)	9.31% (7)	1.6% (14)
Stanlib Core Bond (Pooled)	10.00% (15)	10.14% (1)	-0.26% (15)
SIM Duration Bond Fund	9.98% (16)	9.9% (2)	-0.48% (16)
Cadiz Core Bond	9.93% (17)	9.19% (12)	-1.03% (17)
SYmmETRY Bond Portfolio	9.91% (18)	6.79% (25)	-1.73% (18)
Prudential Yield Enhanced Portfolio	9.63% (19)	9.25% (10)	-4.36% (19)
Stanlib Core Bond	9.49% (20)	9.53% (4)	-5.61% (20)
Metropolitan Managed Gilt Portfolio	9.39% (21)	9.56% (3)	-6.74% (21)
Investec Dynamic Bond Portfolio	9.1% (22)	9.2% (11)	-10.09% (22)
ALBI	9.07% (23)	9.44% (6)	-10.15% (23)
Trident Capital- PQ Active Bond	9.04% (24)	9.26% (9)	-10.68% (24)
GOVI	8.96% (25)	9.03% (15)	-11.88% (25)
ABSA Bond Fund	8.75% (26)	9.02% (17)	-14.19% (26)
JM Busha BondPlus	8.52% (27)	6.1% (28)	-24.72% (28)
Argon Domestic Core Bond	8.17% (28)	9.29% (8)	-19.96% (27)

From Table 5 we observe:

- The corporate bond index was the third best performing portfolio over the last year.
- The 50:50 blend produced a return very close to that of the peer mean, out-performing by 7 bps p.a.
- Most funds out-performed the ALBI, although the number of under-performing funds has increased as the time frame has become shorter.
- The range of returns has once again increased to 4.32% between the best and worst fund.

Table 6 below shows the year-by-year returns (ending 30 September each year): The top quartile funds are highlighted in green, while the bottom quartile funds are highlighted in red. The active funds have been ranked by most recent returns, while the corporate index, the blend and the benchmarks are shown at the bottom of the table.

Table 6: Year-by-year returns

One year returns ending 30 September:	2005	2006	2007	2008	2009
Advantage Moderate Bond FOF	13.13%	5.70%	9.58%	7.01%	12.49%
Prescient Bond QuantPlus	15.00%	5.80%	8.82%	8.87%	11.82%
RMBAM Bond Portfolio	14.52%	5.47%	9.30%	7.49%	11.50%
Cadiz Dynamic Bonds	13.35%	-	-	6.91%	10.80%
Coronation Active Bond Composite	13.24%	6.21%	9.46%	6.79%	10.61%
Pan Africa AM Segregated Domestic Bond	13.44%	5.33%	9.65%	6.65%	10.50%
Prescient Bond Quant	13.91%	5.55%	8.95%	6.86%	10.48%
Investment Solutions Pure Fixed Interest Portfolio	14.39%	5.79%	9.14%	7.03%	10.43%
Futuregrowth Yield Enhanced	13.82%	6.22%	10.26%	7.83%	10.29%
Investec Triple Alpha	-	-	-	7.16%	10.24%
OMIGSA Fixed Income Investments Bond Portfolio	14.27%	5.59%	9.17%	6.25%	10.18%
Stanlib Core Bond (Pooled)	16.96%	7.59%	9.50%	5.98%	10.00%
SIM Duration Bond Fund	14.61%	5.81%	9.91%	5.82%	9.98%
Cadiz Core Bond	14.68%	6.20%	9.52%	6.48%	9.93%
SYmmENTRY Bond Portfolio	14.72%	6.60%	8.89%	7.71%	9.91%
Prudential Yield Enhanced Portfolio	15.07%	5.86%	9.45%	6.69%	9.63%
Stanlib Core Bond	16.31%	5.89%	9.65%	5.85%	9.49%
Metropolitan Managed Gilt Portfolio	14.10%	5.42%	10.10%	5.95%	9.39%
Investec Dynamic Bond Portfolio	13.67%	6.19%	9.67%	7.74%	9.10%
Trident Capital- PQ Active Bond	-	-	9.18%	6.24%	9.04%
ABSA Bond Fund	14.33%	5.60%	8.88%	4.75%	8.75%
JM Busha BondPlus	-	5.12%	8.58%	6.67%	8.52%
Argon Domestic Core Bond	-	-	9.52%	5.94%	8.17%
African Harvest Conservative Bonds	-	-	-	-	-
Alliance Capital Active	13.58%	-	-	-	-
Coronation Active Bond Portfolio	13.24%	6.18%	9.88%	6.45%	-
Coronation Core Bond	-	-	9.87%	-	-
Investec Core Bond Portfolio	13.62%	5.50%	9.36%	-	-
Tri-Linear Fixed Income	12.71%	6.00%	8.54%	10.12%	-
Mean	14.14%	5.82%	9.38%	6.83%	10.18%
GOVI	13.47%	4.91%	9.22%	6.27%	8.96%
ALBI	13.57%	4.96%	9.03%	5.98%	9.07%
Corporate	15.20%	7.03%	9.46%	7.14%	11.50%
Blend	14.33%	5.97%	9.35%	6.71%	10.23%

The table highlights some interesting facts:

- There was a lack of consistency with no fund manager consistently top or bottom quartile over all five years.

- The 50:50 blend and the peer mean were both consistently in the middle of the table with neither portfolio ever top or bottom quartile.
- The corporate index was a good performer, finishing in the top quartile for three years and never in the bottom quartile. Only one active fund had a similar record (the “Futuregrowth Yield Enhanced”).

Figures 3 – 5 below are risk-return plots over the three time frames. In each case we compare the 50:50 blend, the peer mean and the active funds.

Figure 3: Risk - return plot (last 5 years)

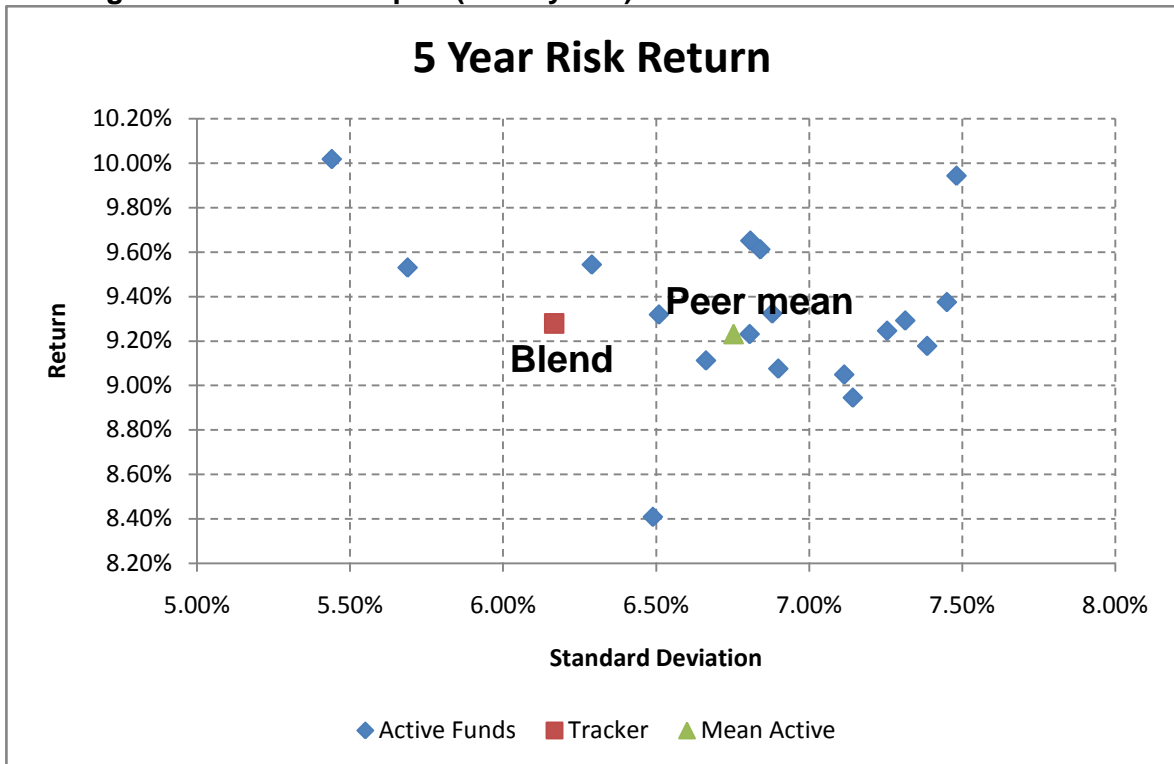


Figure 4: Risk - return plot (last 3 years)

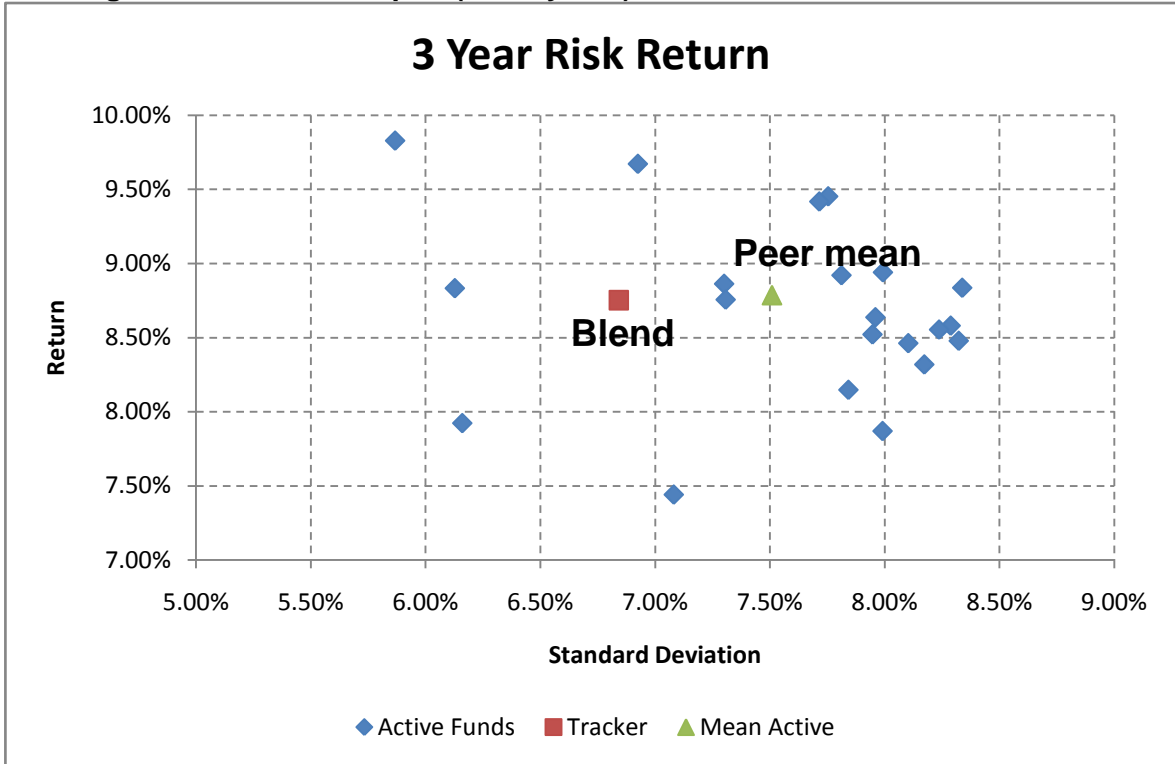
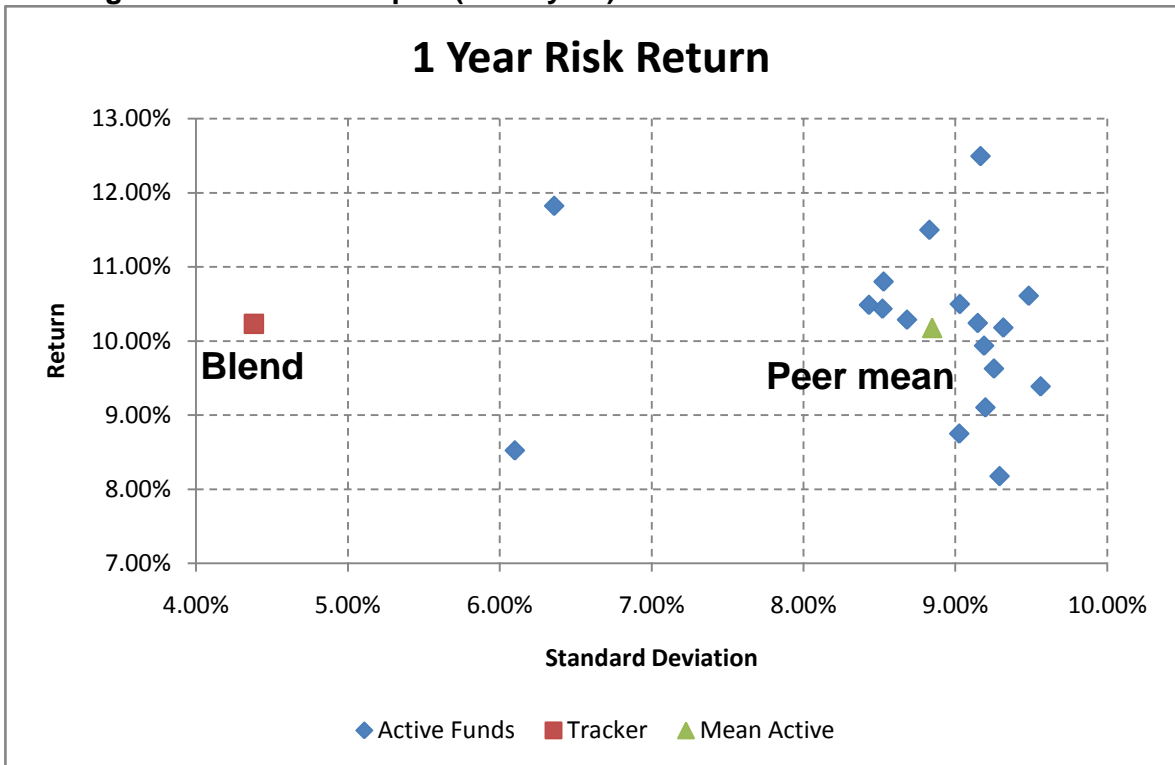


Figure 5: Risk - return plot (last 1 year)



- These three graphs highlight the fact that although the performance of the 50:50 blend was similar to that of the peer mean over all three time frames, the absolute return volatility was significantly lower.
- As mentioned above, because bond returns were relatively close to cash over the three periods, the Sharpe ratio does not highlight the significantly lower return volatility of the corporate bond index and hence the 50:50 blend.

This low risk property of the index is also evident in Table 7 below which quantifies the relative volatility in terms of modified duration.

Table 7: Comparative modified durations

	Average	30-Sep-09
ALBI	5.07	6.14
GOVI	5.01	6.03
Corporate	3.59	3.98
Blend	4.30	5.00
Peer mean	-	5.75

In the next few sections we are interested in trying to ascertain the source of the active funds' out-performance and compare it to that of the corporate and blended indices. In addition we analyse the risk characteristics of the funds in more detail.

Regression analysis

In this section we regress the fund returns against the market, which we proxy using the ALBI. This allows us to determine the funds' average exposure to the bond market, while the timing model⁵ gives some indication of whether the fund managers were able to successfully respond to changing market conditions by adjusting the modified duration of their fund.

The initial model that we fit is given by the following equation:

$$r_p - r_f = \alpha + \beta(r_b - r_f) + \varepsilon,$$

where r_p represents monthly portfolio returns, r_b represents monthly returns on the benchmark (the ALBI in this case), r_f denotes returns from cash (the risk-free asset), ε is an error term, and α and β are the estimated regression coefficients.

The model expresses the excess return (over the risk-free rate) of a portfolio in terms of the fund's exposure to the market (or benchmark), measured by β and an additional return that is independent of the market, measured by α . The market exposure measured by β is the average exposure of the fund over the period of the analysis.

An extension to this model was proposed by Hendriksson and Merton in 1980-81. The model is described by the following regression equation:

⁵ R. Hendriksson, R. Merton, "On Market Timing and Investment Performance. II. Statistical Procedures for Evaluating Forecasting Skills", Journal of Business, Volume 54, Issue 4 (October 1981), 513-533.

$$r_p - r_f = \alpha + \beta(r_b - r_f) + \gamma(r_b - r_f)^+ + \varepsilon,$$

$$\text{where } (r_b - r_f)^+ = \begin{cases} (r_b - r_f) & \text{if } (r_b - r_f) > 0 \\ 0 & \text{if } (r_b - r_f) \leq 0 \end{cases},$$

and γ is estimated in the regression with the other variables defined as before.

The variable γ is a measure of the extent to which the fund returns exhibited timing properties: a positive value indicates positive timing and a negative value indicates negative timing. The difference between the values of α estimated in the two models gives an indication of the value added (or destroyed) through market timing.

Tables 8 below summarises the results of the two models. Numbers in bold are statistically significant at the 95% confidence level.

Table 8: Regression analysis - 5 years

	Standard model		Timing Model			Timing returns
	Alpha	Beta	Alpha	Beta	Gamma	
Stanlib Core Bond (Pooled)	0.11%	1.02	0.14%	1.02	-0.54	-0.02%
Prescient Bond QuantPlus	0.10%	0.73	0.10%	0.73	-0.11	0.00%
Corporate	0.10%	0.70	0.11%	0.70	-0.32	-0.01%
Futuregrowth Yield Enhanced	0.08%	0.92	0.05%	0.91	0.73	0.03%
RMBAM Bond Portfolio	0.08%	0.93	0.06%	0.92	0.57	0.03%
Advantage Moderate Bond FOF	0.07%	0.83	0.08%	0.84	-0.20	-0.01%
Stanlib Core Bond	0.07%	1.01	0.10%	1.02	-0.73	-0.03%
SYmmETRY Bond Portfolio	0.06%	0.77	0.07%	0.77	-0.20	-0.01%
Prudential Yield Enhanced Portfolio	0.06%	0.99	0.03%	0.98	0.83	0.04%
Cadiz Core Bond	0.06%	0.93	0.02%	0.92	0.90	0.04%
Investec Dynamic Bond Portfolio	0.06%	0.98	0.00%	0.97	1.27	0.06%
Investment Solutions Pure Fixed Interst Portfolio	0.06%	0.88	0.06%	0.89	-0.06	0.00%
SIM Duration Bond Fund	0.05%	1.00	0.06%	1.01	-0.23	-0.01%
Coronation Active Bond Composite	0.05%	0.92	0.02%	0.90	0.82	0.04%
Mean	0.05%	0.92	0.04%	0.91	0.24	0.01%
Blend	0.05%	0.84	0.06%	0.84	-0.27	-0.01%
Prescient Bond Quant	0.04%	0.90	0.06%	0.91	-0.32	-0.01%
OMIGSA Fixed Income Investments Bond Portfolio	0.04%	0.97	0.04%	0.97	0.07	0.00%
Pan Africa AM Segregated Domestic Bond	0.04%	0.94	0.03%	0.93	0.32	0.01%
Metropolitan Managed Gilt Portfolio	0.03%	0.97	0.04%	0.97	-0.06	0.00%
GOVI	0.00%	0.98	0.01%	0.98	-0.21	-0.01%
ALBI	0.00%	1.00	0.00%	1.00	0.00	0.00%
ABSA Bond Fund	-0.01%	0.87	0.03%	0.89	-1.08	-0.05%

The table highlights some interesting points:

- The average active fund achieved an alpha of around 5bp per annum over the last five years.
- The blended fund achieved the same level of alpha.
- The average beta of the active funds over five years was 0.92, indicating that the active funds on average had a lower modified duration than the benchmark.
- The blended fund achieved a similar level of return as the peer mean, but with a significantly lower beta of 0.84 (lower than all but two of the active funds).
- The peer mean achieved around 1bp of return per month from timing (over the last 5 years), although this was not statistically significant.

Yield curve exposure analysis

The models utilised in the previous section were originally developed with equity markets in mind. A large portion of fixed income returns can be explained by the yield curve, and so Cadiz has developed a more sophisticated model⁶ that attempts to explain the historical performance of bond funds based on changes in the level and shape of the yield curve.

The model begins by analysing yield curve movements historically, determining the extent of level shifts (where the entire curve moves up or down, more or less in parallel) and slope changes (where the short end of the curve falls, while the long end rises, or vice versa).

Once the historical yield curve shifts have been measured on a monthly basis, the fund returns are regressed against variables representing the extent of each shift on a monthly basis, as well as variables representing market timing (in a similar fashion to the timing model described earlier).

The full model specification is given by the following equation:

$$r_p - r_f = \alpha + \beta_1 k_1 + \beta_2 k_2 + \beta_1^+ k_1^2 + \beta_2^+ k_2^2 + \varepsilon$$

where r_p represents monthly portfolio returns, r_f denotes returns from cash (the risk-free asset), k_1 and k_2 are variables describing the extent of level shifts and slope changes respectively and ε is an error term. The variables α , β_1 , β_2 , β_1^+ and β_2^+ are the estimated regression coefficients. See the original Cadiz report for more detail.

The model's results are summarised in Table 11 below.

In order to illustrate the meaning of each component of the return attribution, consider the following simple example:

A fund manager buys a portfolio consisting of equal weights in two bonds, A and B. The average yield of the portfolio at the purchase date (t_0 in the table below) is 10% p.a. The fund manager holds the portfolio for two months. At the end of month one (t_1 in the table below), the portfolio's average yield is 9% p.a. and at the end of month two (t_2 in the table below), the portfolio's average yield is 8% p.a.

Table 9: Simple example

Example	Bond A (short dated)	Bond B (long dated)	Portfolio average
t0	9%	11%	10%
t1	7%	11%	9%
t2	5%	11%	8%
Average over time			9%

The principal component analysis decomposes the monthly yield shifts into two components as follows:

⁶ "Bond Fund Analysis using Principal Components", Brett Dugmore, Cadiz Securities, 2005.

Table 10: Example PCA

	Bond A	Bond B
Level shift (average monthly)	-1%	-1%
Slope change (average monthly)	-1%	1%

Notice that the sum of the level shift and the slope change gives the total monthly shift for each bond.

The columns in these tables then give the following information:

- **Return (avg. p.a.).** This is the annualised total return of the fund over the period, including reinvested coupons.

In the above example this would be the (annualised) return based on two months, assuming the portfolio was purchased at the start of month one and sold at the end of month two, including the full capital gain from the 4% fall in yields on bond A.

- **Yield (avg. p.a.).** This is a monthly measure representing an estimate of the fund's average yield-to-maturity. The yield-to-maturity is influenced by the fund's positioning along the yield curve as well as its average credit spread to the government curve. In addition, returns due to widening or tightening credit spreads form part of this return number.

In the example above, the yield factor would be the average yield at the start of each month, expressed as a monthly return. This is approximately the average yield (9%, as shown in last line of Table 11) expressed as a monthly quantity: i.e. $9\%/12 = 0.75\%$.

- **Level shifts.** This is the return generated by the average monthly level shift.

In our example above, the average level shift was -1% each month, and so the return on this component would be the capital gain generated by a 1% fall in yields on both bonds in the portfolio.

- **Slope changes.** This is the return generated by the average monthly slope change.

Similarly to the level shift component, this component would be the monthly return generated by the capital gains and losses arising from the average monthly slope change (a fall of 1% on bond A and a rise of 1% on bond B).

- **Level timing.** This represents any return generated in a month due to market timing, i.e. attempts by the fund manager to alter yield curve exposure due to an expectation of a rise or fall in the overall level of yields.

Returning to our example above, if the fund manager anticipated that on average yields were going to fall over the two month period, and he attempted to benefit by investing more in bonds that would benefit from this shift, then the additional return from this active management decision would be shown under this component.

- **Slope timing.** This represents returns generated in an average month from attempts by the fund manager to alter the fund’s exposure to a steepening or flattening yield curve. For example, a fund manager who successfully predicts the outcome of the MPC meetings and adjusts his portfolio accordingly is likely to have a positive contribution from this component.

Similarly to the “Level timing” factor, in the example above, if the investor expected the yield curve to steepen and adjusted his exposure accordingly on a monthly basis, then the additional return arising from this active management decision would be shown here.

- **Residual.** This is a combination of returns arising from yield curve shifts that could not be expressed as a combination of a level shift and a slope change, as well as returns arising from factors not modelled such as intra-month trading.
- **R-square.** This is the standard regression statistic that gives a measure of the degree to which the model fits the data.

The number in brackets gives the fund’s rank on that particular value.

Table 10: Yield curve decomposition - 5 years

Name	Return (avg. p.a.)	Yield (avg. p.m.)	Level shifts	Slope changes	Level timing	Slope timing	Residual	R-square
Corporate	10.02% (1)	0.80% (2)	0.03% (23)	0.00% (1)	0.00% (20)	-0.02% (14)	-0.01% (1)	98.25% (13)
Prescient Bond QuantPlus	10.02% (2)	0.76% (3)	0.03% (22)	0.00% (3)	0.01% (17)	0.01% (2)	-0.01% (2)	97.64% (18)
Stanlib Core Bond (Pooled)	9.94% (3)	0.80% (1)	0.04% (2)	0.00% (16)	0.00% (19)	-0.03% (19)	-0.02% (23)	97.35% (20)
Futuregrowth Yield Enhanced	9.65% (4)	0.73% (9)	0.03% (14)	0.00% (8)	0.06% (5)	-0.03% (20)	-0.02% (11)	98.44% (12)
RMBAM Bond Portfolio	9.61% (5)	0.72% (10)	0.03% (11)	0.00% (5)	0.04% (6)	-0.01% (8)	-0.02% (12)	98.25% (14)
Advantage Moderate Bond FOF	9.54% (6)	0.74% (5)	0.03% (20)	0.00% (23)	0.01% (15)	0.00% (4)	-0.02% (5)	92.89% (23)
SYmmETRY Bond Portfolio	9.53% (7)	0.73% (7)	0.03% (21)	0.00% (21)	0.02% (13)	0.00% (5)	-0.01% (3)	97.55% (19)
Stanlib Core Bond	9.37% (8)	0.76% (4)	0.04% (1)	0.00% (7)	-0.01% (22)	-0.02% (12)	-0.02% (22)	98.64% (8)
Cadiz Core Bond	9.32% (9)	0.71% (12)	0.03% (15)	0.00% (10)	0.08% (2)	-0.06% (22)	-0.02% (13)	98.03% (17)
Investment Solutions Pure Fixed Interst Portfolio	9.32% (10)	0.73% (6)	0.03% (18)	0.00% (9)	0.02% (12)	-0.03% (17)	-0.02% (7)	98.46% (11)
Prudential Yield Enhanced Portfolio	9.29% (11)	0.69% (20)	0.04% (6)	0.00% (13)	0.06% (4)	-0.02% (15)	-0.02% (19)	98.76% (5)
Blend	9.28% (12)	0.73% (8)	0.03% (19)	0.00% (2)	0.01% (18)	-0.02% (11)	-0.02% (4)	99.07% (3)
Investec Dynamic	9.25%	0.66%	0.04%	0.00%	0.08% (1)	-0.01%	-0.02%	98.91%

Bond Portfolio	(13)	(23)	(9)	(20)		(10)	(18)	(4)
Mean	9.23% (14)	0.71% (13)	0.03% (13)	0.00% (15)	0.03% (8)	-0.02% (13)	-0.02% (9)	98.69% (7)
Coronation Active Bond Composite	9.23% (15)	0.71% (11)	0.03% (16)	0.00% (4)	0.07% (3)	-0.06% (23)	-0.02% (10)	96.48% (21)
SIM Duration Bond Fund	9.18% (16)	0.70% (17)	0.04% (3)	0.00% (22)	0.01% (16)	0.01% (1)	-0.02% (21)	98.21% (15)
Prescient Bond Quant	9.11% (17)	0.70% (15)	0.03% (12)	0.00% (12)	0.00% (21)	0.01% (3)	-0.02% (8)	98.75% (6)
Pan Africa AM Segregated Domestic Bond	9.08% (18)	0.71% (14)	0.03% (10)	0.00% (6)	0.04% (7)	-0.04% (21)	-0.02% (14)	98.55% (10)
OMIGSA Fixed Income Investments Bond Portfolio	9.05% (19)	0.69% (19)	0.04% (8)	0.00% (18)	0.02% (11)	-0.01% (6)	-0.02% (15)	98.59% (9)
Metropolitan Managed Gilt Portfolio	8.94% (20)	0.70% (16)	0.04% (7)	0.00% (17)	0.02% (10)	-0.02% (16)	-0.02% (16)	98.15% (16)
GOVI	8.53% (21)	0.67% (21)	0.04% (5)	0.00% (14)	0.01% (14)	-0.01% (9)	-0.02% (17)	99.26% (1)
ALBI	8.48% (22)	0.67% (22)	0.04% (4)	0.00% (11)	0.03% (9)	-0.03% (18)	-0.02% (20)	99.12% (2)
ABSA Bond Fund	8.41% (23)	0.70% (18)	0.03% (17)	0.00% (19)	-0.03% (23)	-0.01% (7)	-0.02% (6)	95.68% (22)

The main conclusions that we draw from this model are:

- We have consistently found⁷ that the best predictor for a fund's ranking on the return table is its ranking on the "Yield" factor.
- Returns arising from the "Level Shift" and "Slope change" factors are dependent on how significantly the yield curve changed its level and shape over the period. (There were significant changes to the yield curve over the period under review). For long-term investment horizons the impact of yield curve shifts is almost always much less than the interest accrued over the period (i.e. the "Yield" component).
- Similarly, the returns due to the "Timing" factors are dependent on both the magnitude of yield curve shifts over the period (i.e. timing opportunities, of which there were many over the period under review) as well as the fund manager's willingness and ability to profit from these opportunities. In general, returns arising from the timing component are small and the evidence indicates mixed success from fund managers attempting to time yield curve shifts.
- This model gives further weight to the importance of high yielding instruments in historical bond performance.

⁷ In the earlier report produced for Dibanisa Fund managers, as well as the original Cadiz report ("Bond Fund Analysis Using Principal Components", Brett Dugmore, Cadiz Securities, 2005) and subsequent analysis of the local unit trust industry.

Tracking the Index

In the previous sections of this report we have motivated the need for an investible corporate bond index and given an indication of the expected return and risk characteristics of tracking funds based on these indices. We now discuss some of the practical issues relating the implementation of a corporate bond tracking fund.

Initial set-up

The largest trades for a corporate bond index are likely to be those at the inception of the fund. In an illiquid market such as the South African corporate bond market, this may require some strategising.

We suggest two possible approaches to manage the initial portfolio purchases:

- Negotiate a lead-in period whereby the mandate allows for higher tracking errors while the fund slowly accumulates the bonds required in the secondary market.
- In the case where the funds to be invested are being transferred from an active bond fund manager, the source portfolio may already contain a large proportion of the required bonds. In this situation it makes sense to transfer the bonds at BESA mark-to-market levels into the index tracking fund. This reduces transaction costs and market impact, and will shorten the time required for the tracking fund to achieve its target tracking error.

Rebalancing trades

There are three situations that will give rise to rebalancing trades:

- **Coupon payments.** As coupons are paid, they are assumed to be reinvested proportionately across all bonds in the index. In practice the amounts to be reinvested are likely to be small, so it is likely that the fund manager may decide to leave the proceeds in cash until the amount to be reinvested is sufficiently large to warrant trading. An alternative may be to invest in government bonds in order to maintain exposure to the bond market and reduce tracking error.
- **Maturing bonds.** When a bond matures the index assumes that the proceeds are reinvested across all bonds in the index. These cash flows may be substantial and it is likely that the fund manager will decide to reinvest the cash immediately.
- **Index re-weighting.** The index is rebalanced at the end of each calendar quarter, i.e. on the 1st January, 1st April, 1st July and 1st October.

When a new bond enters the index the number of bonds in the index will increase (unless there is a bond that matures on the same day. In this case the weights in the existing bonds will drop slightly in order to provide the cash to buy the new bond. Thus, although the index has a “buy-and-hold” condition, it will sometimes be necessary to sell some of the existing bonds in the index to make space for new constituents.

Analysing liquidity in the corporate bond market

Liquidity is a particularly difficult property to measure. Although it can be broadly defined as the ease with which a stock trades, trading statistics alone do not give a complete picture of the true extent of a stock's liquidity.

Historical trade volumes, bid-offer spreads and free-float factors all miss an important component of liquidity: namely the potential to trade. For example, a stock that didn't trade on a particular day and had no bids or offers on a trading screen, may have traded had a buyer or seller entered the market. Unfortunately the willingness of a market participant to trade a stock is not a quantity that is measured and recorded, so we have to make do with the available data.

Cadiz has developed a liquidity estimation model⁸ that is based on historical trade volumes, but goes beyond measuring liquidity through a simple average. The model looks at the empirical distribution of trades for a stock over different time frames in order to ascertain the length of time that it is likely to have taken to trade a particular volume of a given stock. The model assigns probabilities to the likelihood of completing a given order in 1, 2, 3 days etc.

Even though this model is somewhat more sophisticated than some other approaches, it still only provides an upper bound on the expected time required to execute a trade. In other words the model provides a conservative estimate because it is based on actual trades observed in the market, not the potential for the market to accommodate the required trades.

We propose using the model to provide a forecast of the expected time required to implement the initial set-up trades as well as the quarterly rebalancing. This will be the subject of a separate report.

The blended fund

The blended fund consists of a mix of government and corporate bonds that is representative of the composition of the active fund managers. According to the Alexander Forbes Bond Survey⁹ the average active manager held about 72% of his assets in AAA rated instruments. The range was quite wide, varying from 30% to 93%, as at 30 September 2009.

By comparison, a 50:50 blend of the corporate bond index and the GOVI index would currently consist of around 64% AAA rated assets.

Conclusion

This document was prompted by an earlier Cadiz report that highlighted the important role that corporate bonds have played in the out-performance of active bond fund managers.

In this report we describe the construction of an investible corporate bond index with the specific requirements of a tracking fund in mind. We formulate rules for an equally-weighted "buy-and-hold" index of fixed coupon corporate bonds.

We propose a 50:50 blend of the corporate index and the GOVI index and compare the performance of this fund with the performance of the active fund managers, over the last one, three and five years.

⁸ "Liquidity Estimation Spreadsheet", Jaco Maritz, Cadiz Securities, March 2006.

⁹ For example, "Bond Survey September 2009", Alexander Forbes, September 2009.

We found that over all three time frames the blended index produced similar returns to the peer mean of the active fund managers, but with significantly lower return volatility.

This performance was consistently similar to the peer mean over each of the individual one year periods in the analysis. By contrast, individual active managers displayed a degree of inconsistency, with many moving from top to bottom quartile over the five year period.

We concluded that portfolio yield was the most important factor in determining fund performance, with yield curve shifts and active timing decisions forming a much smaller contributor to returns.

We conclude with some recommendations regarding the practical implementation of a corporate bond index tracking fund.

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