RETURN-BASED STYLE ANALYSIS OF DOMESTIC TARGETED ABSOLUTE AND REAL RETURN UNIT TRUST FUNDS IN SOUTH AFRICA

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Abstract

By means of return-based style analysis (RBSA), heterogeneous style sub-categories were identified within the targeted absolute and real return (TARR) category of the South African unit trust market to create a framework for sub-categorisation. The study dealt with TARR funds and their place within the investment universe. The literature review emphasised the importance of asset allocation, which supports the use of RBSA to identify asset allocation and further provided a motivation for the semi-strong form of RBSA applied to the sample data.
The findings suggest that in general, return-based style analysis applied to each fund identifies the asset allocation for the fund and is valid and that the collective results of return-based style analysis applied to the funds can be used to create a framework for sub-categorisation

Keywords: Return-based Style Analysis, Targeted Absolute and Real Return Funds, Fund Categorisation

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1. Introduction

The Association of Collective Investments (ACI) (known as the Association for Savings and Investment SA, ASISA, from October 2008) plays an important role in the South African unit trust industry. Among others, the Association for Savings and Investment SA (ASISA) assumes responsibility for the classification system applied to unit trusts. Towards the end of 2008, the ACI was disbanded and incorporated as part of the Association for Savings and Investment SA (ASISA). The mission of ASISA on behalf of its members is to play "…a significant role in the development of the social, economic and regulatory framework in which our members operate, thereby assisting members to serve their customers better" (ASISA, 2010d).

The classification system of unit trusts in South Africa formed part of the ACI's Code of Practice as published in March 2008 (ACI, 2008a). Herein, unit trusts are classified according to the investment strategy/style proposed in the mandate of the fund.

The classification system proposed by the ACI classifies funds based on the asset allocation within the portfolio. This should lead to homogeneous portfolios within a particular category. However, two categories, namely equity, varied specialist funds and asset allocation, targeted absolute and real return (TARR) funds; are not a grouping of homogeneous funds due to the broad description of the respective categories.

Following changes to the classification system of unit trusts used at the time, the Domestic, Asset Allocation, Targeted Absolute and Real Return category (subsequently only referred to as TARR) was only implemented as such in the last quarter of 2003 (Lambrechts, 2003:40). The category description entails: funds that invest at least 80% of their assets in the South African (i.e. domestic) market; invest in a range of asset classes namely equity, bond, money market and property (the asset allocation decision) which may invest in derivative instruments with low volatility. (ACI 2008a:14). As the TARR unit trust category has a very broad definition, which imposes no bounds on any asset class, performance evaluation and peer comparison are challenging. The growth of TARR funds (Table 1) from inception to date, coupled with both bull and bear market conditions, creates an opportunity to better understand return drivers and fund styles, which is important to industry and investors alike.

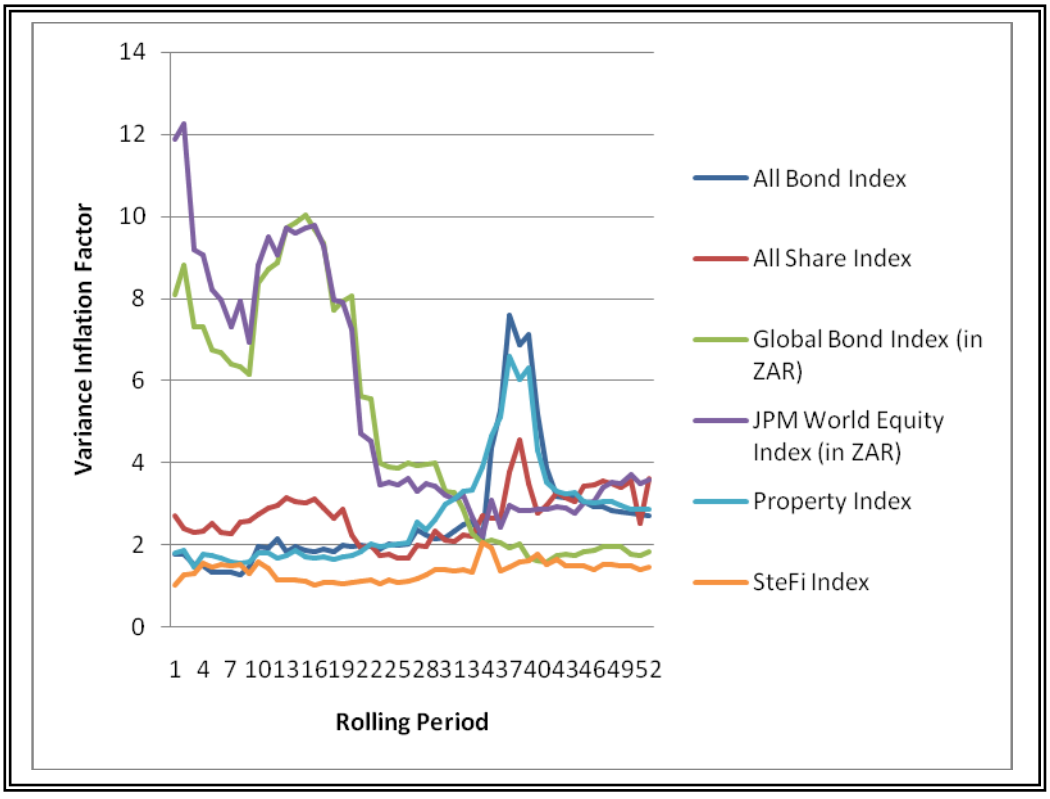
Table 1. Growth in domestic and TARR funds

	Domestic funds			TARR funds		
Date	**Number of funds**	**Total Assets (million)**	**Growth in assets**	**Number of funds**	**Total Assets (million)**	**Growth in assets**
31 Dec 2003*	369	208 915	N/A	16	5 062	N/A
31 Dec 2004*	427	285 392	36,6%	39	9 162	81,0%
31 Dec 2005*	511	385 280	35,0%	50	16 131	76,1%
31 Dec 2006*	633	494 705	28,4%	79	28 022	73,7%
31 Dec 2007 †	700	609 624	23,2%	98	33 757	20,5%
31 Dec 2008 †	738	624 165	2,4%	92	34 237	1,4%
31 Dec 2009 †	760	743 708	19,2%	78[11]	38 770	13,2%
31 Sep 2010†	785	835 288	12,3%	81	44 218	14,1%

*Assets held by fund of funds as well as assets held by other SA unit trusts in local unit trusts were ignored to avoid double counting.
†Figures as provided by ACI and ASISA for 2007-2009 include double counting of assets. Were it also to exclude double counting as in Lambrechts' surveys, growth would be lower than indicated.

Source: Lambrechts (2003:2; 2004:2; 2005b:2; 2006:7); ACI (2008a); ASISA (2009a; 2010b; 2010c)

Figure 1. VIF for each index during sample period



[11] Numerous TARR funds were reclassified during the first quarter of 2009 into the prudential categories.

From humble beginnings, the unit trust industry has grown to an asset class with assets under management of R879 324 million on 30 September 2010 (ASISA, 2010c). The TARR category contributed R44 218 million in assets (ASISA, 2010c).

Currently, there is limited South African research regarding RBSA and none that applies the principles of RBSA to the TARR category. Research on the TARR category is only relevant from 2003 (October 2003 marked the creation of the category). Subsequently, it is hypothesised that the period from October 2003 to December 2009 warrants sufficient historical information for research purposes as it covers a substantial period.

The main purpose of this study is to identify heterogeneous style sub-categories within the TARR category of the South African unit trust market and attempts to create a framework for sub-categorisation by means of return-based style analysis (RBSA).

The research question in this particular study is two-fold: firstly, based on the results of return-based style analysis, can the exposure (to each asset class) over time be determined? Secondly, and this question is more exploratory, based on the return-based style analysis result, can sub-categorisation of the funds based on homogeneous asset exposures, be achieved?

2. Literature review

The variation in returns attributable to asset allocation is estimated at as high as 99.5% (Timmerman 1999), between 94% and 92% (Blake 1999:429; Brinson, Hood & Beebover 1986:43; Vestergen & Redin 2009:24), but no lower than 90% (Ibbotson & Kaplan 2000:32),

Donnelly (1992:C1) stated that many mutual funds are misclassified, leading to the inaccurate classification of the inherent style of funds and the investment objectives of fund categories being misleading. Schiffres and Parmelee (1995) emphasised that knowing a fund's name or official category is not enough and that even a fund mandate may not be sufficient. Kim, Shukla and Tomas (2000:310) as well as Swinkels and Van der Sluis (2006:531) agreed that although some deviations may not be significant or influence the relevance or peer comparison, they in essence mislead investors should deviations become significant.

Although little research prior to 1992 had as primary objective style analysis, it created a foundation for the principles of Sharpe's (1992) style analysis. Bailey and Arnott (1986) identified inherent groups of managers with similar investment styles. Arnott, Kelso, Kiscadden and Macedo (1989) maintained that style is the main factor driving the return patterns of funds. Other research at this time focused on policy asset allocation decisions (Brinson *et al.* 1986; Brinson, Singer & Beehower 1991), portfolio measurement (including risk and return) and benchmark construction (Tierney & Winston, 1991 and Troutman, 1991.

In summary, the building blocks to Sharpe's research of 1988 and 1992 are the:

- development of factor models, albeit the application thereof focus on different primary research objectives (e.g. benchmark construction, separating active from passive return);
- research that questions whether inherent style is consistent with fund objectives;
- premise that funds are misclassified and research focused on valid and reliable ways to test it;
- use of judgemental and cluster analysis techniques (with its inherent limitations and advantages) for style analysis;
- general acceptance of the importance of asset allocation.

The method proposed by Sharpe (1988, 1992) entails an analysis of the returns of funds in relation to appropriate style indices. The resulting style weights (also called exposures, sensitivities or coefficients) are indicative of the style of the funds, or differently phrased, the return drivers of the fund (Dor *et al.*, 2006:10).

The key assumptions of the original Sharpe model (1988, 1992) include the:

- non-factor return component (i.e. e_i) is uncorrelated with the non-factor return component for any other asset (i.e. e_k). Thus the only source of correlation between different asset returns is the factors identified. Differently stated by Chen and Knez (1996), should the return achieved by a manager be the linear relationship of the identified factors (thus $e_i=0$), it indicates that the manager thus possesses no skill. The error term e_i is thus the return due to selection while the first term (in brackets) is the return due to style (i.e. $\left[b_{i1}\tilde{F}_1 + b_{i2}\tilde{F}_2 + ... + b_{in}\tilde{F}_n\right]$).
- sensitivities to factors (b_{i1} to b_{in}) must sum to one and short selling is prohibited (thus $b_{i1}, b_{i2}, \ldots, b_{in} \geq 0$).

Ter Horst *et al.* (2004:30) later defined the three forms of RBSA as *weak, semi-strong and strong* style analysis:

- *Weak style analysis:* no constraints are imposed on factor sensitivities (also called coefficients, style weights).
- *Semi-strong style analysis:* the analysis employs only the constraint of factor weights adding up to one. Swinkels and Van der Sluis (2006:532) argue that this restriction does not imply that short sales in general are restricted, but only that they are not allowed in style categories.
- *Strong style analysis:* the analysis refers to the original model proposed by Sharpe (1992) which

applies both constraints, namely the portfolio constraint (i.e. weights adding to 1) and style weights being non-negative (Lobosco & DiBartolomeo, 1997; Sharpe, 1992; DiBartolomeo & Witkowski, 1997; Robertson *et al.*, 2000).

However, the validity of the RBSA results explicitly depends on the following factors:

- The purpose of the RBSA such as identifying overall style, style shifts, misclassification and performance measurement;
- The extent of available historical data;
- The time frame and market conditions during the sample period;
- The use of rolling periods when appropriate;
- The validity of chosen independent variables such as reflecting of investment style and level of multicollinearity;
- Too many versus too few independent variables in the regression analysis.

DiBartolomeo and Witkowski (1997), in an attempt to test for the misclassification of funds, regressed the returns of funds, not against market indices, but against the return of specific existing categories, namely US mutual fund categories/indices. They claimed that if a fund is correctly classified, the coefficient of the mutual fund index to which the fund belongs should be the greatest. According to them 40% of the funds in the study was misclassified and 25% of the misclassified funds categorised in a classification lower than the inherent risk of the fund.

Lobosco and DiBartolomeo (1997) focused their research on defining a confidence level for the regression coefficients that will be indicative of whether it is indeed a true reflection of actual exposure. Their study focused on creating confidence intervals for the style coefficients defined. Their research added additional strength to the Sharpe style analysis by not only relying on R-square to test the rigour of the style analysis but adding statistical significance as an additional measure.

A study by Gallo and Lockwood (1999) examined the change in investment style of a fund prior and subsequent to a change in fund managers by means of Sharpe's (1992) RBSA methodology. The researchers conducted RBSA analysis for a five-year period preceding a change in fund manager and then subsequently for the five-year period after a change in fund manager. The highest coefficient was deemed to be indicative of the fund style. Comparing the result of the "pre-highest" factor exposure with the "post-highest" factor exposure, the researchers could deduce whether there was a change in investment style.

Robertson *et al.* (2000) applied the methodology employed by DiBartolomeo and Witkowski (1997) to the South Africa general equity unit trust category. Although the sample was much smaller (51 compared with 748 equity funds) and over a shorter time period (48 versus 60 months), they too concluded that many of the funds were indeed misclassified. Of the 24 general equity funds within the sample, 13 (or 54%) were misclassified.

The view of Kim, Shukla and Tomas (2000) supported the results of other researchers, namely that fund misclassification does indeed occur and they concluded that in the sample data of the study, 54% of the funds were indeed misclassified.

Sáez and Izquierdo (2000) in turn evaluated a sample of Spanish mutual funds. The overall results of the study support the research by DiBartolomeo and Witkowski (1997) and Robertson *et al.* (2000) respectively in that misclassification of funds do indeed occur although the misclassification according to them is slightly lower.

To gauge how factor exposures change over time, researchers also have conducted RBSA over rolling periods (Lucas & Riepe, 1996; Annaert & Van Campenhout, 2002). Annaert and Van Campenhout (2002:4) extended on their research and confirmed that style exposures varied over time and that style breaks were evident. All the funds in the analysis exhibited at least one style break, while 60% of funds exhibited more than one.

Swinkels and Van der Sluis (2006:530-533) sought to determine changes in style exposures by using a sample period of 60 months and evaluating the style analysis over rolling periods of 24 months each. The study acknowledged that there was little theoretical reasoning for the rolling period approximations yet they recognised that it might cause sub-optimal use of the data by choosing a random rolling period. In using rolling windows, they conceded that although the use of rolling periods suggests that the style exposure does not stay constant over the full sample period, it is indeed implied that style consistency exists for each rolling window.

A study by Ahmed and Nanda (2005:465) applied RBSA to a sample of quantitative equity funds to determine the appropriate benchmarks for the funds (i.e., the appropriate category). Based on the results, the funds were subsequently categorised into large-cap growth, small-cap growth, large-cap value and small-cap value.

Scher and Muller (2005) used RBSA by Sharpe to determine the exposure of equity unit trusts in South Africa. From the results, it was concluded that 1) the explanatory power of the model increased over time , possibly due to a greater emphasis by managers on style consistency and focus (Scher & Muller, 2005:8) and 2) that growth and large cap styles dominated during the sample period.

Pattarin *et al.* (2004) applied Sharpe's style analysis to a group of Italian mutual funds and found that the Sharpe style analysis and institutional classification were alike.

Ter Horst *et al.* (2004) conceded that estimations of portfolio holdings may differ from that of actual

holdings but "…if the aim is to predict future fund returns, factors exposure seem to be more relevant than actual portfolio holdings, and return-style based style analysis performs better than holding-based style analysis". They distinguished between portfolio holdings and estimated style exposures and acknowledged that estimated factor exposures may differ from actual portfolio holdings. The researchers hence concluded that RBSA is less suitable for predicting future holdings but is superior when attempting to predict future returns.

Lau (2007:131-137) applied the strong form of style analysis to determine the style bias of Malaysian equity unit trusts while applying the weak form of style analysis to measure risk-adjusted performance. He found that the inclusion of asset classes with negative factor loadings enhanced the return of funds during the sample period (February 1996 to January 2001, thus including the 1997-1998 Asian crisis period). To determine style consistency, he opted to divide the sample period into two sub-periods of 30 months each (i.e. January 1997 to June 1999 and July 1999 to December 2001). The results demonstrate considerable differences in style changes for the two sub-periods.

Vestergren and Redin (2009) applied Sharpe's (1992) RBSA to Swedish mutual funds. The application of the model was to determine the so-called policy portfolio without having any information with regard to actual holdings. They established that approximately 92% of the variation in return over time is explained by the asset allocation decision.

Momentum Investment Consulting (2007:8) based the classification it conducted on standard deviation and annual return as to be indicative of three broad sub-categories; following suit with regard to a previous study conducted by SP[2] Advisory Service. The researchers concluded that the styles of the funds were unchanged. In this study, no RBSA or holdings-based analysis was conducted to evaluate the asset class exposures. A similar study was conducted on new funds with only a 12-month track record to gauge the behaviour of such funds.

3. Data and methodology

In this study, the regression analysis is applied to two distinctive groups within the sample data: funds that have data points for the full measurement period (referred to as Group 1) and funds that have less than 75 data points (Group 2). The outcomes of the Group 1 funds result in the sub-categorisation framework, which is consequently applied to the Group 2 funds.

3.1. Sampling design

The criteria for the sample selection are applied to the Domestic Targeted Absolute and Real Return (TARR) category for the period from 1 October 2003 to 31 December 2009. The criteria for inclusion entails that the fund must be classified as a retail fund and have a minimum number of 24 data points (i.e. two years of data); resulting in a sample size of 54 funds.

The analysis for each fund is conducted on 24-month rolling periods and the results thereof are indicative of maximum and minimum asset allocations during the window for which the fund is included in the analysis. The sample period consists of two components: firstly the overall sample period, and secondly, within the overall period, the number of rolling periods (24 months each).

3.2. Return Data

Asset class returns are based on the monthly return. For the international indices, the index value is converted to a ZAR basis and thus the exchange rate exposure captured. The analysis is conducted using monthly returns, which include dividends but do not deduct any costs (including management fees). Both fund return data as well as index data is provided by Profile Media and Bloomberg respectively.

3.3. Selection of appropriate regression model and statistical significance thereof

The semi-strong form of return-based style analysis (RBSA) is applied consistently to each fund and every 24-month period. The only constraint applied to the model is that the sensitivity factors must sum to 1.

The constraint regression model applied is:

$$\tilde{R}_i = \left[b_{i1}\tilde{F}_1 + b_{i2}\tilde{F}_2 + \ldots + b_{in}\tilde{F}_n\right] + \tilde{e}_i$$

Where:
R_i = the return on asset i
F_{i1} = value of factor 1 (i.e. return on an asset class)
e_i = the non-factor component of return on i (i.e. error term)
b_{i1} = the sensitivity of R_i to factors F_{i1} to F_{in}

It is acknowledged that the funds may have very different strategies, which all fall within the scope of the TARR[12] category classification. The appropriateness of the regression model was though based on the category definition. Consequently, the explanatory power of the model will vary among funds.

[12] It is worth noting that on 1 December 2010, proposed changes to the classification system of unit trust funds, particularly the TARR category, were being discussed by the Association of Savings and Investment SA (ASISA), the Financial Services Board (FSB) and industry participants (Mulder, 2010).

4. Application of data analysis process and findings

The process proposed for the analysis was applied to the sample data. This includes Phases 1 to 4, namely Phase 1: selection of appropriate indices/factor exposures as representatives of asset classes within the category; Phase 2: evaluating the results of return-based style analysis of Group 1 funds; Phase 3: developing the sub-categorisation framework to be applied to Group 2 funds, and Phase 4: applying the framework to the Group 2 funds for sub-category.

4.1. Phase 1: Selection of indices (factor exposures) representative of asset classes

The indices suggested for the analysis are: Alexander Forbes 3-month (STeFI) Index, BEASSA All Bond Index (ALBI), FTSE/JSE Africa All Share Index (ALSI), FTSE/JSE Listed Property Index (Property), JP Morgan Global Government Bond Index (JPM) and Morgan Stanley Capital World Index (Global). The indices must be representative of the investable asset classes of the category and exhibited sufficiently low levels of multicollinearity. The test for multicollinearity is conducted by means of the variance inflation factor (VIF)[13] for each rolling period and the results are presented in Figure 1.

The literature review suggests multiple yet conflicting views regarding which VIF value constitutes multicollinearity and necessitates an index being dropped, varying from four or five, to even seven or as high as 10 (see Miles & Shevlin, 2001:130; Vestergren & Redin, 2009:15; Chatterjee & Hadi, 2006:236; Pardoe, 2006:176; Mendenhall & Sincich, 2003:349; Montgomery & Peck, 1982:300). Furthermore, Montgomery and Peck (1982:300) suggest that one or more large VIF factors indicate multicollinearity. Given conflicting opinions by researchers and the exploratory nature of the study, a value of 10[14] is chosen to be indicative of multicollinearity and is the benchmark used.

The majority of the VIF factors in actual fact fall below four. Although, the international indices (in South African rand) exhibit higher VIF factors, the indices are still the most appropriate given the restrictions of the study (i.e. short time periods and limitation on number of indices), coupled with an attempt to apply the same regression model to each fund and rolling period.

4.2. Phase 2: Return-based style analysis of Group 1 funds

Phase 2 applies return-based style analysis to the nine funds that have 75 data points namely: Absa Inflation Beater Fund, Allan Gray Optimal Fund, Coronation Capital Plus Fund, Old Mutual Dynamic Floor Fund, Investec Absolute Balanced Fund, Nedgroup Investments Optimal Income Fund, Prudential Inflation Plus Fund, RMB Absolute Focus Fund, SIM Inflation Plus Fund. It must be emphasised that these funds are chosen primarily because of availability of information and not because of a belief that they are representative of all potential sub-categories of TARR funds. The analysis entails:

Step 1: Evaluate STeFI (domestic short-term) asset allocation.

Step 2: Evaluate ALBI (domestic fixed-income) asset allocation.

Step 3: Evaluate ALSI (domestic equity) asset allocation.

Step 4: Evaluate the remaining three asset class allocations, namely Global, JPM and Property, in other words global equity, global fixed-income and domestic property.

Step 5: Evaluate explanatory power of regression analysis.

Step 6: Interpret annualised return and standard deviation.

The sub-categorisation based initially only on steps 1 to 3, results in the framework presented in Table 2. Applying step 1 to 3 to Group 1, results in eight potential sub-categories of which the Group 1 funds fall within three thereof. It is important to note that due to the low volatility nature of the category, some of the so-called sub-categories identified to this point, may never be plausible for a fund within the TARR category.

[13] VIF entails running a regression where each of the independent variables is used, one by one, with the rest of the indices as dependent variables. A high correlation between two variables is indicative of multicollinearity and thus the variable should be dismissed.

[14] Higher levels of potential multicollinearity are accepted due to the exploratory nature of the study.

Table 2. Homogeneoussub-categories based on asset allocation to STeFI, ALSI and ALBI factor exposures (Steps 1, 2 and 3)

	Criteria: Steps 1 to 3							
Step 1: STeFI	Maximum allocation at or above 75%				Maximum allocation below 75%			
Step 2: ALSI	Maximum allocation at or above 25%		Maximum allocation below 25%		Maximum allocation at or above 25%		Maximum allocation below 25%	
Step 3: ALBI	Maximum allocation at or above 25%	Maximum allocation below 25%	Maximum allocation at or above 25%	Maximum allocation below 25%	Maximum allocation at or above 25%	Maximum allocation below 25%	Maximum allocation at or above 25%	Maximum allocation below 25%
Resulting sub-categories								
Categories	**Category 1 STeFI ≥75% ALSI ≥25% ALBI ≥25%**	**Category 2 STeFI ≥75% ALSI ≥25% ALBI <25%**	**Category 3 STeFI ≥75% ALSI <25% ALBI ≥25%**	**Category 4 STeFI ≥75% ALSI <25% ALBI <25%**	**Category 5 STeFI<75 % ALSI ≥25% ALBI≥25%**	**Category 6 STeFI<75% ALSI ≥25% ALBI<25%**	**Category 7 STeFI<75 % ALSI <25% ALBI≥25 %**	**Category 8 STeFI<7 5% ALSI <25% ALBI<25 %**
Funds			SMXF ABIB	AGOF INAB NHCF RMFA	CCPF DYFF PRIP			

The following was noteworthy regarding steps 1 to 3: In step 1, the Old Mutual Dynamic Floor Fund (DYFF), Prudential Inflation Plus Fund (PRIP) and the Coronation Capital Plus Fund (CCPF) exhibit a maximum asset allocation to STeFI below 100% with PRIP exhibiting the highest minimum asset allocation at 30%. This suggests that the DYFF, PRIP and CCPF funds are not homogeneous to the rest of the funds. The guideline going forward is set to evaluate all other funds based on whether the maximum asset allocation to STeFI is at or above 75%.

Step 2 was proposed to evaluate the asset allocation to ALBI. Subsequently it was found that the regression output data is more clearly differentiated for ALSI than for ALBI. The methodology was adapted to switch Steps 2 and 3 (i.e. evaluate ALSI and thereafter ALBI). The order in which the asset allocation is evaluated was found to be non-critical. Some of the group 1 funds clearly exhibit a higher allocation to equity (i.e. ALSI), based on both the minimum and maximum asset allocations. Considering the arbitrary percentage for the maximum asset allocation at or above 25% was selected to distinguish different sub-categories. Given the exploratory nature of the study and the range of possible investment approaches, there is no magic number in the literature or practice. Applying the criteria of a maximum asset allocation at or above 25% does not induce any further sub-category changes.

Next, the ALBI asset allocation is evaluated (Step 3). Again neither the literature nor practice can provide a magic number as to appropriate asset allocation. Considering the high asset allocation to STeFI and the results of the regression model, the arbitrary percentage for the maximum asset allocation at or above 25% is selected to distinguish different sub-categories.

Table 3. Homogeneoussub-categories based on further analysis: Steps 4 to 6

	Criteria: Steps 4 to 6 Qualitative assessment Step 4: Global, JPM and Property exposure (no definite guidelines, comparative analysis) Step 5: Explanatory power Step 6: Annualised return and standard deviation					
Categories in terms of Step 1 to 3 with allocated funds:	**Category 3 STeFI ≥75% ALSI <25% ALBI ≥25%**		**Category 4 STeFI ≥75% ALSI <25% ALBI <25%**		**Category 5 STeFI<75% ALSI ≥25% ALBI≥25%**	
Funds	SMXF ABIB		AGOF INAB NHCF RMFA		CCPF DYFF PRIP	
Category split in terms of Steps 4 to 6:	Category 3A	Category 3B Greater global exposure, higher risk and return characteristic relative to other funds	Category 4A	Category 4B Greater global exposure	Category 5A	Category 5B Greater global and domestic property exposure
Funds	ABIB	SMXF	AGOF INAB RMFA	NHCF	DYFF PRIP	CCPF

Steps 4 to 6 include the analysis of the remaining three indices as well as a review of the explanatory power, and lastly, annualised return and standard deviation. This analysis is conducted per sub-category to assess whether it reinforces or conflicts with the analysis to date.

The following pertains to each category:

- Category 3: It was concluded that the SMXF and ABIB are representative of two heterogeneous subcategories based on the asset allocation to the two global indices (i.e. Global and JPM), with the SMXF fund seemingly more exposed to global markets. Regarding the explanatory power of the regression analysis, the ABIB fund's adjusted R-square varies much more over the analysis period than is the case for the SMXF fund. It is acknowledged that the two funds do not exhibit the same level of explanatory power for the same time periods. The maximum and minimum returns offered by the SMXF and ABIB funds are very different. Although a component of this may be due to manager skill, the large difference coupled with large differences in asset allocation supports the notion that the two funds are not homogeneous. Statistically, determining the *level of significance* is not part of the study. It is safe to say though that the two funds are representative of two different sub-categories.
- Category 4: It was concluded that it would be incorrect to view the four funds as homogeneous as the risk and return characteristic and global exposure of the NHCF fund seems divergent from the rest. Despite acknowledging the concerns regarding consistency in the explanatory power of the regression model and its application to individual funds, due primarily to the level of the global asset allocation of the NHCF fund, it would seem that this fund represents a different sub-category.
- Category 5: The conclusion regarding the three funds is that it would be incorrect to view the three funds as homogeneous as the global and domestic property exposures of the CCPF fund are different from those of the other two funds. This is the category with the best explanatory power.

The evaluation of each of the Group 1 funds in Phase 2 naturally to the initial framework (criteria presented in Table 3) for further evaluation of the remaining 45 funds. The value of Steps 1 to 4 is certain for sub-categorisation. Step 5 is important for future research as it varies significantly for funds individually and for the group as a whole. This is not statistically or otherwise dealt with.

4.3. Phase 3: Sub-categorisation framework to be applied to Group 2 funds

Phase 3, the categorisation framework applied to the Group 2 funds (only Steps 1 to 3), which was derived from the results in Phase 2, is presented in Table 4. The framework excluded attempts at sub-categorisation based on global and domestic property allocations justified by the following arguments: In the analysis of the Group 1 funds, global and domestic property exposure was compared with peers within the same sub-category (Step 4). This was significantly constrained for the Group 2 funds as the time periods for which each fund was included in the sample period were different; additionally, from the regression analysis, it is clear that the explanatory power of the regression analysis for some Group 2 funds was at times very low. Given the data

restrictions and running the risk of uncontrolled data mining, the risk of an attempt to further sub-categorisation based on these exposures, was not deemed valuable and sound enough to attempt.

Table 4. Framework for Group 2 analysis

	First level							
Categories	**Category 1**	**Category 2**	**Category 3**	**Category 4**	**Category 5**	**Category 6**	**Category 7**	**Category 8**
Steps 1 to 3 criteria:	**STeFI ≥75% ALSI ≥25% ALBI ≥25%**	**STeFI ≥75% ALSI ≥25% ALBI <25%**	**STeFI ≥75% ALSI <25% ALBI ≥25%**	**STeFI ≥75% ALSI <25% ALBI <25%**	**STeFI<75 % ALSI ≥25% ALBI≥25 %**	**STeFI<75% ALSI ≥25% ALBI<25%**	**STeFI<75 % ALSI <25% ALBI≥25 %**	**STeFI<75 % ALSI <25% ALBI<25 %**
	Second level							
	For each Group 2 fund that exhibits an asset allocation below threshold for any asset class: Compare with maximum-minimum asset allocation to Group 1 funds for the appropriate sample window							

The analysis was further enhanced by adding the second-level analysis, which compared the maximum-minimum asset allocation of each Group 2 sample fund exhibiting an asset allocation below a particular threshold with the maximum-minimum asset allocation of the Group 1 funds exhibited an allocation above the threshold for the overall sample period. The Group 2 fund will inevitably have an analysis window shorter than the total 75 months. The minimum and maximum asset allocations for the Group 1 funds should thus be the window similar to that of the Group 2 fund. Any Group 2 fund that exhibited an asset allocation below a particular threshold is in essence potentially misclassified simply because of the data window, such as excluding a rolling period in which a Group 1 fund exhibited an asset allocation above the threshold.

The second-level evaluation is only required should a fund exhibit an allocation below any threshold as this may simply be a function of fewer data points rather than being indicative of investment style. Additionally, many of the Group 2 funds include more 'bear market' data points within the overall sample period, which is characterised by a flight to safety and subsequently less risky tactical asset allocations. The tactical asset allocation that is thus evident and exhibited in the regression results may not be indicative of strategic asset allocation with which the study is concerned.

4.4. Phase 4: Applying the sub-categorisation framework to Group 2 funds

The framework proposed in phase 3 is subsequently applied to all Group 2 funds. In steps 1 to 3 (first-level analysis), the Group 1 funds were classified based on the thresholds per asset class as stipulated below with the results in Table 5:

- firstly, STeFI at or above 75% versus below 75%;
- secondly, ALSI at or above 25% versus below 25% and
- lastly, ALBI at or above 25% versus below 25%.

Table 5. Homogeneoussub-categories based on asset allocation to STeFI, ALSI and ALBI factor exposures (Steps 1, 2 and 3)

	Criteria: Steps 1 to 3							
	Resulting sub-categories							
Categories	**Category 1 STeFI ≥75% ALSI ≥25% ALBI ≥25%**	**Category 2 STeFI ≥75% ALSI ≥25% ALBI <25%**	**Category 3 STeFI ≥75% ALSI <25% ALBI ≥25%**	**Category 4 STeFI ≥75% ALSI <25% ALBI <25%**	**Category 5 STeFI<75 % ALSI ≥25% ALBI≥25 %**	**Category 6 STeFI<75 % ALSI ≥25% ALBI<25 %**	**Category 7 STeFI<75 % ALSI <25% ALBI≥25 %**	**Category 8 STeFI<75% ALSI <25% ALBI<25%**
Group 1 Funds			SMXF ABIB	AGOF INAB NHCF RMFA	CCPF DYFF PRIP			
Group 2 Funds	CPEP MNTR UBRU MDAB1 STMF CCIP CCEL	ISRR M4IA METP MJBR MSMP MSAP MNWC SMRA	PAWP SDFF	FRIA NPRA MDCF SPSA MILB MAMI MNBF MICA MNSI MDWR MLAR ABAF SARBA DARF	SCPF KTFP STIFBA MBVA SBAA	MDWO PEIA1 PEPA1 SBSA SLSA	MISG PIPA1	CODA MBAB

In the event of a fund being in a lower band (i.e. below a specific level specified), extra care was taken in interpreting the results as the results might have been due to: 1) poor explanatory power of the model, thus making the results invalid and 2) short time period of the particular fund. This entailed not only applying the framework bounds as proposed but additionally the asset allocation for the time period for which the Group 2 fund was indeed included in the sample. Finally, the explanatory power of the model as applied to each period is assessed and any inconsistencies noted.

The research is based on the following set of assumptions: all funds in the sample are assumed to be correctly classified as TARR funds; any historical information prior to 1 October 2003 is not included in the research as the category was officially only started on 1 October 2003; retail funds are representative of the category; and funds are only included for the period while it was in the TARR category.

Limitations applicable to the research and the possible effects thereof on the interpretation of the RBSA results are:

- The TARR category has not been in existence for a long period resulting in fewer historical data points.
- The use of only 24 data points for regression analysis is acknowledged to have its limitations regarding inference drawn from the results.
- One regression model is proposed to be applied to each and every fund and capture the return drivers thereof. Based on the explanatory power of the regression, it may indicate that the general model proposed is not the most suitable for a particular fund.
- As the asset allocations vary over time, the explanatory power of the model will subsequently be influenced.
- Caution when interpreting the RBSA results must be taken for funds with fewer data points. For such funds, it is also challenging to test for style shifts and/or consistency of style over time.
- The threshold will be the maximum and/or minimum asset allocation for each asset class based on the results of the Group 1 funds and judgement.
- VIF of 10 was selected. A lower VIF may yield superior results (i.e. better explanatory power).

4.4.1. Second-level analysis of Group 2 funds

Table 6 presents the sub-categorisation of the Group 2 funds that require further analysis (i.e. any funds that exhibit an allocation below a set threshold).

Table 6. Group 2 funds exhibiting asset allocations below the thresholds

Step 1: STeFI					Max. allocation < 75%			
					MISG†† PIPA1†† PEIA1††† PEPA1††† SBSA††† CODA† MBAB†		SLSA††† STIFBA††† MBVA††† SBAA††† SCPF††† KTFP††† MDWO‡	
Step 2: ALSI			Max. allocation < 25%				Max. allocation < 25%	
			MILB** MAMI** PAWP*** SDFF*** ABAF**	FRIA** MDCF** SPSA** MNBF** MICA**	MNSI** MDWR** MLAR** SARBA** DARF**		MISG†† PIPA1† † CODA† MBAB†	
Step 3: ALBI		Max. allocation < 25%*		Max. allocation < 25%			Max. allocation < 25%	
		ISRR* M4IA* METP* MJBR* MSMP* MSAP* MNWC* SMRA*		FRIA** NPRA* MDCF** SPSA** MILB** MAMI** MNBF**	MICA** MNSI** MDWR** MLAR** ABAF** SARBA** DARF**	MDWO‡ PEIA1* PEPA1* SBSA* SLSA*		CODA† MBAB†

Notes:
†Evaluate STeFI, ALSI and ALBI allocation (Group 2A).
††Evaluate STeFI and ALSI allocation (Group 2B).
††† Evaluate STeFI allocation (Group 2C).
*Evaluate only ALBI allocation (Group 2D).
**Evaluate ALSI and ALBI allocation (Group 2E).
***Evaluate only ALSI allocation (Group 2F).
‡ Evaluate SteFI and ALBI allocation (Group 2G).

Analysis of Group 2A to 2G was conducted as per the second-level in the framework. For illustrative purposes, the detailed application thereof for only Group 2A is presented. It is though clearly indicative of the process followed for every other category.

Group 2A: Group 2A includes funds that exhibit an asset allocation below 75%, below 25% and again below 25% to STeFI, ALSI and ALBI respectively. The funds are thus compared with Group 1 funds that originally exhibited an asset allocation to the three asset classes above the threshold. However, the Group 2A funds are compared with the asset allocations of the Group 1 funds for their particular data window (not the whole sample period).

Firstly, the STeFI asset allocation of the CODA and MBAB funds are compared with the asset allocation of the Group 1 funds that exhibit an allocation to STeFI at or above 75%. The Group 1 funds maintain a potential maximum asset allocation at or above 75%, irrespective of the window, except the SMXF fund for the window covering Periods 49 to 52 (window for fund MBAB). Thus it can be concluded that the CODA fund is definitely correctly classified based on its STeFI allocation but the MBAB fund may indeed belong to a different category.

Secondly, the ALSI asset allocations of the funds are scrutinised. Two of the three Group 1 funds that originally exhibited an equity exposure above 25%, were lower than the threshold for the applicable windows. Again, the classification based on ALSI may be challenged.

Subsequently, the ALBI asset allocation of the CODA and MBAB funds is compared with the asset allocation of the Group 1 funds that exhibit an allocation to ALBI at or above 25% in terms of the initial categorisation; 80% of the Group 1 funds exhibit an allocation to ALBI below the 25% threshold for the particular windows. This makes it plausible that the MBAB and CODA funds could be incorrectly classified simply due to the analysis window (see Table 6). The process described, was subsequently followed for Groups 2B to 2G.

In summary, the sub-categorisation is straightforward when applied to the Group 1 funds but not when applied to Group 2 funds. This is primarily due to many of the Group 2 funds only capturing a small window, which leads to the asset allocation being more reflective of tactical decisions than strategic asset allocation. However, the STeFI asset allocation did seem to be consistent and definitive in its part in the classification system meaning that irrelevant of analysis period or market, funds do seem to adhere at any point in time to either an asset allocation to STeFI at or above the 75% threshold or below that. However, ALSI and ALBI

allocations are not consistent. Additionally, Step 5 which evaluates the explanatory power of the regression analysis, is important for future research as it varies significantly for funds individually and for the group as a whole. This was not statistically or otherwise dealt with further. Step 6, evaluating annualised return and standard deviation, should be considered with caution as manager alpha, in other words excess return, is included in the annualised total return.

4.5. Contributions and Implications

The study facilitated a better understanding of the styles within the TARR category. The sub-categorisation framework proposed as a result of the Group 1 funds forms the basis for further investigation into style analysis of the TARR category. The Group 1 funds initially included an assessment of both the global and domestic property asset allocations. Further, given the discretion of portfolio managers in their investment strategy, it will always be challenging to find a regression model that can be consistently applied to all periods.

While the exploratory nature of this study was restricted because of to the availability of historical information, future research could be extended by repeating the study when more historical information for the TARR category is available. To further test the results of such research, such a study could be coupled with a regression analysis based on the identified sub-categories as the independent variables. The hypothesis would be that a fund that was correctly classified based on the sub-categorisation framework should exhibit the highest sensitivity to that particular sub-category, namely independent variable. It is acknowledged that given the nature of the TARR category, high levels of multicollinearity may make such a study and the result thereof questionable. Research that focuses on whether funds within the same sub-category imitate shifts in asset allocations by comparing specific rolling period results of funds, may also create a better understanding of fund manager skill, when managers make tactical shifts compared with their peers.

Future research may also focus on enhanced style analysis techniques as applied to hedge funds, which may enhance the results of sub-categorisation.

The matter of misclassification of style was often a research topic in the literature. Because many of the TARR funds were reclassified to prudential categories, in particular prudential low equity, return-based style analysis for the purpose of identifying misclassified funds within the TARR category, may yield interesting results.

The study provides insights to academia, practitioners, investors and industry alike into a category which, in its short history, has captured a large portion of the unit trust market; a category for which return drivers are not easily identifiable and peer comparison remains a challenge.

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