UNIVERSITY OF CAPE TOWN

Asset Allocation and Regulation 28

A Research study submitted in partial fulfillment of the requirement for the degree of masters of commerce

By Athenkosi Mjebeza (MJBATH001)

2/28/2016

Supervisor: Paul van Rensburg

Abstract

This paper aims to determine the impact Regulation 28 has on optimal asset allocation. The revised Regulation 28 of the pensions fund act came into effect as of 1 July 2011 which imposed certain restrictions or constraints on pension funds under direct control of trustees. This study evaluates some of the constraints imposed on the Regulation 28 through the use of Markowitz (1952) efficient frontier framework and a non-parametric model. With offshore allocation increased to 25% and an additional 5% to African (ex SA) markets the study also explores the diversification prospects to international, emerging and African (exSA) markets. The findings suggest that international markets bring about increase benefits to South African markets; however, when the Regulation 28 constraint is imposed the benefits slightly diminishes. Further analysis show that emerging and African markets bring little to no benefits to optimal South African pension fund allocation. Locally, the study looked at the gold index and the findings suggest that the gold asset class increases the welfare of an investor and it's a safe haven asset class.

Table of Contents

1.

Introduction

The South African pension/retirement fund industry is ranked as the 15th largest pension fund industry internationally. It has eight million in members with assets under management valued at R2 trillion (Campher, 2010:1).

The R2 trillion is the life savings of many South Africans and for many citizens it is the biggest asset they will ever own their life time. This magnifies the prudence needed to manage these assets within the retirement industry. Several regulations have been introduced in the industry to ensure adequate management of these assets. Section 36(1) (Bb) of the Pension Funds Act, No 24 of 1956, authorizes the Minister of Finance to set regulations on investable assets and limiting the amount and the extent to which a pension fund may invest in particular assets which led to the introduction of the Regulation 28.

Since its initial inception, Regulation 28 has been revised with new regulation taking effect in 1 July 2011. This study evaluates the impact of the revised Regulation 28 has on the pension fund industry with respect to asset allocation. Empirically, there has been a debate to the extent asset allocation impacts the return of a fund. Many studies have pointed to asset allocation playing an important role in explaining the return of funds. This argument was supported by Ibbotson and Kaplan (2000) study which suggested that approximately 90% of the variability of monthly returns can be explained by asset allocation across time whilst market timing and security selection make up the rest[1]. Therefore it's important to understand the impact Regulation 28 has on asset allocation as a whole in the South African environment.

Since the inception of Regulation 28, offshore allocations has been changed from 15% to 20% and now 25%. An additional 5% has also been allocated to African markets (excluding South Africa). The study aims to evaluate the impact this leeway will have with respect to

[1] Section 3.2 discusses this debate in detail

diversification prospects and asset allocation. In so doing, it tries to establish which of these markets; international markets (mostly developed nations), emerging markets and African markets (excluding SA) is the best market to invest in for South African pension funds. Thereafter, it pays special attention the rest of the Regulation 28 constraints and their impact on asset allocation. The findings are aimed at informing trustees, regulatory bodies and asset management firms managing these assets with respect to the impact Regulation 28 has on asset allocation. Furthermore, it raises awareness on the impact international markets, emerging markets and African markets have in terms of diversification prospects.

The study tackles the problem through the use of Markowitz (1952) mean-variance optimization model that considers the risk-return trade off. Through applying it in a series of scenarios, the study will unpack the impact foreign allocation to international markets (mostly developed nations), emerging markets and Africa (excluding South Africa) has with respect to the South African pension fund industry. Markowitz (1952) model is a parametric approach in assessing Regulation 28 as it assumes a normal distribution. History has shown that markets don't always follow a normal distribution due to three standard deviation movements caused by market crashes. The study also makes use of a non-parametric approach. It does so by looking at actual funds in the South African industry and evaluates the impact Regulation 28 might have on them through comparing regulated and unregulated unit trusts. Since foreign allocation has a significant amount in Regulation 28 the diversification prospects of these markets in question are evaluated through a correlations analysis as well.

2.

Theoretical Overview

2.1 Introduction

Sharpe (1992) defines asset allocation as the distribution of an investor's fund amongst a number of predefined asset classes. Asset allocation plays an important role in explaining a significant portion of a fund's returns. Therefore it's important to understand the impact Regulation 28 has on asset allocation as a whole. This chapter starts off with the concept of market efficiency which forms the underlying assumption of Markowitz (1952) portfolio selection tool, the efficient frontier of risky assets which is used to understand the impact Regulation 28 has on asset allocation. Thereafter, the Regulation 28 and its various constraints are discussed. The chapter closes off with the concept of diversification since Regulation 28 increased foreign asset allocations from 20% to 25% allowing for more diversification opportunities.

2.2 Market Efficiency

Fama (1970) stated that the primary role of capital markets is the allocation of ownership of the economy's capital stock. In such markets security prices provide accurate signals for resource allocation under the assumption of market efficiency. Efficient markets, are markets where security prices "fully reflect" all available information at any point in time. In such markets, investors cannot consistently earn above average risk-adjusted returns through the use of past, public or private information as all information is fully reflected in prices of securities. However, the idea of markets being efficient only holds true under several assumptions. The one assumption arguably the most controversial is that investors are completely rational with regards to decision making. This assumption has not been easily accepted which has led to several criticism of the idea of markets being efficient. Nevertheless, the concept of markets being efficient has given an intuitive insight on the functioning of markets around the world and led to the development of various Capital

Market Theories. The Modern Portfolio Theory (MPT) by Markowitz (1952) and Tobin's (1958) separation theory are Capital Market Theories underpinned by the idea of market efficiency. The abovementioned Capital Market Theories provide a manner in which risk-averse investors that have homogeneous expectations, with respect to the mean, variance subsequently the covariance of asset returns can allocate their assets to maximize their return whilst minimizing risk in so doing maximize their expected utility with regards to their wealth decisions.

2.3 Modern Portfolio Theory

In line with market efficiency and portfolio diversification Markowitz (1952) developed a portfolio selection tool that incorporated risk and return trade off. The model assumes that investors are risk averse and the nature of risk aversion can be explained through the Expected Utility theory which states that investor will disregard and any risky projects without the ample reward. This concept underpins mean-variance optimizers, that is, investors that want to maximize expected returns for a given level of risk or minimize risk for a given level of expected returns. Equation 2.1 and 2.2 mathematically describe expected return and risk as respectively:

$$\mathbf{E}(\mathbf{R_p}) = \sum_{i=1}^{n} \boldsymbol{w_i}\ \boldsymbol{R_i} \qquad \mathbf{2.1}$$

$$\boldsymbol{\sigma_p^2} = \sum_{i}^{n} . \sum_{j}^{n} \boldsymbol{w_i}\ \boldsymbol{w_j}\ \boldsymbol{\sigma_{ij}} \qquad \mathbf{2.2}$$

Where:

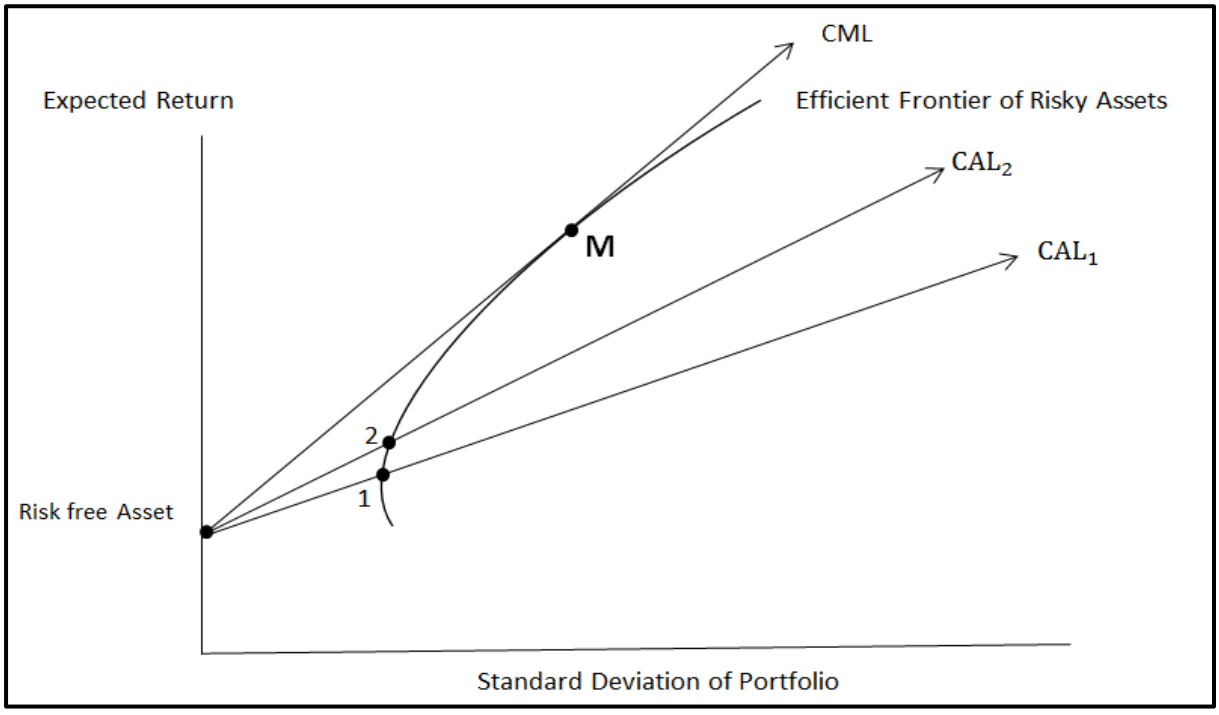
ω_i *and* ω_j *are the weights of stock i and j in portfolio p*

R_i *and* R_j *are the returns of stock* i *and* j *in portfolio p*

σ_{ij} *is the covariance between* i *and* j

Expected return of a portfolio (equation 2.1) is the weighted average of the constituent's returns and portfolio risk (equation 2.2) is the variance of a two asset portfolio. The square root of the variance results to the portfolio standard deviation which measures the variation or dispersion of the returns around the mean. Portfolio risk as measured by the variance offers some interesting characteristics; it will always be less than the weighted average of its constituent $\sum_j^n w_i \ \sigma_j$. The only instance in which portfolio standard deviation will be equal to the sum of its two parts is when the correlation between the assets is perfectly correlated, that is correlation is equal to 1. If not, diversification benefits will set in and the lower the correlation, the greater the benefit of diversification and risk reduction. With the assumptions that investors are risk averse, markets are efficient and investors hold well diversified portfolios, that is, assets in portfolio are less than perfectly correlated Markowitz (1952) derived the efficient frontier of risky assets depicted in figure 2.1:

Figure 2.1 Efficient Frontier of Risky Asset



Source: Figure modified from Bodie Kane and Marcus (2003;184)

Assets that lie on the efficient frontier are mean variance efficient; they earn the highest return for a given level of risk as measured by standard deviation. The efficient frontier consists of only risky assets and to manage the risk investors can opt to invest a portion of

their portfolio in risk free assets. Consider point 1 in the efficient frontier, it consist of only risky assets to manage the risk investors can add a risk-free assets to their portfolios and the combination is represented by the Capital Allocation Line 1 (CAL1). CAL2 offers a different combination of risky and risk free assets, however, CAL2 is better than CAL1 because for the same amount of risk it offers a higher expected returns. Given the assumption that investors are mean-variance optimizers they will want earn the highest expected return for a given level of risk therefore CAL2 will look more attractive. Subsequently, investors will want a higher return for a given level of risk hence will move upward until they reach Capital Market Line (CML).The point where the CML is tangent to the efficient frontier is denoted by **M,** this is called the Market Portfolio which is the optimal portfolio.

Attaining the optimal market portfolio is the first step in Tobin's (1958) two step separation theorem. The second step is the manipulation of the risk free asset by investors within the CML combination to satisfy their risk appetites. A conservative investor's portfolio would contain more risk-free assets in his combination (CML) and an aggressive manager would contain more equity and can even leverage his/her position as it assumed the manager can borrow unlimited funds at a risk-free rate. Markowitz (1952) efficient frontier of risky assets was originally designed to select efficient stocks portfolios, however, it has been widely used as an asset allocation tool as it shows the best asset allocation that minimises risk and maximises return. The study plans to use this tool to understand the impact Regulation 28 has on asset allocation. For instance, does the efficient frontier shift outwards or inwards when Regulation 28 is imposed and what impact does the foreign asset allocation have? The details and specifics on the application of this tool are discussed the methodology section, the main aim of this section was to give the theoretical insight.

2.4 Regulation 28

The revised Regulation 28 of the pensions fund act, came into effect as of 1 July 2011 which imposed certain restrictions or constraints on pension funds under direct control of trustees. This was done with the intention to safeguard funds against imprudent decision making and ensuring appropriately diversified funds. The constraints are imposed on various asset classes which include equities (local and offshore), properties, and foreign asset classes. The

constraints or maxima prescribed by Regulation 28 which is applicable to the various funds relates to the fair value of the assets under direct control of the trustees. The main asset class constraints with respect to the revised Regulation 28 are as follows:

- No more than 75% invested in equities (local and offshore)
- No more than 25% invested in properties (local and offshore)
- No more than 25% invested in foreign assets (excluding African investments)
- No more than 5% invested in African investments (excluding South African)
- A fund may invest up to 10% of its assets in commodities, which may be in gold, however, there is a limit of 5% in other commodities
- A fund may invest up to 15 percent in alternative investments, however, hedge funds and private equity funds are each limited to 10%
- 100% of retirement fund assets may be invested in cash. There are sub-limits of 25 percent on deposits with any one local bank and five percent with foreign banks.

Appendix 1 gives a more detailed description of Regulation 28. It should be noted that Regulation 28 disallows double counting, that is, the sum of local and offshore equity should not exceed the 75% constraint. These maxima described above apply to all retirement annuities, pension funds, provident funds and preservation funds. Initially, not more than 15 % could be invested into off-shore markets and overtime this has been increased to 25%. There has also been an additional 5% that can be invested in African investments (excluding South Africa). This will definitely have implications on diversification. This is the next concept explored in the theoretical, the idea behind diversification when it comes to asset allocation and portfolio construction.

2.5 Diversification

The striking increase of Regulation 28's offshore account from its initial 15% to 20% and now 25% and an additional 5 to Africa (ex-South Africa) has allowed more leeway for International investment. Asset managers have flexibility to allocate more assets to international markets and from a strategic or tactical asset allocation point of view allowing for more diversified opportunities.

Since the arithmetic average return of a portfolio is the weighted average of its constituent's, diversification lies not solely on return enhancement but risk reduction for given level of return. Hence, diversification is in a manner sensitive to the risk measure used in this case standard deviation. As mentioned earlier, if the return of a stock being added in a portfolio is less than perfectly correlated theoretical risk reduction will occur. With respect to foreign allocation, the economic climate domestically and internationally varies hence; the return correlation of domestic and international assets will differ, that is, it will be less than perfectly correlated. This would open doors for diversification opportunities.

2.6 Conclusion

This chapter gave a theoretical overview on the key concepts which underpin this study. Furthermore, the chapter gave a brief motivation for the asset allocation technique used to evaluate the Regulation 28. Moreover, the Regulation 28 was briefly discussed with its implication it has on the diversification. The concept of diversification was further elaborated upon highlighting the impact correlation and portfolio concentration has on portfolio diversification. Next, a literature review of prior studies it presented with regards to asset allocation and the Regulation 28 in an international and domestic context.

3

Review of Prior Literature

3.1 Introduction

In the previous chapter, the theoretical overview behind the fundamental concepts used in this study was presented. This chapter looks at the stance taken by empirical findings from a domestic and an international perspective. The chapter starts off with a discussion on the importance of asset allocation, thereafter, it looks at asset allocation with regards to offshore allocation into international and emerging markets. A South African market perspective is explored with regards to asset allocation and the Regulation 28 findings.

3.2 Importance of Asset Allocation

Brinson Hood and Beebower (1986) evaluated the relative importance of an investment policy, market timing and security selection in influencing funds return. Through the use of 91 pension plans in the SEI Large Plan Universe from 1974 to 1984 the study concluded that asset allocation has a huge impact in determining pension fund returns. On average, 93.6% variation in returns could be explained by asset allocation. Throughout the 91 funds, asset allocation explained no more than 98.6% and no less than 75.5% of returns.

A follow up study by Brinson, Singer and Beebower (1991) found a similar conclusion that asset allocation played a significant role in explaining the variation on returns as opposed security selection and market timing. Their studies focused on the pension funds in the United Kingdom and extended from December 1977 to December 1988 and consisted of 82 pension funds. Their findings suggested that more than 90% of performance in funds could be explained by asset allocation.

Later studies criticized the findings of Brinson Hood and Beebower (1986) suggesting that their study focused solely on the return variation. The study had intended to explain returns

attributed to different policies and the portion of return level explained by policy return. Hensel, Ezra and Ilkiw (1991) studies argue that the return variation was due to market movements which dominated the time-series regression on the total return computed by Brinson Hood and Beebower (1986).

Ibbotson and Kaplan (2000) address this concern in a latter study which consisted of 94 United States of America (USA) balanced pension funds which had 10 years' worth of data. The data spanned from 1 March 1988 ending 31 March 1998.Their findings suggested that asset allocation explains about 90% of the variability of returns over time span similar to Brinson Hood and Beebower (1986) findings. In addition, the authors had sought to explain an additional concerns that Brinson Hood and Beebower (1986) had failed to address, that is, the variation in returns amongst funds which could be attributed to differences in policies and the portion of return explained by policy return. The findings suggested that 40% variation in returns amongst funds could be attributed to differences in policies and approximately 100% return levels of returns are explained by differences in policies.

It remains a huge debate whether the importance of asset allocation has been overstated by the prior research or not, however, many studies have favored asset allocation having a significant contribution in explaining portfolio returns. Next, the study presents the empirical evidence supporting the importance of asset allocation and offshore allocation into international markets and emerging markets. Offshore investments have been increased to a significant stake in Regulation 28. Therefore is important to evaluate the importance and impact of offshore allocation has on portfolios.

3.3 Asset Allocation: Offshore allocation to international markets

Markowitz (1952), seminal paper laid the foundation for portfolio diversification. Subsequent papers on diversification have followed which depict international diversification as beneficial for investors/pension funds who want to minimize risk for a given level of return and if possible gain additional returns. With the concept of diversification in mind, investors are face with a decision between various domestic asset classes but lately investing in various international classes has been seen as a viable option.

Burtless (2007) evaluated whether retirement funds in eight countries would have obtained higher expected returns with lower level of downside risk if investors invested part of their retirement funds in foreign stocks and bonds. The author made use of data spanning from 1927 to 2005 and the author's findings suggests that there are potential gains in including international stocks and bonds in your portfolio. Further analysis showed that including offshore investments increases an investor's expected return whilst risk remains constant. This was true for retirement funds that had long term perspective in mind and were willing on making additional contribution in their funds. From the results presented by the study it was clear that increasing allocation to offshore investments raises expected returns without raising the risk of a catastrophic investment performance.

Pfau (2008) conducted a study on emerging markets pension funds and international diversification. The author makes use of Markowitz's (1952) modern portfolio theory and data spanning from January 1988 to December 2006. The author's findings suggest that on average, half of the portfolios in emerging markets should be invested offshore. The author made use of four asset classes which consisted of domestic stocks, domestic fixed income, foreign stocks and foreign bonds. With some limitations stated in the article the author reaches a conclusion that emerging markets can benefit from international diversification and there is a cost associated with prohibiting international diversification.

In a study titled "SA Gentlemen Prefer Foreign Bonds" Bradfield, Munro and Silberman (2011) evaluated how the foreign allocation should be blended amongst the foreign asset classes. The authors go far back in history considering data from January 1971to June 2009. Initially, they consider the structural risks of foreign assets and their findings suggests that on a one year rolling basis foreign cash and foreign bonds are driven by the volatility of the currency. The annualized risk of the rand/dollar during this period is 11%, foreign cash (R) 11.1% and foreign bonds 12.1% which one can view that the currency definitely plays a role as one would expect the volatility of cash to be low (close to 0) without a currency effect.

Thereafter, Bradfield, Munro and Silberman (2011) seek to establish how foreign cash and foreign bonds can bring about diversification benefits in respect to the South African market.

Through a 5 year rolling basis, correlations between the ALSI and the two foreign asset classes were established. The findings suggest that the correlation between local equity and the South African currency is negative. The correlation between returns on the rand to the dollar and local equity was documented to be -0.11. Similarly, foreign bonds and foreign cash in Rands displayed negative correlation with domestic equity of -0.06 and -0.05 respectively. The authors argue that this is expected as foreign cash and bonds are driven by currency movements unlike foreign equity. Based on these findings, diversification benefits could be expected from South African investors that allocates a portion of his portfolio offshore markets.

Further analysis by Bradfield Munro and Silberman (2010) also determined the extent to which investors can receive diversification benefits from holding foreign assets. By conducting scenarios of extreme monthly returns of less than 10% it was evident that foreign bonds and cash almost on all occasion performed well as opposed to foreign equity. This basically highlighted the diversification benefits brought by the foreign cash and bonds to South African investor invested in the ALSI. All the studies reported on diversification thus far have focused on offshore allocation to international markets; it is also important to understand the impact offshore allocation to emerging markets. Next, this papers looks at studies that have explored offshore allocation to emerging markets.

3.4 Asset allocation: Offshore allocation to emerging markets

Wepener (2002) provides a case for investing in emerging markets based on two factors growth trajectory and low correlations with developed markets. With respect to growth trajectory, it comes as no surprise, as emerging markets are famous for phenomenal growth prospects achieved in the past. Accompanying the high growth prospects there has been the high levels of volatility which could be risky for pension funds. The second reason that makes emerging markets so attractive is their low correlation with developed markets. However, from a perspective of an investor within emerging market (like South Africa) investing to other emerging markets does not seem compelling for diversification purposes as the correlations are seemingly high.

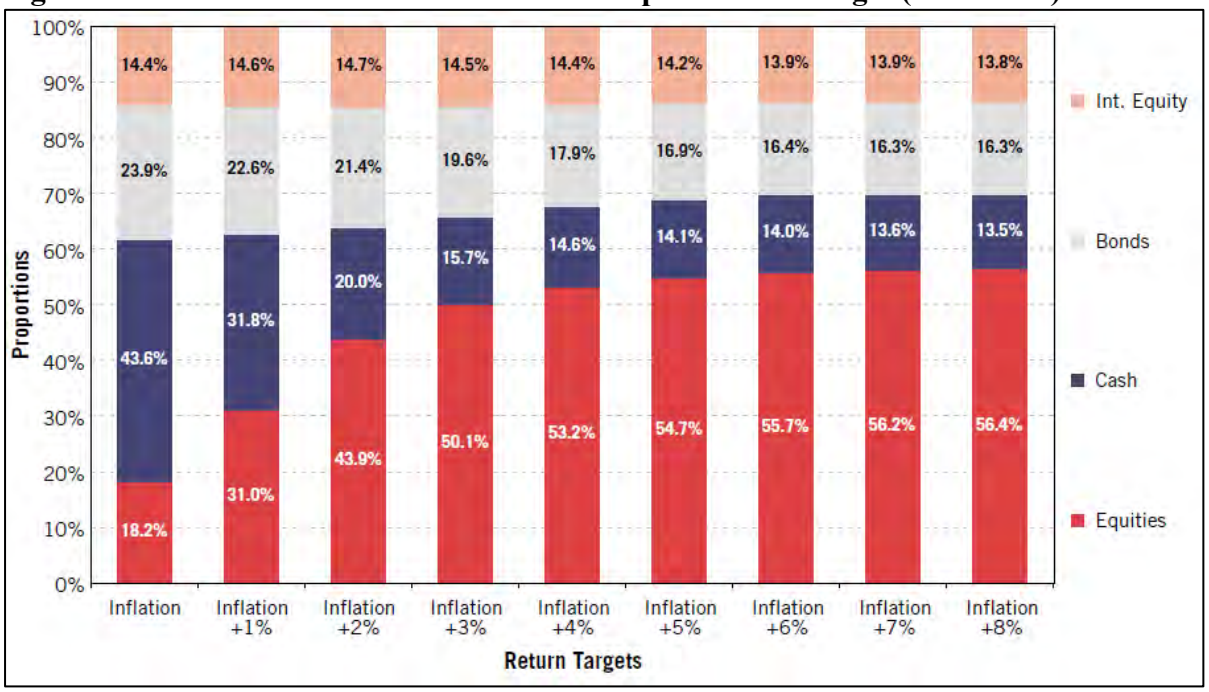
Bradfield, Munro and Silberman (2011) evaluate the inclusion of emerging market assets in portfolios with the use of data from January 1971 to December 2010. Their findings suggested that there is a high correlation between the ALSI and the Emerging Market Index in rand terms. This means that there are little to no diversification benefits by including emerging market stocks in a domestic portfolio from a South African perspective.

Further analysis by Bradfield, Munro and Silverman (2011), shows that most currencies from emerging markets tend to co-move with the rand which explains the high correlation between the MSCI emerging market index and the ALSI. When the ALSI is falling there is some correlation with emerging markets and there is even a higher correlation between ALSI and Emerging markets when the ALSI is experiencing a bull market. Due to the high correlation between emerging markets and the ALSI there is not much diversification benefits although they offer high growth prospects.

3.5 Asset allocation: A South African perspective

Swartz (2004) conducted a study assessing the probabilities of beating absolute return targets. The analysis was based on an extensive data set which spanned from 1 January 1925 to 31 December 2003 a total of 78 years considering four asset classes. Figure 3.1 below demonstrates the findings, of the 1st decile portfolios with a constrained international equity to 15% (Regulation 28 restrictions to offshore allocation in the year 2004 was at 15%) for the various inflation and inflation plus targets. Figure 3.1 depicts the findings:

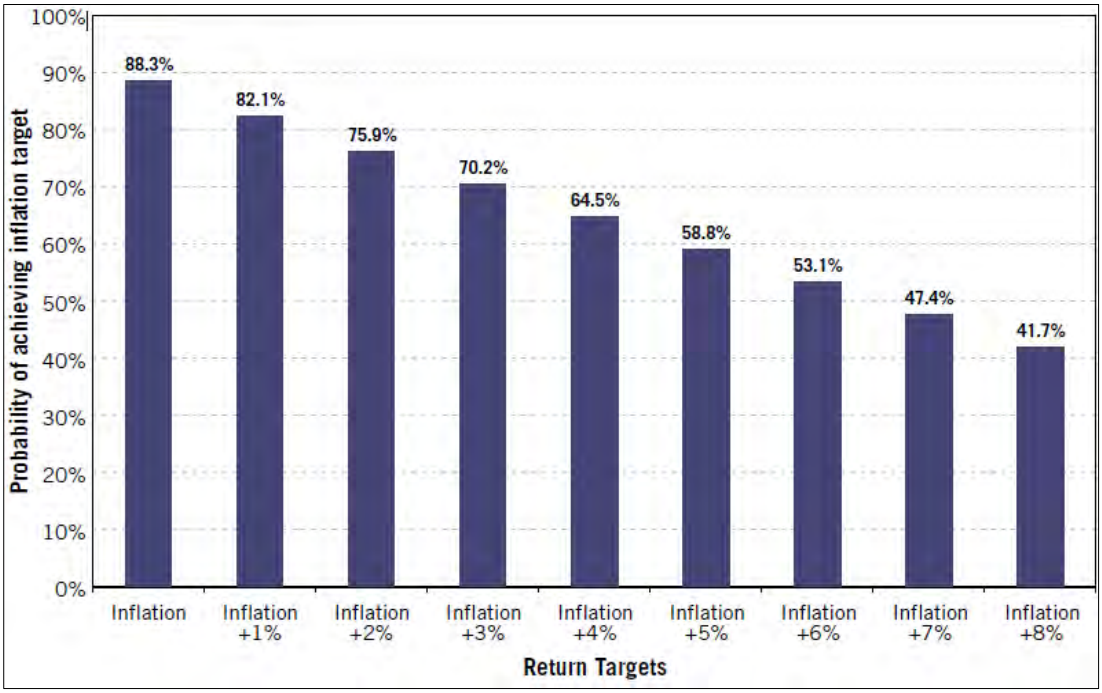
Figure : 3.1 Decile asset combinations for each peformance target (1925-2003)



Source: Swartzs (2004;14)

The author's findings suggests that a predominate holdings in cash and bonds is the best allocation mix for beating conservative targets such as inflation only targets. The portfolio is dominated by cash (with 43.6% of the holdings), followed by bonds (at 23.9%) and local equity (18.2%). For higher inflation-based return targets there is a need for sacrifice cash and a lesser extent bonds for equities to meet the inflation plus targets. This can be viewed in the inflation plus targets such as inflation +8% where local equities dominate. The holding of local equity is at 56.4%, cash reduced 16.3% and bonds reduced to 13.5%. The probability of achieving these return targets were also documented and figure 3.2 displays the results:

Figure 3.2: The probabilities of 1st decile portfolio beating inflation



Source: Swartzs (2004;14)

The probabilities of achieving these return targets decrease linearly as the inflation targets increases. The first decile portfolio has on average a 88.3% chance of beating an inflation only portfolio over a 36 months holding period. As the inflation targets increase incrementally the probabilities decreases to 41.7% for the inflation plus 8% portfolio. The analysis of the results was applied throughout the sample period (1 January 1926 to 31 December 2003).

Further findings by the author suggest that during periods of increasing inflation, cash is more attractive than bonds in their portfolios and the opposite is true for periods where there is a systematic decrease in inflation. In his study, Swartz (2004) also views that historically there has been extreme difficulty in strategic allocation for meeting inflation +5% and greater targets and the strategy of increasing equity in strategic asset allocation would have been unsuccessful. When considering capital preservation targets as opposed to inflation plus targets only, the author's findings suggest that there is a lower proportion of equity for all return targets which led to a lower probability of underperforming capital preservation targets. On the other hand, the strategic asset allocations with high inflation targets (inflation +8%) and capital preservation mandates are similar to their unconstrained assets allocation

results.

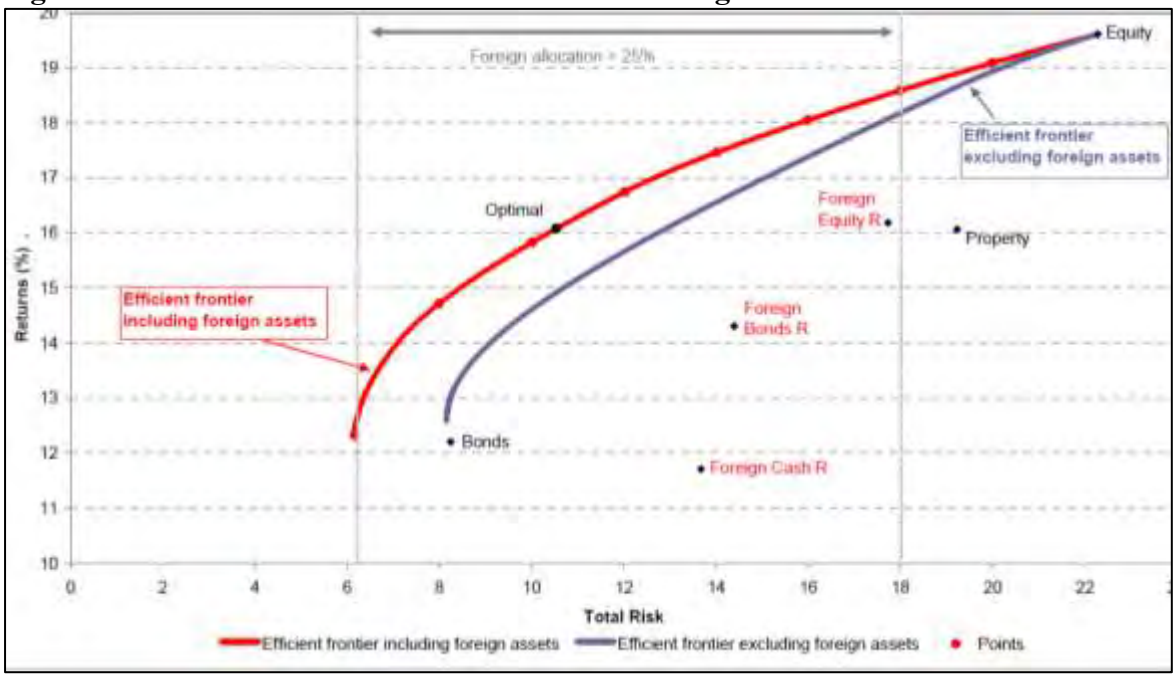
Here onwards, the various studies focus on offshore allocation. In a study titled "Asset Allocation-How much Should We Allocate Abroad"? Swartz and Munro (2006) evaluate the feasibility of holding offshore allocation greater than 15% (a max of 25%) abroad and what should the remaining asset allocation be? The data used in the study spans across 79 years dating back to 1925 considering 5 asset classes. In order to provide a feasible solution to the purpose their study the two authors make us of parametric and a non-parametric approach to asset allocation. The parametric approach is the traditional risk return framework and the nonparametric approach is similar to that of Swartz (2004). The findings of the authors suggest that, historically, asset managers needed an allocation of more than 15% to beat inflation plus targets. For inflation only targets managers needed international equity of 27% and international bonds at 3.8%. For inflation plus targets such as inflation plus 8% managers needed international equity of 33.9% and international bonds at 5.2%. This means asset managers should hold greater than 15% abroad to meet some of the demanding mandates.

To answer the second part of their study, what would be the optimal asset allocation with a 25% constraint through a use of no covariance approach? The authors rebalance the 15% offshore optimal asset allocation for beating inflation +4% to a proportionate 25% offshore allocation. After the rebalancing the authors suggests a 57.6% in local equity, 19.9% in international equity, 14.9% local bonds, 0.8% international cash, international bonds 4.3% and 2.5% in property. When a covariance approach is used asset allocation stands at 53.3% in local equity, 20.6% in international equity, 18.9% local bonds, 4.4% international cash, international bonds 0.0% and 2.8% in property.

With the new regulations in place which allowed investors/asset managers increase foreign asset allocation up to 25% Bradfield and Munro (2011) evaluated whether should individuals take the 25% abroad? Put differently, should the asset managers/investors take the opportunities to tactically overweight their positions on their portfolios on offshore allocation? To evaluate this, the authors make use of data spanning from 1 January 1971 to 30 December 2011 a total of 40 years and the make use of six asset classes whilst adopting a parametric and on parametric approach. The non-parametric is similar to that of Swartz

(2004). On the other hand and the parametric approach is an efficient frontier excluding foreign assets and then superimpose with efficient frontier including foreign assets. This done to view what impact foreign asset allocation has on the entire spectrum of risk and return. Figure 3.3 below depicts the findings of the two efficient frontiers:

Figure 3.3: Efficient frontiers with and without foreign assets



Source: Bradfield & Munro (2011;8)

Figure 3.3 indicates that the inclusion of foreign assets has resulted to the efficient frontier moving significantly to the left, indicating risk reduction and in the same process moving up indicating increased returns. These results brings a rejuvenating interest to the concept of diversification, diversification is not only about risk reduction it can also be about the return enhancing aspect. Bradfield and Munro (2011) suggest that the return enhancing factor is from the negatively correlated bonds which results to returns coming in when the portfolio is performing poorly. The findings of the non-parametric approach support Swartz (2004) and Swartz and Munro (2006) findings mentioned earlier.

A recent study by Van Heerden and Koegelenbeg (2013) determined whether it would be optimal in a risk-return perspective for South African investors to invest 25% abroad. The study considers 7 different portfolio construction techniques with varying time horizons. The authors considered a 10-, 20- and 30- year investment horizons. Their findings suggested that

over 10 years investment horizon a domestic only fund outperformed foreign asset allocation fund. When they stretched the time horizon to a 20 and 30 year period they go mixed results of which outperformed which. Nonetheless, the author's findings showed that a majority of optimization techniques were inclined towards foreign asset allocation as the investment horizon were increased.

3.6 Conclusion

After reviewing prior literature it can be viewed that asset allocation is an important factor in explaining the returns of a fund. Furthermore, the inclusion of international assets in an allocation mix brings about diversification benefits and in some instances return enhancement. On the other hand, emerging markets are seemingly highly correlated with the South African markets meaning that there could be little diversification benefits. This brings us to a predicament, could the inclusion of emerging economies and Africa (excluding South Africa), which comprises of mostly emerging economies, be beneficial an element? It has a component in the Regulation 28 and this is an area that has not been tested by prior literature which this study plans to explore with respect to the impact on South African pension fund industry.

The offshore allocation asset classes is an area that has been explored explicitly by the Cadiz articles, this study will explore the rest of the Regulation 28 asset classes which have not been addressed namely, the inclusion of commodities, African and emerging markets. With regards to emerging markets, offshore allocation has been predominately measured by the MSCI world index representing an international index. This index is predominately influence by developed countries, hence we view what will happen when emerging market index are included instead in offshore allocation.

Lastly, little has been done to view whether asset managers or investors South Africa have been hampered or are benefiting from the Regulation 28 being enforced. Hence, the study will compare the performance of regulated funds against those not regulated to see if there are any inferences with regards to asset allocation.

4

Data and Methodology

4.1 Introduction

This next section gives a detailed description on the data and methodology used to evaluate Regulation 28 and asset allocation. This section starts off with a research problem followed by the research questions that serve as a guideline to addressing the problem. The methodology needed to execute the study is presented and the chapter closes of with a detailed description of the data used in this study.

4.2 Research Problem

The aim of this study is to evaluate the impact Regulation 28 has on asset allocation. This will be accomplished by determining whether it is feasible to impose Regulation 28 constraints on asset allocation. Each constraint, imposed on the various asset classes is evaluated. From an offshore allocation perspective, the study tries to determine where South African funds should invest these funds as there is a leeway of 30% to these markets[2].

4.3 Research Questions:

1. The study will evaluate whether it is optimal to have 25% offshore allocation?
2. The study will evaluate whether it is optimal to have 5% allocation into Africa (exSA)?
3. The study will evaluate whether it is optimal to have 10% in commodities?
4. The study will evaluate whether it is optimal to invest in emerging markets?
5. The study will evaluate whether it is optimal to invest in Africa (exSA)?
6. The study will evaluate whether it is optimal to invest in South African commodities?
7. The study will evaluate what impact does the Regulation 28 have on South African pension funds and unit trusts?

[2] Up to 25% of assets may be invested offshore and 5% may be invested in Africa (excluding South Africa)

4.4 Methodology

4.4.1 Constructing the Efficient Frontier

The study adopts Markowitz (1952) portfolio selection tool which is based on the basic principles behind choosing optimal proportions of assets in portfolio construction which was described in chapter 2.

Considering a portfolio that consist of n stocks whereby the price of each asset clas denoted by the symbol i during time t….n can be detonated as P_{it} and the stock returns ($r_{i,t}$) are defined as:

$$\boldsymbol{r_{i,t} = \left(\frac{P_{i,t}}{P_{i,t-1}}\right) - 1} \quad \textbf{(4.1)}$$

Markowitz (1952) efficient frontier aims at to maximize returns as represented by equation 4.1. In so doing minimizing the variance calculated from a covariance matrix $\boldsymbol{\sigma_{ij}}$ represented by equation 4.2:

$$\boldsymbol{\sum_i \sum_j w_i w_j \sigma_{ij}} \quad \textbf{(4.2)}$$

This will be subject to the sum of the weighted average return of the constituents. Hence we reintroduce equation 2.1:

$$\boldsymbol{R_p = \sum_{i=1}^{n} w_i r_{it}} \quad \textbf{(2.1)}$$

Assuming the sum of the parts (weights) of constituents equal to 1:

$$\boldsymbol{\sum_{i=1}^{n} w_i = 1} \quad \textbf{(4.3)}$$

and there is no short selling **:**

$$0 \leq w_i \leq 1 \quad (4.4)$$

Having established how the n asset stock efficient frontier will be constructed in part 1, part 2 focuses on the application of the efficient in quantifying the impact of offshore allocation and Regulation 28have.

4.4.2 Quantifying the impact of offshore allocation and the Regulation 28

This section of the chapter explains how the efficient frontier described above will be used to evaluate the impact the Regulation 28 on asset allocation. Initially the study will construct an efficient frontier which consists of domestic assets only. Thereafter, an additional efficient frontiers will constructed which includes the domestic asset classes and an offshore asset classes. To summarize;

1. The first efficient frontier will consist of domestic asset classes only
2. The second efficient frontier will consist of domestic asset classes + international asset classes as represented by the MSCI world indices
3. The third efficient frontier will be similar to the second asset allocation, however, the Regulation 28 constraints will imposed.

This is done for the various constraints being tested and its implications are observed. By generating efficient frontiers that include and exclude foreign assets one can view the impact foreign asset allocation has on risk reduction (if there is any at all), return enhancement (if there is any at all) and whether asset allocation is affected by Regulation 28.

4.5 Diversification impact of the various asset classes

To view the impact of diversification of the various offshore asset classes we compute their various correlations with respect to the domestic asset classes using the formula below:

$$\rho_{ij} = \frac{\sigma_{ij}}{\sigma_i \sigma_j} \quad (4.5)$$

$Where$:
ρ_{ij} $correlation\ of\ asset\ i\ and\ asset\ j$
σ $standard\ deviation\ of\ asset\ i\ and\ asset\ j$

The correlations are computed for varying time frames to paint a clear picture on their diversification impact.

4.6 Regulation 28 compliant unit trust vs. non-compliant funds

The study also adopts a non-parametric approach with regards to analyzing the impact regulation 28 has on asset allocation in the South African pension fund industry. The idea behind the approach is to group unit trusts into two groups. The first group is regulation 28 compliant and the second group is not regulation 28 compliant. To ensure the comparison is not bias to any of the groups, certain measure have been considered through the steps taken in selecting these groups.

Step 1

All the funds registered in 2015 were pooled together with their respective attributes such as class, risk rating and whether they were regulation 28 complaint or not. This resulted to a total of 157 funds.

Step 2

the funds were grouped into a Regulation 28 complaint funds and a non-Regulation 28 complaint funds. Regulation 28 group consisted of 47 unit trusts and the non-Regulation 28 group had 110 unit trusts

Step 3

the unit trusts were further classified according to their risk ratings.

3.1 Funds that had a risk rating of conservative moderate, moderate and moderate aggressive were considered.

3.2 After classification of risk rating unit trust that had a class of A, A1, B, B1, B2, B3 and C were considered.

Step 4

all the funds that had data available from 1 January 2011 (year Regulation 28 became effective) to 31 December 2015 were considered. This resulted to **28** regulation 28 compliant funds and **30** non Regulation 28 complaints funds.

Step 5

the funds were then analyzed on a risk return spectrum

4.7 Sample Selection and Data

4.7.1 Sample Selection

The time frame in this study extends from 28 February 1979 to 30 June 2015 a total of 437 monthly observations. The period in consideration encompasses both a contraction and expansion period, henceforth it is free of any time biases. Furthermore, for the purpose of the study we also extract a contraction period 1990 to 1999 and an expansion period from 2000 to 2015.

4.7.2 Data

The data used in this study is listed as follows:

Domestic bond index:

- Proxied by the JSE All Bond index from 1 February 1979 to June 2015
- Data collected from Datastream

Domestic equity index excluding property:

- Proxied by the JSE All Share index from 1 February 1979 to June 2015
- Data collected from Datastream

Domestic cash:

- Proxied by the 3 months T-bill from 1 February 1979 to June 2015
- Data will collected from Datastream

Domestic property:

- Proxied by a combination of Property Unit Trust Index, Property Loan Stock Index and Listed Property Index to obtain a dataset for the full

period 1 February 1979 to June 2015

- Data collected from Datastream

JSE Gold Index:

- From 1 February 1979 to June 2015
- Data collected from Bloomberg

. The offshore allocation asset classes considered in this study are as follows:

Foreign Equity: International index

- Proxied by the MSCI Global Equity Index from 1 February 1979 to 30June 2015
- Data collected from Datastream

Foreign equity: Emerging market index

- Proxied by the MSCI emerging market index from 1 January 1988 to 30 June 2015
- Data collected from Bloomberg

Foreign equity: Africa index (ex SA)

- Proxied by the MSCI Africa (ex SA) index from 1 June 2002 to 30 June 2015
- Data collected from Bloomberg

Foreign bonds: International bond index

- Proxied by the JP Morgan World Bond Index from 1 Febuary 1979 to 30 June 2015
- Data collected from Bloomberg

Unit trust data from 1 January 2011 to 31December 2015

The annualised returns and their corresponding standard deviations are found in table 4.1 below:

Table 4.1: Returns and risks of major asset classes (Feb 1979 to June 2010)

Asset Class	Return % p.a	Total risk% p.a
Cash	11,53	1,26
Bonds	12,67	8,59
Equity	19,53	20,64
Property	19,06	17,91
Gold	12,53	18,62
Foreign Cash(Rands)	12,73	14,23
Foreign Bonds (Rands)	11,58	15,24
Foreign Equity (Rands)	15,55	17,10
Emerging markets (Rands)	16,13	21,89[3]
Africa (ex SA) (Rands)	12,71	22,69[4]

From table 1 it can be noted that the South African equity has shown the highest return followed by the SA property index. With regards to the total risk, Africa (ex SA) has the highest risk followed by the Emerging market index.

Table 4.2 and table 4.3 below give the descriptive statistics of the asset classes used in this study.

Table 4.1: Descriptive statistics of Domestic Assets (monthly data used)

Cash	*%*	*Bonds*	*%*	*Equity*	*%*	*Property*	*%*	*Gold*	*%*
Mean	0,91	Mean	1,03	Mean	1,68	Mean	1,60	Mean	1,12
Median	0,88	Median	1,02	Median	1,93	Median	1,54	Median	0,75
Mode	0,46	Mode	0,07	Mode	2,11	Mode	0,61	Mode	#N/A
Standard Deviation	0,36	Standard Deviation	2,48	Standard Deviation	5,96	Standard Deviation	5,17	Standard Deviation	5,37
Kurtosis	-0,77	Kurtosis	4,82	Kurtosis	2,07	Kurtosis	1,30	Kurtosis	12,83
Skewness	0,36	Skewness	-0,18	Skewness	-0,54	Skewness	0,11	Skewness	1,97
Minimum	0,33	Minimum	-14,46	Minimum	-29,30	Minimum	-15,39	Minimum	-17,30
Maximum	1,85	Maximum	11,41	Maximum	17,85	Maximum	22,72	Maximum	45,61

[3] Due to data constraints the period considered here is from 1 January 1988 to 30 June 2015

[4] Due to data constraints the period considered here is from 1 June 2002 to 30 June 2015

Table 4.2: Descriptive statistics of Domestic Assets (monthly data used)

Foreign Cash Rands	*%*	*Foreign Bonds Rands*	*%*	*Foreign Equity Rands*	*%*	*Emerging marketsRands*	*%*	*Africa (ex SA) Rands*	*%*
Mean	1,09	Mean	1,01	Mean	1,33	Mean	1,45	Mean	1,21
Median	0,91	Median	0,77	Median	1,30	Median	1,30	Median	0,77
Mode	0,01	Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	4,11	Standard Deviation	4,40	Standard Deviation	4,94	Standard Deviation	6,32	Standard Deviation	6,55
Kurtosis	3,71	Kurtosis	3,47	Kurtosis	1,81	Kurtosis	1,55	Kurtosis	0,75
Skewness	0,59	Skewness	0,64	Skewness	-0,03	Skewness	-0,03	Skewness	0,40
Range	34,07	Range	37,70	Range	38,11	Range	51,79	Range	38,16
Minimum	-12,83	Minimum	-14,62	Minimum	-19,66	Minimum	-26,00	Minimum	-16,68
Maximum	21,23	Maximum	23,07	Maximum	18,45	Maximum	25,79	Maximum	21,48

Based on the descriptive statistics, there are some signs of normality from the data, however, the data is far from a perfect normal distribution. A few highlights, there are no instances where asset classes have a mean mode and median which are equal but the mean, median and mode are not far apart. The skewness of the data for most of the class fit within the range of 1 and -1 indicating a certain level of normality. The gold asset class on the other hand, does not fit in this range, it has a skewness of 1.97 indicating that the returns of the gold asset class is positively skewed. Lastly the kurtosis, generally a kurtosis of 3 would resemble a normal distribution as a rule of thumb, aside from foreign cash and foreign bonds, the kurtosis of the asset class does not follow a normal distribution.

5

Results and Analysis

5.1 Introduction

This section documents the outcomes of the impact Regulation 28 have on asset allocation. It starts by evaluating the impact offshore allocations have on domestic asset allocation and what happens when the Regulation 28 constraint is imposed. Thereafter, a similar test is conducted on emerging markets and Africa (ex SA). Lastly, the South Africa pension fund industry is also analyzed using a non-parametric approach that compares the performance of Regulation 28 complaint unit trusts and non-Regulation 28 compliant trusts.

5.2 International findings

This section begins the assessment of domestic and offshore allocation by looking at the correlations of the various asset classes from 1 February 1979 to 30 June 2015 documented in Table 5.1:

Table 5.1: Correlation matrix between major asset classes

(Feb 1979 to June 2015)

	Cash	Bonds	Equity	property	Gold	Foreign Cash*	Foreign Bonds*	Foreign Equity*	R/$
Cash	1,00								
Bonds	0,11	1,00							
Equity	-0,07	0,29	1,00						
property	-0,07	0,35	0,40	1,00					
Gold	-0,07	-0,02	0,16	0,00	1,00				
Foreign Cash*	0,13	-0,26	-0,08	-0,19	0,38	1,00			
Foreign Bonds*	0,26	-0,14	-0,06	-0,15	0,35	0,81	1,00		
Foreign Equity*	0,07	-0,15	0,32	0,05	0,11	0,47	0,48	1,00	
R/$	0,12	-0,18	-0,07	-0,23	0,46	0,78	0,62	0,34	1,00

* **denotes that asset class is in rand terms**

From a domestic perspective, the results in table 5.1 indicate that there is a negative correlation between cash and domestic equity whilst domestic equity has a positive correlation with bonds. As we move along to the offshore asset classes one can view that there is a negative correlation between the domestic equity and offshore cash and bonds. This highlights their appeal from a diversification viewpoint. A few studies have pointed out that the negative correlation displayed by the foreign bonds and cash is primarily driven by the embedded currency effect. The rand/dollar effect has a negative correlation with domestic equity, which gives rise to the currency effect. With the foreign equity, the case is somewhat different; the embedded negative correlation effect from the currency effect just dampens the strong positive correlation domestic equity has with the foreign equity. Next, we move along to see what effect does this have to asset allocation and the Regulation 28 through an efficient frontier analysis documented in figure 5.1:

Figure 5.1: Efficient frontier including and excluding foreign assets (Feb 1979 to June 2015)

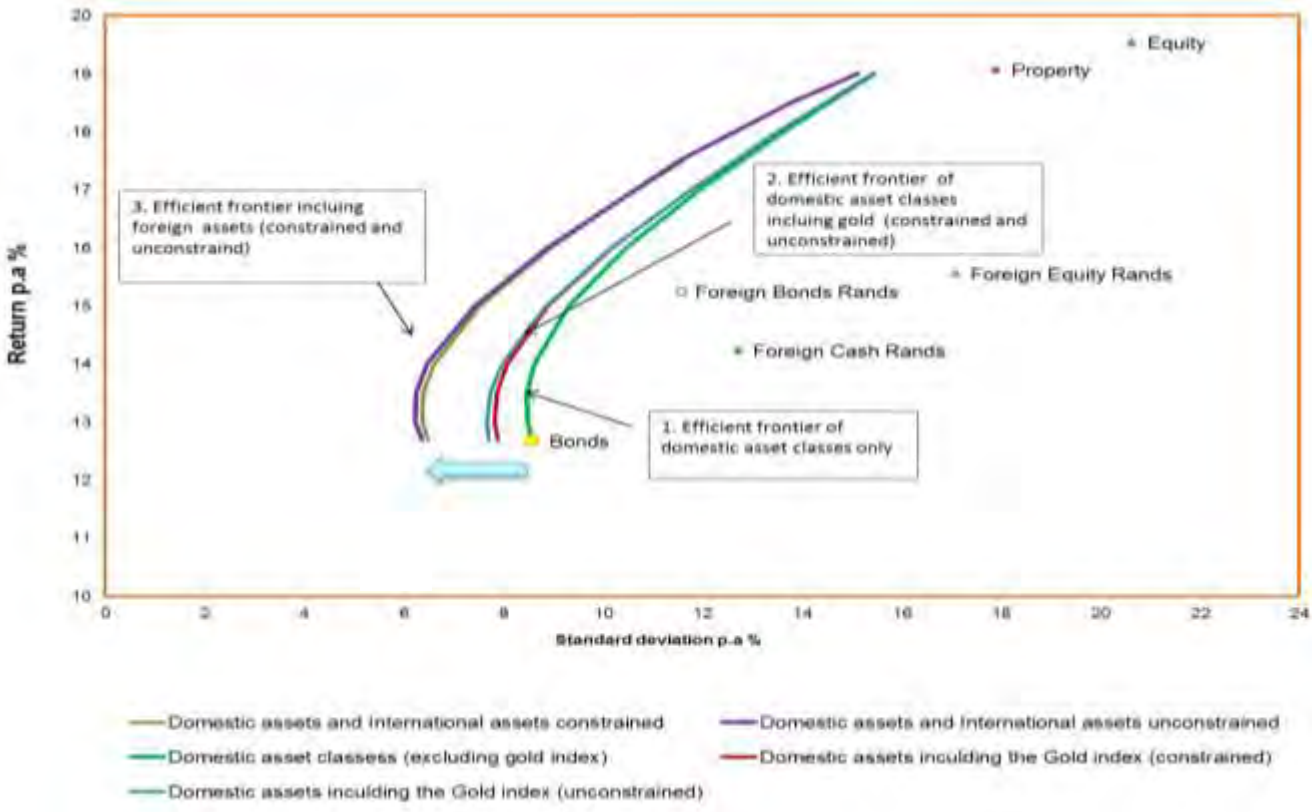


Figure 5.1 displays the position of the six-asset classes' and the resulting efficient frontiers. The first efficient frontier from the right (green) consists of domestic asset classes. The third efficient frontier (blue) is a result of adding the gold index return and when constrained to 10% as per Regulation 28 it results to the second efficient frontier (red). Likewise with the offshore asset classes, when you add the theses asset classes it results to the efficient frontier shifting to the far left depicted by the 5th efficient frontier. When offshore asset allocation is constrained to 25% and the maximum equity both offshore and domestic is constrained to 75% as per Regulation 28 it results to the fourth efficient frontier.

From figure 5.1 it can be viewed that when you add the gold index and the offshore (international) asset classes to the domestic efficient frontier it results to the efficient frontier shifting the left indicating risk reduction. This means there is a relative attractiveness for diversification purposes when you include the gold index and it gets even better when you add the international asset classes. A point that should be highlighted, in table 5.1, gold has a positive correlation with domestic equity, however, its low risk factor results to a risk reduction in the portfolio. On the other hand, aside from offshore equity, the other international asset classes showed a negative correlation and also had a lower risk levels

which could be the reason international assets resulted to more risk reduction. Notably, in figure 5.1, the Regulation 28 constraints slightly reduce the welfare of investors. The reduction is not drastic as it is close the corresponding unconstrained efficient frontier. Henceforth, by imposing the constraints to a fund an investor does not lose much yet benefits knowingly their funds is not over or under exposed to certain asset classes.

The results can also be viewed differently with the same underlining fundamental, Regulation 28 drives investors to diversify their funds as opposed to holding a domestic only assets. In so doing this increases the welfare of the investor through risk reduction for the same level of return. This is also the case with the gold index. Figure 5.1 also show the benefits are slightly limited compared to an unregulated fund that would have decided on offshore allocation.

5.3 Emerging market findings

The analysis of the emerging market also starts with the analysis of the correlation between the emerging markets and the other major asset classes particularly the domestic asset classes. Figure 5.2 documents the correlation effects:

Table 5.2: Correlation matrix between major asset classes including emerging markets

(31 Jan 1988 to June 2015)[5]

	Cash	Bonds	Equity	property	Gold	Foreign Cash*	Foreign Bonds*	Foreign Equity*	rand returns	Emerging markets*
Cash	1,00									
Bonds	0,12	1,00								
Equity	-0,08	0,27	1,00							
property	-0,08	0,43	0,31	1,00						
Gold	-0,10	-0,13	0,01	-0,18	1,00					
Foreign Cash*	0,05	-0,34	-0,11	-0,23	0,45	1,00				
Foreign Bonds*	0,19	-0,24	-0,08	-0,18	0,40	0,80	1,00			
Foreign Equity*	-0,03	-0,16	0,42	0,00	0,08	0,46	0,45	1,00		
R/$	0,02	-0,24	-0,06	-0,29	0,57	0,71	0,51	0,29	1,00	
Emerging markets*	-0,02	0,03	0,59	0,14	0,03	0,18	0,17	0,67	0,10	1,00

* **denotes that asset class is in rand terms**

Predominately, table 5.2 shows the same correlation relationship amongst the asset classes

[5] Data sample is slightly reduced due to data constraints as the MSCI emerging market index was only established 1988

even with the slight change in the sample period. However, the relationships are seemingly much stronger as most the figures are slightly higher. With respect to the emerging markets, the additional asset class, it has a positive correlation with the other asset classes aside from domestic cash. From hindsight, this means emerging markets might not be attractive for diversification purposes from the period 31 January 1988 to 30 June 2015. To further test this claim, the study looks at the implication of introducing an emerging market asset class would have on the wealth of an investor from an efficient frontier spectrum depicted in table 5.2.

Figure 5.2: Efficient frontier including and excluding Emerging markets

(31 Jan 1988 to June 2015)

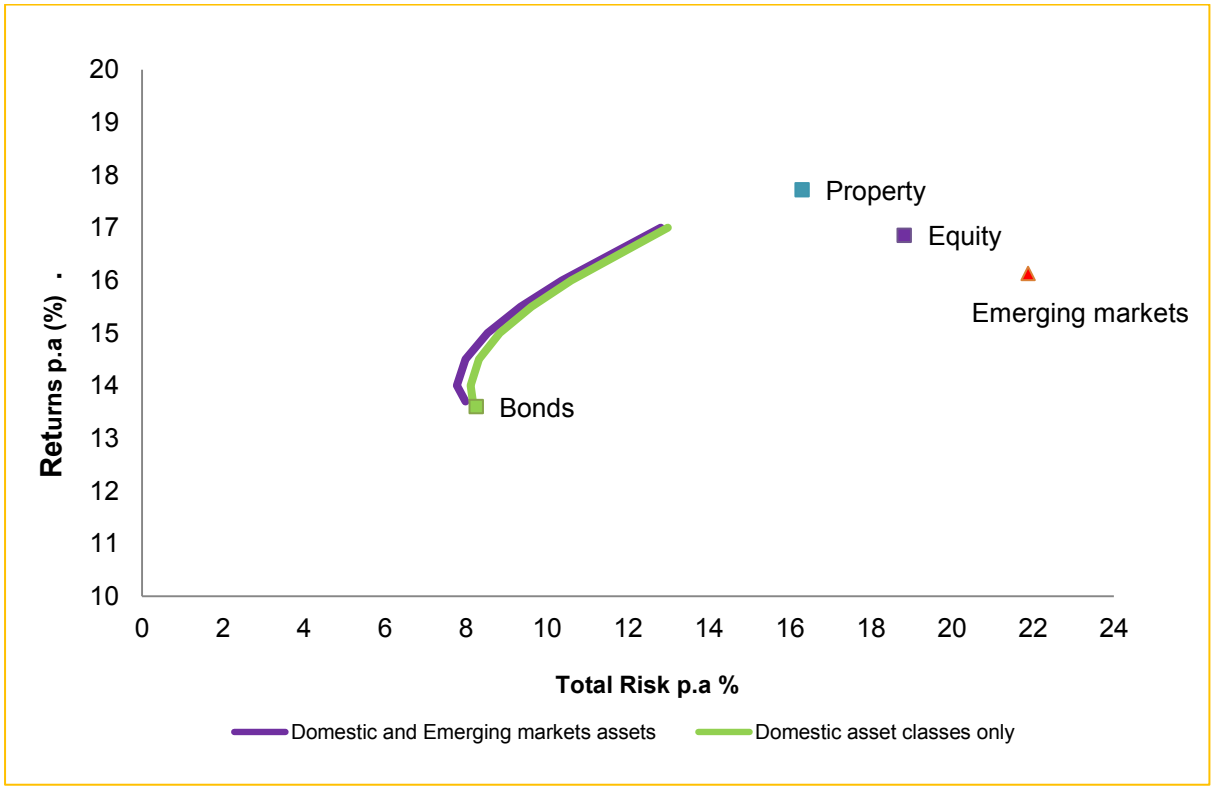


Figure 5.2 displays the position of the four-asset classes' and the resulting efficient frontiers. The first efficient frontier from the right (green) consists of domestic asset classes. The second efficient frontier (purple) is a result of adding the emerging market index unconstrained

It can be viewed from figure two that when one adds the emerging markets to the initial domestic only asset classes, there is little risk reduction indicating that there is a lack of attractiveness to investing in these markets. When you look at the emerging markets, in return versus risk space one can view that this asset class is highly risky yet offers little return

indicating that these markets are not attractive. Another striking feature is the asset allocation, in appendix 2, the allocation to emerging markets is all less than 25% yet it's unconstrained, this means that a higher allocation to emerging markets would result to inefficient portfolios. Put differently, a higher allocation to emerging markets would result to portfolios that are not mean-variance efficient which lie inside the efficient frontier. This could be the result of the high risk that accompanies emerging markets and the positive correlation documented in the correlation matrix (table 5.2). In the next section, the study analyzes the inclusion of Africa (excluding South Africa) as an additional asset class.

5.4 Africa (excluding SA) findings

To view the impact Africa (ex SA) asset class has on the domestic asset classes, the study starts of by looking at the correlation effects:

Figure 5.3: Correlations of major asset classes with Africa (ex SA) markets

(31 Jan 2002 to June 2015)

	Cash	*Bonds*	*Equity*	*property*	*Gold*	*Foreign Cash**	*Foreign Bonds**	*Foreign Equity**	*R/$*	*Emerging market*s*	*Africa (ex SA)**
Cash	1,00										
Bonds	0,11	1,00									
Equity	-0,23	0,05	1,00								
property	-0,02	0,65	0,26	1,00							
Gold	-0,03	-0,11	-0,11	-0,24	1,00						
Foreign Cash*	-0,07	-0,33	-0,13	-0,30	0,49	1,00					
ForeignBonds*	0,15	-0,22	-0,05	-0,21	0,45	0,78	1,00				
ForeignEquity*	-0,32	-0,26	0,55	-0,07	0,00	0,45	0,39	1,00			
R/$	-0,12	-0,24	-0,18	-0,33	0,57	0,69	0,44	0,18	1,00		
Emerging markets*	-0,22	-0,08	0,80	0,10	-0,08	0,08	0,15	0,76	-0,12	1,00	
Africa (ex SA)*	-0,11	-0,22	0,31	-0,11	0,08	0,31	0,34	0,55	0,05	0,50	1,00

- **Asset class returns is in Rands**

With respect to the domestic asset class, the Africa (exSA) asset class has a negative correlation with cash bonds and property. The rest of the asset classes, local equity and gold there is positive correlation. This is a similar pattern with the R/$ which could indicate the currency is the main driver of this pattern. With respect to the offshore allocations, there is a strong correlation between Africa (exSA) and emerging markets and global equities. Whilst relatively lower, there is also a strong correlation with offshore bonds and cash. Figure 5.3

displays the efficient frontier and the impact of including Africa (exSA) in a domestic only efficient frontier. Thereafter, the Africa (exSA) efficient is constrained to 5% as per Regulation 28.

Figure 5.3: Efficient frontier including and excluding Africa (ex SA) markets

(31 Jan 2002 to June 2015)

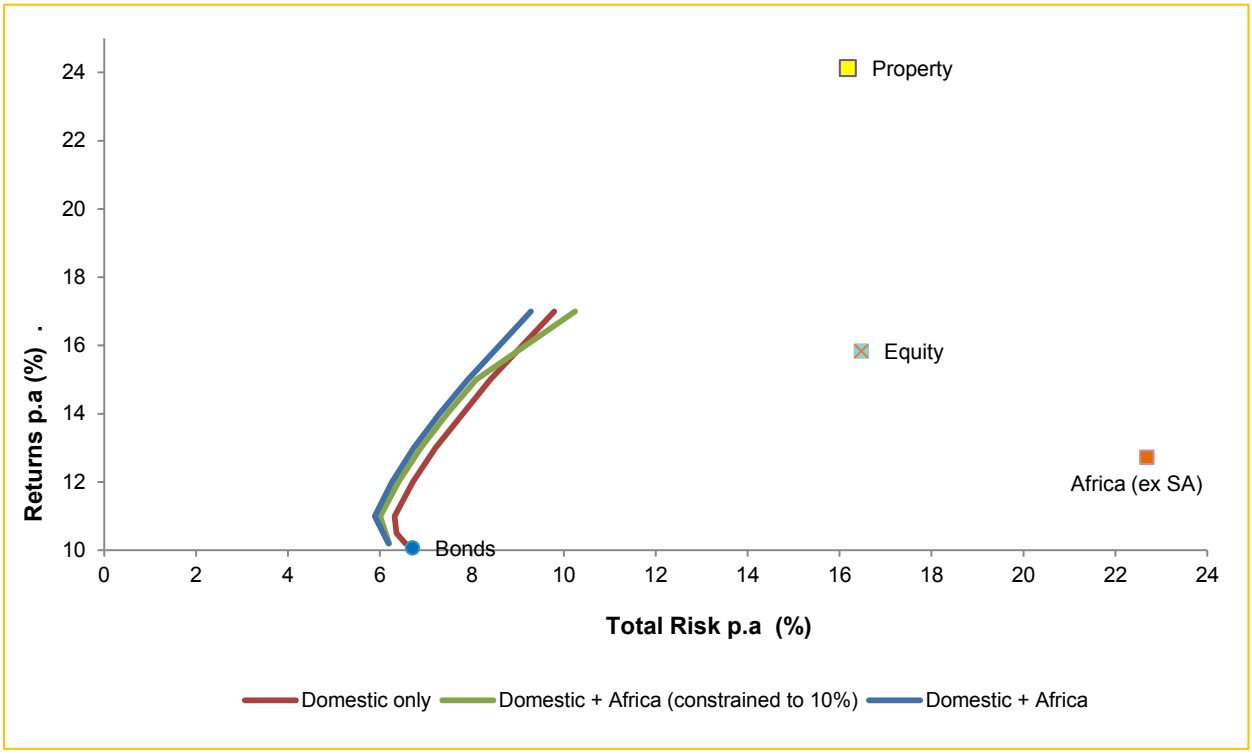


Figure 5.3 displays the position of the four-asset classes' and the resulting efficient frontiers. The first efficient frontier from the right (brown) consists of domestic asset classes only. The second efficient frontier (blue) is a result of adding the Africa (exSA) index unconstrained. The third efficient frontier in the middle is result of adding the Africa index and imposing a 5% constraint as per Regulation 28.

The results in figure 5.3 indicate that there is little benefit in adding African (ex SA) markets in the domestic only assets. This could be due to the positive correlation African markets exhibit with domestic equity. When the Africa (exSA) asset class is constrained to 5% as per Regulation 28 it results to the green efficient frontier. The green efficient frontier overlaps the domestic only efficient frontier indicating returns are decrease to extent less than the domestic only efficient frontier. This could be due to the high risk exhibited by African(exSA) markets. When you turn your eye to the individual asset classes it can be viewed (figure5.3) that Africa (ex SA) has high risk levels yet offers little return. In the same

period, SA property displayed extremely high returns relative to the other asset classes. Hence it would be beneficially if an investor didn't invest in this market.

5.5 Asset allocation

From the first section of this chapter, it is clear that by adding the international asset classes it is where you can get the greatest benefits as opposed to adding emerging or Africa (exSa) assets. Henceforth, we look at the asset allocation attributes of the domestic asset class (only) and the domestic plus international asset class in table 5.3 and 5.3 b:

Table 5.3a: Asset allocation: domestic and international assets (constrained)

(Feb 1979 to June 2015)

Points along the efficient frontier of domestic and international assets (constrained)

Portfolio	**9**	8	7	6	5	4	3	2	1
Average return p.a (%)	**17,5**	17,0	16,5	16,0	15,0	14,0	13,5	13,0	12,7
Standard Deviation p.a (%)	**11,6**	10,7	9,8	9,0	7,5	6,6	6,4	6,4	6,5
Sharpe Ratio	**0,514**	0,512	0,508	0,499	0,460	0,374	0,308	0,230	0,180
Bonds	**3%**	12%	20%	27%	42%	57%	64%	72%	75%
Equity	**28%**	24%	21%	18%	12%	6%	3%	0%	0%
Property	**44%**	39%	35%	30%	21%	13%	8%	3%	0%
Foreign Cash Rands	**22%**	18%	18%	19%	19%	20%	21%	21%	22%
Foreign Bonds Rands	**0%**	0%	0%	0%	0%	0%	0%	0%	1%
Foreign Equity Rands	**3%**	7%	7%	6%	6%	5%	4%	4%	1%
Foreign allocation	**25%**	25%	25%	25%	25%	25%	25%	25%	25%
Allocation to equity	**75%**	70%	62%	54%	38%	23%	15%	7%	1%

Table 5.3b: Asset allocation: domestic and international assets (unconstrained)

(Feb 1979 to June 2015)

Points along the efficient frontier of domestic and international assets (unconstrained)

Portfolio	8	**7**	6	5	4	3	2	1
Average return p.a (%)	18,5	**17,5**	16,0	15,0	14,0	13,5	13,0	12,7
Standard Deviation p.a (%)	13,8	**11,5**	8,9	7,4	6,5	6,2	6,2	6,4
Sharpe Ratio	0,505	**0,517**	0,504	0,467	0,382	0,315	0,236	0,184
Bonds	0%	**0%**	21%	36%	50%	58%	65%	68%
Equity	32%	**25%**	16%	10%	4%	1%	0%	0%
Property	51%	**43%**	30%	21%	13%	8%	2%	0%
Foreign Cash Rands	3%	**20%**	23%	24%	25%	25%	26%	24%
Foreign Bonds Rands	0%	**0%**	0%	0%	0%	0%	0%	5%
Foreign Equity Rands	14%	**11%**	10%	9%	9%	8%	7%	3%
Foreign allocation	17%	**31%**	32%	33%	33%	33%	33%	32%
Allocation to equity	97%	**80%**	56%	41%	25%	17%	9%	3%

Table 5.3a depicts the asset allocation attributes of the points along the efficient frontier of a constrained efficient frontier from figure 5.1. Table 5.3b displays the corresponding efficient frontier of an unconstrained efficient frontier.

An observation that can be made table 5a is that foreign allocation is maxed as you move along from the 1st portfolio (lowest return) to the portfolio 8th portfolio (highest return), in table 5.3a the allocation to equity increases at the expense of SA bonds until it reaches maximum constraint of 75%. When you turn your attention to table 5.3b, foreign allocation for the majority of the portfolios is above 30% with less allocation to equity. However, for the last two portfolios, with high returns foreign allocation drastically increases at astronomical levels whilst allocation to equity gradually increases. The unconstrained efficient frontier resulted to a better welfare. This is due to the fact that, for greater return levels there is a need to sacrifice other asset class for the sake of investing solely on equities.

5.6 Contraction vs Expansion markets

This section of the study looks the correlation of major classes during expansion and contraction periods. The expansion period extends from 31 January 1988 to 31 December 2001 and the contraction period extends from 31 January 2002 to 30 June 2015. Table 5.4

documents the summarized version of the correlation effects between the major asset classes and domestic equity.

Table 5.4: Correlation between domestic equity and major asset classes

Correlation between domestic equity and….	whole sample	contraction	expansion
Cash	-0,07	-0,23	-0,09
Bonds	0,29	0,04	0,36
property	0,4	0,25	0,35
Gold	0,16	-0,11	0,13
Foreign Cash Rands	-0,08	-0,12	-0,08
Foreign Bonds Rands	-0,06	-0,05	-0,13
Foreign Equity Rands	0,32	0,53	0,36

Table 5 above shows the correlation relationships between domestic equity and the abovementioned asset classes. The expansion period extends from 31 January 1988 to 31 December 2001 and the contraction period extends from 31 January 2002 to 30 June 2015. See appendix for the full correlation matric of both the contraction and expansion periods.

Most of the correlation relations maintain the same relationship (sign does not change) during the contraction and expansion period aside from the gold asset class. When markets are in contraction, there is a negative relationship between gold and domestic equity whilst in expansion periods it has a positive relationship with domestic equity which makes it a safe haven for investor's especially in conservative funds or Regulation 28 imposed funds since it has a low risk characteristics.

During expansion periods, bonds show a jump in the strength of the positive correlation whilst foreign cash remains unchanged with a negative correlation. During contraction periods, foreign bonds and foreign cash remain relatively the same with whole sample period. The strength the of the positive relationship between equity and foreign equity increases which basically show that when there is a recession or 3 standard deviations movements in the market like the 2007/08 recessions all markets tend to move in one direction and that's down. Surprisingly enough when markets are in contraction phase bonds are close to being uncorrelated with domestic equity and cash show a stronger negative correlation with equity.

5.7 South African pension fund environment

The descriptive statistics in the previous chapter indicated that the data does follow a normal distribution. The data was slightly positively skewed, hence, the study also looks at a nonparametric approach to evaluating the impact Regulation 28 has on asset allocation. Chapter 4 described a manner in which unit trusts would be selected and put into two groups. The one group would consist of Regulation 28 complaint assets and the other group constitutes of asset classes that are not Regulation 28 complaint. The two sets of groups 5 year annualized return and standard deviation from 1 January 2011 to 31 December 2015 were computed and plotted on a return risk spectrum:

Figure 5.4 Return and risk of South African unit trusts
(1 January 2011 to 31 December 2015)

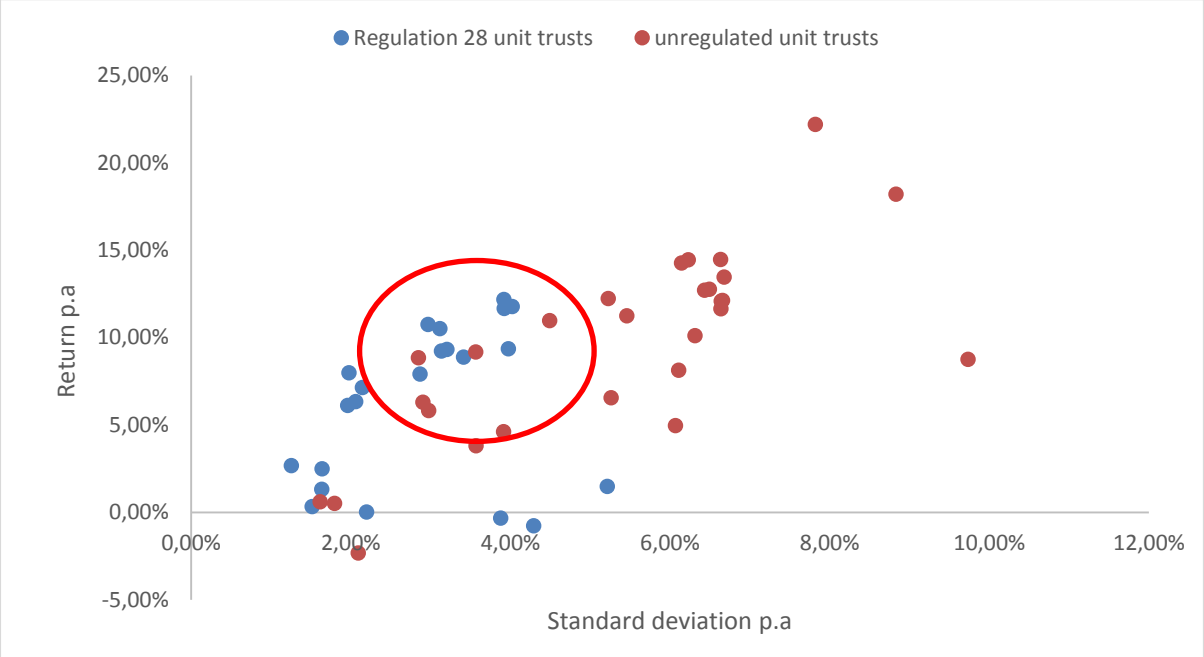
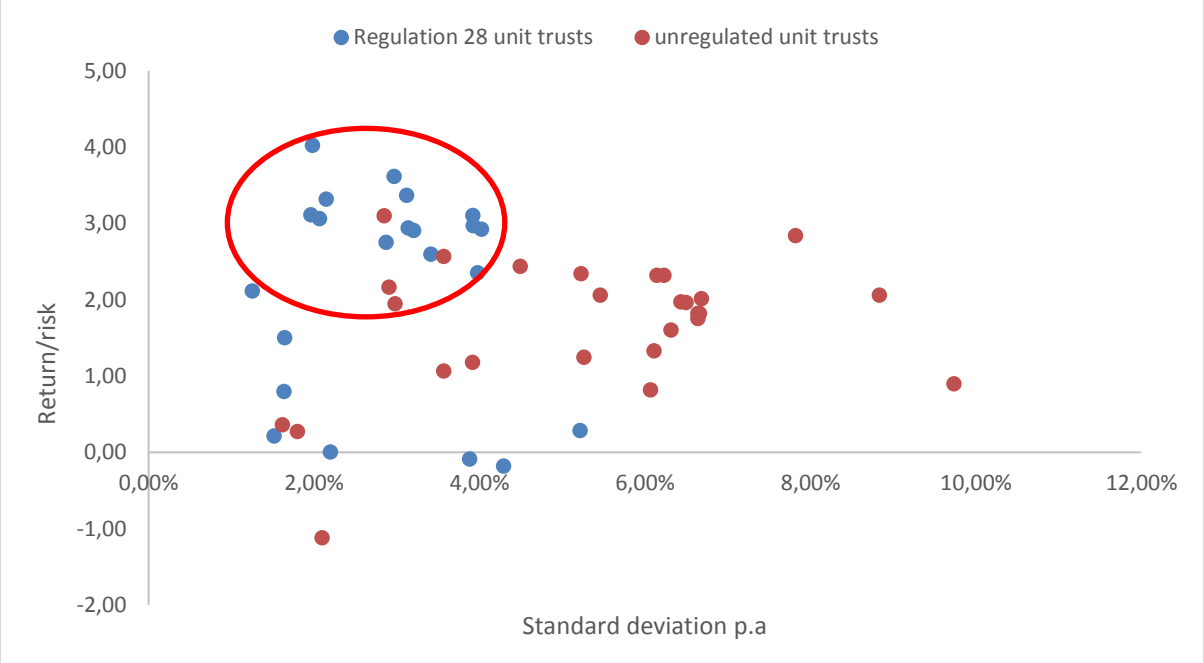


Table shows that the unregulated unit trusts have higher returns than the regulated unit trusts, on the other hand, the unregulated unit trusts have higher risk levels than the regulated unit trusts. The unit trusts on the same risk return space, that is, the unit trusts that lie on the 3.5% standard deviation to 4% circled in red it seems like the regulated unit trusts generate higher return levels than the unregulated unit trusts. For a better comparison, the return to volatility

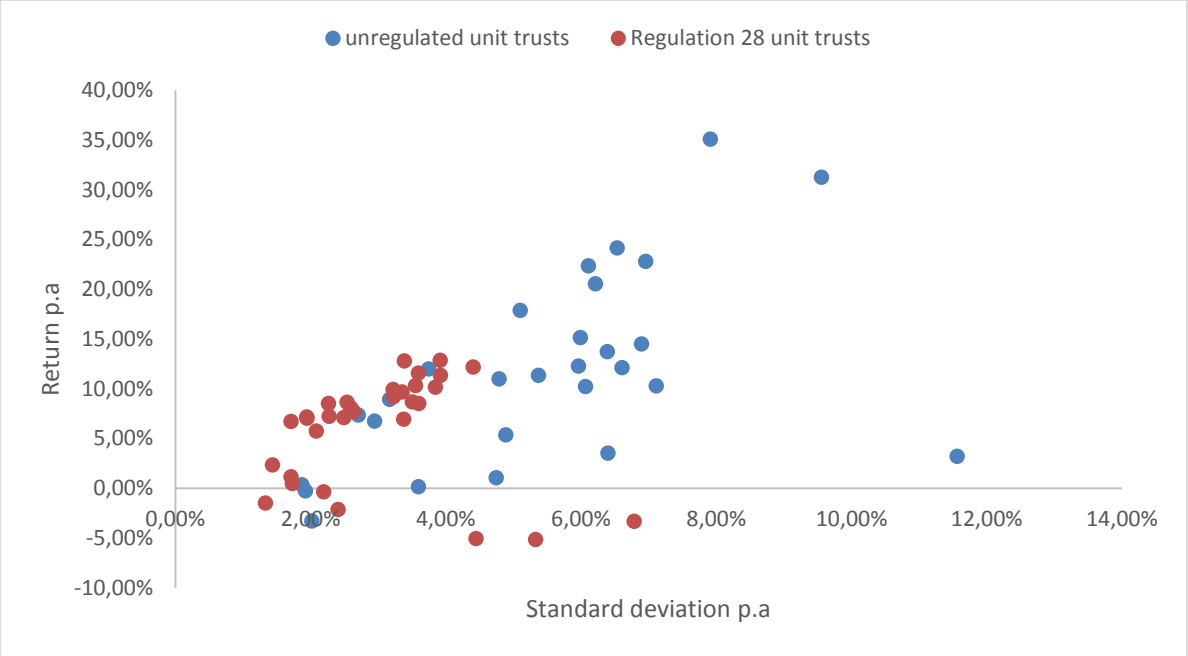
ratio is computed for each unit trust and is plotted in table below:

Figure 5.5 Risk/Reward ratio of South African unit trusts
(1 January 2011 to 31 December 2015)



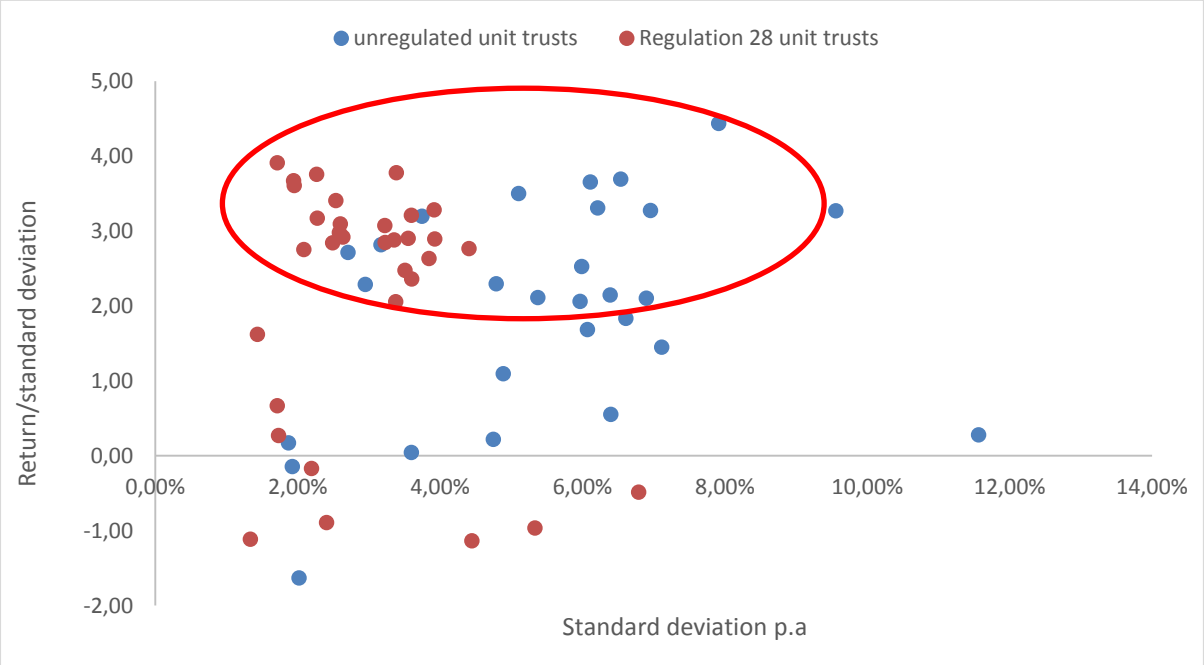
The return to volatility ratio compares the return an investment earns to the risk inherent in the investment. This ratio is plotted against the risk of the unit trust in place of the returns in table above for a better comparison. The diagram shows that on a risk adjusted basis regulated unit trusts offer higher welfare to investors than unregulated unit trusts over a 5 year investment horizon. The unit trust do this with a lower level of risk compared to the unregulated unit trust (circled in red). The above analysis was over a 5 year investment horizon, the next analysis is over a shorter time a 3 year investment horizon:

Figure 5.6 Return and risk of South African unit trusts
(1 January 2013 to 31 December 2015)



The 3 year analysis looks similar in the sense that regulated unit trusts have lower risk levels and low returns whilst the unregulated unit trusts have higher risk levels and higher returns. An interesting observation is that the unit trusts that had negative returns over the 5 year basis also have negative returns over the three year basis as well. The unit trust are scattered over the risk-return spectrum, the regulated unit trusts lie on the low risk levels whilst the unregulated unit trusts lie on the other end hence it's hard to tell which performed better, hence the risk-to volatility can provide more clarity presented on table below:

Figure 5.7 Risk/Reward ratio of South African unit trusts
(1 January 2011 to 31 December 2015)



Over a 3 year horizon it seems like the regulated and unregulated unit trusts offer an investor the same level of welfare. However, the unregulated unit trusts do with a low level of risk hence, regulated unit trusts would have been better. Without throwing caution to the wind, it seems like there has been a few unit trusts over the five year period and now three year period that struggle to get out of the negative return zone. This could indicate that for underperforming Regulation 28 unit trusts struggle to turn things around or these asset managers simply have bad asset allocation, stock picking or market timing skills. Moneyweb published the top 10 Regulation 28 complaint unit trusts on the 20th February 2015. The unit trusts below made it to the top ten, over a 5 year period ending 31 January 2015.

Table 5.5: Top ten regulated unit trusts

(31 Jan 2011 to June 2015)

Unit trust	Return p.a
Rezco Value Trend Unit trust	18.67%
MET Odyssey Balanced FoF A	16.52%
Autus BCI Balanced Unit trust A	16.32%
Coronation Balanced Plus Unit trust A	16.20%
AS Forum BCI Aggressive FoF	16.11%
Nedgroup Investments Core Diversified Unit trust B	16.11%
Momentum Best Blend Balanced FoF	16.07%
Foord Balanced Unit trust	16.04%
Prudential Balanced Unit trust	16.01%
Southern Charter BCI Growth FoF	15.69%
FTSE/JSE All Share Index	17.33%

Source: (moneyweb: 2015,1)

Only the Rezco value trend unit trust earned a return level higher than the FTSE/JSE allshare index. Return, is only one metric in measuring performance, in a risk adjusted basis there is a high chance that Regulation 28 unit trusts could outperform the benchmark as the analysis thus far have shown Regulation 28 unit trusts are able to remain at low risk levels regardless of the returns they earn. Nonetheless, the study looks at the top ten unit trusts to view what the asset allocation of these unit trusts would look like. Figure 5.4 presents the asset allocation mix of these unit trusts through a box and whisker diagrams:

Figure 5.8: Distribution of asset allocation mix that made it to the top 10 regulated unit trusts

(31 Jan 2002 to June 2015)

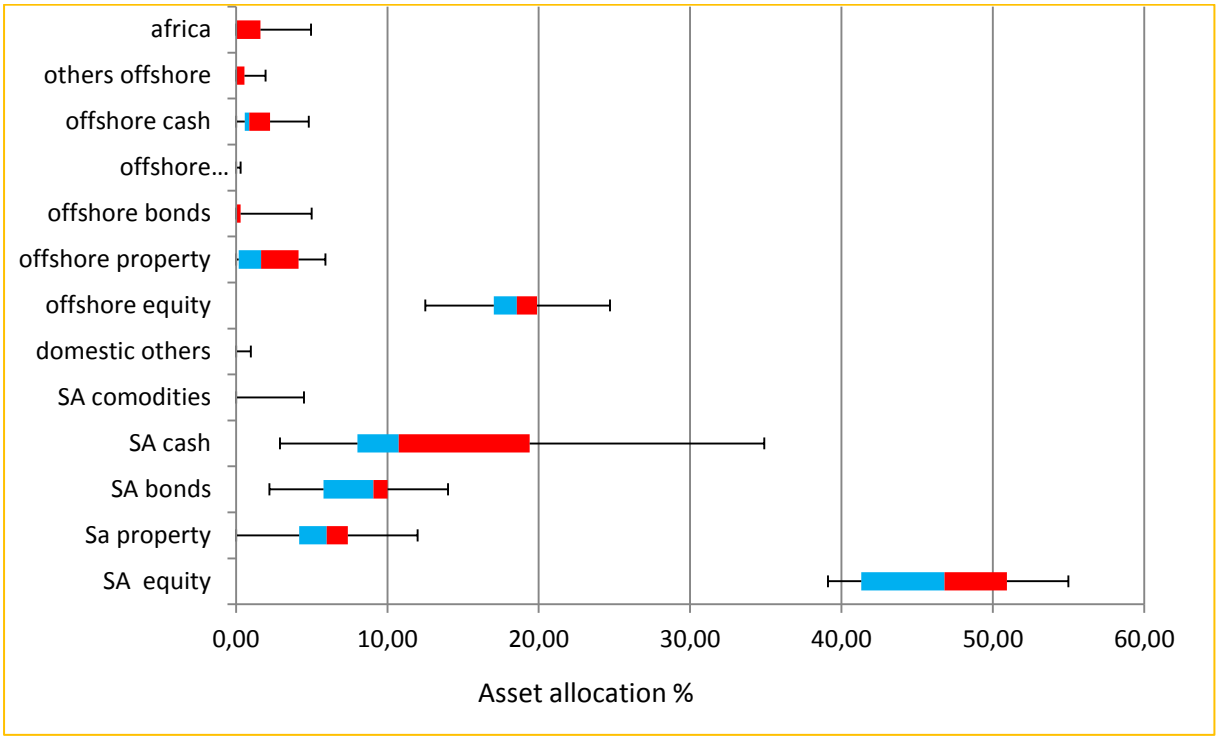


Figure 5.4 depicts the box and whiskers charts for the asset allocation mix of the unit trusts that made it to the top 10 regulated unit trusts. Separating the red and the blue box is the median of the asset allocation mix for its respective asset classes. The range from one whisker to the next (lowest value to the highest value) represents the spread of all the asset allocation mixes. The interquartile range, the box, starts from the blue box to the red box and it represents the middle half of the data set.

Based on the findings depicted in figure 5.8, regulated pension funds spread their resources in all the asset classes. With respect to domestic equity, the least allocation is just under 40% and the highest allocation is approximately 55%, and offshore equity varying from 12 to 25% which is the result of the Regulation 28 at play. The cash box and whiskers is spread out and is skewed to the right indicating a few unit trusts allocate in the regions above the median (around 12%), however, there are a few outliers. There's not a lot allocated in commodities and other asset classes both locally and offshore. The allocation to equity which is around 75% (domestic + offshore) is being balanced by cash which is mostly money market

instruments. General equity funds, by regulation should be greater than 80% hence the high return levels they generate is accompanied by higher risk levels. These funds are doing relatively given that the maximum they can invest in equity is capped at 75% whist the JSE FTSE allshare index is made up of equity only.

6

Conclusion

The study has evaluated the impact Regulation 28 has on asset allocation on the South African pension fund industry. The study showed when offshore asset class or the gold index is introduced it results to an increase in the welfare of the investor, that is risk decreases whilst returns remains the same, in a way the welfare of the investor increases, however, once the Regulation 28 constraint is imposed some of the incremental welfare decreases. In some instances, like the case of the African market analysis, not only did the risk increase after the decrease from introducing African markets, return levels declined as the tip of the efficient frontier overlapped the domestic only efficient frontier (figure 5.3). This showed the far reaching extent at which imposing the regulation constraints can reduce the welfare of investor, in the form of decreasing returns whilst risk increased.

It should be noted that Regulation 28 drives investors to diversify their funds as opposed to holding a domestic only assets. In so doing this increased the welfare of the investor through risk reduction for the same level of return. This was the case with the gold index and offshore allocation to international markets. When emerging markets and Africa (exSA) was considered that was not the case due to the high risk exhibited by these markets. The downside of Regulation 28 is that it curbs the maximum potential the investor could be received by investing into these markets.

Another general trend, the additional asset class (Africa and Emerging markets) offered lower returns relative to the domestic asset class yet it was more risky. This could have resulted to it having minimal impact in improving the welfare of the investor and when the Regulation 28 constraint was imposed it resulted to returns decreasing as well. In the case of the emerging markets, the asset class was so risky that there were no portfolios that lied on the efficient frontiers, in other words it resulted to inefficient portfolios.

The non-parametric analysis showed that the regulated fund exhibit low return levels relative

to unregulated funds but did so at high risk levels compared to regulated funds. On a risk-adjusted basis it was evident regulated funds outperformed their counter parts. Hence, the study can conclude that Regulation 28 funds results to an increase in the welfare of an investment through prudent management of asset allocation.

The correlations effect showed some interesting results, international equity, emerging markets and African (exSA) markets all showed a positive correlation with domestic equity. The offshore bonds and offshore cash had a negative correlation with domestic equity due to the currency effect a phenomenon well documented by prior studies. This makes offshore bonds and offshore cash attractive for diversification purposes. The gold asset class also had some interesting characteristics, throughout the sample period it showed a positive correlation with the domestic equity and the relationship was positive during expansion period as well. In the contraction period it showed a negative correlation with domestic asset classes which makes it a safe haven for investors.

For further studies, it would be advisable for researchers to look at the alternative assets such as hedge funds and their impact. Currently there is little data available, hence, could not be considered in this study. The study made a number of assumptions such as no short selling, assumed investors invested in the various market indices. It would be wise to look the impact of short selling would have and also look at the ability of stock picking as oppose to investing in market indices.

7

Bibliography

1. Bradfield, D., Munro, B. & Silberman,K. 2010. Sa gentlemen prefer foreign bonds - (in their allocation to foreign assets)? Cadiz:1-6.

2. Bradfield, D., & Munro, B. (2011). Lowering the bar on the foreign allowance to 25%: tacktical and strategic implcations for asset managers. *Cadiz*, 1-5.

3. Brinson, G. P., Hood, R. L. & Beeboweer, G. L. 1986. Determinants of Porfolio Performance. *Finacial Analyst Journal*. 42(4):133-138.

4. Brinson, G. P., Singer, B. D. & Beebower, G. L. 1991. Determinants of Porfolio Performance. *Financial Analyst Journal*.42(4): 40-48.

5. Burtless, G. 2007. International investments for retirement savers:Historical evidence on risk and return. *Centre for retirement research working paper*.1-44.

6. Cairns, P. 2015. How have Sa's top Reg 28 funds peformed? Cape Town, South Africa:http://www.moneyweb.co.za/investing/how-have-sas-top-reg-28-funds performed.

7. Cairns , P. 2015. SA's top performing equity funds. Cape Town, South Africa. http://www.moneyweb.co.za/uncategorized/sas-top-performing-equity-funds-2/.

8. Campher, L. (2010). Association for Savings and Investment South Africa (ASISA) & Actuarial Society of South Africa . *Joint Media Release* , 1-3.

9. Fama, E. F. 1970. Efficinet Capital Market: A Review of Theory and Emperical Work. *American Finance Association. 25(2*): 383-417.

10. Hensel, C. R., Ezra, D. D. & Ilkiw, J. H. 1991. The importance of asset allocation decison. *Financial analyst journal. 47(3):* 65-72.

11. Ibbotson, R. G. & Kaplan, P. D. 2000. Does Asset Allocation Policy Return Explain 40,90,100% of performance. *Financial Analyst Journal. 56(1)*:10-11.

12. Markowitz, H. 1952. Portfolio Selection. *The Journal of Finance. 7(1)*:77-91.

13. Pfau, W. D. 2008. Emerging pension funds and international diversification.*Economic issues*.14(2):1-18.

14. Swartz , J. 2004. Strategic Asset Allocation: Assessing the probailities if beating absolute return targets. *Cadiz*: 1-27.

15. Swartz, J. & Munro, B. 2006. Asset allocation - how much abroad? A strategic perspective. *Cadiz*, 1-15.

16. Tobin, J. 1958. Liquidity prefrence as behaviour towards risk. *Review of economic studies*. 65-86.

17. Van Heerden, J. D. & Koegelenberg, F. J. 2013. Optimal Asset Allocation strategies for South African pension funds. *Journal of Studies in Economics and Econometrics*. 37(1): 29-53.

8

Appendix

Appendix 1: Regulation 28 constraints

	Column 1			Column 2	
Item	Categories of assets			Limits being the maximum percentage of aggregate fair value of total assets of fund	
				Per issuer/entity, as applicable	For all issuers/ entities
1.	CASH				100%
1.1	Notes and coins; any balance or deposit in an account held with a South African bank; A money market instrument issued by a South African bank including an Islamic liquidity management financial instrument; Any positive net balance in a margin account with an exchange; and Any positive net balance in a settlement account with an exchange, operated for the buying and selling of assets.			25%	100%
1.2	Any balance or deposit held with a foreign bank; A money market instrument issued by a foreign bank including an Islamic liquidity management financial instrument;			5%	
2.	DEBT INSTRUMENTS INCLUDING ISLAMIC DEBT INSTRUMENTS				100% for debt instruments issued by or guaranteed by the Republic, otherwise 75%
2.1	Inside the Republic and foreign assets				
	(a)	Debt instruments issued by, and loans to, the government of the Republic, and any debt or loan guaranteed by the Republic			100%
	(b)	Debt instruments issued or guaranteed by the government of a foreign country		10%	
	(c)	Debt instruments issued or guaranteed by a South African bank against its balance sheet: -			75%
		(i)	listed on an exchange with an issuer market capitalisation of R20 billion or more, or an amount or conditions as prescribed	25%	

		(ii)	listed on an exchange with an issuer market capitalisation of between R2 billion and R20 billion, or an amount or conditions as prescribed	15%	
		(iii)	listed on an exchange with an issuer market capitalisation of less than R2 billion, or an amount or conditions as prescribed	10%	
		(iv)	not listed on an exchange	5%	25%
	(d)	Debt instruments issued or guaranteed by an entity that has equity listed on an exchange, or debt instruments issued or guaranteed by a public entity under the Public Finance Management Act, 1999 (Act No. 1 of 1999) as prescribed: -		10%	50%
		(i)	listed on an exchange	10%	50%
		(ii)	not listed on an exchange	5%	25%
	(e)	Other debt instruments: -		5%	25%
		(i)	listed on an exchange	5%	25%
		(ii)	not listed on an exchange	5%	15%
3.	EQUITIES				75%
3.1	Inside the Republic and foreign assets				
	(a)	Preference and ordinary shares in companies, excluding shares in property companies, listed on an exchange: -			75%
		(i)	issuer market capitalisation of R20 billion or more, or an amount or conditions as prescribed	15%	
		(ii)	issuer market capitalisation of between R2 billion and R20 billion, or an amount or conditions as prescribed	10%	
		(iii)	issuer market capitalisation of less than R2 billion, or an amount or conditions as prescribed	5%	
	(b)	Preference and ordinary shares in companies, excluding shares in property companies, not listed on an exchange		2.5%	10%

4.	IMMOVABLE PROPERTY				25%
4.1	Inside the Republic and foreign assets				
	(a)	Preference shares, ordinary shares and linked units comprising shares linked to debentures in property companies, or units in a Collective Investment Scheme in Property, listed on an exchange:-			25%
		(i)	issuer market capitalisation of R10 billion or more, or an amount or conditions as prescribed	15%	
		(ii)	issuer market capitalisation of between R3 billion and R10 billion, or an amount or conditions as prescribed	10%	
		(iii)	issuer market capitalisation of less than R3 billion, or an amount or conditions as prescribed	5%	
	(b)	Immovable property, preference and ordinary shares in property companies, and linked units comprising shares linked to debentures in property companies, not listed on an exchange		5%	15%
5.	COMMODITIES				10%
5.1	Inside the Republic and foreign assets				
	(a)	Kruger Rands and other commodities listed on an exchange, including exchange traded commodities: -			10%
		(i)	gold	10%	
		(ii)	each other commodity	5%	
6.	INVESTMENTS IN THE BUSINESS OF A PARTICIPATING EMPLOYER INSIDE THE REPUBLIC IN TERMS OF: -				
	(a)	section 19(4) of the Pension Funds Act			5%
	(b)	To the extent it has been allowed by an exemption in terms of section 19(4A) of the Pension Funds Act			10%
7.	HOUSING LOANS GRANTED TO MEMBERS IN ACCORDANCE WITH THE PROVISIONS OF SECTION 19(5)				95%

8.	HEDGE FUNDS, PRIVATE EQUITY FUNDS AND ANY OTHER ASSET NOT REFERRED TO IN THIS SCHEDULE				15%
8.1	Inside the Republic and foreign assets				
	(a)	Hedge funds			10%
		(i)	Funds of hedge funds	5% per fund of hedge funds	
		(ii)	Hedge funds	2.5% per hedge fund	
	(b)	Private equity funds			10%
		(i)	Funds of private equity funds	5% per fund of private equity funds	
		(ii)	Private equity funds	2.5% per private equity fund	
	(c)	Other assets not referred to in this schedule and excluding a hedge fund or private equity fund			2.5%

Source: www.fsb.co.za

Appendix 2: Asset allocations including emerging markets (31 Jan 1988 to June 2015)

Average return	17,00	16,00	15,50	15,00	14,50	14,00	13,70
Standard Deviation	3,70	2,99	2,70	2,46	2,31	2,24	2,31
Annual Standard Deviation	12,80	10,36	9,34	8,5328	7,9873	7,7746	7,9869
Sharpe Ratio	0,45	0,46	0,45	0,44	0,41	0,35	0,31
Bonds	8,8%	34,5%	47,3%	60,2%	73,0%	85,8%	96,0%
Equity	19,5%	12,1%	8,4%	4,7%	1,1%	0,0%	0,0%
Property	59,9%	41,2%	31,8%	22,5%	13,1%	2,6%	0,0%
Emerging markets	11,8%	12,2%	12,4%	12,6%	12,8%	11,7%	4,0%

Appendix 3: Correlation of major asset classes during expansion period (31 January 1988 to 31 December 2001)

	Cash	Bonds	Equity	property	Gold	Foreign Cash	Foreign Bonds	Foreign Equity	rand returns
Cash	1,00								
Bonds	0,02	1,00							
Equity	-0,09	0,36	1,00						
property	-0,03	0,33	0,35	1,00					
Gold	-0,18	-0,16	0,13	-0,15	1,00				
Foreign Cash	-0,09	-0,43	-0,08	-0,14	0,43	1,00			
Foreign Bonds	-0,06	-0,38	-0,13	-0,14	0,40	0,86	1,00		
Foreign Equity	-0,05	-0,13	0,36	0,07	0,19	0,50	0,52	1,00	

Appendix 4: Correlation of major asset classes during contraction period (31 January 2002 to 30 June 2015)

	Cash	Bonds	Equity	property	Gold	Foreign Cash	Foreign Bonds	Foreign Equity
Cash	1,00							
Bonds	0,11	1,00						
Equity	-0,23	0,04	1,00					
property	-0,02	0,65	0,25	1,00				
Gold	-0,04	-0,12	-0,11	-0,24	1,00			
Foreign Cash	-0,11	-0,34	-0,12	-0,30	0,50	1,00		
Foreign Bonds	0,12	-0,21	-0,05	-0,21	0,45	0,78	1,00	
Foreign Equity	-0,35	-0,28	0,53	-0,08	0,02	0,48	0,40	1,00