

**THE IMPACT OF FUND ATTRIBUTES ON THE  
PERFORMANCE OF SOUTH AFRICAN COLLECTIVE  
INVESTMENT SCHEMES: A PANEL DATA ANALYSIS**

Research Report

by

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## DECLARATION

I, Anne Taylor, declare that this research report is my own unaided work. It is submitted in partial fulfilment of the requirements for the degree of Master of Commerce in Finance at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.



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Signature

28 February 2022

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Date

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## ABSTRACT

With the heightened attention on collective investment schemes (CISs) as attractive investment vehicles, the performance of CISs and the factors that could potentially influence this performance has become increasingly important. As such, the extent to which fund attributes affect fund performance has been widely researched by practitioners and scholars. In contrast to the extensive research that has been conducted on fund attribute-performance relationships of funds operating in developed international markets, limited literature exists within a South African context. Accordingly, this study attempts to identify favourable fund attributes within the South African CIS environment by providing empirical evidence on the impact that fund attributes, namely size, family size, age, and expense ratios, have on the performance of South African CISs by employing panel data methodologies. Specifically, a sample of 175 South African–Equity–General classified funds as per the Association for Savings and Investment South Africa Classification Standard are analysed over the period January 2000 to September 2021.

Pooled ordinary least squares, fixed effects, and random effects models are estimated when fund performance is measured as total return, the Treynor ratio, Sharpe ratio, information ratio, and Jensen's alpha. The results indicate that fund size and age are significantly negatively related to performance. Contrarily, fund family size impacts performance in a significant positive manner whereas fund expense ratios have an insignificant influence on performance. Hence, the most favourable South African–Equity–General CIS based on its fund attributes is a younger and smaller fund belonging to a larger fund family. The observed fund attribute-performance relationships of South African CISs conform with that of international funds identified in other studies with the exception of the fund expense ratio attribute in which a significant negative relationship has primarily been reported. The findings of this study provide valuable insights to the South African CIS repository of academic knowledge. Furthermore, the results may assist investors of CISs to identify funds with favourable attributes in an attempt to enhance their returns. CIS institutions and managers of funds that possess favourable attributes can also use the results as part of their marketing campaigns to promote their favourable fund characteristics.

## TABLE OF CONTENTS

LIST OF TABLES .....	V
LIST OF FIGURES .....	VII
DEFINITION OF KEY TERMS .....	IX
LIST OF ABBREVIATIONS.....	XII
CHAPTER 1 – INTRODUCTION .....	1
1.1 BACKGROUND .....	1
1.2 PROBLEM STATEMENT .....	2
1.3 PURPOSE STATEMENT .....	4
1.4 RESEARCH OBJECTIVES .....	4
1.5 IMPORTANCE AND BENEFITS OF THE STUDY .....	4
1.6 DELIMITATIONS.....	5
1.7 STRUCTURE OF THE STUDY .....	6
2 CHAPTER 2 – LITERATURE REVIEW.....	7
2.1 INTRODUCTION.....	7
2.2 INVESTMENT COMPANIES .....	7
2.3 COLLECTIVE INVESTMENT SCHEMES.....	10
2.3.1 Definition of collective investment schemes.....	10
2.3.2 History of the development of collective investment schemes .....	11
2.3.3 Advantages and disadvantages of investing in collective investment schemes .....	13
2.3.4 Structure of collective investment schemes .....	15
2.3.5 Categories of collective investment schemes .....	16
2.3.6 Single-strategy funds versus fund of funds .....	18
2.3.7 Active funds versus passive funds .....	19
2.3.8 Classes of collective investment scheme shares.....	20
2.4 CLASSIFICATION OF COLLECTIVE INVESTMENT SCHEMES .....	21
2.4.1 First tier of classification.....	21

2.4.2	Second tier of classification .....	22
2.4.3	Third tier of classification .....	23
2.5	ANALYSIS OF THE SOUTH AFRICAN COLLECTIVE INVESTMENT SCHEME INDUSTRY .....	26
2.5.1	History of the South African collective investment scheme industry .....	26
2.5.2	Asset management companies .....	27
2.5.3	Number of funds and total assets based on the first tier of classification .....	28
2.5.4	Number of funds and total assets based on the second tier of classification .....	30
2.5.5	Number of funds and total assets based on the third tier of classification .....	36
2.6	DETERMINANTS OF COLLECTIVE INVESTMENT SCHEME PERFORMANCE .....	41
2.6.1	Fund size .....	42
2.6.2	Fund family size .....	50
2.6.3	Fund age .....	54
2.6.4	Fund expense ratios.....	58
2.7	SUMMARY .....	65
3	CHAPTER 3 – RESEARCH METHOD.....	67
3.1	INTRODUCTION.....	67
3.2	DATA .....	67
3.2.1	Dependent variables .....	67
3.2.2	Independent variables.....	70
3.2.3	Sample.....	71
3.2.4	Multiple imputation by chained equations for fund expense ratios.....	73
3.3	PANEL DATA METHODOLOGIES .....	75
3.3.1	Features of panel data .....	75
3.3.2	Types of panel data.....	76
3.3.3	Advantages of panel data .....	78
3.3.4	Panel data models .....	78
3.3.5	Robustness tests.....	82

3.3.6	Model specification tests .....	83
3.4	DIAGNOSTIC TESTS .....	87
3.4.1	Stationarity.....	87
3.4.2	Multicollinearity.....	89
3.4.3	Heteroskedasticity .....	91
3.4.4	Serial correlation .....	92
3.5	RESEARCH METHOD LIMITATIONS .....	95
3.6	SUMMARY .....	96
4	CHAPTER 4 – DATA ANALYSIS .....	97
4.1	INTRODUCTION.....	97
4.2	DESCRIPTIVE STATISTICS .....	97
4.3	DIAGNOSTIC TESTS .....	99
4.3.1	Stationarity.....	99
4.3.2	Multicollinearity.....	100
4.3.3	Heteroskedasticity .....	101
4.3.4	Serial correlation .....	102
4.3.5	Correcting for heteroskedasticity and serial correlation.....	103
4.4	RESULTS.....	104
4.4.1	Total return .....	104
4.4.2	Treynor ratio .....	108
4.4.3	Sharpe ratio.....	111
4.4.4	Information ratio .....	115
4.4.5	Jensen’s alpha .....	118
4.5	SUMMARY .....	122
5	CHAPTER 5 – DISCUSSION OF RESULTS .....	123
5.1	INTRODUCTION.....	123
5.2	FUND SIZE .....	123
5.2.1	Results of the present study .....	123
5.2.2	Comparison with previous studies.....	124
5.3	FUND FAMILY SIZE .....	128

5.3.1	Results of the present study .....	128
5.3.2	Comparison with previous studies.....	129
5.4	FUND AGE .....	132
5.4.1	Results of the present study .....	132
5.4.2	Comparison with previous studies.....	133
5.5	FUND EXPENSE RATIOS .....	136
5.5.1	Results of the present study .....	136
5.5.2	Comparison with previous studies.....	137
5.6	SUMMARY .....	140
6	CHAPTER 6 – CONCLUSION AND RECOMMENDATIONS .....	142
6.1	INTRODUCTION.....	142
6.2	SUMMARY OF RESULTS.....	142
6.3	CONCLUSION .....	144
6.4	RECOMMENDATIONS FOR FUTURE RESEARCH .....	145
6.4.1	Increased fund scope.....	146
6.4.2	Increased scope of factors that affect fund performance.....	146
6.4.3	An explanation for the existence of the identified relationships.....	147
	REFERENCES .....	148

## LIST OF TABLES

Table 1: First tier of classification according to the ASISA Fund Classification Standard .....	22
Table 2: Second tier of classification according to the ASISA Fund Classification Standard.....	23
Table 3: Top ten asset management companies based on assets under management as at Q3 2021 .....	28
Table 4: Number of funds and total assets as at Q3 2021 of South African funds according to tier three of the ASISA Fund Classification Standard .....	36
Table 5: Top ten collective investment schemes based on assets under management as at Q3 2021 .....	38
Table 6: Number of funds and total assets as at Q3 2021 of Worldwide funds according to tier three of the ASISA Fund Classification Standard .....	39
Table 7: Number of funds and total assets as at Q3 2021 of Global funds according to tier three of the ASISA Fund Classification Standard .....	40
Table 8: Number of funds and total assets as at Q3 2021 of Regional funds according to tier three of the ASISA Fund Classification Standard .....	41
Table 9: Number of CISs included in the sample over the period of analysis .....	72
Table 10: Panel data matrix example .....	75
Table 11: Panel data matrix of the present study.....	77
Table 12: Descriptive statistics of the measures of fund performance .....	97
Table 13: Descriptive statistics of the fund attributes .....	98
Table 14: Im-Pesaran-Shin panel unit root test on dependent variables .....	99
Table 15: Im-Pesaran-Shin panel unit root test on independent variables.....	100
Table 16: Pairwise correlation matrix of the independent variables .....	101
Table 17: Breusch-Pagan test for heteroskedasticity.....	102
Table 18: Breusch-Godfrey test for serial correlation.....	102

Table 19: The impact of fund attributes on fund performance measured as total return .....	105
Table 20: <i>F</i> -test for fixed effects .....	107
Table 21: Breusch-Pagan test for random effects.....	107
Table 22: The impact of fund attributes on fund performance measured as the Treynor ratio.....	109
Table 23: <i>F</i> -test for fixed effects .....	110
Table 24: Hausman test .....	111
Table 25: The impact of fund attributes on fund performance measured as the Sharpe ratio.....	112
Table 26: <i>F</i> -test for fixed effects .....	114
Table 27: Hausman test .....	114
Table 28: The impact of fund attributes on fund performance measured as the information ratio .....	116
Table 29: <i>F</i> -test for fixed effects .....	117
Table 30: Hausman test .....	118
Table 31: The impact of fund attributes on fund performance measured as Jensen's alpha.....	119
Table 32: <i>F</i> -test for fixed effects .....	121
Table 33: Hausman test .....	121
Table 34: Summary of the impact that fund size has on fund performance .....	123
Table 35: Summary of the impact that fund family size has on fund performance .	128
Table 36: Summary of the impact that fund age has on fund performance .....	132
Table 37: Summary of the impact that fund expense ratios have on fund performance .....	137
Table 38: Summary of main findings .....	142

## LIST OF FIGURES

Figure 1: Structure of a collective investment scheme.....	16
Figure 2: Classification of South African funds according to the ASISA Fund Classification Standard .....	24
Figure 3: Classification of Worldwide funds according to the ASISA Fund Classification Standard.....	25
Figure 4: Classification of Global funds according to the ASISA Fund Classification Standard.....	25
Figure 5: Classification of Regional funds according to the ASISA Fund Classification Standard.....	26
Figure 6: Number of funds according to tier one of the ASISA Fund Classification Standard.....	29
Figure 7: Total assets according to tier one of the ASISA Fund Classification Standard .....	29
Figure 8: Total assets according to tier one of the ASISA Fund Classification Standard divided between retail and institutional funds .....	30
Figure 9: Number of South African funds according to tier two of the ASISA Fund Classification Standard .....	31
Figure 10: Total assets of South African funds according to tier two of the ASISA Fund Classification Standard .....	32
Figure 11: Number of Worldwide funds according to tier two of the ASISA Fund Classification Standard .....	32
Figure 12: Total assets of Worldwide funds according to tier two of the ASISA Fund Classification Standard .....	33
Figure 13: Number of Global funds according to tier two of the ASISA Fund Classification Standard .....	34
Figure 14: Total assets of Global funds according to tier two of the ASISA Fund Classification Standard .....	34

Figure 15: Number of Regional funds according to tier two of the ASISA Fund Classification Standard .....	35
Figure 16: Total assets of Regional funds according to tier two of the ASISA Fund Classification Standard .....	36

## DEFINITION OF KEY TERMS

Adjusted $R^2$	A modified version of $R^2$ which measures the goodness-of-fit of a regression model that is adjusted for degrees of freedom, and thus, does not automatically increase when another independent variable is added to a regression model (DeFusco, McLeavey, Pinto, & Runkle, 2015b).
Assets under management	The total market value of the assets managed by a fund (Riley & Brown, 2015b).
Collective investment scheme	An investment vehicle that pools the capital of numerous investors to collectively invest in a range of financial securities with each investor entitled to a proportional share of the net benefits of ownership of the underlying assets (van Wyk, Botha, & Goodspeed, 2015).
Cross-sectional data	Observations on many individuals at a certain point of time (Xu, Lee, & Eom, 2007).
Fund age	The number of days, months, or years that a fund has existed which is measured since its inception date (Ferreira, Keswani, Miguel, & Ramos, 2013).
Fund attributes	Characteristics of a fund such as its age, flows, fees or expenses, size, and turnover, amongst others (Ferreira et al., 2013).
Fund expense ratios	The percentage of a fund's assets deducted annually for expenses, including management fees, administrative fees, and operating costs, but not including security trading fees (Ferreira et al., 2013).
Fund family size	The total assets under management of the institution or asset management company that a fund belongs to (Ferreira et al., 2013).
Fund size	The total assets under management of a fund (Ferreira et al., 2013).

Generalised least squares	A regression estimation technique that addresses unequal or non-constant variance of the idiosyncratic errors across observations (DeFusco et al., 2015b).
Information ratio	A measure of risk-adjusted performance calculated as a fund's return in excess of the benchmark relative to the variability of that excess return (Bailey, Richards, & Tierney, 2007).
Investment objectives	Desired investment outcomes primarily pertaining to return and risk (Maginn, Tuttle, McLeavey, & Pinto, 2007).
Jensen's alpha	A measure of risk-adjusted performance that represents a fund's differential return compared to the return required to compensate for the systematic risk assumed by the fund (Bailey et al., 2007).
Ordinary least squares	A regression estimation technique used to estimate the parameters in a regression model (DeFusco, McLeavey, Pinto, & Runkle, 2015a).
Panel data	Combines both time series and cross-sectional data with observations on many individuals at different time intervals (Brooks, 2008; Xu et al., 2007).
Performance	An evaluation of how well a fund has been managed and operated which can be measured using total return or risk-adjusted performance measures (Ferreira et al., 2013).
$R^2$	Measures the fraction of the total variation in the dependent variable that is explained by the independent variable or variables in a regression model (DeFusco et al., 2015a).
Sharpe ratio	A measure of risk-adjusted performance that compares the excess return of a fund to its total risk where total risk is measured by the fund's standard deviation of returns and is also referred to as the reward-to-variability ratio (Bailey et al., 2007).
Time series data	Observations on an individual at multiple time intervals (Xu et al., 2007).

Total return	The change in the market value of a fund adjusted for dividends, capital appreciation, and fees and expenses during the measurement period expressed as a percentage of the capital employed in the fund over the measurement period (Riley & Brown, 2015a).
Treynor ratio	A measure of risk-adjusted performance that relates a fund's excess returns to the systematic risk assumed by the fund and is also referred to as the reward-to-volatility ratio (Bailey et al., 2007).

## LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ASISA	Association for Savings and Investment South Africa
AUM	Assets under management
CIS	Collective investment scheme
CISCA	Collective Investment Schemes Control Act 45 of 2002
FSCA	Financial Sector Conduct Authority
GLS	Generalised least squares
LM	Lagrange multiplier
OLS	Ordinary least squares
SEC	Securities and Exchange Commission
TER	Total expense ratio
U.S.	United States

# CHAPTER 1 – INTRODUCTION

## 1.1 BACKGROUND

Collective investment schemes (CISs<sup>1</sup>), also referred to as mutual funds or unit trusts in other countries, play an increasingly important role in financial markets around the world (Prather, Bertin, & Henker, 2004). Investor demand for CISs has grown considerably due to the fact that these investment products provide individuals with a relatively inexpensive opportunity of investing in capital markets as well as access to professional management and oversight of their investment portfolios (Kaur, 2018; Low, 2010). Importantly, CISs are one of the most favoured investment vehicles for individuals to invest in as a means to meet their investment objectives (Prather et al., 2004; Rehman, Khan, Shah, & Khan, 2018). The primary motivations for individuals investing their money is to save so as to meet future cash needs and/or to increase their wealth (Goetzmann, 1996). In order to achieve this, many investors rely on CISs due to the fact that they are an attractive investment option that provides the benefit of risk diversification to investors with limited capital (Investment Company Institute, 2021a; Kaur, 2018; Rehman et al., 2018).

Considerable growth of CISs has occurred in most financial markets around the world. Evidence of the popularity of these investment vehicles is the size of the assets under management (AUM) of funds worldwide. The International Investment Funds Association (2021) report that as at Q3 2021, total worldwide assets invested in open-ended funds totalled US\$68.23 trillion, with the Americas accounting for US\$35.66 trillion (52.25%), Europe accounting for US\$22.74 trillion (33.32%), Asia-Pacific accounting for US\$9.65 trillion (14.14%), and Africa accounting for US\$0.20 trillion (0.29%) of the total AUM of worldwide open-ended funds. Notably, the fund market in the United States is the largest in the world with many investors having ownership of U.S.-registered funds (Investment Company Institute, 2021a). Similar to the United States, CISs also serve as popular investment vehicles in South Africa. Despite the overall size of the South African CIS industry being considerably smaller to that of the

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<sup>1</sup> Note that the terms 'CIS', 'scheme', and 'fund' are used interchangeably throughout this study and all refer to collective investment schemes.

United States, it is still a developing industry that has seen exponential growth. Specifically, the CIS industry in South Africa has grown from R600 000 worth of AUM when the first CIS was launched in 1965 to approximately R2.96 trillion of AUM across 1 685 different local CISs as at Q3 2021 (ASISA, 2021; Meyer-Pretorius & Wolmarans, 2006).

The popularity of CISs as investment vehicles coupled with the variability of performance across different CISs has led practitioners and scholars<sup>2</sup> to study fund performance as well as the factors that influence fund performance. Particularly, the impact that fund characteristics have on performance has been widely researched in an attempt to explain superior or inferior fund performance (Filip, 2018). The majority of studies that have been conducted in this regard have focused on the CIS industries of developed economies. Conversely, extensive empirical research on the relationship between fund attributes and fund performance has not been conducted within the context of the emerging economy of South Africa. Considering that investors search for investment strategies that maximise their returns, information on the fund attributes that contribute to performance in a positive or negative way is of significant relevance to investors who are selecting CISs to form part of their investment portfolios (Kaur, 2018; Low, 2010; Yin-Ching & Mao-Wei, 2003). Consequently, this study seeks to shed light on the fund attribute-performance relationships prevalent in the South African CIS market with the aim of identifying favourable fund characteristics.

## **1.2 PROBLEM STATEMENT**

In light of the continued growth of the South African CIS industry, it is evident that this industry plays a very important role in the functioning of the South African financial market. Emphasising its importance is the fact that many individual and institutional investors use South African CISs as investment vehicles to achieve savings and investment objectives. This is evidenced by the billions of Rands invested into South African CISs. Recently, CISs operating in South Africa recorded annual net inflows of R212.84 billion for the year ended 2020, the highest annual net inflows ever recorded

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<sup>2</sup> See, for example, Brown and Goetzmann (1995), Carhart (1997), Chevalier and Ellison (1997), Grinblatt and Titman (1989), Gruber (1996), Hendricks, Patel, and Zeckhauser (1993), Ippolito (1989), Jensen (1968), Malkiel (1995), and Sharpe (1966).

over the industry's 55 year history (ASISA, 2021). Due to the increased importance and popularity of these investment vehicles, the performance of CISs is of considerable importance to financial market participants seeking to enhance their investment returns. Hence, it is necessary that investors understand the factors that affect fund performance and the extent to which these factors affect this performance (Low, 2010). Examples of factors that have been analysed as potential determinants of fund performance includes fund attributes (for example, size, flows, fees, turnover, and age, amongst others) and country characteristics (for example, financial development, economic development, investor protection, and quality of legal institutions, amongst others) (Ferreira et al., 2013). For the purposes of this study, fund attributes as a determinant of South African CIS performance are investigated.

Numerous international studies<sup>3</sup> have analysed the influence of fund attributes on fund performance. These studies have examined a host of fund attributes such as fund and family size, flows, fees and expenses, turnover, age, net asset value, and characteristics of the fund manager including tenure, education, number of funds under management, and management structure, amongst others. Research in this regard has primarily been conducted on funds operating in the United States and, to a lesser extent, funds operating in European, Asian, and Australian markets. The findings of these international studies on the relationship between fund attributes and fund performance is mixed and varies considerably depending on the countries, types of funds, and sample periods analysed. Nevertheless, very limited research on fund attribute-performance relationships have been conducted within an African context. Intuitively, the international results cannot be applied or might not be relevant in terms of African countries, such as South Africa, since these countries are emerging economies with their own unique CIS industries.

The mixed results of international studies on the impact that fund attributes have on fund performance in addition to the limited South African research in this regard lead to the undertaking of this study. Therefore, this study can be viewed as a first attempt

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<sup>3</sup> See, for example, Chen, Hong, Huang, and Kubik (2004), Dahlquist, Engström, and Söderlind (2000), Droms and Walker (1996), Ferreira et al. (2013), Filip (2018), Kaur (2018), Otten and Bams (2002), Payne, Prather, and Bertin (1999), and Yap and Pierce (2008).

to identify favourable fund attributes within the South African CIS landscape. The results thereof will be particularly advantageous to investors seeking to invest in South African CISs with superior performance so as to maximise their expected returns.

### **1.3 PURPOSE STATEMENT**

The main purpose of this study is to determine the relationship between numerous fund attributes and the performance of South African CISs, specifically South African–Equity–General classified funds, through the use of panel data methodologies with the intention of identifying favourable fund attributes. The attributes analysed in this study include fund size, family size, age, and expense ratios.

### **1.4 RESEARCH OBJECTIVES**

The research objectives that direct this study include:

- To determine whether statistically significant relationships exist between the various fund attributes under investigation and the performance of South African CISs.
- If significant relationships are observed between the analysed fund attributes and the performance of South African CISs, this study aims to ascertain the direction of these relationships.
- After meeting the above objectives, this study then seeks to establish whether the identified fund attribute-performance relationships of South African CISs conform with that of international funds observed in other studies.

### **1.5 IMPORTANCE AND BENEFITS OF THE STUDY**

The South African CIS industry has grown considerably over the past five and a half decades since the launch of the first CIS. To the author’s knowledge, there has only been restricted studies on the impact that fund size has on the performance of South African CISs with no studies having researched the influence that other fund attributes, such as family size, age, and expense ratios, have on the performance of South African CISs. Given this limited literature within a South African context, a study in this regard is not only relevant but also necessary. The information gleaned from this study will add valuable insights to the existing repository of academic knowledge. Particularly, the results will allow for the identification of the similarities and differences

between the fund attribute-performance relationships of South African CISs compared to funds operating in international markets.

Gaining an understanding of the impact that various fund attributes have on the performance of South African CISs will also lead to several practical benefits for CIS investors and managers. The findings will establish whether investors should consider fund attributes when deciding between different CIS alternatives. Moreover, current and prospective investors of CISs can use the results of this study in their investment decision-making process regarding which type of CIS is favourable based on the fund's attributes and the impact that such attributes have on its performance. Furthermore, the findings will be beneficial to CIS fund managers and the institutions, or fund families, that these funds belong to. Managers of funds that possess favourable attributes can use the results as part of their marketing campaigns to promote their funds in an attempt to gain a competitive advantage and make funds more attractive to investors.

## **1.6 DELIMITATIONS**

This study has various delimitations that must be mentioned. The study is limited to the analysis of only South African–Equity–General classified funds as per the Association for Savings and Investment South Africa (ASISA) Fund Classification Standard for the period January 2000 to September 2021. Thus, not all South African CISs that operated during this time period are analysed. For example, South African CISs classified as Multi Asset, Real Estate, or Interest Bearing funds as well as the other sub-categories of CISs classified as Equity funds are not investigated. Additionally, this study addresses how four fund attributes, namely fund size, family size, age, and expense ratios, impacts the performance of South African–Equity–General CISs. The aforementioned attributes are examined since they are the most widely investigated characteristics in prior literature. Analysing these fund attributes allows the results of the present study to be easily compared to that of previous studies to identify whether the performance of South African CISs are impacted by fund attributes in a similar manner to funds operating in international markets. Other fund attributes such as flows, turnover, trading activity, and management structure are not addressed in this study.

## **1.7 STRUCTURE OF THE STUDY**

This research report contains six main chapters with each having several sections. The next chapter, Chapter 2, provides an overview of CISs and analyses the relevant literature pertaining to the impact that various fund attributes have on the performance of these schemes. Following this, Chapter 3 describes the research methodology employed to conduct the study. The data is then analysed in Chapter 4 whereafter the overall findings are reviewed in Chapter 5. Subsequently, the conclusion and recommendations for future research are outlined in Chapter 6.

## **CHAPTER 2 – LITERATURE REVIEW**

### **2.1 INTRODUCTION**

A study on the impact that fund attributes have on the performance of South African collective investment schemes (CISs) first necessitates a detailed overview of what CISs are. As such, a description on investment companies is provided in this chapter whereafter CISs as important investment vehicles are defined and elaborated on. Following this, the classification of CISs is outlined with emphasis being placed on the way in which CISs are classified in South Africa. Thereafter, an analysis of the South African CIS industry is conducted. With the aforementioned foundational background and understanding of CISs, this chapter then scrutinises the existing literature pertaining to the influence that fund attributes have on the performance of these investment vehicles.

### **2.2 INVESTMENT COMPANIES**

The motives behind individuals investing and constructing portfolios are plentiful and differs for each due to their unique financial situations (Chaurasia, 2017). The investment planning of many individuals includes, for example, investing to start a business, saving towards purchasing a house, providing for their children's education, or accumulating sufficient funds for an income in retirement (Investment Company Institute, 2021a). The investment needs of individuals also differs considerably from person to person (Chaurasia, 2017). For instance, some individuals invest for growth and will thus invest in assets that have the potential for capital gains whereas others, such as retirees, invest primarily for income to fund retirement needs, and therefore, may prefer to invest in fixed-income assets or dividend-paying shares.

Regardless of the ultimate goal, each individual accepts the responsibility of ensuring that they are able to meet their financial needs at various stages of their life (Canova, Rattazzi, & Webley, 2005; Moreland, 2018; Zeka, Antoni, Goliath, & Lillah, 2016). However, the challenge faced by all individual investors is to find the right set of investment products to meet their desired needs. The skills required in order to make appropriate investment decisions, the complex nature of financial products and

markets, and the diverse set of investment products available to investors makes this process a difficult one (Fischer & Gerhardt, 2007; Marsden, Zick, & Mayer, 2011; Nguyen, Gallery, & Newton, 2016). In light of the unique set of challenges faced by investors, many individuals seek external financial advice from professional financial service providers in order to make appropriate financial decisions on their behalf (Fischer & Gerhardt, 2007; Marsden et al., 2011; Nguyen et al., 2016).

An example of such a financial service provider includes investment companies (also known as investment trusts) which offer investors a variety of financing options. Specifically, an investment company is a type of fund that pools the capital of numerous individual and/or institutional investors in order to invest in a range of financial securities on a collective basis (Riley & Brown, 2015b). Millions of investors worldwide pursue investment goals using these investment companies (Khorana, Servaes, & Tufano, 2005). Adding to the popularity of investment companies is the fact that they are characterised as transparent investment vehicles that invest in identifiable financial instruments which are regularly marked-to-market (Khorana et al., 2005). A key benefit of investing in an investment company is that it provides investors the opportunity to combine their money with that of other investors in order to gain exposure to a wide range of financial instruments that might have otherwise been difficult to access in the investors own individual capacity. Further, instead of assembling a portfolio on their own, investors entrust investment companies with the selection and management of their investment portfolios. An investment company's performance is driven by the financial performance of the underlying securities and other assets that it owns. Notably, each investor has a pro-rata claim on any of the profits and losses incurred by the investment company (Riley & Brown, 2015b).

In the United States, investment companies are overseen by the Securities and Exchange Commission (the U.S. SEC) under the regulation of the Investment Company Act of 1940. The U.S. SEC (2013) categorise investment companies into three main types: open-ended companies, closed-ended companies, and unit investment trusts, with each type having its own distinct features. Open-ended companies do not have a limit on the number of units issued which infers that shares can be redeemed or additional shares can be issued at a value equivalent to the fund's net asset value at the time of investment. Over the past few decades, there has been

rapid growth globally in the assets under management (AUM) of these types of investment companies (Khorana et al., 2005). According to the International Investment Funds Association (2021), worldwide regulated open-ended fund assets totalled US\$68.23 trillion as at Q3 2021.

Similar to open-ended companies, the shares of unit trusts are also redeemable with investors buying or selling shares whenever they desire. The primary difference between open-ended companies and unit trusts, however, lies in their structure. With an open-ended company, the directors of the company are responsible for ensuring that the fund manager and custodian perform their duties in conformity with the constituent documents and adhere to their fiduciary responsibilities toward investors whereas a unit trust does not follow such a structure (Meyer-Pretorius & Wolmarans, 2006). Rather, a unit trust is established under a trust deed with the trust company overseeing the unit trust. The end result for investors is the same under each structure since both open-ended companies and unit trusts serve as savings and investment vehicles that offer investors the opportunity to outsource their investment decisions to professional fund managers (Meyer-Pretorius & Wolmarans, 2006).

In contrast to open-ended companies and unit trusts, closed-ended companies are funds with limited share capital. Consequently, closed-ended companies issue a fixed number of shares, and thus, no new investment money is accepted into the fund. New investors of closed-ended companies invest by buying existing shares from investors selling their shares. Similarly, investors liquidate their position in the fund by selling their shares to other investors on the secondary market at a price determined by the market. Closed-ended funds account for a much smaller percentage of the total net asset value of all funds worldwide compared to open-ended funds (Investment Company Institute, 2021b).

This study focuses on unit trusts which are commonly referred to as CISs in South Africa. Accordingly, the following section provides a detailed analysis of CISs.

## **2.3 COLLECTIVE INVESTMENT SCHEMES**

To form a holistic understanding of this study, it is imperative to comprehend what CISs are. Therefore, the definition of CISs, the history of the development of CISs, the advantages and disadvantages of investing in CISs, and the structure of CISs are discussed in this section. This is followed by an explanation on the categories of CISs and the ways in which CISs can be differentiated. Particularly, the investment strategies followed by CISs, the way in which CISs are managed, and the classes of CIS shares are detailed.

### **2.3.1 Definition of collective investment schemes**

In South Africa, the regulatory body responsible for the jurisdiction of the CIS industry is the Financial Sector Conduct Authority (FSCA). The FSCA is an independent organisation that was established by the Financial Sector Regulation Act 9 of 2017 with the primary purpose of regulating and supervising the financial services industry (FSCA, 2021). Notably, the Financial Services Board was replaced with the FSCA on 1 April 2018. The FSCA oversees the CIS industry in South Africa through the administration of the Collective Investment Schemes Control Act 45 of 2002, the Cisca (2002), which became effective on 3 March 2003 by replacing the Unit Trust Control Act 54 of 1981 (du Randt, 2015). The Cisca (2002) states that a CIS:

“...means a scheme, in whatever form, including an open-ended investment company, in pursuance of which members of the public are invited or permitted to invest money or other assets in a portfolio, and in terms of which:

- (a) two or more investors contribute money or other assets to and hold a participatory interest in a portfolio of the scheme through shares, units, or any other form of participatory interest; and
- (b) the investors share the risk and the benefit of investment in proportion to their participatory interest in a portfolio of a scheme or on any other basis determined in the deed, but not a collective investment scheme authorised by any other Act...”.

Upon analysing the definition of a CIS as per the Cisca (2002) above, it is evident that CISs are investments in which a group of investors' money is pooled and then invested in a range of financial assets on their behalf to form a CIS portfolio. Investors

of CISs invest either single or periodic lump sums (subject to the particular CISs stipulated minimum investment amount) or make monthly investments (du Randt, 2015). CISs take different levels of risk, and as such, invest in different types of financial assets. The investment portfolio of CISs represents the assets owned by the fund which is managed by a professional fund manager who makes all the decisions in terms of which investments are appropriate to buy and sell given the mandate and risk level of the fund.

A CIS is divided into equally priced uniform participatory interests, hence, investors share in the scheme's risk (losses and expenses) and benefits (gains and income) on a proportional basis. The number of participatory interests held by an investor represents their proportionate share of the scheme's overall assets and is determined by how much money they have invested into the scheme. The price of an investor's participatory interest is dependent upon the value of the assets that are held in the portfolio. Thus, the price of a participatory interest will fluctuate with movements in the market value of these assets (du Randt, 2015). Prices of a scheme's participatory interests are calculated each day and are made available to the public through the media. Important to note is that both buy and sell prices are calculated for each participatory interest with buying prices typically being 5% to 7% higher than selling prices (du Randt, 2015). The difference between these two prices is referred to as the spread and accrues to the CIS manager. It must be highlighted that the Cisca (2002) adjusted the term 'unit trust' to 'collective investment scheme'. Accordingly, rather than referring to 'a unit' in a 'unit trust fund', the Act now refers to 'a participatory interest' in a 'scheme'. Despite the adjustment in terminology, investors have persisted to allude to 'units' and 'unit trusts' (du Randt, 2015). Given the definition of CISs, the history of the development of CISs is explained below.

### **2.3.2 History of the development of collective investment schemes**

Investment vehicles that pool investors' money together originally emerged in the 18<sup>th</sup> century in the Netherlands when a broker from Amsterdam, Abraham van Ketwich, invited subscriptions to a fund in July 1774 (Rouwenhorst, 2005). The fund was named Eendragt Maakt Magt which translates to 'unity creates strength'. This fund invested in foreign government bonds as well as plantation loans in the West Indies which were

an early version of today's mortgage-backed securities. Eendragt Maakt Magt, exhibiting similar characteristics to modern close-ended mutual funds, issued 2 000 shares that were bought by members of the public whereafter participation in the fund could only be obtained by purchasing existing shares from shareholders of the fund in the open market (Rouwenhorst, 2005). Most details known about Eendragt Maakt Magt comes from a manuscript copy of the prospectus of the fund which is kept in the Amsterdam City municipal archives. From this prospectus, it is believed that van Ketwich created the fund to provide smaller investors the opportunity to invest in a diversified portfolio of securities who would not have been able to gain exposure to such diversification in their individual capacity (Rouwenhorst, 2005).

Following the success of Eendragt Maakt Magt, another fund named Voordeelig en Voorsigtig translating to 'profitable and prudent' was founded in 1776 by a group of bankers in Utrecht in the Netherlands. The prospectus of Voordeelig en Voorsigtig reflects the diversification sentiment of Eendragt Maakt Magt with the investment list of Voordeelig en Voorsigtig mirroring that of Eendragt Maakt Magt (Rouwenhorst, 2005). Nevertheless, a distinguishing feature of Voordeelig en Voorsigtig was that it invested in the shares of Eendragt Maakt Magt suggesting that it was a form of a fund of funds. In 1779, van Ketwich established his second fund named Concordia Res Parvae Crescunt which translates to 'in harmony small things grow' and is the Latin origin of Eendragt Maakt Magt (Rouwenhorst, 2005). A differentiating factor of this fund compared to van Ketwich's first fund was its investment strategy. As stated in its prospectus, Concordia Res Parvae Crescunt invested in securities with prices below their intrinsic value. This implies that Concordia Res Parvae Crescunt exhibited a similar investment philosophy to modern value mutual funds (Rouwenhorst, 2005). Eendragt Maakt Magt was dissolved in 1824, 50 years after its inception, with Concordia Res Parvae Crescunt being dissolved in 1893, 114 years after its inception, making it one of the longest-lived funds ever to have existed in the history of mutual funds.

Many other funds were established in the Netherlands after the inception of the aforementioned funds during the 1780s and 1790s (Rouwenhorst, 2005). These funds primarily invested in the debt of the United States. The first known fund established outside of the Netherlands was the Foreign and Colonial Government Trust in London,

England in 1868. Similar to Eendragt Maakt Magt, this fund also invested in foreign government bonds (Chambers & Esteves, 2014). The inception of other funds in England soon followed and by 1875 eighteen other funds had been established in London (Bullock, 1959). Noteworthy, funds were only introduced in the United States in the 1890s, more than a century after the inception of Eendragt Maakt Magt in the Netherlands. These early funds mostly issued a fixed number of shares, however, the first open-ended mutual fund was founded in 1924 with the inception of the Massachusetts Investors Trust in Boston in the United States. This fund allowed for the continuous issuance and redemption of shares at a value that was proportional to the net asset value of the fund (Rouwenhorst, 2005).

Importantly, many of the features of these early funds persist today, more than two centuries after the emergence of the first fund in the 18<sup>th</sup> century in the Netherlands (Rouwenhorst, 2005). Since the development of these investment vehicles, funds have become popular investment products with the number of open-ended funds worldwide being approximately 129 215 as at Q3 2021 (International Investment Funds Association, 2021). This popularity can be attributed to the fact that CISs are accessible by all types of investors thereby providing millions of individuals with a relatively easy way of investing in capital markets. Hence, CISs typically serve as vital investment vehicles for many South Africans who are not investment professionals themselves so as to meet savings and investment goals. As such, it is necessary to review the advantages and disadvantages of investing in CISs.

### **2.3.3 Advantages and disadvantages of investing in collective investment schemes**

There are numerous advantages and disadvantages associated with investing in CISs. A few of the advantages include professional portfolio management, diversification benefits, investment safety and transparency, affordability, and convenience and accessibility. Notable disadvantages include no guarantee of performance and the fund fees associated with investing in CISs. These advantages and disadvantages are expanded upon next.

### **2.3.3.1 Advantages**

Some of the main reasons for investing in CISs include:

- **Professional portfolio management:** Compared to average individual investors, the fund managers of CISs possess greater knowledge and experience of the financial markets (du Randt, 2015). In the long run, this expertise should enable them to provide investment returns that are superior to those of inexperienced investors navigating the financial markets on their own. Additionally, fund managers assist investors with the administrative burden associated with investing such as paying for shares, collecting dividends or interest, and attending to rights issues, amongst others (du Randt, 2015).
- **Diversification:** CIS managers allocate investors' pooled money across an array of securities thereby reducing the risk of potential losses to their portfolios (du Randt, 2015; Singal & Manrai, 2018). The same range of diversification offered by CISs generally cannot be obtained by individual investors because it is a costly process to purchase a large number of small holdings (du Randt, 2015). Therefore, investors that have a small investable amount are provided with the opportunity to invest in a diversified portfolio through a CIS which they would not have otherwise been able to do (Singal & Manrai, 2018).
- **Investment safety and transparency:** The CIS industry is highly regulated with funds having to register with the FSCA in South Africa. Due to the regulation that governs the CIS industry, investors can be assured that they are unlikely to be subject to fraud. Furthermore, CISs are transparent regarding the characteristics of funds including costs, benchmarks, and strategies, amongst others (Singal & Manrai, 2018).
- **Affordable:** Although the minimum investment amount may differ amongst the numerous CISs in existence, individual investors do not need a large sum of capital to start investing in CISs. This provides many individuals with the opportunity to invest in these products (du Randt, 2015; Singal & Manrai, 2018).
- **Convenience and accessibility:** The participatory interests of CISs are relatively easy to buy and sell. Thus, individuals have the ability to invest at will as well as access their invested money in a relatively short period of time if need be (du Randt, 2015; Singal & Manrai, 2018).

### **2.3.3.2 Disadvantages**

Despite the advantages of investing in CISs, there are also disadvantages of doing so, such as:

- No guarantees: Generally, the performance of CISs is not guaranteed, and therefore, there is the possibility that an investor could lose money with such an investment (Singal & Manrai, 2018).
- Fees: There are certain fees involved when investing in CISs due to the expertise received from the professional fund managers that manage CISs (Singal & Manrai, 2018). CISs are, however, required to fully disclose all fees and expenses charged which can be seen on the fund factsheets or minimum disclosure documents of CISs.

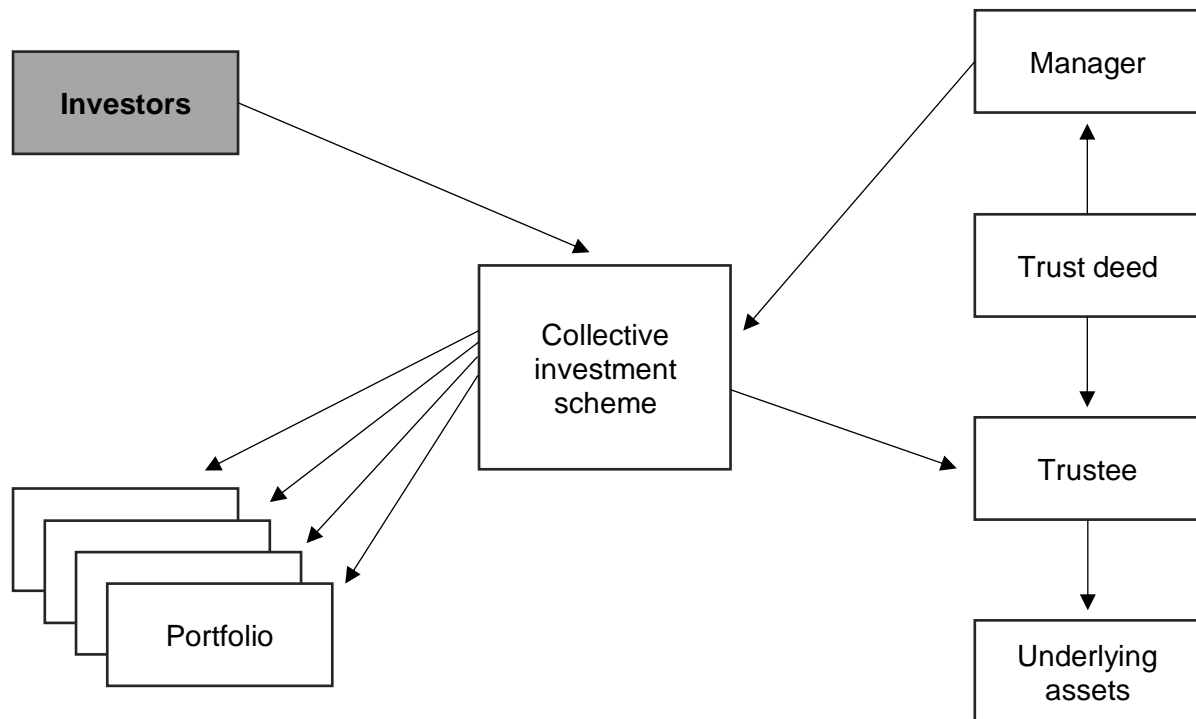
Evidently, the benefits of investing in CISs far outweigh the disadvantages, and as such, they remain popular investment vehicles. In order to adequately understand the functioning of CISs, an explanation of the structure of CISs is required. Consequently, a description in this regard follows.

### **2.3.4 Structure of collective investment schemes**

The assets of CISs are typically held in the form of a trust (du Randt, 2015). Thus, the four factors that play a key role in the trust and structure of a CIS are the CIS manager, the CIS portfolio, the trust deed, and the trustee. Firstly, a CIS manager is tasked with the job of running the fund in accordance with its mandate. The fund managers are also involved with the operations, marketing, and sales of the CIS (du Randt, 2015). In South Africa, fund managers are authorised in terms of the Cisca (2002) to administer CISs and are therefore required to run their funds in accordance with the Act. Secondly, the CIS portfolio represents the money from a group of investors that was pooled and invested in specific assets based on the policy of the CIS. This portfolio is divided into identical participatory interests that represent the same proportion of all the assets held by the fund (du Randt, 2015). Accordingly, the investors of a CIS hold the rights to the assets of the trust. Thirdly, the trust deed is the agreement between the CIS manager and the trustee and is otherwise referred to as the document of incorporation (du Randt, 2015). Noticeably, the trust deed sets out the conditions of the trust which are to be followed by all parties involved. Fourthly, the trustee ensures that the fund manager runs the trust in accordance with the fund's

investment goals and objectives. The trustee is also responsible for the oversight of the operations of the CIS as well as ensuring regulatory compliance (du Randt, 2015). Additionally, the trustee's job entails safeguarding of the trust's assets thereby protecting the interests of the CIS investors. The structure of a CIS, as described above, is summarised in Figure 1.

**Figure 1: Structure of a collective investment scheme**



Source: Adapted from du Randt (2015)

In spite of the structure of CISs being the same, there are many factors that differentiate them. One of these factors is the different categories of CISs that exist which is elaborated on in the following subsection.

### **2.3.5 Categories of collective investment schemes**

The CISCA (2002) divides CISs into five different categories, namely:

- 1) CISs in securities;
- 2) CISs in property;
- 3) CISs in participation bonds;
- 4) Declared CISs; and

## 5) Foreign CISs.

Each of these five categories of CISs are discussed in more detail below.

### **2.3.5.1 *Collective investment schemes in securities***

CISs in securities are those in which the scheme portfolio consists mainly of securities. Securities can include financial instruments such as shares, preference shares, bonds, warrants, options, or futures (CISCA, 2002).

### **2.3.5.2 *Collective investment schemes in property***

A CIS in property is one in which the scheme portfolio consists of property shares and immovable property. The Act defines property shares as shares in and of "...a fixed property company or a holding company which has no subsidiaries other than fixed property companies which are wholly owned..." (CISCA, 2002). Furthermore, immovable property is defined in the Act as "...any piece of land registered as an erf, lot or stand in a deeds registry..." (CISCA, 2002).

### **2.3.5.3 *Collective investment schemes in participation bonds***

A CIS in participation bonds is one in which the scheme portfolio consists mainly of assets in the form of participation bonds. The CISCA (2002) defines a participation bond as a mortgage bond over immovable property. With these investments, investors' money is pooled and then lent to individuals or companies to purchase or develop properties, typically of a commercial and/or industrial nature (du Randt, 2015). The Act states that the minimum investment period for this category of CIS is 5 years (CISCA, 2002).

### **2.3.5.4 *Declared collective investment schemes***

Declared CISs are defined as CISs other than those in securities, property, or participation bonds, and which have been declared to be CISs by the Minister of Finance (CISCA, 2002). Therefore, these are CISs that do not fall within the definition of any of the other categories of CISs mentioned above.

### **2.3.5.5 Foreign collective investment schemes**

Foreign CISs are defined as foreign schemes established outside of South Africa that solicit investments from members of the public in South Africa and which are denominated in a foreign currency (CISCA, 2002). These CISs can only solicit investments from members of the public after approval has been obtained from the FSCA via an application process. South African investors may invest in foreign CISs through the use of their offshore investment allowances (du Randt, 2015). The South African Reserve Bank entitles taxpaying South African residents over the age of 18 years to a foreign investment allowance of a maximum of R10 million per calendar year (Stiglingh, Koekemoer, van Heerden, Wilcocks, & van der Zwan, 2019). This allowance requires a Foreign Tax Clearance Certificate from the South African Revenue Service. Additionally, a further R1 million per calendar year can be transferred abroad by taxpaying South African residents over the age of 18 years through the single discretionary allowance afforded to such persons without having to obtain a Foreign Tax Clearance Certificate (Stiglingh et al., 2019). Rand-denominated CISs that have exposure to foreign markets should not be misinterpreted as foreign CISs. Rather, these funds are local CISs with international exposure, and as such, do not require South African investors to use their aforementioned offshore investment allowances (du Randt, 2015).

In addition to the five categories of CISs described above, CISs can also be differentiated by the investment strategy adopted. This is explained in the next subsection.

### **2.3.6 Single-strategy funds versus fund of funds**

CISs can either follow a single-strategy approach or a multi-strategy approach. Funds following a single-strategy approach are generally referred to as single-strategy funds whereas funds following a multi-strategy approach are known as multi-strategy funds and are commonly referred to as fund of funds in South Africa. A single-strategy fund is one which invests directly into a variety of financial instruments in accordance with its investment mandate (Reddy, Brady, & Patel, 2007). Instead of investing directly in securities, a fund of funds follows an investment strategy that involves investing in multiple other funds, typically other CISs. Hence, fund of funds hold portfolios of other

single-strategy funds (Reddy et al., 2007). Accordingly, the returns of a fund of funds is informed by the returns of the underlying CISs in which the fund invests.

Fund of funds provide investors with greater diversification and reduced risk benefits (Reddy et al., 2007). One of the greatest advantages of investing in a fund of funds is, however, the tax efficiency associated with these funds. A fund of funds can buy and sell its underlying funds without having to pay capital gains tax allowing the fund manager to make changes to the holdings of the fund more frequently. Capital gains tax is only triggered when the investor of the fund of funds sells his/her participatory interests (du Randt, 2015). Due to the benefits associated with these funds, fund of funds have gained in popularity with many managers introducing such funds into their offerings. Despite this, fund of funds have traditionally been more expensive due to the fact that the fees charged to investors have to cover both the manager's fees and the fees related to the underlying funds in which the fund is invested in (Reddy et al., 2007).

Another way in which CISs are distinguishable is the way in which they are managed. An overview of the primary ways in which CISs are managed follows below.

### **2.3.7 Active funds versus passive funds**

CISs can either be actively managed, in which case they are referred to as active funds, or passively managed, in which case they are generally referred to passive funds or index funds. The managers of active funds seek to outperform a given index or benchmark portfolio which is defined as the portfolio which the fund manager's performance is evaluated against (Vanguard, 2017). Active fund managers achieve this by buying or holding securities that they believe will perform well compared to the index or benchmark portfolio as well as by avoiding securities that they believe will underperform the index or benchmark. These managers shift assets between various markets and asset classes to reflect changing economic and market conditions (Vanguard, 2017). Thus, active managers engage in security selection and market timing. Notably, these types of managers are granted a significant degree of discretion over asset allocation decisions to maximise total returns over the long term (Vanguard, 2017).

Since outperforming an index or benchmark is difficult to achieve, passive or index funds are offered by many asset management companies. In contrast to active funds, managers of passive or index funds attempt to hold a broad spread of securities within some specified index, such as the FTSE/JSE All Share Index, with the aim of matching the overall performance of the index (Vanguard, 2017). Therefore, the primary objective of these types of funds is to deliver returns as close to the index as possible. Due to the strategy followed by passive or index funds, they do not require the same level of research and security analysis as active funds which typically results in these funds having lower levels of portfolio turnover (Vanguard, 2017). As such, investors of passive or index funds generally incur lower fees and more favourable tax outcomes.

A further point of difference between CISs is their classes of shares. The two primary classes of CIS shares are explained in the next subsection.

### **2.3.8 Classes of collective investment scheme shares**

CISs issue different classes of shares with each class holding the same assets and being managed by the same fund manager (Nanda, Wang, & Zheng, 2009). Importantly, the class of CIS shares determines the type of CIS investor. The two main classes of CIS shares includes the retail class and the institutional class. A retail class is one in which individual's invest for their own personal account, and thus, the investment is held in the name of the individual investor (Nanda et al., 2009). Contrarily, an institutional class is only offered to institutional investors, such as banks, pensions funds, or insurance companies, making large investments on behalf of their clients (Baker, Haslem, & Smith, 2009). Compared to a retail class, an institutional class will have a high stipulated minimum investment amount, hence, individual investors do not invest in this class. The participatory interests of an institutional class are not held in the name of an individual investor but rather in the name of an institution (Nanda et al., 2009). These two distinct classes are generally referred to as Class A shares and Class B shares of a CIS. The retail class available to individual investors is referred to as Class A and typically charges higher fees (Nanda et al., 2009). On the other hand, the institutional class is referred to as Class B which charges reduced fees.

With so many CISs in existence, it can be a difficult process to choose which CIS to invest in. Accordingly, the classification of CISs is of utmost importance in making this process easier. The classification of CISs in South Africa is explored in the following section.

## **2.4 CLASSIFICATION OF COLLECTIVE INVESTMENT SCHEMES**

In South Africa, CISs are classified according to the stipulation of the Association for Savings and Investment in South Africa (ASISA). The ASISA is a non-profit company that was formed in 2008 by merging the Association of Collective Investments, the Investment Management Association of South Africa, the Linked Investment Service Providers Association, and the Life Offices' Association. The ASISA plays an important role in the South African financial sector as it represents the savings, investment, and insurance industry.

The ASISA, through the ASISA Fund Classification Standard, assumes responsibility for the classification system applied to CISs. More specifically, the ASISA Fund Classification Standard establishes a classification system for regulated CIS portfolios in South Africa which provides investors and financial advisors alike with a framework that can assist them during the investment decision-making process (ASISA, 2018). This framework ensures that CISs with comparable investment objectives and investment universes, as proposed in their mandates, are grouped together. Ultimately, the objectives of the ASISA Fund Classification Standard are to promote investor awareness and understanding of the various CIS portfolio types, assist investors with the comparison of CIS portfolios both within and across classification categories, and aid investors with the evaluation of possible risks of investing in a particular type of CIS portfolio (ASISA, 2018). Important to note is that the ASISA Fund Classification Standard only applies to the CISs in securities category as per the Cisca (2002) discussed in section 2.3.5. The ASISA Fund Classification Standard classifies CISs according to three main tiers which is discussed next.

### **2.4.1 First tier of classification**

The first tier classifies CISs according to the domicile of the schemes' assets (that is, according to the schemes' geographical investment universe). Under this tier, CISs

are classified as either South African, Worldwide, Global, or Regional portfolios as indicated in Table 1 (ASISA, 2018).

**Table 1: First tier of classification according to the ASISA Fund Classification Standard**

<b>First tier of classification</b>	<b>Description</b>
South African	CISs that invest a minimum of 60% of their assets in South African investment markets. These CISs may invest no more than 30% of their assets outside of South Africa plus an additional 10% of their assets in other African nations (that is, Africa excluding South Africa).
Worldwide	CISs that invest in both South African and foreign markets. There are no limits set for either domestic or foreign assets for these types of CISs.
Global	CISs that invest a minimum of 80% of their assets outside South Africa. No restriction applies to these CISs in terms of assets of a specific geographical country (for example, the United States) or geographical region (for example, Europe or Asia).
Regional	CISs that invest a minimum of 80% of their assets in a specific country (for example, the United States) or geographical region outside South Africa (for example, Europe or Asia).

Source: Adapted from ASISA (2018)

#### **2.4.2 Second tier of classification**

The second tier classifies CISs according to the asset allocation of the schemes' investments (that is, according to the type of assets that the scheme invests in). CISs are classified as either Equity, Multi Asset, Real Estate, or Interest Bearing portfolios under this tier, evident in Table 2 (ASISA, 2018).

**Table 2: Second tier of classification according to the ASISA Fund Classification Standard**

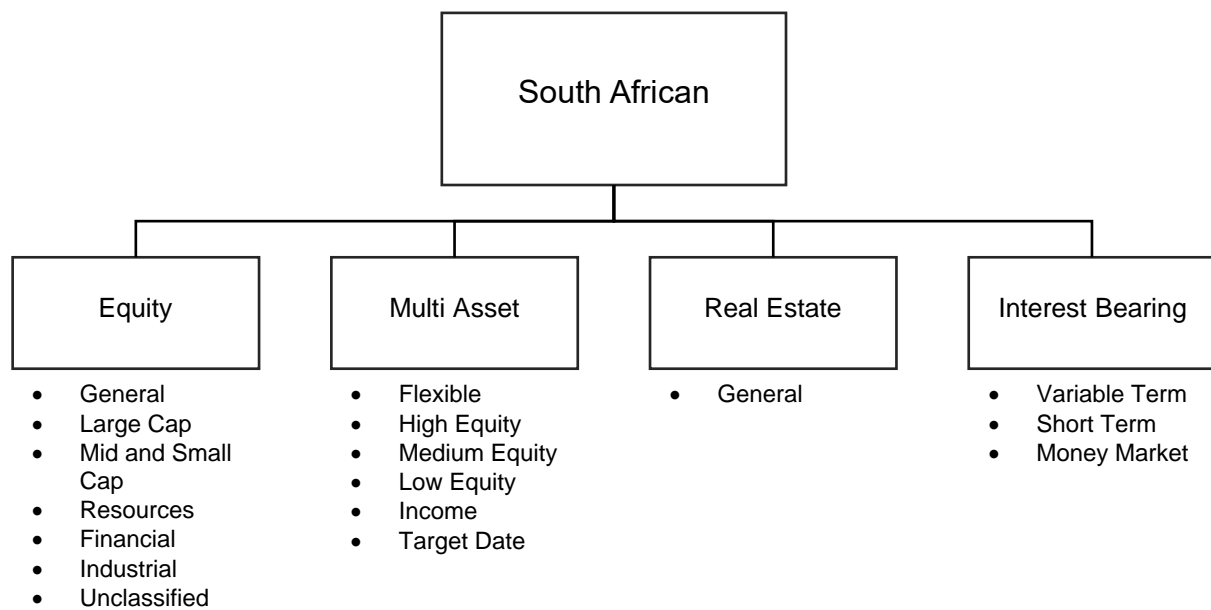
<b>Second tier of classification</b>	<b>Description</b>
Equity	CISs that invest a minimum of 80% of the market value of their portfolios in equities. The primary goal of these types of CISs is to seek maximum capital appreciation.
Multi Asset	CISs that invest in a wide variety of investments in the equity, bond, money, and real estate markets with the goal of maximising total returns over the long term.
Real Estate	CISs that invest a minimum of 80% of the market value of their portfolios in listed property shares, CISs in property and property loan stock, and real estate investment trusts. The primary objective of these types of CISs is to provide high levels of income as well as long-term capital appreciation.
Interest Bearing	CISs that only invest in bonds, money market investments, and other interest earning securities. These CISs are prohibited from investing in equity securities, real estate securities, or cumulative preference shares.

Source: Adapted from ASISA (2018)

### **2.4.3 Third tier of classification**

The third tier further classifies CISs according to their investment focus or style employed. This tier is a sub-category of the second tier of the ASISA Fund Classification Standard (ASISA, 2018). The third tier of South African classified funds are listed in bullet points under the Equity, Multi Asset, Real Estate, and Interest Bearing portfolios depicted in Figure 2.

**Figure 2: Classification of South African funds according to the ASISA Fund Classification Standard**

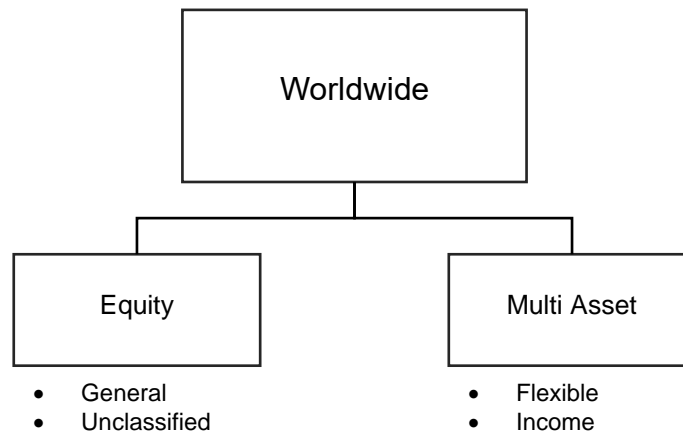


Source: Adapted from ASISA (2018)

Since the CISs investigated in this study are South African–Equity–General classified funds, a description of these types of funds is necessary. South African–Equity–General classified funds are CISs that invest in selected shares from equity markets across all market sectors as well across the range of large, mid, and smaller market capitalisation shares. The primary investment objective of these CISs is to offer medium- to long-term capital growth.

Figure 3 provides an overview of the third tier of funds classified as Worldwide. The third tier is detailed in bullet points under the Equity and Multi Asset portfolios.

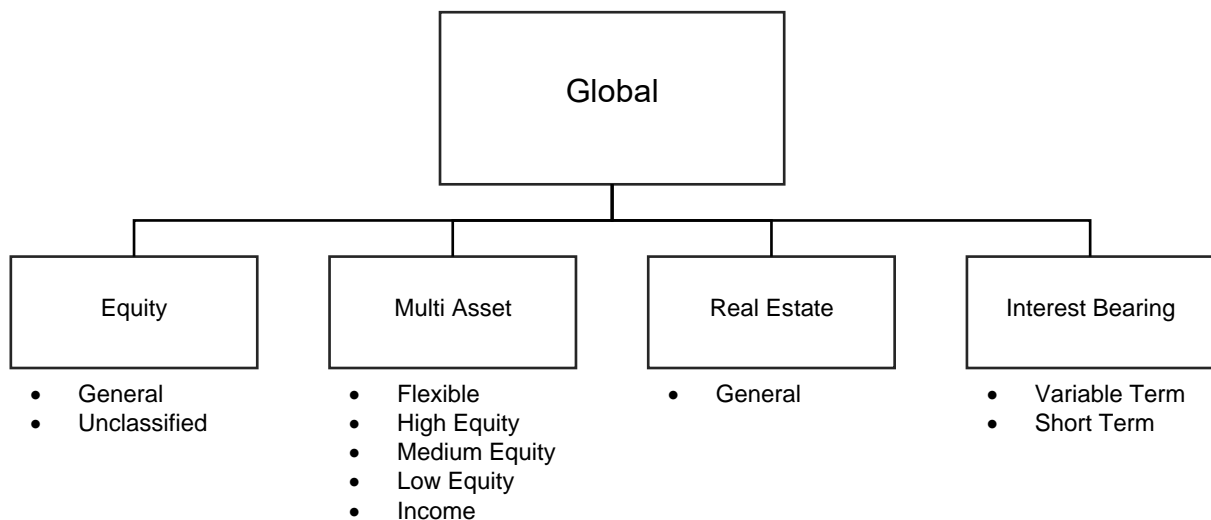
**Figure 3: Classification of Worldwide funds according to the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2018)

Figure 4 below provides a visual representation of the third tier of Global classified funds which are listed in bullet points under the Equity, Multi Asset, Real Estate, and Interest Bearing portfolios.

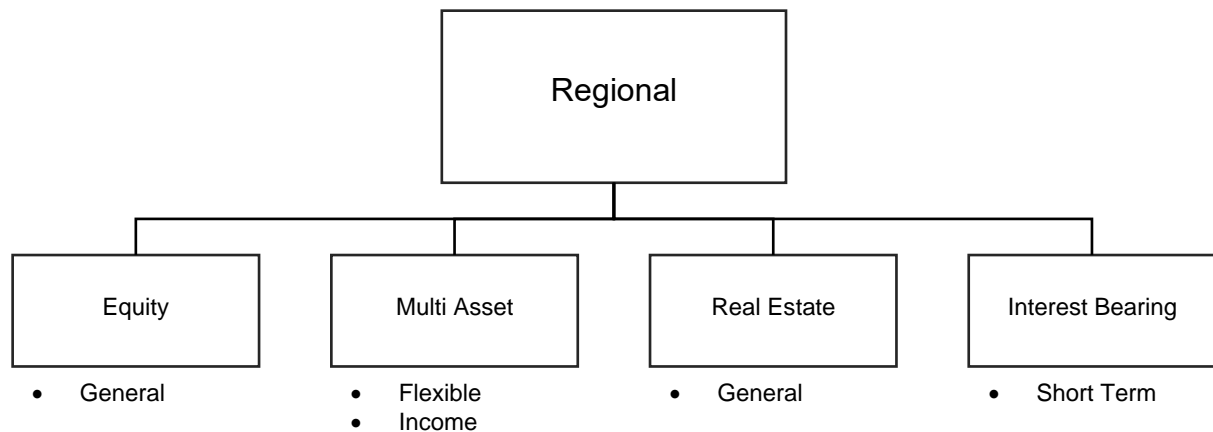
**Figure 4: Classification of Global funds according to the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2018)

The third tier of funds classified as Regional can be seen in Figure 5. This is presented in bullet points under the Equity, Multi Asset, Real Estate, and Interest Bearing portfolios.

**Figure 5: Classification of Regional funds according to the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2018)

With the foundational background of the classification of CISs in South Africa, a detailed overview of the South African CIS industry is provided in the following section.

## **2.5 ANALYSIS OF THE SOUTH AFRICAN COLLECTIVE INVESTMENT SCHEME INDUSTRY**

Since this study analyses CISs within a South African context, it is necessary to conduct a thorough analysis of the South African CIS environment. The history of the South African CIS industry, the asset management companies that provide South African investors with CISs, and a breakdown of the CISs that exist within the South African environment according to the ASISA three tier classification system are detailed in this section.

### **2.5.1 History of the South African collective investment scheme industry**

The CIS industry in South Africa dates back to 14 June 1965 when the first CIS, the South African Growth Equity fund, was launched. This fund had initial assets worth approximately R600 000 (Meyer-Pretorius & Wolmarans, 2006). By the end of 1965, there were two funds in existence with a combined asset value of approximately R3 million. Over the period 1965 to 1970, the South African CIS industry experienced

an average annual compounded growth rate of 259.04% (Meyer-Pretorius & Wolmarans, 2006). This excessive growth did, however, slow during the 1970s. Nevertheless, ten new funds were launched over the period 1965 to 1980 and by the end of 1980, the CIS industry had approximately R683 million worth of AUM. Strong growth persisted during the latter part of the 1980s with eleven new funds being launched in 1987 alone. The industry continued to expand by growing to 36 funds worth approximately R7.5 billion as at the end of 1990 (Meyer-Pretorius & Wolmarans, 2006). Even greater growth was experienced over the period 1990 to 2000 with the industry exponentially growing to 334 registered funds with a combined asset value of R128.4 billion as at the end of 2000. By the end of 2005, there were 617 funds in existence managing approximately R415.1 billion worth of assets. Greater expansion occurred within the CIS industry over the following five years with 943 registered funds in existence by the end of 2010 accounting for a total asset value of approximately R938 billion (Meyer-Pretorius & Wolmarans, 2006). Since then, the industry has continued to grow considerably and as at Q3 2021, the CIS industry consisted of 1 685 different local CISs worth approximately R2.96 trillion of AUM (ASISA, 2021).

Asset management companies create CISs for investors to invest in, hence, they play a very important part in the South African CIS industry. As such, the role players in this regard are detailed in the following subsection.

### **2.5.2 Asset management companies**

There are numerous asset management companies that operate within the South African CIS industry. As at Q3 2021, there were approximately 45 asset management companies offering a variety of 1 685 CISs to investors. Table 3 presents the top ten asset management companies based on AUM as at Q3 2021. Notably, from analysing Table 3, the South African CIS industry seems to be relatively concentrated with the top ten asset management companies controlling 70.82% of the market and offering 57.74% of the funds in existence as at Q3 2021.

**Table 3: Top ten asset management companies based on assets under management as at Q3 2021**

Asset management company	Number of funds		Assets under management	
	#	% Market share	Rm	% Market share
Ninety One	24	1.42	319 109	9.48
STANLIB	89	5.28	312 626	9.28
Allan Gray	11	0.65	310 710	9.23
Coronation	23	1.36	276 552	8.21
Nedgroup	41	2.43	268 970	7.99
Old Mutual	70	4.15	230 374	6.84
Boutique Collective Investments	374	22.20	214 162	6.36
Sanlam	194	11.51	199 025	5.91
Prescient	124	7.36	132 877	3.95
PSG	23	1.36	120 605	3.58
<b>Total</b>	<b>973</b>	<b>57.74</b>	<b>2 385 009</b>	<b>70.82</b>

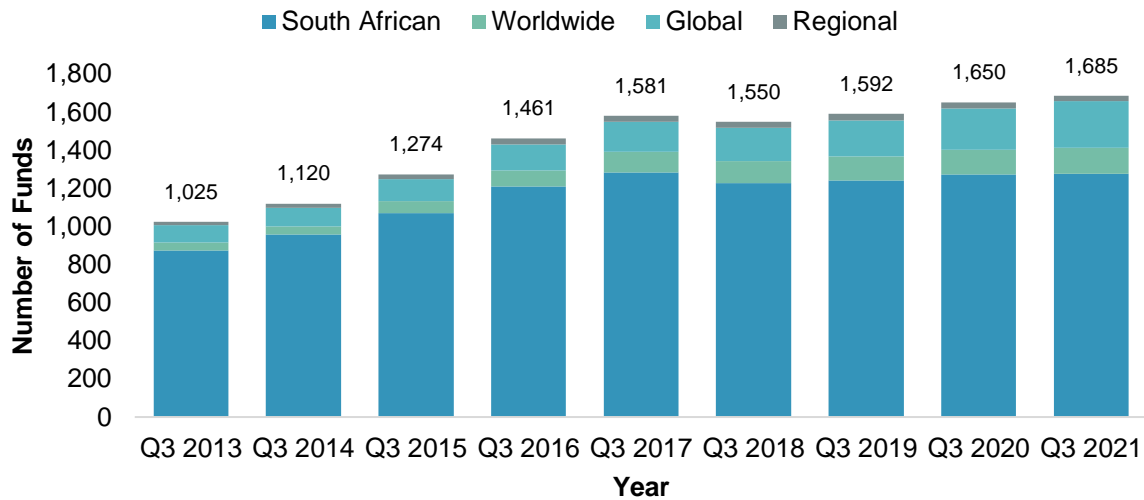
Source: Adapted from ASISA (2021)

The next subsections (2.5.3 to 2.5.5) provide an overview of the CISs that exist within the South African environment according to the ASISA three tier classification system. As stated in section 2.4, the ASISA Fund Classification Standard only applies to the CISs in securities category as per the CISCA (2002). Therefore, the other categories of CISs described in section 2.3.5 are not reported on in the following subsections.

### **2.5.3 Number of funds and total assets based on the first tier of classification**

Figures 6 and 7 detail the number of funds and the AUM per fund classification according to the ASISA's first tier. Data starting from 2013 is displayed due to the fact that the ASISA used a different classification system in the years preceding 2013 whereafter the revised standard for classification was implemented.

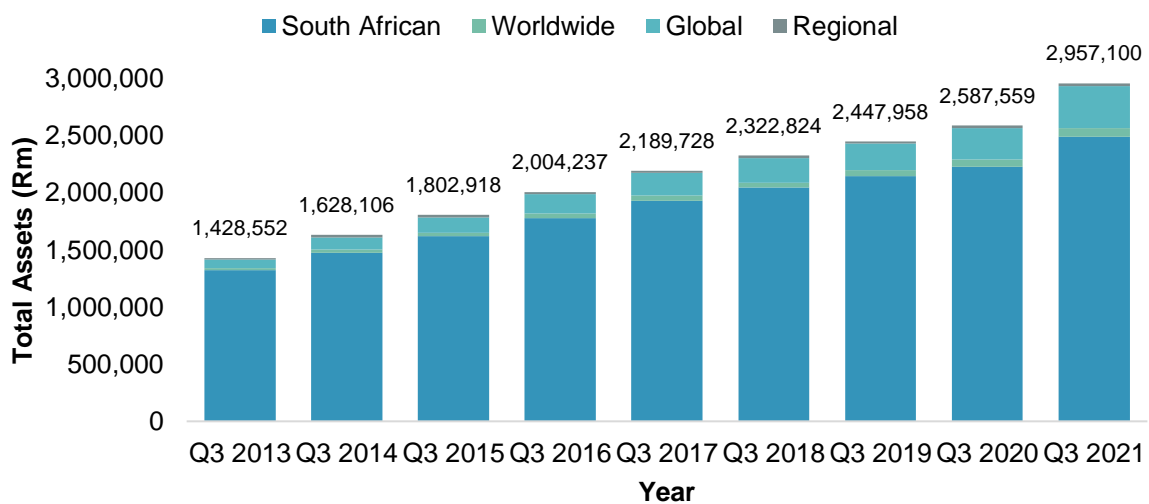
**Figure 6: Number of funds according to tier one of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

The graph above illustrates that there has been an increase in the number of funds in existence within the South African CIS industry. Evidently, South African CISs accounted for the majority of the number of funds for the period Q3 2013 to Q3 2021. More specifically, as at Q3 2021, South African classified funds accounted for 75.73% of the total 1 685 funds in existence with Global funds accounting for 14.60%, Worldwide funds accounting for 8.13%, and Regional funds accounting for only 1.54%.

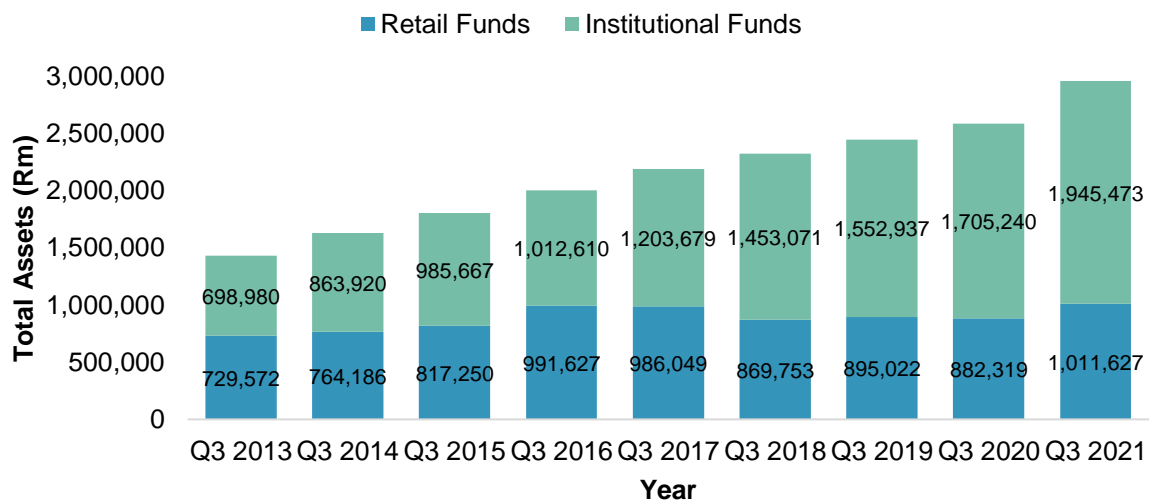
**Figure 7: Total assets according to tier one of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

The increase in total industry AUM over the period analysed can be observed in Figure 7. As can be seen, the largest percentage of total AUM was also attributed to South African classified CISs. As at Q3 2021, South African CISs accounted for 84.21% of the industry’s total assets of R2.96 trillion. Furthermore, of the total assets as at Q3 2021, funds classified as Global accounted for 12.37%, Worldwide funds accounted for 2.58%, and Regional funds accounted for 0.83%. Noteworthy, more than 50% of the total assets over the period analysed were attributed to institutional funds with the exception of Q3 2013 where 48.93% of the total assets were managed by institutional funds. Figure 8 displays the market composition according to the AUM of retail and institutional CISs.

**Figure 8: Total assets according to tier one of the ASISA Fund Classification Standard divided between retail and institutional funds**



Source: Adapted from ASISA (2021)

Most recently, of the R2.96 trillion of AUM, 34.21% were managed by retail funds whilst 65.79% were managed by institutional funds.

#### **2.5.4 Number of funds and total assets based on the second tier of classification**

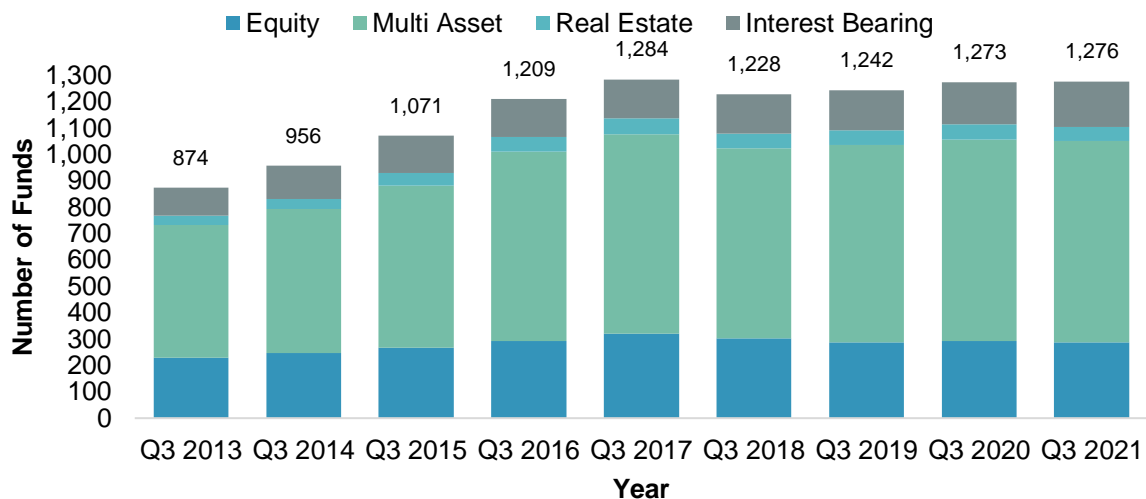
The analysis of the number of funds as well as the total assets per fund classification according to the ASISA’s second tier can be seen in this subsection. Similar to the analysis of CISs according to the ASISA’s first tier of classification, data starting from

2013 has been analysed due to the ASISA using a different classification system in the years preceding 2013.

### 2.5.4.1 South African funds

Figure 9 below shows that South African classified funds were dominated by Multi Asset portfolios over the period Q3 2013 to Q3 2021. In particular, more than 50% of South African CISs were Multi Asset funds over the analysed period. More recently, as at Q3 2021, 59.87% of South African funds were Multi Asset funds, 22.41% were Equity funds, 13.48% were Interest Bearing funds, and 4.23% were Real Estate funds.

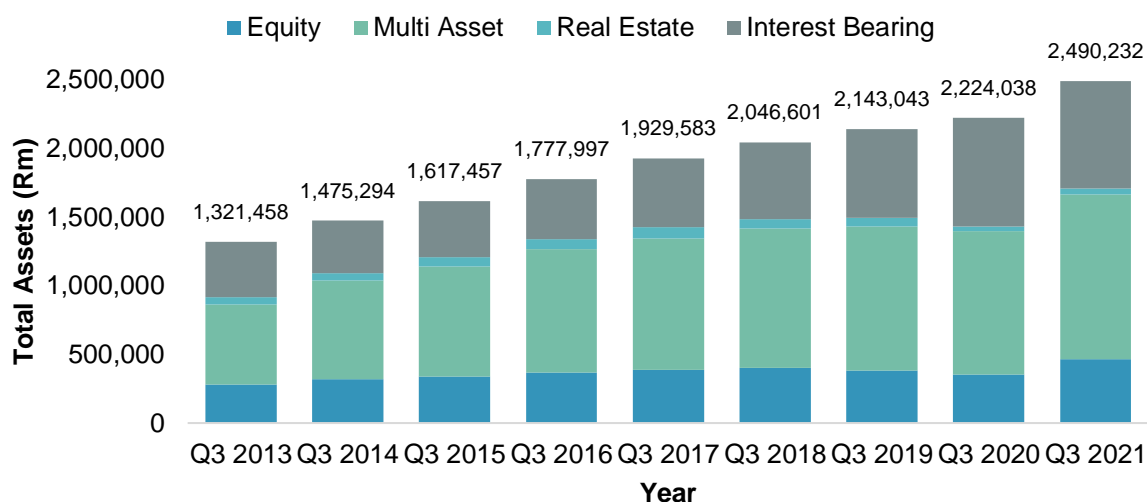
**Figure 9: Number of South African funds according to tier two of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

The AUM of South African classified funds can be seen in Figure 10. Evidently, the largest proportion of AUM was attributed to Multi Asset portfolios. As at Q3 2021, of the total AUM of South African funds, 48.06% was attributed to Multi Asset funds, 31.32% was attributed to Interest Bearing funds, 18.76% was attributed to Equity funds, and 1.85% was attributed to Real Estate funds.

**Figure 10: Total assets of South African funds according to tier two of the ASISA Fund Classification Standard**

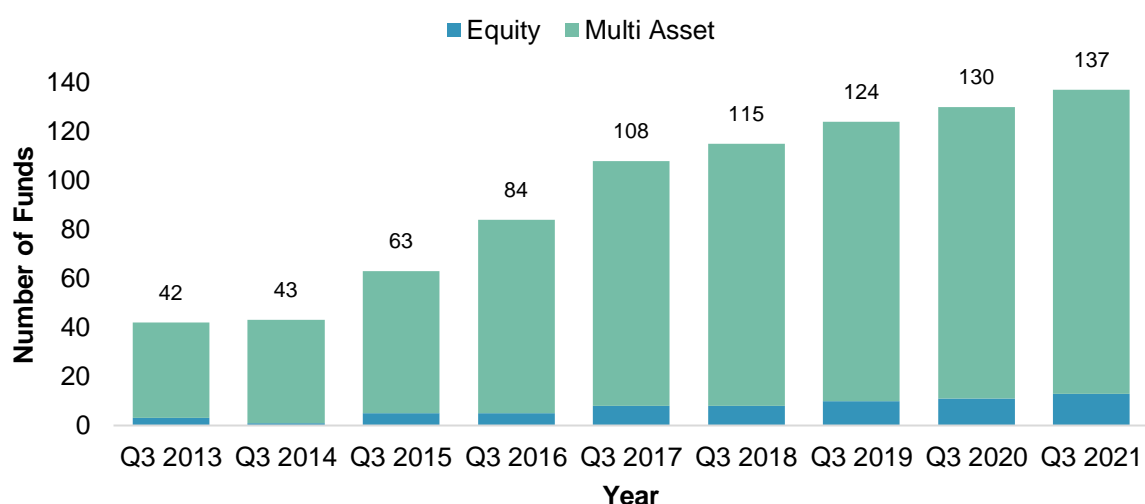


Source: Adapted from ASISA (2021)

#### 2.5.4.2 Worldwide funds

As seen in Figure 11, the majority of Worldwide funds over the analysed period were Multi Asset portfolios. Particularly, Multi Asset funds accounted for 90.51% of total Worldwide funds as at Q3 2021 with the remaining 9.49% of funds being Equity funds.

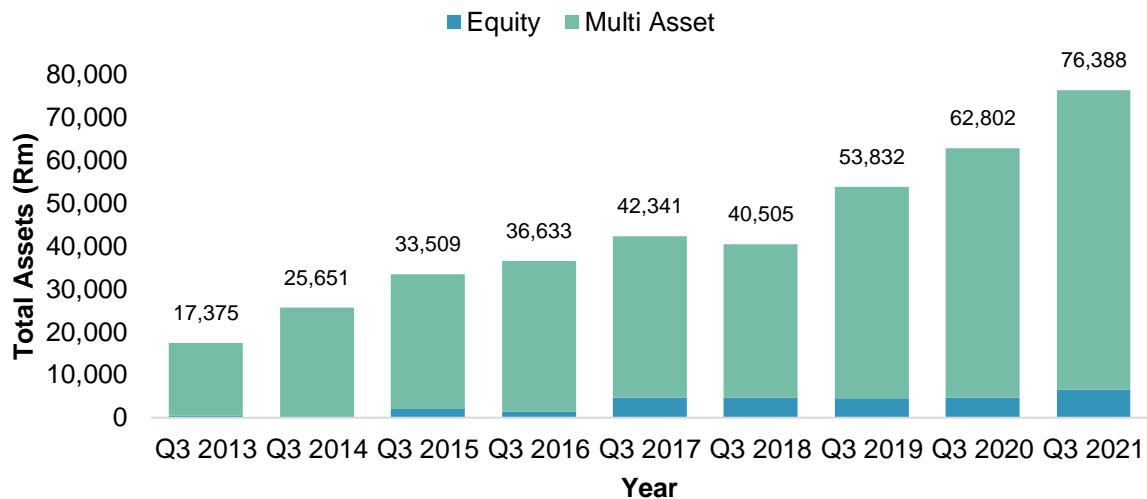
**Figure 11: Number of Worldwide funds according to tier two of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

Figure 12 depicts that the largest proportion of the total assets of Worldwide funds was attributed to Multi Asset portfolios. In terms of the AUM of Worldwide funds as at Q3 2021, 91.49% were managed by Multi Asset portfolios whereas 8.51% were managed by Equity funds.

**Figure 12: Total assets of Worldwide funds according to tier two of the ASISA Fund Classification Standard**

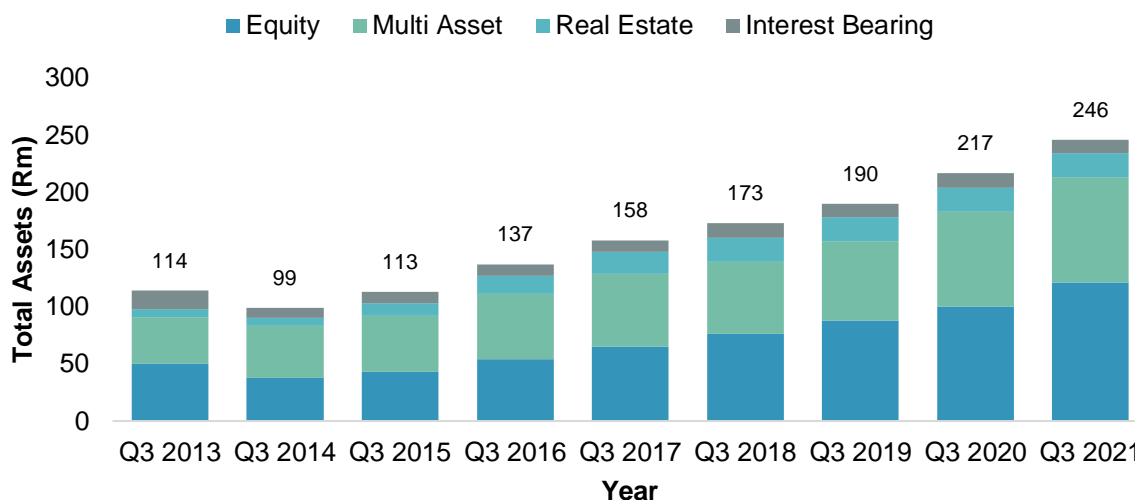


Source: Adapted from ASISA (2021)

### 2.5.4.3 Global funds

As observed in Figure 13, the largest number of Global funds were Equity and Multi Asset funds over the period Q3 2013 to Q3 2021. Specifically, as at Q3 2021, Global funds consisted of 49.19% Equity funds, 37.40% Multi Asset funds, 8.54% Real Estate funds, and 4.88% Interest Bearing funds.

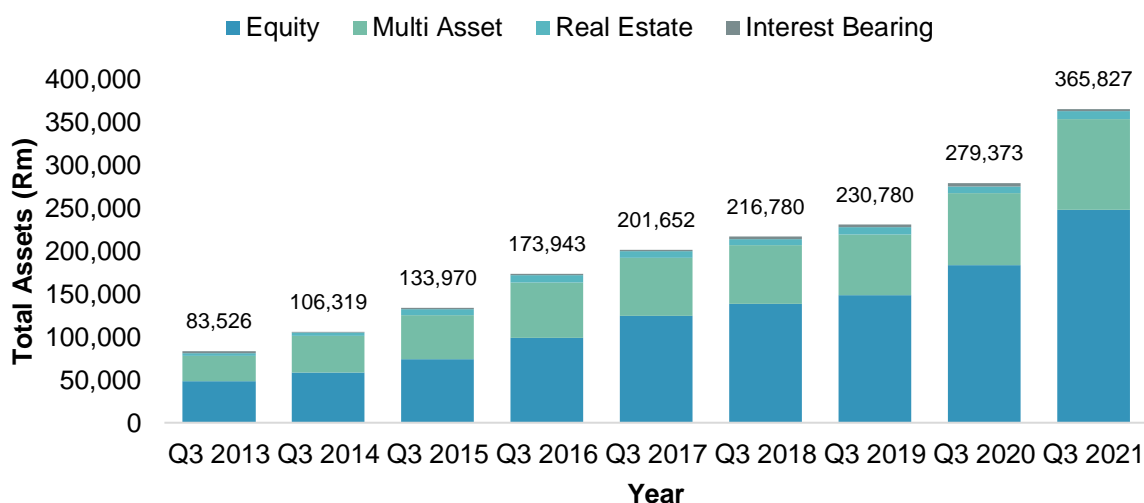
**Figure 13: Number of Global funds according to tier two of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

Evident in Figure 14 below, the AUM of Global classified funds were largely managed by Equity funds over the analysed period. As at Q3 2021, 67.92% of the total assets attributed to Global funds were managed by Equity funds, 28.84% were managed by Multi Asset funds, 2.49% were managed by Real Estate funds, and 0.75% were managed by Interest Bearing funds.

**Figure 14: Total assets of Global funds according to tier two of the ASISA Fund Classification Standard**

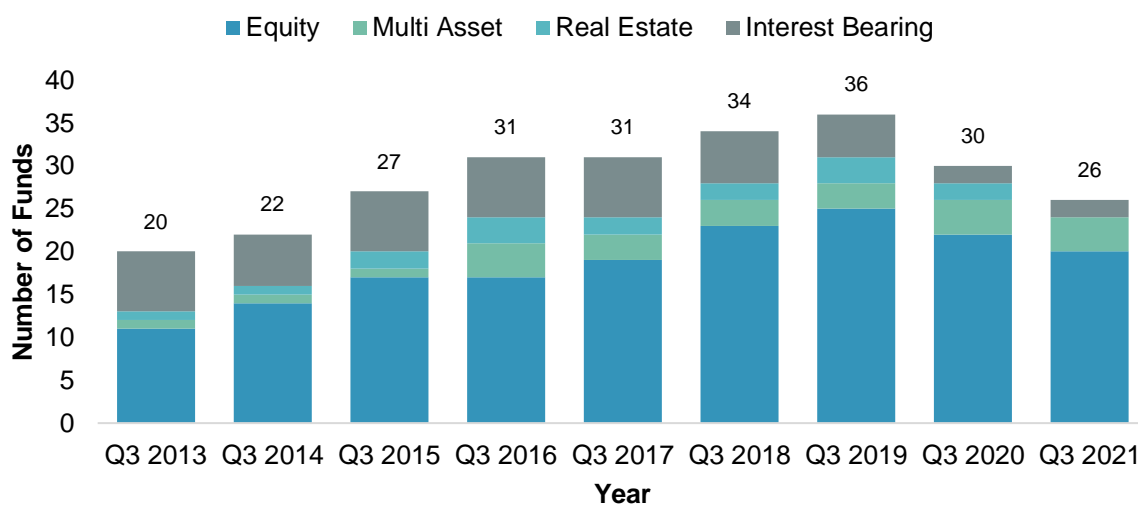


Source: Adapted from ASISA (2021)

#### 2.5.4.4 Regional funds

Figure 15 displays that Equity portfolios made up the majority of Regional classified funds. Recently, as at Q3 2021, 76.92% of Regional funds were Equity portfolios, 15.38% were Multi Asset portfolios, and 7.69% were Interest Bearing portfolios. Interestingly, there were no Real Estate portfolios as at Q3 2021 which is in contrast to the preceding 8 years in which there was a presence of Real Estate portfolios.

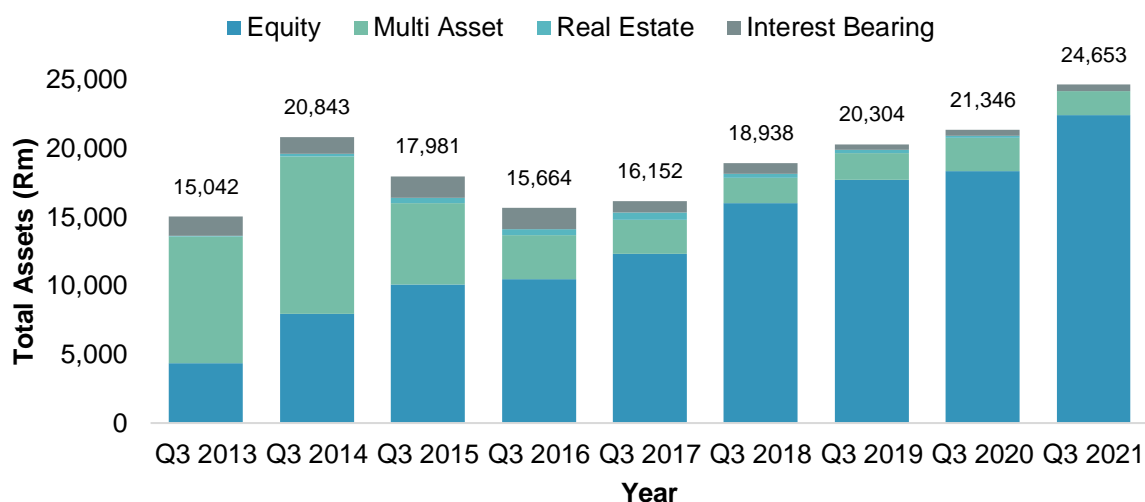
**Figure 15: Number of Regional funds according to tier two of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

Figure 16 graphically illustrates the total assets of Regional funds over the analysed period. As is evident, the largest proportion of AUM was managed by Equity funds. Particularly, as at Q3 2021, 91.04% of Regional funds were managed by Equity funds, 7.00% were managed by Multi Asset funds, and 1.96% were managed by Interest Bearing funds. Since there were no Real Estate funds as at Q3 2021, no assets were managed by these types of funds.

**Figure 16: Total assets of Regional funds according to tier two of the ASISA Fund Classification Standard**



Source: Adapted from ASISA (2021)

### 2.5.5 Number of funds and total assets based on the third tier of classification

An overview of the number of funds and AUM per fund classification according to the ASISA’s third tier is discussed below. Important to note is that unlike the first and second tier of classifications in which data was displayed from Q3 2013 to Q3 2021, the third tier of classification displays data as at Q3 2021.

#### 2.5.5.1 South African funds

Table 4 reports that the largest number of South African portfolios were Multi Asset–High Equity and Equity–General funds accounting for 19.36% and 18.18% of all South African classified funds as at Q3 2021 respectively. Moreover, the largest proportion of AUM was attributed to Multi Asset–High Equity funds which accounted for 23.21% of the total assets of South African portfolios.

**Table 4: Number of funds and total assets as at Q3 2021 of South African funds according to tier three of the ASISA Fund Classification Standard**

Classification	Number of funds		Assets under management	
	#	% Total	Rm	% Total
<b>EQUITY</b>				
General	232	18.18	414 360	16.64

Large Cap	27	2.12	34 016	1.37
Mid and Small Cap	8	0.63	6 510	0.26
Resources	7	0.55	5 519	0.22
Financial	6	0.47	2 020	0.08
Industrial	4	0.31	4 279	0.17
Unclassified	2	0.16	497	0.02
<b>Subtotal</b>	<b>286</b>	<b>22.41</b>	<b>467 201</b>	<b>18.76</b>
<b>MULTI ASSET</b>				
Flexible	82	6.43	63 809	2.56
High Equity	247	19.36	577 971	23.21
Medium Equity	111	8.70	58 780	2.36
Low Equity	183	14.34	226 632	9.10
Income	130	10.19	262 780	10.55
Target Date	11	0.86	6 950	0.28
<b>Subtotal</b>	<b>764</b>	<b>59.87</b>	<b>1 196 922</b>	<b>48.06</b>
<b>REAL ESTATE</b>				
General	54	4.23	46 073	1.85
<b>Subtotal</b>	<b>54</b>	<b>4.23</b>	<b>46 073</b>	<b>1.85</b>
<b>INTEREST BEARING</b>				
Variable Term	69	5.41	135 209	5.43
Short Term	49	3.84	279 276	11.21
Money Market	54	4.23	365 551	14.68
<b>Subtotal</b>	<b>172</b>	<b>13.48</b>	<b>780 036</b>	<b>31.32</b>
<b>Total</b>	<b>1 276</b>	<b>100</b>	<b>2 490 232</b>	<b>100</b>

Source: Adapted from ASISA (2021)

In addition to these statistics, the largest CISs measured by AUM can be seen in Table 5. Of the top ten CISs ranked on total assets, it is evident that all of these funds were South African classified funds. Furthermore, South African–Multi Asset–High Equity funds accounted for three of the top ten positions while South African–Interest Bearing–Money Market funds and South African–Equity–General funds both accounted for two of the top ten positions. South African–Interest Bearing–Short Term, South African–Multi Asset–Low Equity, and South African–Multi Asset–Income funds

each accounted for one of the top ten positions. Important to highlight is that the top ten CISs based on AUM accounted for 20.60% of the market as at Q3 2021. Moreover, seven of the top ten CISs were retail funds with the remaining three being institutional funds.

**Table 5: Top ten collective investment schemes based on assets under management as at Q3 2021**

Fund name	Classification	Retail (R) or Institutional (I)	Assets under management	
			Rm	% Market share
Allan Gray Balanced Fund	South African–Multi Asset–High Equity	R	149 832	5.07
Coronation Balanced Plus Fund	South African–Multi Asset–High Equity	R	93 438	3.16
Nedgroup Investments Core Income Fund	South African–Interest Bearing–Short Term	I	59 724	2.02
Ninety One Opportunity Fund	South African–Multi Asset–High Equity	R	56 215	1.90
Nedgroup Investments Corporate Money Market Fund	South African–Interest Bearing–Money Market	I	48 098	1.63
Allan Gray Stable Fund	South African–Multi Asset–Low Equity	R	46 353	1.57

Coronation Strategic Income Fund	South African–Multi Asset–Income	R	41 711	1.41
Ninety One Money Market Fund	South African–Interest Bearing–Money Market	R	41 125	1.39
Allan Gray Equity Fund	South African–Equity–General	R	37 537	1.27
Prudential Core Value Fund	South African–Equity–General	I	35 093	1.19
<b>Total</b>			<b>609 127</b>	<b>20.60</b>

Source: Adapted from ASISA (2021)

### 2.5.5.2 Worldwide funds

As observed in Table 6, Worldwide classified funds were dominated by Multi Asset–Flexible funds as at Q3 2021. These funds accounted for 91.51% of the total number of Worldwide funds and 91.49% of the total AUM of these funds.

**Table 6: Number of funds and total assets as at Q3 2021 of Worldwide funds according to tier three of the ASISA Fund Classification Standard**

Classification	Number of funds		Assets under management	
	#	% Total	Rm	% Total
<b>EQUITY</b>				
General	12	8.76	6 497	8.50
Unclassified	1	0.73	2	0.003
Subtotal	13	9.49	6 499	8.51
<b>MULTI ASSET</b>				
Flexible	124	90.51	69 890	91.49
Income	0	0.00	0	0.00
Subtotal	124	90.51	69 890	91.49
<b>Total</b>	<b>137</b>	<b>100</b>	<b>76 388</b>	<b>100</b>

Source: Adapted from ASISA (2021)

### 2.5.5.3 Global funds

From Table 7, the largest number of Global funds were Equity–General funds which accounted for 48.78% of these funds. Equity–General funds also accounted for the largest proportion of the total AUM of Global funds at 67.87%.

**Table 7: Number of funds and total assets as at Q3 2021 of Global funds according to tier three of the ASISA Fund Classification Standard**

Classification	Number of funds		Assets under management	
	#	% Total	Rm	% Total
<b>EQUITY</b>				
General	120	48.78	248 294	67.87
Unclassified	1	0.41	162	0.04
Subtotal	121	49.19	248 457	67.92
<b>MULTI ASSET</b>				
Flexible	58	23.58	51 289	14.02
High Equity	14	5.69	37 610	10.28
Medium Equity	4	1.63	3 751	1.03
Low Equity	10	4.07	8 841	2.42
Income	6	2.44	4 029	1.10
Subtotal	92	37.40	105 519	28.84
<b>REAL ESTATE</b>				
General	21	8.54	9 100	2.49
Subtotal	21	8.54	9 100	2.49
<b>INTEREST BEARING</b>				
Variable Term	9	3.66	1 919	0.52
Short Term	3	1.22	831	0.23
Subtotal	12	4.88	2 750	0.75
<b>Total</b>	<b>246</b>	<b>100</b>	<b>365 827</b>	<b>100</b>

Source: Adapted from ASISA (2021)

### 2.5.5.4 Regional funds

As can be seen in Table 8, the largest percentage of Regional classified funds as at Q3 2021 was attributed to Equity–General funds which accounted for 76.92% of the

total number of Regional funds. Equity–General funds also accounted for the largest proportion of AUM of Regional funds at 91.04%.

**Table 8: Number of funds and total assets as at Q3 2021 of Regional funds according to tier three of the ASISA Fund Classification Standard**

Classification	Number of funds		Assets under management	
	#	% Total	Rm	% Total
<b>EQUITY</b>				
General	20	76.92	22 444	91.04
Subtotal	20	76.92	22 444	91.04
<b>MULTI ASSET</b>				
Flexible	3	11.54	1 283	5.20
Income	1	3.85	442	1.79
Subtotal	4	15.38	1 725	7.00
<b>REAL ESTATE</b>				
General	0	0.00	0	0.00
Subtotal	0	0.00	0	0.00
<b>INTEREST BEARING</b>				
Short Term	2	7.69	484	1.96
Subtotal	2	7.69	484	1.96
<b>Total</b>	<b>26</b>	<b>100</b>	<b>24 653</b>	<b>100</b>

Source: Adapted from ASISA (2021)

With the completion of the analysis of the South African CIS industry, the determinants of CIS performance are elaborated on in the next section. In particular, important literature pertaining to the impact that fund attributes have on the performance of CISs is examined.

## **2.6 DETERMINANTS OF COLLECTIVE INVESTMENT SCHEME PERFORMANCE**

Investors of CISs have to undertake the process of screening and selecting the best funds to invest in that will fulfil their necessary investment objectives. Generally, fund performance is a critical aspect in this process since investors want to invest in funds

with superior performance in order to maximise their expected returns (Ferreira et al., 2013; Kaur, 2018). Accordingly, a multitude of international studies have been conducted to explain the determinants of fund performance. These studies have primarily analysed fund attributes and country characteristics as a way of explaining better or worse future fund performance. The focus of this study is on fund attributes as potential determinants of fund performance. Examples of the fund attributes that have been evaluated in prior studies include size, holdings, turnover, age, fees or expenses, flows, and management characteristics, amongst others. The present study investigates fund size, family size, age, and expense ratios as determinants of the performance of South African–Equity–General CISs. These attributes have been selected since they are the most widely examined characteristics in prior literature. Thus, this section provides an overview of the existing literature on the influence that these fund attributes have on fund performance.

### **2.6.1 Fund size**

The size of a fund is typically measured as its total AUM which continuously changes over the life of a fund. For example, funds with good past performance generally attract more investors resulting in increased cash inflows into these funds, and as such, the size of well performing funds typically increases over time with many of them growing into very large funds (Ciccotello & Grant, 1996). Important to highlight is that numerous studies have focused on investigating whether a fund's size can influence its performance with empirical evidence existing on the size-performance relationship of funds operating in many financial markets around the world. As a result, fund size is one of the most common fund attributes that has been researched (Ferreira et al., 2013).

#### **2.6.1.1 Association overview**

The empirical research on the impact that size has on fund performance has reported conflicting results. Nevertheless, a large percentage of this literature documents a negative relationship suggesting that a fund's performance deteriorates as it increases in size. Therefore, it can be said that size erodes performance (Bodson, Cavenaile, & Sougné, 2011). An explanation for this negative association could be that larger funds might incur diseconomies of scale (Yap & Pierce, 2008). On the other hand, some

studies show evidence of a positive relationship implying that larger funds outperform their smaller peers. This relationship is consistent with the theory of economies of scale and could be as a result of the cost advantages that larger funds have over smaller funds. These benefits include being able to spread expenses over a larger asset base, having access to more resources for research and investment opportunities as well as being able to negotiate better spreads (Ciccotello & Grant, 1996; Ferreira et al., 2013; Yap & Pierce, 2008). In addition to a positive and negative relationship, studies have also found evidence of a concave relationship which infers that an optimal fund size exists. Particularly, this association suggests that performance increases when fund size is below a specific level of AUM, known as the optimal fund size, and decreases when fund size is above this level of AUM (Tang, Wang, & Xu, 2012). In light of these contrasting relationships, a review of the literature pertaining to the impact that fund size has on performance is provided below.

#### **2.6.1.2 Empirical studies**

An extensive body of research supports a negative relationship between fund size and performance, especially in terms of U.S. funds. For instance, Ciccotello and Grant (1996) undertook a study to determine whether investors should invest in larger or smaller U.S. mutual funds. These authors investigated a sample of equity mutual funds consisting of 182 aggressive growth funds, 248 long-term growth funds, and 196 growth and income funds for the period 1982 to 1992. A significant negative relationship was only found to exist for the 182 aggressive growth funds. Specifically, the results showed that smaller funds with aggressive growth objectives outperformed their larger peers. Ciccotello and Grant (1996) further supported this finding by calculating the increased wealth that an individual investing in funds with aggressive growth objectives would have achieved when rebalancing their investment portfolio every five years to include only the smallest quartile of funds at that particular time. The calculation starts in 1982 with an individual investing an amount of \$10 000 in each size quartile of the three types of equity mutual funds analysed in the study. In 1987, the portfolio is then reinvested in the funds of each size quartile at that time. If the investor reinvested their portfolio in the largest fund size quartile of the aggressive growth funds, the portfolio would have been worth \$32 817 as of 1992. However, if the investor reinvested their portfolio in the smallest fund size quartile of the aggressive growth funds, the portfolio would have been worth \$47 735 as of 1992. This shows

that the investor would have yielded a larger return if they reinvested their portfolio in the smallest fund size quartile of the aggressive growth funds.

A further study is that of Chen et al. (2004) who investigated the effect that lagged fund size had on performance for a sample of diversified U.S. equity mutual funds operating over the period 1962 to 1999. These authors identified that smaller funds outperformed their larger counterparts both before and after fees and expenses. This was particularly the case for funds that focused on investing in small capitalisation and illiquid stocks. As such, Chen et al. (2004) posited that the primary reason for fund size eroding performance was related to liquidity issues. In addition to liquidity concerns, organisational diseconomies related to hierarchy costs was also found to be a plausible explanation.

Moreover, when evaluating a comprehensive sample of U.S. actively managed equity mutual funds for the period 1993 to 2002, Yan (2008) also discovered a significant inverse relationship between lagged fund size and performance. In this study, fund performance was measured in terms of four alphas including Jensen's alpha, the Fama-French three-factor alpha, the Carhart four-factor alpha, and the conditional four-factor alpha. Consistent with Chen et al. (2004), Yan (2008) detected this negative relationship to be more prominent for funds that held fewer liquid stocks (that is, small capitalisation stocks) in their portfolios. Yan (2008) did not, however, find any evidence to suggest that smaller funds outperformed larger funds when the larger funds held mostly liquid shares. Thus, Yan (2008) concluded that smaller funds only significantly outperformed the least liquid larger funds. Both Chen et al. (2004) and Yan (2008) postulated that an increase in the size of funds that held small capitalisation shares, or illiquid holdings, increased both the trading costs and market impact costs of such funds which subsequently impeded fund performance. Another U.S. study to make mention of is that of Bessler, Kryzanowski, Kurmann, and Lückoff (2016). These authors studied a sample of 3 946 U.S. actively managed equity mutual funds over the period 1992 to 2007 to determine the association between lagged fund size and risk adjusted-performance. By doing so, it was found that increasing fund size had an effect of lowering fund performance calculated using the Carhart four-factor model. Hence, these findings correspond well with that of the abovementioned U.S. studies.

A negative relationship has also been observed within an Australian context. Over the period 1980 to 1995, Sawicki and Finn (2002) investigated 55 Australian balanced mutual funds. The findings of this study showed that, of the superior performing funds in the sample, small funds accounted for a disproportionate number of top performers and were further underrepresented in amongst low performers. Furthermore, a statistically significant negative relationship for a different sample of Australian mutual funds was also documented by Yap and Pierce (2008). These authors analysed the influence that fund size had on the performance of 168 Australian open-ended equity mutual funds in existence during 2002 to 2006. In this study, fund performance was measured utilising Jensen's alpha, a five-factor model obtained by introducing an illiquidity premium for small capitalisation stocks into the Carhart four-factor model, and a conditional Jensen's alpha model. The results indicated that as funds increased their AUM, fund abnormal performance declined.

Chan, Faff, Gallagher, and Looi (2009) also confirmed that a negative relationship existed between the size and performance of Australian mutual funds over the period 1998 to 2001 when using the Fama-MacBeth regression approach. These authors suggested that this association was due to the higher market impact costs that larger managers incurred compared to smaller managers. This was found to be as a result of larger managers transacting in larger quantities. Therefore, Chan et al. (2009) further identified that aggregate market impact costs were positively related with fund size. This was especially true for large managers pursuing highly active trading strategies compared to those following passive trading strategies since the latter engaged in less trading activity thereby reducing their market impact costs. Additionally, the authors stated that in an attempt to avoid these high transaction costs, large managers may change the way in which they manage and construct their fund portfolios which could negatively impact fund performance. Specifically, large managers may invest in larger and more liquid stocks, take smaller active positions relative to the benchmark, and trade less actively than small managers. A negative relationship has also been discovered in terms of European funds by Blake, Caulfield, Ioannidis, and Tonks (2014). These authors analysed a dataset of 561 open-ended equity mutual funds from the United Kingdom over the period 1998 to 2008. When estimating fixed effects models, size was found to be a fund characteristic that

significantly impacted fund performance in a negative manner for both gross and net returns.

Contrary to the studies above that identified a negative relationship, some studies have reported the presence of a positive relationship existing between fund size and performance. One such study is that of Otten and Bams (2002) in which the sample of funds evaluated consisted of 506 open-ended equity mutual funds operating over the period 1991 to 1998 from France, Italy, Germany, the Netherlands, and the United Kingdom. The findings of this study showed that there was a significant positive relationship between fund size and risk-adjusted performance measured using the Carhart four-factor model. Noteworthy, Otten and Bams (2002) were unable to determine the relationship in this regard for the Italian funds in the sample due to the lack of data availability for these funds. Moreover, when studying 152 Polish domestic and foreign equity mutual funds during the period 2002 to 2015, Filip (2018) found evidence in support of a statistically significant positive relationship between fund size and risk-adjusted returns when estimating both fixed effects and random effects models. Particularly, when the Treynor ratio, Sharpe ratio, and Sortino ratio were used as risk-adjusted performance measures for the sample of domestic funds, size influenced performance in a statistically significant positive manner. This relationship was also detected for the sample of foreign funds when performance was estimated using the Sharpe ratio, Sortino ratio, and the Carhart four-factor model. Accordingly, the findings of Filip (2018) confirm the presence of economies of scale in Polish funds.

Several other studies have identified a concave or nonlinear relationship between fund size and performance with one such study being that of Indro, Jiang, Hu, and Lee (1999). When investigating a sample of 683 actively managed U.S. equity mutual funds operating during the period 1993 to 1995, these authors discovered that mutual funds needed to maintain a minimum fund size in order to achieve a performance sufficient to cover the cost of acquiring and trading on information (that is, the cost of an active investment strategy). Additionally, when mutual funds surpassed the optimal size, fund performance became negative. Notably, the regressions indicated that an optimal fund size ranged between US\$946 million and US\$1.1 billion of net assets. Similarly, Bodson et al. (2011) also observed a concave quadratic relationship between fund size and performance when analysing a sample of 2 926 mutual funds

that operated between 2000 and 2010. The sample of mutual funds in this study consisted of 1 652 equity funds, 1 044 bond funds, and 230 mixed allocation funds. Importantly, these authors found this concave quadratic relationship to exist when measuring performance using the Treynor ratio, Sharpe ratio, Jensen's alpha, Carhart four-factor model, and a further performance measure proposed by the authors themselves. The results of this study showed that an optimal fund size existed in which performance was maximised when fund size was between US\$36.66 million and US\$324.93 million.

A concave relationship has also been documented in terms of Chinese mutual funds by Tang et al. (2012). These authors undertook an investigation on a comprehensive sample of Chinese open- and closed-ended equity mutual funds from 2004 to 2009 to determine the relationship between fund size and performance. The performance measures used in this study included the Sharpe ratio, Jensen's alpha, and the Fama-French three-factor model. Tang et al. (2012) found evidence of an inverted U-shape relationship between fund size and performance in which the optimal fund size was discovered to be approximately ¥1 billion. The authors reported that this concave relationship could be explained by both economies of scale and liquidity constraints. More specifically, economies of scale impacted smaller funds to a greater extent while larger funds were impacted more by liquidity constraints.

Other studies have detected an insignificant relationship between fund size and performance. As part of the seminal study of Sharpe (1966), the effect that fund size had on fund performance was investigated in an attempt to explain the reason for differences in the performance of mutual funds. Noteworthy, the performance measure used in this study was the reward-to-variability ratio (also referred to as the Sharpe ratio). By analysing a sample of 34 U.S. open-ended mutual funds that were in operation during the period 1954 to 1963, Sharpe (1966) identified that the larger funds exhibited somewhat better performance although the relationship was marginal as evidenced by the low Spearman rank correlation coefficient of +0.234. Consequently, Sharpe (1966) postulated that fund size was an insignificant factor in predicting future performance. In terms of an Australian perspective, Gallagher and Martin (2005) analysed the relationship between fund size and risk-adjusted performance derived from a three-factor model for a sample of 387 actively managed Australian equity

mutual funds over the period 1991 to 2000. These authors reported that the smaller retail funds did not significantly outperform their larger peers. Fund size was also found to be unrelated to the performance of institutional funds.

Similarly, when evaluating a sample of 19 domestic equity mutual funds in Singapore over the period 1999 to 2004, Sing (2007) discovered that the larger funds in the sample outperformed the smaller funds, however, the relationship was statistically insignificant. Furthermore, Low (2010) analysed a sample of 65 Malaysian unit trust funds during the period 1999 to 2004. Through this analysis, Low (2010) documented that there was no association between fund size and risk-adjusted returns measured using Jensen's alpha. Nevertheless, the results showed that a significant negative relationship existed between the percentage growth in fund size and fund performance. Thus, Low (2010) concluded that funds tended to become less efficient in their operations as they grew larger. An insignificant relationship was also discovered by Basso and Funari (2017). These authors studied a sample of 260 western European equity mutual funds between 2006 and 2009. By doing so, it was found that larger funds produced better performance compared to smaller funds although the positive relationship was statistically insignificant.

It must be noted that some studies have observed mixed results pertaining to the relationship between fund size and performance. One of these studies is that of Grinblatt and Titman (1989) who researched the performance of a sample of U.S. equity mutual funds over the period 1975 to 1984. The findings of this study showed that investing in the smaller funds in the sample resulted in a return gross of expenses which outperformed that of the larger funds. However, when performance was measured net of expenses, the returns of the smaller funds was not significantly different from those of the larger funds. Another study to mention is that of Dahlquist et al. (2000) who investigated mutual funds operating in Europe. These authors evaluated a sample of Swedish mutual funds comprised of 80 regular equity mutual funds, 46 equity funds offering tax benefits that formed part of a public savings program, 42 bond funds, and 42 money market funds over the period 1993 to 1997. This study revealed that size had little effect on the regular equity funds whereas it had a strong negative relation on the performance of the equity funds from the public

savings program. In addition, there were indications that fund size had a weak positive impact on the performance of the bond and money market funds.

A further study with mixed results is that of Ferreira et al. (2013) who analysed the association between fund performance and multiple fund characteristics including age, fund and family size, fees and expenses, and management structure, amongst others. In this study, performance was measured using the Carhart four-factor model. The comprehensive dataset consisted of 16 316 open-ended actively managed equity mutual funds from 27 countries operating during the period 1997 to 2007. In terms of the U.S. funds in the sample, smaller funds performed better compared to the larger funds. Particularly, the findings showed that a one-standard deviation increase in the size of U.S. funds resulted in a decrease in abnormal performance of approximately 0.15% per quarter or 0.6% per year. Contrarily, the larger non-U.S. funds outperformed the smaller funds since a one-standard deviation increase in the size of these funds yielded an increase in abnormal performance of approximately 0.11% per quarter or 0.44% per year. Therefore, Ferreira et al. (2013) posited that the diseconomies of scale prevalent in U.S. mutual funds did not hold true universally because the performance of non-U.S. funds did not deteriorate with an increase in fund size. Ferreira et al. (2013) stated that a possible explanation for the diminishing returns to scale of the U.S. funds was due to the liquidity constraints faced by these funds and not due to the fact that the U.S. funds were significantly larger in size compared to the non-U.S. funds.

The aforementioned studies only investigated the influence that size had on fund performance in international markets, however, limited research also exists within a South African context. For example, Hibbert (2003), Molelekoa (2012), and Wessels (2019) conducted studies in this regard for their respective master's research reports. Hibbert (2003) analysed a limited sample of 14 South African equity funds over the period 1990 to 1999 in which fund performance was measured using total return, the Treynor ratio, Sharpe ratio, and Jensen's alpha. The results indicated that a statistically insignificant relationship existed between these funds and their performance. Likewise, Molelekoa (2012) found no evidence of fund size having an influence on fund performance, measured as total return, for a sample of 104 South African equity funds operating during the period 2001 to 2011. On the other hand,

Wessels (2019) discovered contrasting results to that of Hibbert (2003) and Molelekoa (2012). By investigating a sample of 46 equity funds and 19 balanced funds that were in continuous existence over the period 2009 to 2019, a statistically significant negative relationship was detected, albeit very slight, when total return was used as a measure of fund performance.

Furthermore, van Andel (2014), a manager in the product development team at Allan Gray, suggested that investors should not be concerned with fund size as a factor that impacts fund performance. Specifically, van Andel (2014) did not find evidence of a relationship existing between the AUM of funds and their annualised rolling returns over a one-, three-, and five-year period for a sample of South African–Equity–General CISs. Contrarily, fund size was identified as a determinant of fund performance by Pillay, Muller, and Ward (2010) who undertook a study on a sample of 1 000 simulated equally weighted hypothetical equity portfolios in South Africa during the period 1991 to 2008. In particular, performance was found to be affected by size for funds greater than R5 billion.

From the studies elaborated on above, it is evident that the existing literature on the association between fund size and performance is inconclusive with prior studies finding evidence of either a negative, positive, concave, or insignificant relationship. Despite this, there is more evidence in support of a negative or insignificant relationship existing between fund size and performance.

### **2.6.2 Fund family size**

Funds generally belong to or are affiliated with asset management companies, also referred to as fund families, that offer investors a range of funds with different investment strategies. In addition to a given fund's size, the size of the family to which it belongs is also an attribute that has been examined by existing literature, albeit to a much lesser extent compared to the other attributes under investigation in the present study. Fund family size is measured as the total AUM of the institution, or fund family, that a particular fund belongs to. From Table 5 in section 2.5.5, the top ten CISs based on AUM operating in the South African market belong to large fund families. Most of these CISs are offered by the top ten largest asset management companies detailed

in Table 3 in section 2.5.2. Evidently, there are numerous large asset management companies that offer a multitude of funds, however, there are also many smaller asset management companies in existence. This then posits an intriguing question: does the size of the asset management company influence the performance of a given fund? Since size at the individual fund level might not fully explain fund performance, it is sensible to also consider the impact that size at the organisational level has on performance.

### **2.6.2.1 Association overview**

A positive association between family size and fund performance suggests that the larger the fund family that a given fund belongs to in terms of AUM, the better the fund's performance will be (Ferreira et al., 2013). Presumably, large fund families can benefit from economies of scale due to the fact that expenses, such as those related to research, administration, trading commissions, and lending fees, can be shared amongst funds that collectively have a larger asset base. This is in contrast to smaller fund families who have to share these expenses amongst funds with a smaller asset base (Chen et al., 2004; Ferreira et al., 2013). Additionally, large fund families can take advantage of economies of scope from using the same or similar resources to manage many different kinds of funds (Chen et al., 2004; Ferreira et al., 2013). These factors should enhance larger fund families' capability of generating superior performance relative to smaller fund families that cannot take advantage of such economies.

There is also the possibility of a negative relationship existing between family size and fund performance. A negative association implies that funds belonging to asset managers with less AUM will outperform funds from asset managers with more AUM. An explanation for this includes organisational diseconomies, particularly those associated with organisational hierarchy, which leads to inefficiencies and ultimately compromised fund performance (Ferreira et al., 2013). Nevertheless, an overview of the association between fund family size and performance that has been documented by prior studies is to follow.

### **2.6.2.2 Empirical studies**

One study that provides evidence in support of a positive relationship between fund family size and performance is that of Chen et al. (2004). When investigating a sample of diversified U.S. equity mutual funds in existence over the period 1962 to 1999, these authors identified that funds belonging to larger fund families were able to generate superior performance compared to funds from smaller families. Notably, this relationship was found to hold when performance was measured in terms of both gross and net returns. Similar results were discovered by Yan (2008) when analysing a sample of U.S. actively managed equity mutual funds operating over the period 1993 to 2002. Specifically, a statistically significant positive relationship was observed between fund family size and performance measured using Jensen's alpha, the Fama-French three-factor alpha, the Carhart four-factor alpha, and the conditional four-factor alpha. Yan (2008) concluded that these findings were consistent with the notion that larger fund families are able to take advantage of economies on certain fixed costs such as those on brokerage, marketing, and research. Importantly, the significant positive association at the organisational level reported by Chen et al. (2004) and Yan (2008) was in contrast to both of their findings at the individual fund level in which a statistically significant negative relationship was detected between fund size and performance. This infers that investors should focus on investing in small funds of large families.

Another study that examined the effect of family size on mutual fund performance was that of Ferreira et al. (2013). When evaluating a sample of 16 316 open-ended actively managed equity mutual funds from 27 countries operating during the period 1997 to 2007, these authors identified that a statistically significant positive relationship existed between fund family size and abnormal performance measured using the Carhart four-factor model. The effect of family size on performance was found to be of a similar magnitude for funds operating in the United States compared to those operating outside the United States. On average, the findings showed that a one-standard deviation increase in family size resulted in an increase in performance of approximately 0.08% per quarter or 0.32% per year. This result was primarily attributable to the benefit of economies in trading commissions and lending fees that larger fund families have the opportunity of capitalising on.

A further study that investigated a sample of non-U.S. mutual funds is that of Tang et al. (2012). When analysing a sample of Chinese open- and closed-ended equity mutual funds from 2004 to 2009, these authors discovered that fund performance was significantly positively related to fund family size. This relationship was detected when the Sharpe ratio, Jensen's alpha, and the Fama-French three-factor model were used as measures of fund performance. As such, Tang et al. (2012) posited that better performing funds were likely to be managed by larger asset management companies. Fund family size was also found to have a significant positive impact on performance for a different sample of Asian mutual funds by Fu and Liu (2015). The sample used in this study consisted of 188 equity funds from Taiwan operating during the period 1995 to 2014. Through panel data regression analyses, Fu and Liu (2015) identified that medium sized funds from larger families generated superior performance as measured by raw return and the Carhart four-factor model. On the contrary, small funds from small families performed the worst.

Despite the aforementioned studies reporting a significant positive relationship between family size and fund performance, there are also studies with opposing results in which an insignificant relationship has been documented. For instance, when estimating fixed effects models, Blake et al. (2014) observed that fund size had a statistically insignificant positive impact on fund performance for a sample of 561 open-ended equity mutual funds from the United Kingdom in existence over the period 1998 to 2008. This relationship was detected when fund performance was measured in terms of both gross and net returns. Another study to mention is that of Bessler et al. (2016) who analysed a sample of 3 946 U.S. actively managed equity mutual funds that were in operation over the period 1992 to 2007. These authors evaluated fund family size in terms of total AUM as well as the number of funds under supervision at the organisational level, referred to as family breadth by the authors. Using the Carhart four-factor alpha as a measure of fund performance, funds belonging to families with larger total AUM outperformed funds from smaller families with lower total AUM. However, this relationship was found to be statistically insignificant. Nevertheless, Bessler et al. (2016) documented that funds belonging to families that managed only a few funds (that is, low breadth families) significantly outperformed funds belonging to families that managed many funds (that is, high breadth families). This finding was

justified by organisational diseconomies faced by high breadth families which resulted in inefficient decision making that negatively affected fund performance.

Moreover, Filip (2018) examined the relationship between fund family size and the performance of 152 Polish domestic and foreign equity mutual funds over the period 2002 to 2015. By estimating both fixed effects and random effects models, fund family size was found to be an attribute that had a statistically insignificant impact on fund risk-adjusted returns. Noteworthy, this relationship existed for both the domestic and foreign funds in the sample when performance was calculated using the Treynor ratio, Sharpe ratio, Sortino ratio, and the Carhart four-factor model. Therefore, these findings suggest that funds belonging to larger families do not necessarily outperform those belonging to smaller families.

From the studies detailed above, it is evident that prior researchers have primarily observed that there is a positive relationship between fund family size and fund performance.

### **2.6.3 Fund age**

Fund age refers to the number of days, months, or years that a fund has existed which is measured as the time from the fund's inception date to the end of the analysis period. A fund's age is an indication of its longevity as well as the period of time in which the fund has survived in a competitive environment (Ferreira et al., 2013; Prather et al., 2004). The age of a fund can also provide information about its operating experience since a fund gains experience with each year of operation (Kaur, 2018).

#### **2.6.3.1 Association overview**

A negative relationship between fund age and performance implies that as a fund ages, its ability to generate superior returns declines, and thus, younger funds outperform older funds. Contrarily, a positive relationship suggests that older funds perform better compared to younger funds. The relationship between fund age and performance can either be a negative or positive one as there is evidence to support both associations (Ferreira et al., 2013). A negative relationship can exist between fund age and performance because the managers of younger funds may be more alert

and flexible to changing markets or more committed to achieve better performance in an effort to survive and obtain recognition in the initial phases of operation (Ferreira et al., 2013; Yap & Pierce, 2008). In spite of this, younger funds typically incur higher costs, such as marketing costs, and management may also lack experience which may affect the younger fund's ability to outperform their older peers (Ferreira et al., 2013; Gregory, Matatko, & Luther, 1997; Yap & Pierce, 2008). Additionally, funds gain experience with each year of operation, and as such, may perform better due to the 'learning-by-doing' effect. Accordingly, a positive relationship may exist between fund age and performance. Prior literature on the association between fund age and performance is discussed below.

### **2.6.3.2 Empirical studies**

A study that analysed a sample of U.S. mutual funds to determine the impact that fund age has on performance is that of Payne et al. (1999). To do such, these authors made use of pooled ordinary least squares (OLS) regression to analyse 813 U.S. equity mutual funds for the period 1993 to 1995. This study focussed on investigating five main classifications of equity funds including growth, aggressive growth, growth and income, equity income, and balanced funds. The results indicated that fund age was positively and significantly associated with fund performance particularly for the growth fund category. Notably, three-year risk-adjusted returns were used to measure fund performance. Evidence in contradiction to the findings of Payne et al. (1999) has been reported by Chen et al. (2004). These authors studied the relationship between several fund characteristics and the performance of diversified U.S. equity mutual funds spanning from 1962 to 1999. By regressing monthly fund returns on fund age lagged by one month, a negative but statistically insignificant relationship was discovered. Similarly, Prather et al. (2004) also found a negative but statistically insignificant relationship between fund age and performance when studying U.S. equity mutual funds over the period 1996 to 2000 in which modified Jensen's alpha was employed to determine fund performance. This finding revealed that fund age was not an attribute that influenced fund performance.

Evidence in support of a statistically significant negative relationship between fund age and performance has been documented by Karoui and Meier (2009). These authors evaluated the performance and portfolio characteristics of 828 newly launched U.S.

equity mutual funds over the period 1991 to 2005. The results of this study showed that new funds exhibited superior performance compared to older funds when performance was estimated using the Carhart four-factor model. Specifically, newly launched funds outperformed older funds over the first 12 and 36 months after their launch dates by 0.05% and 0.12% per month respectively. Although new funds initially performed better, the effect was found to fade away after five years.

A further study that assessed U.S. mutual funds with the addition of also analysing mutual funds from other non-U.S. countries is that of Ferreira et al. (2013). By evaluating the fund characteristics of an extensive sample of 16 316 open-ended actively managed equity funds from 27 countries over the period 1997 to 2007, these authors found mixed results regarding the relationship between fund age and performance measured using the Carhart four-factor model. In terms of the U.S. mutual funds, no relation between fund age and performance was found to exist. However, the authors observed that newer non-U.S. funds performed better than older non-U.S. funds. In particular, for the sample of non-U.S. mutual funds, Ferreira et al. (2013) detected that a one standard deviation increase in fund age was associated with a decrease in fund performance of 0.06% per quarter or 0.24% per year. Thus, these findings indicated that a negative relationship existed between fund age and the performance of non-U.S. funds

In terms of a European perspective, Otten and Bams (2002) investigated the influence of fund characteristics on risk-adjusted performance by analysing 506 open-ended equity mutual funds over the period 1991 to 1998. The sample of funds came from five important European mutual fund countries namely France, Italy, Germany, the Netherlands, and the United Kingdom. By making use of the Carhart four-factor model to measure risk-adjusted fund performance, the results obtained showed that younger funds performed better compared to older funds. Although this negative relationship was identified for each country analysed, it was only statistically significant for funds from Germany and the United Kingdom. It must be noted that Italian funds were not reported on in this regard due to the lack of availability of information. Another study that examined a European sample of mutual funds is that of Annaert, van den Broeck, and Vander Vennet (2003). Through their analysis of 179 European equity mutual

funds operating over the period 1995 to 1998, no significant relation was found to exist between fund age and performance measured using Jensen's alpha.

Likewise, when a sample of Spanish mutual funds in existence over the period 2000 to 2009 was evaluated by Murcia (2011), no statistically significant relationship between fund age and performance, measured as the net annual fund yield, was detected. This association was discovered for the overall sample comprising fixed income, balanced fixed income, balanced equity, Euro equity, international equity, and global funds. A significant negative relationship was, however, observed for the fixed income funds and balanced equity funds from the total sample. A further study to make mention of is that of Filip (2018) who investigated the relationship between several fund attributes and the performance of 152 domestic and foreign equity mutual funds in Poland that operated during the period 2002 to 2015. Through this study, fund age was identified as a fund attribute that negatively influenced the risk-adjusted performance of the domestic funds when performance was calculated using the Treynor ratio, Sharpe ratio, and Sortino ratio. This relationship was also found to exist in the foreign fund sample and was particularly strongest when performance was estimated with the Carhart four-factor model.

The influence of fund age on performance has also been examined in South America by Eid Júnior and Rochman (2009). The sample used in this study consisted of 699 Brazilian mutual funds from four main investment categories namely stocks, fixed income, hedge, and exchange rate funds. When analysing these funds between 2001 and 2006, Eid Júnior and Rochman (2009) found that older mutual funds from the stocks and hedge fund investment categories generated superior performance measured as Jensen's alpha. Hence, there was a positive association between fund age and performance for these two investment categories.

Studies evaluating the fund age-performance relationship have also been conducted in the Asian region. For example, Lee, Yen, and Chen (2008) investigated a sample of 122 Taiwanese open-ended equity mutual funds from 2001 to 2006. By doing so, fund age had an insignificant impact on fund performance measured as either raw return, market-adjusted return, Jensen's alpha, or the Sharpe ratio. Moreover, Afza and Rauf (2009) analysed funds operating in the Pakistani mutual fund industry. These

authors studied open-ended mutual funds in existence in Pakistan for the period 1999 to 2006. Through their analysis, a positive but statistically insignificant relationship between fund age and performance was observed in which fund performance was measured using the Sharpe ratio. This result indicated that, on average, older funds performed the same or only slightly better compared to younger funds over the sample period. Another Asian study was conducted by Kaur (2018) who examined a sample of Indian diversified growth equity mutual funds over the period 2004 to 2013. This study discovered a positive relationship between fund age and performance that was statistically significant in the case of gross average returns but statistically insignificant for risk-adjusted returns measured as the Sharpe ratio and four-factor conditional Carhart alpha.

Evidence from an Australian perspective was gathered by Yap and Pierce (2008) when studying a sample of 168 Australian open-ended equity funds from 2002 to 2006. In doing so, a significant inverse relationship was found to exist between fund age and performance. In this study, fund performance was calculated using Jensen's alpha, a five-factor model obtained by introducing an illiquidity premium for small capitalisation stocks into the Carhart four-factor model, and a conditional Jensen's alpha model. This significant negative relationship revealed that funds with a longer period of existence underperformed relative to those with a shorter period of existence. As such, the authors concluded that as funds aged, their ability to generate abnormal returns declined.

As is evident from the above literature, the existing international evidence on the relationship between fund age and performance is mixed with results varying across countries and sample periods. Nevertheless, there is more evidence in support of a negative or insignificant relationship existing between fund age and performance compared to a positive relationship.

#### **2.6.4 Fund expense ratios**

A fund's expense ratio, also referred to as the total expense ratio (TER), represents the fund's total expenses over its average net assets for the year and is expressed as a percentage (Babalos, Kostakis, & Philippas, 2009; Ferreira et al., 2013; Malkiel,

1995). A fund's expense ratio reduces the return received by investors of the fund and typically includes costs such as management fees, custody and trustee fees, operating fees, and audit fees, amongst others. Investors of CISs are charged with this expense in order to compensate the fund management company for the services rendered in the management of the fund. Fund managers calculate and disclose these expense ratios which are generally quoted on the fund's fact sheets. Therefore, investors will be aware of a particular fund's expense ratio prior to making an investment in the fund. Important to highlight is that the TER of a fund will be dependent on the class of the investment since different classes of a fund each have their own TER that is comprised of costs specific to that fee class.

#### **2.6.4.1 Association overview**

A positive relationship between fund expense ratios and performance suggests that funds charging investors higher expenses are able to generate higher returns. Conversely, a negative relationship indicates that funds with lower expense ratios perform better. This infers that funds with higher expense ratios do not achieve returns sufficient to justify the higher expenses (Malkiel, 1995). Intuitively, one would expect the association between a fund's expense ratio and its performance to be positive. This is because funds charging higher fees should generate an appropriately higher level of return for its investors otherwise, if this was not the case, investors would rather invest in funds with lower fees (Otten & Bams, 2002). Additionally, if a fund manager has proved to investors that he or she is capable of earning superior returns, investors would be willing to compensate the manager with higher fees and expenses (Grinblatt & Titman, 1994). It must be noted, however, that higher expense ratios do not necessarily imply superior fund performance (Elton, Gruber, Das, & Hlavka, 1993). There is academic literature suggesting that funds charging lower expense ratios offer better performance relative to their peers charging higher expense ratios. As such, prior literature on the relationship between fund expense ratios and performance is discussed next.

#### **2.6.4.2 Empirical studies**

Extensive research has been conducted on the relationship between fund expense ratios and the performance of U.S. mutual funds. Most of these U.S. studies have found the existence of a negative relationship with one such study being the seminal

work of Sharpe (1966). This study attempted to determine the reasons for differences in mutual fund performance by analysing the effect of fund expense ratios on performance. In this study, fund performance was measured as a fund's reward-to-variability ratio (also referred to as the Sharpe ratio). Sharpe (1966) tested the aforementioned implications by evaluating 34 U.S. open-ended mutual funds over the period 1954 to 1963. The results of this study showed that funds with lower expense ratios experienced better future performance indicating that a negative relationship existed between fund expense ratios and performance.

Another study to mention is that of Elton et al. (1993) who questioned the results of Ippolito (1989). Notably, Ippolito (1989) identified that expense ratios were unrelated to risk-adjusted returns when using the Sharpe ratio as a measure of performance for a sample of U.S. mutual funds that were in existence between 1965 and 1984. Elton et al. (1993) undertook their own investigation to re-examine the influence of fund expense ratios on performance measured as Jensen's alpha. By analysing a sample of U.S. mutual funds for the period 1965 to 1984, these authors discovered that there was a significant negative relationship between performance and average expenses. Due to the fact that higher expenses were associated with poorer performance, Elton et al. (1993) concluded that fund management does not necessarily increase fund performance by an amount sufficient to justify higher fees.

Malkiel (1995) also investigated the relationship between fund expense ratios and performance for a sample of diversified U.S. equity mutual funds operating during the period 1982 to 1991. An extremely strong and significant negative relationship was observed between fund expense ratios and risk-adjusted performance when Jensen's alpha was used as a measure of performance. Malkiel (1995) further decomposed the expense ratios into investment advisory and non-advisory expenses (that is, accounting and record-keeping expenses, expenses relating to advertising, and other marketing expenses). By regressing fund performance on these decomposed expense ratios, it was found that non-advisory expenses were negatively related to performance whereas there was a positive relationship between advisory expenses and fund performance.

A further study that examined the influence of fund expense ratios on performance is the seminal work of Carhart (1997). In this study, a sample of 1 892 diversified U.S. equity mutual funds were evaluated over the period 1962 to 1993. By doing so, a significant negative relationship was detected between fund expense ratios and net-of-fees performance calculated using a four-factor model in which the Fama-French three-factor model was augmented with the momentum factor of Jegadeesh and Titman (1993) (also referred to as the Carhart four-factor model). The results suggested that expenses had at least a one-for-one negative impact on fund performance. In particular, Carhart (1997) found that for every 1% increase in fund expense ratios, annual abnormal return decreased by approximately 1.54%.

Apap and Griffith (1998) also analysed a sample of U.S. equity funds to determine the impact that fund expense ratios had on the abnormal return and total return of these funds during the period 1983 to 1992. The dataset consisted of funds from five equity classification categories namely maximum capital gains, long-term growth, growth and current income, equity income, and small company growth funds. Through their analysis, the authors identified a significant inverse relationship between fund expense ratios and abnormal returns. Specifically, the results indicated that for every 1% increase in a fund's expense ratio, abnormal returns reduced by approximately 0.49% to 2.44% depending on the equity classification of the fund. Similarly, Apap and Griffith (1998) also found that a significant inverse relationship existed between fund expense ratios and total returns. The results showed that for every 1% increase in a fund's expense ratio, total return decreased by approximately 2.07% to 6.37% depending on the fund's equity classification.

Another U.S. study that discovered a significant negative relationship is that of Yin-Ching and Mao-Wei (2003). By investigating U.S. mutual funds over the period 1961 to 2000, these authors observed that the majority of lower expense ratio funds outperformed their higher expense ratio counterparts. Likewise, Prather et al. (2004) studied a sample of U.S. equity mutual funds over the period 1996 to 2000 to determine the impact of expense ratios on fund performance. These authors found that expense ratios were negatively related to fund performance when modified Jensen's alpha was used as a measure of performance. This negative relationship indicated that investors overcompensated fund managers for unsatisfactory

performance. A further study that detected similar results is that of Pollet and Wilson (2008). When examining a sample of U.S. mutual funds from 1975 to 2000, Pollet and Wilson (2008) identified that higher expenses were negatively associated with returns. This relationship has also been discovered between fund expense ratios and the before-fee performance of mutual funds by Gil-Bazo and Ruiz-Verdú (2009). These authors evaluated a sample of U.S. diversified domestic equity mutual funds for the period 1961 to 2005. In doing so, the authors documented a negative relationship between expense ratios and before-expense risk-adjusted performance estimated using the Carhart four-factor model.

Despite the aforementioned U.S. studies that reported a statistically significant negative association between fund expense ratios and performance, there are studies that have found positive or insignificant relationships. One study that observed a significant positive relationship is that of Droms and Walker (1996). These authors assessed the relationship between the expense ratios and performance of U.S. equity mutual funds in operation over the period 1971 to 1990. Three measures of performance were used in the regression model namely total return, the Treynor ratio, and Sharpe ratio. Droms and Walker (1996) found evidence of a significant positive relationship in which higher expenses were associated with higher performance for all three measures of fund performance. The authors stated that this association implies that additional expenses incurred in the pursuit of higher returns were rewarded for the funds in the sample. Nevertheless, a study in support of an insignificant relationship existing between fund expense ratios and performance is that of Carlson (1970) who investigated a sample of U.S. equity funds operating during the period 1958 to 1967. The results of this study revealed that there was a positive but statistically insignificant relationship between expense ratios and fund performance measured in terms of the Sharpe ratio.

Moreover, Grinblatt and Titman (1994) found no statistical relationship between expense ratios and mutual fund performance, calculated using Jensen's alpha, when analysing a sample of U.S. mutual funds that existed between 1974 and 1984. They did, however, find that there was a significant negative relationship between performance and management fees. Furthermore, the study of Chen et al. (2004) identified a negative but statistically insignificant relationship between fund expense

ratios and performance. This insignificant relationship was discovered for a sample of diversified U.S. equity mutual funds operating over the period 1962 to 1999. Noteworthy, fund performance was calculated by adjusting the gross and net fund returns using a market model, the capital asset pricing model, the Fama-French three-factor model, and the Carhart four-factor model. More recently, Ferreira et al. (2013) analysed the determinants of mutual fund performance for a sample of open-ended actively managed equity mutual funds from 27 countries over the period 1997 to 2007. These authors observed a negative association between fund expense ratios and net-of-fees fund performance estimated using the Carhart four-factor model. However, Ferreira et al. (2013) noted that this relationship was statistically insignificant for U.S. mutual funds and only statistically significant in some specifications of non-U.S. mutual funds.

Studies have also been conducted on the association between fund expense ratios and the performance of European mutual funds such as the study of Dahlquist et al. (2000) in which Swedish equity mutual funds were investigated between 1993 and 1997. The results of this study showed that higher fee funds tended to underperform relative to lower fee funds. Interestingly, the authors detected that, in some cases, funds charging higher fees performed better than those charging lower fees before fees were deducted in the calculation of fund performance. Dahlquist et al. (2000) concluded that the results suggest that higher fees or more expensive management may result in good fund performance but it is not high enough to cover the fees charged by these funds. Another study that found European fund performance to be negatively related to expense ratios is that of Otten and Bams (2002). These authors measured the effect of fund expense ratios on risk-adjusted performance for a sample of open-ended equity mutual funds over the period 1991 to 1998 from France, Germany, the Netherlands, and the United Kingdom. The Carhart four-factor model was used as a measure of fund performance in this study. The results indicated that there was a significant negative relationship between fund expense ratios and risk-adjusted performance in three out of the four European countries namely Germany, the Netherlands, and the United Kingdom. Expense ratios were also negatively related to fund performance for funds from France but this relationship was statistically insignificant.

Babalos et al. (2009) evaluated the impact that fund expense ratios had on all Greek domestic equity mutual funds operating during the period 2000 to 2006 by estimating fixed effects and random effects models. The two measures of fund performance that were employed in this study included Jensen's alpha and the Carhart four-factor model. The authors discovered that high expense ratios were significant predictors of negative future performance. Thus, Babalos et al. (2009) posited that investors should avoid investing in funds that charge a high expense ratio due to the lower performance associated with these types of funds. Contrarily, when Korkeamaki and Smythe Jr (2004) examined a sample of Finnish mutual funds over the period 1993 to 2000, an insignificant relationship was identified between fund expense ratios and performance calculated using the Fama-French three-factor model. This relationship was observed when the authors estimated both pooled OLS and random effects models. In spite of the results of the abovementioned studies, a positive relationship has also been documented in terms of a European perspective by Filip (2018). This author analysed the influence that expense ratios had on risk-adjusted fund performance for a sample of domestic and foreign mutual funds operating in Poland over the period 2002 to 2015. In this study, fixed effects and random effects models were estimated when the Treynor ratio, Sharpe ratio, Sortino ratio, and the Carhart four-factor model were used as measures of fund performance. It was found that funds charging investors higher expenses were able to generate higher returns. This positive and statistically significant impact on achieved returns was particularly prevalent for the domestic funds in which the Treynor ratio, Sharpe ratio, and Sortino ratio were the measures of fund performance.

The influence of fund expense ratios on performance has also been investigated in Asia. Rehman et al. (2018) undertook a study to evaluate the influence of fund attributes on fund returns for a sample of close-ended mutual funds in Pakistan operating between 2007 to 2013. By regressing fund expense ratios on fund returns, the findings of this study revealed that expense ratios were significantly inversely related to fund returns. This result infers that profitability declined as expense ratios increased and vice versa. Despite this, Kaur (2018) detected contrasting results to that of Rehman et al. (2018). Kaur (2018) examined the impact of expense ratios on the performance of Indian diversified growth equity mutual funds that were in existence over the period 2004 to 2013. When measuring performance as gross average returns

and Sharpe ratios, the effect of expense ratios was significantly positive, however, it was negative and insignificant when performance was measured using the four-factor conditional Carhart alpha.

Evidence on the influence of expense ratios on fund performance also exists in terms of an Australian perspective. Yap and Pierce (2008) analysed the impact that fund expense ratios had on the performance of Australian open-ended equity mutual funds over the period 2002 to 2006 by conducting pooled cross-sectional OLS regressions. The performance measures that were utilised in this study included Jensen's alpha, a five-factor model obtained by introducing an illiquidity premium for small capitalisation stocks into the Carhart four-factor model, and a conditional Jensen's alpha model. Through this study, the authors found that a significant negative relationship existed between fund expense ratios and performance. This result indicated that fund managers were unable to generate superior performance to recover the fees imposed.

Although there is evidence to suggest that a positive or insignificant relationship exists between fund expense ratios and performance, the majority of prior literature from data sets around the world covering varying time periods support the existence of a negative relationship.

## **2.7 SUMMARY**

Many investors worldwide utilise CISs to gain exposure to a wide range of financial instruments. Therefore, this chapter emphasised the importance of CISs and provided a comprehensive overview of what these investment vehicles entail. In particular, the definition of CISs, the history of the development of CISs, the benefits and limitations associated with investing in these investment vehicles, and the structure of CISs were expanded upon. Moreover, the various categories of CISs and the factors that differentiate CISs were discussed. Since this study's focus is on South African CISs, the ASISA Fund Classification Standard was explained so as to understand the different types of CISs operating in the South African CIS market. Following this, the South African CIS industry was reviewed by providing statistics on the number of funds in existence as well as on the AUM of these funds.

Thereafter, the determinants of CIS performance were examined with particular emphasis on the influence that fund size, family size, age, and expense ratios have on the performance of CISs. From this evaluation, it was discovered that the relationship between the aforementioned attributes and fund performance varies depending on the fund attribute under investigation, the market in which the study was conducted, and the sample period under review. In spite of this, the majority of prior studies have found more evidence in support of a negative or insignificant relationship between fund size and performance as well as between fund age and performance. Additionally, existing literature primarily supports the existence of a positive relationship between family size and performance. Furthermore, most prior studies observed a negative relationship between fund expense ratios and performance.

## **CHAPTER 3 – RESEARCH METHOD**

### **3.1 INTRODUCTION**

This chapter provides an overview of the data used in this study with particular emphasis being placed on the dependent and independent variables as well as the sample of collective investment schemes (CISs) that are investigated. Moreover, the research methodologies adopted, namely panel data methods, are elaborated on. Additionally, the diagnostic tests that are conducted prior to the estimation of the panel data models to ensure the accuracy of the results are detailed. Lastly, the research method limitations applicable to the present study are outlined.

### **3.2 DATA**

This study focuses on analysing the impact that fund attributes have on the performance of South African–Equity–General classified funds that were in operation during the period January 2000 to September 2021. Thus, fund performance is the dependent variable in this study with the various fund attributes (fund size, family size, age, and expense ratios) being the independent variables. A description on the dependent and independent variables used in this study as well as the sample of CISs analysed is provided in this section. Furthermore, the imputation method adopted for the fund expense ratio attribute is also explained.

#### **3.2.1 Dependent variables**

The results of the present study are sensitive to the performance measures employed, and as such, to reduce the inherent problem of interpretation posed by the use of only one fund performance measure, five measures of performance are used in this study. Specifically, total return as well as several risk-adjusted performance measures including the Treynor ratio, Sharpe ratio, information ratio, and Jensen's alpha are applied to measure fund performance. No one measure is superior but by considering several measures together, this study is able to draw more definitive conclusions. It is

important to highlight that previous studies<sup>4</sup> analysing fund attribute-performance relationships have also adopted these performance measures. Hence, the present study's findings can be compared to these prior studies to determine whether the fund attribute-performance relationships of South African CISs conform with that of international funds. Each of the five chosen measures of performance are discussed in more detail below.

### 3.2.1.1 Total return

Total return represents the monthly total return of a fund including both dividends and capital appreciation whilst accounting for fees by deducting portfolio management fees, administrative fees, and other fund expenses (Riley & Brown, 2015a). The total return of a fund is expressed mathematically as:

$$Total\ return_{it} = \frac{EP_{it} + Div_{it} + Cap\ Dist_{it} - Fees_{it} - BP_{it}}{BP_{it}} \quad (1)$$

where  $Total\ return_{it}$  is the total return of fund  $i$  in period  $t$ ;  $EP_{it}$  is the ending price of fund  $i$  in period  $t$ ;  $Div_{it}$  is the dividend payments made by fund  $i$  in period  $t$ ;  $Cap\ Dist_{it}$  is the capital gains distributions made by fund  $i$  in period  $t$ ;  $Fees_{it}$  represents the portfolio management fees, administrative fees, and other fund expenses of fund  $i$  in period  $t$ ; and  $BP_{it}$  is the beginning price of fund  $i$  in period  $t$ . The total return of the CISs included in the present study's dataset is retrieved from the Morningstar Direct database.

### 3.2.1.2 Treynor ratio

The Treynor ratio, introduced by Treynor (1965), relates a fund's excess returns to the systematic risk assumed by the fund. As such, this ratio is also referred to as the reward-to-volatility ratio. The Treynor ratio is calculated as follows:

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<sup>4</sup> See, for example, Afza and Rauf (2009), Annaert et al. (2003), Apap and Griffith (1998), Babalos et al. (2009), Bodson et al. (2011), Carlson (1970), Droms and Walker (1996), Eid Júnior and Rochman (2009), Elton et al. (1993), Filip (2018), Grinblatt and Titman (1994), Hibbert (2003), Ippolito (1989), Kaur (2018), Lee et al. (2008), Low (2010), Malkiel (1995), Molelekoa (2012), Tang et al. (2012), and Wessels (2019).

$$Treydor\ ratio_{it} = \frac{\bar{R}_{it} - \bar{r}_{ft}}{\hat{\beta}_{it}} \quad (2)$$

where  $Treydor\ ratio_{it}$  is the Treynor ratio of fund  $i$  in period  $t$ ;  $\bar{R}_{it}$  is the mean monthly rate of return of fund  $i$  in period  $t$ ;  $\bar{r}_{ft}$  is the mean risk-free rate of return in period  $t$ ; and  $\hat{\beta}_{it}$  is the beta or sensitivity to returns on the market portfolio of fund  $i$  in period  $t$ . In this study,  $\bar{r}_{ft}$  is proxied by the monthly yield on the 10-year South African government bond sourced from the South African Reserve Bank. Furthermore, the market portfolio used in the calculation of  $\hat{\beta}_{it}$  is proxied by the monthly return of the FTSE/JSE All Share Index retrieved from IRESS.

### 3.2.1.3 Sharpe ratio

The Sharpe ratio, also referred to as the reward-to-variability ratio, was developed by Sharpe (1966) and is a modified version of the Treynor ratio. This ratio measures the excess return of a fund to its total risk where total risk is measured by the fund's standard deviation of returns. The Sharpe ratio is expressed as follows:

$$Sharpe\ ratio_{it} = \frac{\bar{R}_{it} - \bar{r}_{ft}}{\hat{\sigma}_{it}} \quad (3)$$

where  $Sharpe\ ratio_{it}$  is the Sharpe ratio of fund  $i$  in period  $t$  and  $\hat{\sigma}_{it}$  is the monthly standard deviation of the rate of return of fund  $i$  in period  $t$ .

### 3.2.1.4 Information ratio

The information ratio measures a fund's return in excess of the benchmark relative to the variability of that excess return (Bailey et al., 2007). In other words, this ratio measures the reward earned by a fund per incremental unit of risk created by deviating from the benchmark's holdings. The numerator of the information ratio is referred to as the active return while the denominator is referred to as the active risk or tracking error (Bailey et al., 2007). The information ratio is calculated as:

$$Information\ ratio_{it} = \frac{\bar{R}_{it} - \bar{R}_{bt}}{\hat{\sigma}_{i-b,t}} \quad (4)$$

where  $Information\ ratio_{it}$  is the information ratio of fund  $i$  in period  $t$ ;  $\bar{R}_{bt}$  is the mean monthly rate of return of the benchmark in period  $t$ ;  $\hat{\sigma}_{i-b,t}$  is the monthly standard

deviation of the difference between the returns of fund  $i$  and the returns on the benchmark in period  $t$ . In this study,  $\bar{R}_{bt}$  is proxied by the monthly return of the FTSE/JSE All Share Index obtained from IRESS. Hence, the benchmark in the calculation of  $\hat{\sigma}_{i-b,t}$  is also proxied by the monthly return of the FTSE/JSE All Share Index.

### 3.2.1.5 Jensen's alpha

Jensen's alpha, also known as ex post alpha, was introduced by Jensen (1968, 1969) and is used to measure a fund's differential return compared to the return required to compensate for the systematic risk assumed by the fund. Jensen's alpha is stated as:

$$Jensen's\ alpha_{it} = \bar{R}_{it} - [\bar{r}_{ft} + \hat{\beta}_{it}(\bar{R}_{mt} - \bar{r}_{ft})] \quad (5)$$

where  $Jensen's\ alpha_{it}$  is the Jensen's alpha of fund  $i$  in period  $t$  and  $\bar{R}_{mt}$  is the mean monthly rate of return of the market portfolio in period  $t$ . For the purposes of this study, the proxy used for  $\bar{R}_{mt}$  is the monthly return of the FTSE/JSE All Share Index retrieved from IRESS.

### 3.2.2 Independent variables

Fund size, family size, age, and expense ratios are the independent variables in this study. These variables are defined as follows:

- $Size_{it}$  is calculated as the natural logarithm of the monthly value of assets under management (AUM) in millions of Rand of fund  $i$  in period  $t$ ;
- $Family_{it}$  is calculated as the natural logarithm of the monthly value of AUM in millions of Rand of the asset management company to which fund  $i$  belongs in period  $t$ ;
- $Age_{it}$  is calculated as the natural logarithm of the number of days from fund  $i$ 's inception date to time  $t$ ;
- $Expense_{it}$  is calculated as the total expenses of fund  $i$  in relation to its AUM in period  $t$  and is expressed as a percentage.

Data pertaining to these fund attributes for the CISs in the sample are retrieved from the Morningstar Direct database. Natural logarithm transformations, also known as logs to base  $e$  where  $e$  is Euler's number of 2.71828, are made on fund size, family

size, and age. As stated by Brooks (2008), there are three main reasons why logarithm transformations are useful in data analysis. Firstly, logarithm transformations can assist in rescaling the data so that the variance is more constant. Secondly, taking a logarithm can be used to transform a skewed distribution closer to a normal distribution. Thirdly, logarithm transformations can be used to make a non-linear multiplicative relationship between variables into a linear additive relationship (Brooks, 2008).

From the dependent and independent variables, the performance of the CISs included in the present study's dataset can be expressed as a function of the fund attributes under investigation as follows:

$$Perf_{it} = f(Size_{it}; Family_{it}; Age_{it}; Expense_{it}) + \varepsilon_{it} \quad (6)$$

where  $Perf_{it}$  represents the monthly performance of fund  $i$  in period  $t$  for each of the five performance measures detailed in section 3.2.1 and  $\varepsilon_{it}$  is the error term which represents the effect of variables that have been omitted from the function  $f$  such as other fund attributes or country characteristics that are not analysed.

### 3.2.3 Sample

The sample of all the South African–Equity–General classified funds that were in operation during the period January 2000 to September 2021 is narrowed to exclude funds that could compromise the accuracy of the findings. In constructing the narrowed sample, only actively managed South African–Equity–General CISs are selected. Thus, passively managed or index-tracking funds are excluded because the performance of these CISs is informed by the performance of the index which they track. Fund of funds are also removed from the sample due to the fact that the performance of these types of CISs is determined by the returns delivered by the underlying CISs in which these funds invest. Additionally, Shari'ah-compliant funds<sup>5</sup> are excluded because the managers of these funds are required to invest in securities

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<sup>5</sup> Shari'ah-compliant funds are funds that comply with Islamic law and meet specific requirements desired by followers of the Muslim religion (van Wyk et al., 2015). For example, Shari'ah-compliant funds are prohibited from investing in the securities of companies that engage in activities that are non-Halal such as alcohol and pork production.

that comply with Islamic law, and therefore, do not have a free choice of investing in securities. Hence, the performance of Shari’ah-compliant funds is informed by the securities that these funds are permitted to invest in. Multiple fund classes are also eliminated to avoid duplicate counting of the same fund. The share class that is kept includes the funds classified as ‘retail’ by Morningstar Direct.

Moreover, funds included in the sample are required to have been in existence for at least 12 consecutive months. Importantly, in order for a fund to stay in the sample, information pertaining to all the key variables in Equation (6), namely fund performance, size, family size, age, and expense ratios, must be accessible from the Morningstar Direct database. If data cannot be retrieved for all of these variables for a particular fund, the fund is removed from the sample. Lastly, to ensure that the present study does not suffer from survivorship bias, both active and defunct CISs are included in the sample. As such, the CISs included in the sample do not have to operate over the entire period of analysis. Thus, if a fund shuts down, merges with another South African–Equity–General classified fund, or a new fund begins operating at any point during the January 2000 to September 2021 time period, the fund is still included in the sample provided that it meets the other requirements detailed above.

Based on the aforementioned criteria, the narrowed sample consists of 175 South African–Equity–General CISs operating between January 2000 to September 2021. The number of CISs included in the sample over the period of analysis can be seen in Table 9 below.

**Table 9: Number of CISs included in the sample over the period of analysis**

<b>Year</b>	<b>Number of CISs</b>	<b>Year</b>	<b>Number of CISs</b>
2000	22	2011	69
2001	28	2012	75
2002	30	2013	84
2003	32	2014	99
2004	35	2015	116
2005	37	2016	129
2006	44	2017	147

2007	48	2018	150
2008	52	2019	162
2009	58	2020	171
2010	62	September 2021	175

Source: Author's calculations

It is important to highlight that the January 2000 to September 2021 period of analysis is chosen since it captures the exponential growth of the South African CIS industry. During this period, the South African CIS industry grew from a total of 334 local registered funds with a combined asset value of R128.4 billion by the end of 2000 to approximately R2.96 trillion of AUM across 1 685 different local CISs as at Q3 2021 (ASISA, 2021; Meyer-Pretorius & Wolmarans, 2006). Evidently, the narrowed sample of South African–Equity–General CISs in Table 9 captures this growth as the number of CISs included in the present study's sample grew from 22 funds in 2000 to 175 funds as at September 2021. Notably, this period of analysis begins when the sample size is sufficiently large for a thorough investigation to be conducted and ends when the present study is completed. Since five measures of performance are utilised in this study, five separate datasets are created. Each dataset comprises the observations of the respective performance measure (either total return, the Treynor ratio, Sharpe ratio, information ratio, or Jensen's alpha) and the four fund attributes (fund size, family size, age, and expense ratios) of the 175 CISs included in the sample.

### **3.2.4 Multiple imputation by chained equations for fund expense ratios**

Data pertaining to the expense ratio attribute from the Morningstar Direct database is only accessible from the beginning of 2007. This is in contrast to the other attributes under investigation in which data is accessible for the entire period of analysis. Over the period January 2000 to September 2021, the total number of observations for each of the fund size, family size, and age attributes is 20 404 across the sample of 175 funds. However, the total number of observations for the expense ratio attribute is only 17 854. Hence, 2 550 observations of the expense ratios of the funds that were in existence prior to 2007 have not been captured by Morningstar Direct and are therefore unknown. To address this missing data problem, the 44 funds that were in operation before 2007, as can be seen in Table 9, could be removed from the sample.

This, however, would lead to information loss on the known observations of the fund size, family size, and age attributes of these funds and would further reduce the sample size by 25.14%. Additionally, the period of analysis would decrease from 21 years and 9 months (January 2000 to September 2021) to 14 years and 9 months (January 2007 to September 2021). Alternatively, the missing data problem could be rectified by imputing the missing fund expense ratio observations with the mean or median expense ratio of the funds, with zero, or with a more complex approach using machine learning algorithms.

To overcome the problems associated with removing the 44 funds that were in operation prior to 2007, the multiple imputations by chained equations (MICE) method is adopted to impute the missing data points. An advantage of the MICE method is that it creates multiple imputations instead of a single imputation, such as the mean or median, thereby accounting for the statistical uncertainty about the relations in the data (van Buuren & Groothuis-Oudshoorn, 2011). The MICE framework is based on Fully Conditional Specification in which missing data is imputed on a variable-by-variable basis through an iterative series of predictive models. In each iteration, the missing values are replaced with plausible values where each incomplete variable is imputed by a separate model using other variables in the dataset (van Buuren & Groothuis-Oudshoorn, 2011). Since MICE yields imputations that should be statistically correct, it is a suitable method to employ to impute the missing fund expense ratio data in the present study. To impute the missing expense ratio observations with the MICE framework, the 'mice' function from the 'mice' package in  $R^6$  is utilised.

The dataset described in this section is known as panel data as it combines both time series and cross-sectional data. As such, the use of panel data methodologies in conducting this study is appropriate. Therefore, an explanation on panel data analysis is to follow.

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<sup>6</sup> An open-source programming language for statistical analysis.

### 3.3 PANEL DATA METHODOLOGIES

The use of panel data methodologies allows for the evaluation of the relationship between the dependent variables of the study (the performance of South African–Equity–General CISs obtained using five different measures of performance) and a set of independent variables (fund size, family size, age, and expense ratios of South African–Equity–General CISs). Thus, an overview of the features of panel data, the different types of panel data, and the advantages associated with panel data are discussed in this section. Following this, the different panel data methods and robustness tests that are conducted in the present study are described. An explanation of the model specification tests that are undertaken to identify the preferred model for each of the five separate datasets is also provided.

#### 3.3.1 Features of panel data

Panel data, also termed longitudinal data or pooled time series cross-sectional data, combines both time series and cross-sectional data (Brooks, 2008). Time series data consists of observations on an individual or several individuals at multiple time intervals whereas cross-sectional data consists of observations on many individuals at a certain point of time (Xu et al., 2007). By combining these two types of data, panel data consists of observations on many individuals at different time intervals. Specifically, a panel data set contains  $N$  individuals each of which includes  $T$  observations (Hsiao, 2003). A visual representation of panel data is displayed in Table 10.

**Table 10: Panel data matrix example**

Individual	Year	Dependent variable (Y)	Independent variables		
			X1	X2	X3
1	2019	.	.	.	.
1	2020	.	.	.	.
1	2021	.	.	.	.
2	2019	.	.	.	.
2	2020	.	.	.	.
2	2021	.	.	.	.

3	2019	.	.	.	.
3	2020	.	.	.	.
3	2021	.	.	.	.

Source: Adapted from Baltagi (2005)

### 3.3.2 Types of panel data

Panel data can be categorised as either balanced or unbalanced, long or short, and fixed or rotating (Greene, 2002; Longhi & Nandi, 2015). In order to fully understand panel data methodologies, an explanation on the different types of panel data is required.

#### 3.3.2.1 *Balanced versus unbalanced panel data*

A balanced panel is a data set in which observations for all individuals are observed across all periods. On the other hand, an unbalanced panel is a data set in which observations for some individuals are not observed for every period. Therefore, it can be said that the total number of observations for a balanced panel is  $NT$  whereas the total number of observations for an unbalanced panel is not  $NT$ . Reasons for panel data being unbalanced include attrition and selection bias (Longhi & Nandi, 2015; Xu et al., 2007). An unbalanced panel can be converted into a balanced panel through listwise deletion in which an individual is excluded from analysis if any value of the individual is not observed for every period (Longhi & Nandi, 2015).

In the present study, if a fund remains in the sample over the entire period of analysis, the fund will have 1 305 data points (five cross-sectional data points including the four fund attributes and the respective measure of fund performance observed over 261 monthly periods). If the dataset is balanced, the total number of observations for each fund attribute and performance measure would be 45 675 [ $175 (N) \times 261 (T)$ ]. Since many new CISs emerged over the period January 2000 to September 2021 and other funds become defunct, funds enter and leave the dataset over the period of analysis. As such, the total number of observations in the present study is not  $NT$ . Rather, the total number of observations for each fund attribute and performance measure is 20 404, hence, the data is classified as unbalanced. By applying the panel data matrix

example in Table 10, the panel data matrix of the present study can be seen in Table 11.

**Table 11: Panel data matrix of the present study**

<b>Fund</b>	<b>Year</b>	<b>Fund performance</b>	<b>Size</b>	<b>Family</b>	<b>Age</b>	<b>Expense</b>
1	January 2000	.	.	.	.	.
1	⋮	⋮	⋮	⋮	⋮	⋮
1	September 2021	.	.	.	.	.
⋮	⋮	⋮	⋮	⋮	⋮	⋮
175	January 2000	.	.	.	.	.
175	⋮	⋮	⋮	⋮	⋮	⋮
175	September 2021	.	.	.	.	.
Total observations		20 404	20 404	20 404	20 404	20 404

Source: Author's calculations

### **3.3.2.2 Long versus short panel data**

A long panel has a few individuals (small  $N$ ) but many time periods (large  $T$ ), and thus, a long panel data set is narrow in width (cross-sectional) and long in length (time series) (Cameron & Trivedi, 2010). Contrarily, a short panel is one which contains many individuals (large  $N$ ) but only a few time periods (small  $T$ ). Accordingly, a short panel data set can be said to be wide in width (cross-sectional) and short in length (time series) (Cameron & Trivedi, 2010). In the present study, the cross section of funds is equal to 175 ( $N$ ) while the number of time series points is equal to a maximum of 261 ( $T$ ). Since the time series component is larger than the cross-sectional component ( $T > N$ ), the panel can be described as long.

### **3.3.2.3 Fixed versus rotating panel data**

In a fixed panel, the individuals are kept the same throughout the analysis where some quantity about them is measured in each period (Greene, 2002). On the other hand, in a rotating panel, the individuals are not measured for each period but are rather brought in and out of the sample in some specified pattern (Greene, 2002). Since the

CISs and fund attributes analysed in this study are kept the same over the entire period of analysis, the panel can be defined as fixed.

### **3.3.3 Advantages of panel data**

There are many advantages associated with using panel data that need to be highlighted. One of the primary advantages of panel data is that it allows researchers to analyse more complicated models and a broader range of issues that cannot be identified and measured through the use of pure time series or pure cross-sectional methods (Baltagi, 2005; Hsiao, 2003). In addition, panel data improves the efficiency of econometric estimates by providing researchers with a large number of data points thereby increasing the number of degrees of freedom as well as the power of the test and further reducing problems of multicollinearity among explanatory variables (Baltagi, 2005; Brooks, 2008; Klevmarken, 1989). Moreover, the use of panel data better controls for the key econometric problem of researchers finding, or not finding, certain results due to the presence of omitted (mismeasured or unobserved) variables that are correlated with explanatory variables (Brooks, 2008; Hsiao, 2003). Therefore, the use of panel data methods, such as the fixed effects and random effects models explained in the next subsection, removes the impact of omitted variable bias in regression results. Panel data methods also control for individual heterogeneity since the individuals are assumed to be heterogeneous (Baltagi, 2005; Hsiao, 2003; Klevmarken, 1989). On the contrary, time series and cross-sectional studies are unable to control for heterogeneity, and thus, the results obtained with these models could be biased.

### **3.3.4 Panel data models**

Three types of regression models for panel data are adopted in the present study. These include the pooled ordinary least squares (OLS) model, the fixed effects model, and the random effects model. Evident from Chapter 2, other studies<sup>7</sup> analysing fund attribute-performance relationships have also employed these methodologies. Estimating three econometric models for each measure of performance instead of only

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<sup>7</sup> See, for example, Babalos et al. (2009), Blake et al. (2014), Filip (2018), Fu and Liu (2015), Korkeamaki and Smythe Jr (2004), Payne et al. (1999), and Yap and Pierce (2008).

a single model increases the robustness of the results of the present study. Additionally, by considering several models together, this study is able to determine which of the fund attributes are consistently significant irrespective of the econometric model applied thereby producing more conclusive results. An overview of these three models is presented below.

### **3.3.4.1 Pooled ordinary least squares model**

The pooled OLS model is one of the most basic estimation models for panel data. This is because the pooled OLS model, as the model name suggests, pools the data and then applies OLS (Xu et al., 2007). An important assumption of this model is that the idiosyncratic error term is uncorrelated with the explanatory variables (Greene, 2002; Wooldridge, 2010). Noteworthy, the pooled OLS model ignores differences in time  $t$  and individuals  $i$  which makes it a restrictive model since panel data contain the information of time and cross-sectional dimensions (Wooldridge, 2010). Accordingly, this model does not consider heterogeneity or individuality within the cross section of individuals and across time which could bias estimated regression coefficient standard errors. The generic form of the pooled OLS model is expressed as:

$$y_{it} = \alpha + \beta_1 X_{1it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (7)$$

where  $y_{it}$  is the dependent variable of  $i$  in period  $t$ ;  $\alpha$  is the intercept term applicable to all individuals in the sample;  $\beta_k$  is a  $k \times 1$  vector of parameters to be estimated on the explanatory variables (with  $k$  representing the number of independent variables in the regression model);  $X_{kit}$  is a  $1 \times k$  vector of observations on the explanatory variables for each  $i$  in period  $t$ ;  $\varepsilon_{it}$  represents the idiosyncratic error term of the regression;  $t = 1, 2, \dots, T$ ; and  $i = 1, 2, \dots, N$ . Important to highlight is that the intercept term  $\alpha$  and slope estimates  $\beta_k$  in the regression model are kept fixed both cross-sectionally and over time, evidenced by the exclusion of  $i$  and  $t$  terms from the subscripts of these coefficients (Brooks, 2008).

Taking Equation (7) and applying the dependent and independent variables of the present study described in section 3.2, the pooled OLS model takes the form:

$$Perf_{it} = \alpha + \beta_1 Size_{1it} + \beta_2 Family_{2it} + \beta_3 Age_{3it} + \beta_4 Expense_{4it} + \varepsilon_{it} \quad (8)$$

Given the panel nature of the data in the present study, there is a possibility of heterogeneity being present across both individual funds and time. This is due to the fact that fund performance is consistently changing across periods and managers. Since the intercept term of the pooled OLS model cannot vary across individuals and time, the fixed effects and random effects models are considered alongside the pooled OLS model in the present study. In contrast to the pooled OLS model, the fixed effects and random effects models allow for the modelling of cross-sectional and period specific heterogeneity which can affect the consistency and efficiency of regression coefficient estimates. These panel data methods are discussed next.

### **3.3.4.2 Fixed effects model**

The fixed effects model is appropriate when controlling for omitted variables that are constant over time and vary across individuals otherwise referred to as unobserved heterogeneity or fixed effects and is denoted as  $\alpha_i$  (Xu et al., 2007). Similar to the pooled OLS model, the fixed effects model is estimated using OLS. Important assumptions of this model include the unobserved heterogeneity being correlated with the explanatory variables and the idiosyncratic error term being independent of the explanatory variables (Wooldridge, 2010; Xu et al., 2007). The generic form of the fixed effects model is described mathematically as:

$$y_{it} = \alpha_i + \beta_1 X_{1it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (9)$$

The difference between this equation and that of the pooled OLS model presented in Equation (7) lies in the  $i$  term present in the subscript of the intercept term  $\alpha_i$ . More specifically, unlike the pooled OLS model, the fixed effects model allows the intercept or alpha to vary across individuals and time if fixed effects are detected in either (Brooks, 2008). This assumption, however, does not apply to the slope estimates  $\beta_k$  which, similar to the pooled OLS model, are fixed both cross-sectionally and over time. Applying the dependent and independent variables of the present study to Equation (9) results in the fixed effects model taking the form:

$$Perf_{it} = \alpha_i + \beta_1 Size_{1it} + \beta_2 Family_{2it} + \beta_3 Age_{3it} + \beta_4 Expense_{4it} + \varepsilon_{it} \quad (10)$$

When the unobserved heterogeneity is independent of the explanatory variables, the fixed effects model cannot be utilised. However, in such a situation, the random effects model is suitable (Xu et al., 2007). As such, a discussion on the random effects model follows.

### **3.3.4.3 Random effects model**

The random effects model is estimated using generalised least squares (GLS) and extends the fixed effects model. Particularly, the unobserved heterogeneity is regarded as a random variable instead of fixed in the random effects model (Baltagi, 2005; Greene, 2002). Therefore, a benefit of this model is that it treats in-sample individual cross-sectional differences as random. The random effects model is appropriate when the cross-sectional individuals in a panel are randomly selected from a large population (Brooks, 2008). Importantly, the intercept term of this model arises from two components: one component that is the same for all cross-sectional individuals and over time, and one component that differs cross-sectionally but not over time. In other words, it arises from one fixed component and one random component (Brooks, 2008). The intercept term of the random effects model is described as:

$$\alpha_i = \bar{\alpha} + \delta_i \quad (11)$$

where  $\alpha_i$  comprises the population average intercept  $\bar{\alpha}$  as well as an individual-specific random term  $\delta_i$  referred to as the random effect. If Equation (11) is substituted in Equation (9), the model is expressed as follows:

$$y_{it} = (\bar{\alpha} + \delta_i) + \beta_1 X_{1it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (12)$$

Since unobserved heterogeneity or individuality within the cross section of individuals and across time is captured in the random effect  $\delta_i$ , unbiased and efficient regression coefficients can be estimated under the random effects model. Notably, this framework assumes that the random effect  $\delta_i$  has a zero mean, is independent of the individual observation error term, has a constant variance, and is independent of the explanatory variables (Brooks, 2008).

The properties of the random effect  $\delta_i$  are similar to that of a typical error term, and therefore, the random effects model can take the generic form:

$$y_{it} = \bar{\alpha} + \beta_1 X_{1it} + \dots + \beta_k X_{kit} + (\varepsilon_{it} + \delta_i) \quad (13)$$

$$y_{it} = \bar{\alpha} + \beta_1 X_{1it} + \dots + \beta_k X_{kit} + \vartheta_{it} \quad (14)$$

where  $\vartheta_{it}$  is the combined error term of the conventional error term  $\varepsilon_{it}$  and the random effect  $\delta_i$ . Similar to the assumption of the random effect  $\delta_i$ , the combined error term  $\vartheta_{it}$  is expected to be independent of the explanatory variables.

Taking Equation (14) and applying the dependent and independent variables of the present study, the random effects model is expressed as:

$$Perf_{it} = \bar{\alpha} + \beta_1 Size_{1it} + \beta_2 Family_{2it} + \beta_3 Age_{3it} + \beta_4 Expense_{4it} + \vartheta_{it} \quad (15)$$

To estimate the pooled OLS model in Equation (8), the fixed effects model in Equation (10), and the random effects model in Equation (15), the 'plm' function from the 'plm' package in *R* is utilised.

### 3.3.5 Robustness tests

The results obtained from the aforementioned panel data models could be influenced by a missing factor in the analysis. As such, to test the robustness of the results, the pooled OLS, fixed effects, and random effects models for each measure of performance are estimated for a second time in which a control variable is introduced. Consistent with the study of Filip (2018), a stock market index is used as the control variable. In the present study, the FTSE/JSE All Share Index is used as a proxy for the stock market and is referred to as *StockIndex*. Thus, a fifth factor is introduced into Equations (8), (10), and (15) as follows:

$$Perf_{it} = \alpha + \beta_1 Size_{1it} + \beta_2 Family_{2it} + \beta_3 Age_{3it} + \beta_4 Expense_{4it} + \beta_5 StockIndex_{5it} + \varepsilon_{it} \quad (16)$$

$$Perf_{it} = \alpha_i + \beta_1 Size_{1it} + \beta_2 Family_{2it} + \beta_3 Age_{3it} + \beta_4 Expense_{4it} + \beta_5 StockIndex_{5it} + \varepsilon_{it} \quad (17)$$

$$Perf_{it} = \bar{\alpha} + \beta_1 Size_{1it} + \beta_2 Family_{2it} + \beta_3 Age_{3it} + \beta_4 Expense_{4it} + \beta_5 StockIndex_{5it} + \vartheta_{it} \quad (18)$$

where  $StockIndex_{it}$  is the mean monthly rate of return of the FTSE/JSE All Share Index applied to fund  $i$  in period  $t$ .

Importantly, if the results of the pooled OLS, fixed effects, and random effects models yield similar results for the fund attribute-performance relationships when  $StockIndex$  is included compared to the results obtained when  $StockIndex$  is excluded from the models, the results can be deemed to be robust.

### 3.3.6 Model specification tests

Due to the panel nature of the data in the present study, the panel data methods, namely the fixed effects and random effects models, are preferred over the pooled OLS model since both of these models allow for the modelling of cross-sectional and period specific heterogeneity. Nevertheless, various model specification tests are conducted to determine which of the three econometric models are preferred for each of the five separate datasets. Specifically, tests that compare the pooled OLS model to the fixed effects model, the pooled OLS model to the random effects model, and the fixed effects model to the random effects model are performed as discussed below.

#### 3.3.6.1 Pooled ordinary least squares model versus fixed effects model

In determining whether the pooled OLS model or fixed effects model is superior, a test for the significance of the fixed effects in a regression model needs to be performed. To test for fixed effects, an  $F$ -test or  $\chi^2$  test can be conducted. Notably, these tests apply dummy variables<sup>8</sup> for each cross-sectional individual and each period of time otherwise known as least squares dummy variable estimators (Baltagi, 2005; Greene, 2002). A joint test of whether all the coefficients of the dummy variables are zero is executed. To test for fixed effects in the present study, the  $F$ -test for fixed effects is

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<sup>8</sup> A dummy variable is a binary variable that takes the value one if a particular condition is true or zero if that condition is false (DeFusco et al., 2015b). Dummy variables are commonly used to examine group and time effects in regression analysis (Xu et al., 2007).

conducted. The null hypothesis under this test states that there are no fixed effects present in the data set, and thus,  $\alpha_i$  is equal to zero:

$$H_0: \alpha_i = 0 \text{ for all } i \quad (19)$$

The alternative hypothesis states that  $\alpha_i$  is greater than zero, hence, there are fixed effects present in the data set:

$$H_a: \alpha_i > 0 \text{ for all } i \quad (20)$$

Failure to reject the null hypothesis in Equation (19) implies that there is no heterogeneity or individuality within the cross section of individuals and across time, and therefore, no fixed effects (Baltagi, 2005; Greene, 2002). Accordingly, the pooled OLS model that considers only a single intercept is superior over the fixed effects model. On the other hand, if the null hypothesis is rejected, the fixed effects model is preferred compared to the pooled OLS model.

The  $F$ -test statistic is calculated as follows:

$$F = \frac{(RRSS - URSS)/(N - 1)}{(URSS)/(NT - N - k)} \stackrel{H_0}{\sim} F_{(N-1), (NT-N-k)} \quad (21)$$

where  $RRSS$  is the restricted residual sums of squares of the pooled OLS model;  $URSS$  is the unrestricted residual sums of squares of the least squares dummy variable model; and  $\stackrel{H_0}{\sim} F_{(N-1), (NT-N-k)}$  indicates that under the null hypothesis of no fixed effects in Equation (19), the  $F$ -test statistic has an  $F$ -distribution with  $(N - 1), (NT - N - k)$  degrees of freedom.

The  $F$ -test for fixed effects is conducted using the 'pFtest' function from the 'plm' package in  $R$ . To determine whether the pooled OLS model or fixed effects model is superior, the p-value of the  $F$ -test statistic is analysed.

### **3.3.6.2 Pooled ordinary least squares model versus random effects model**

If the results of the  $F$ -test for fixed effects suggest that the pooled OLS model is preferred over the fixed effects model, a test for random effects is undertaken to determine whether the pooled OLS model or the random effects model is superior. To

test for random effects, a Lagrange multiplier (LM) test<sup>9</sup> can be conducted such as the King-Wu test of King and Wu (1997), the Breusch-Pagan test of Breusch and Pagan (1980), the Honda test of Honda (1985), or the Gourieroux-Holly-Monfort test of Gourieroux, Holly, and Monfort (1982). To test for random effects in the present study, the Breusch-Pagan test for random effects is conducted. The null hypothesis under this test specifies that the variance of the random effect  $\delta_i$  is equal to zero:

$$H_0: \sigma_{\delta_i}^2 = 0 \text{ for all } i \quad (22)$$

The alternative hypothesis of the Breusch-Pagan test for random effects specifies that the variance of the random effect  $\delta_i$  is greater than zero:

$$H_a: \sigma_{\delta_i}^2 > 0 \text{ for all } i \quad (23)$$

Failure to reject the null hypothesis in Equation (22) indicates that the random effect  $\delta_i$  is a degenerate random variable. This implies that there is no random heterogeneity or individuality within the cross section of individuals and across time, and thus, no random effects (Baltagi, 2005; Greene, 2002). As such, the random effects model reduces to a model that is very similar to the pooled OLS model indicating that the pooled OLS model is superior to the random effects model. Alternatively, if the null hypothesis is rejected in favour of the random effects model, the pooled OLS model that considers only a single intercept is inappropriate since it does not account for random differences across individuals and time (Greene, 2002).

The test statistic of the Breusch-Pagan test for random effects is calculated using the LM as follows:

$$LM = \frac{NT}{2(T-1)} \left[ \frac{\sum_{i=1}^N [\sum_{t=1}^T \varepsilon_{it}]^2}{\sum_{i=1}^N \sum_{t=1}^T \varepsilon_{it}^2} - 1 \right]^2 \stackrel{H_0}{\sim} \chi_1^2 \quad (24)$$

where  $\stackrel{H_0}{\sim} \chi_1^2$  indicates that under the null hypothesis of no random individual effects in Equation (22), the Breusch-Pagan test statistic follows an asymptotic  $\chi^2$  distribution with one degree of freedom.

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<sup>9</sup> The LM test, proposed by Silvey (1959) and Aitchison and Silvey (1960), is used to test whether restrictions imposed on a model estimated by maximum likelihood is violated by the data.

To test for random effects in the present study, the Breusch-Pagan test for random effects in unbalanced panels is conducted using the 'plmtest' function from the 'plm' package in *R*. Specifically, the p-value of the test statistic is analysed to identify whether the pooled OLS model or fixed effects model is superior.

### 3.3.6.3 Fixed effects model versus random effects model

If the *F*-test for fixed effects explained in section 3.3.6.1 indicates that the fixed effects model is superior compared to the pooled OLS model, a test needs to be conducted to compare the fixed effects and random effects models. An important consideration in choosing between the fixed effects and random effects models is whether the random effect  $\delta_i$  and the explanatory variables  $X_{kit}$  are correlated (Baltagi, 2005; Wooldridge, 2010). To test this assumption, the Hausman test developed by Hausman (1978) can be applied in which the random effects estimator  $\hat{\beta}_{RE}$  is compared to the fixed effects estimator  $\hat{\beta}_{FE}$ . Noteworthy, when the random effect  $\delta_i$  is independent of the explanatory variables  $X_{kit}$ , the random effects estimator  $\hat{\beta}_{RE}$  and the fixed effects estimator  $\hat{\beta}_{FE}$  are both consistent for  $\beta_k$  but only the random effects estimator  $\hat{\beta}_{RE}$  is asymptotically efficient (Baltagi, 2005). However, when the random effect  $\delta_i$  and the explanatory variables  $X_{kit}$  are correlated, the random effects estimator  $\hat{\beta}_{RE}$  becomes biased and inconsistent for  $\beta_k$  whereas the fixed effects estimator  $\hat{\beta}_{FE}$  is unbiased and consistent for  $\beta_k$ . The null hypothesis of the Hausman test states that the random effect  $\delta_i$  and the explanatory variables  $X_{kit}$  are uncorrelated or independent of one another:

$$H_0: E(\delta_i|X_{it}) = 0 \quad (25)$$

The alternative hypothesis of this test states that the random effect  $\delta_i$  and the explanatory variables  $X_{kit}$  are correlated:

$$H_a: E(\delta_i|X_{it}) \neq 0 \quad (26)$$

Failure to reject the null hypothesis in Equation (25) implies that the random effects model is preferred over the fixed effects model in large samples because it produces more efficient estimators (Baltagi, 2005; Wooldridge, 2010). Contrarily, if the null hypothesis is rejected, a statistically significant difference exists between the random

effects and fixed effects estimates. This is interpreted as evidence against the random effects assumption of the random effect  $\delta_i$  being independent of the explanatory variables  $X_{kit}$  (Wooldridge, 2010). Therefore, the fixed effects model is superior compared to the random effects model in large samples.

The Hausman test statistic is computed as follows:

$$H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' [\text{Var}(\hat{\beta}_{FE}) - \text{Var}(\hat{\beta}_{RE})]^{-1} (\hat{\beta}_{FE} - \hat{\beta}_{RE}) \stackrel{H_0}{\sim} \chi_M^2 \quad (27)$$

where  $\hat{\beta}_{FE}$  is the  $M \times 1$  vector of fixed effects estimates (with  $M$  representing the dimension of the slope vector  $\beta_k$ );  $\hat{\beta}_{RE}$  is the  $M \times 1$  vector of random effects estimates;  $\text{Var}(\hat{\beta}_{FE})$  is the asymptotic variance of the fixed effects estimator trends;  $\text{Var}(\hat{\beta}_{RE})$  is the asymptotic variance of the random effects estimator trends; and  $\stackrel{H_0}{\sim} \chi_M^2$  indicates that under the null hypothesis in Equation (25), the Hausman test statistic follows an asymptotic  $\chi^2$  distribution with  $M$  degrees of freedom.

To determine whether the fixed effects model or the random effects model is superior, the p-value of the Hausman test generated using the 'phtest' function from the 'plm' package in *R* is analysed.

### 3.4 DIAGNOSTIC TESTS

Prior to conducting the aforementioned panel regression analyses discussed in section 3.3.4, a series of diagnostic tests are undertaken to ensure the reliability of the results. These diagnostic tests are conducted to check the panel data for stationarity, multicollinearity, heteroskedasticity, and serial correlation. An explanation on each of the diagnostic tests is provided in the following subsections.

#### 3.4.1 Stationarity

To ensure the validity of time series models and panel data models, the underlying data is required to be stationary. Accordingly, unit root testing is critical in both time series analysis and panel data analysis (Hsiao, 2003). Time series data is assumed to be covariance-stationary if: (1) the expected value of the time series is constant and finite in all periods, (2) the variance of the time series is constant and finite in all

periods, and (3) the covariance of the time series with itself for a fixed number of periods in the past or future is constant and finite in all periods (DeFusco et al., 2015b). If a time series has a unit root, it is not covariance-stationary which can lead to spurious regressions (Brooks, 2008). In such a case, taking the first difference of the variable containing a unit root could assist in converting it to a stationary variable. Tests such as the Dickey-Fuller test of Dickey and Fuller (1979, 1981), an augmented version of the Dickey-Fuller test referred to as the augmented Dickey-Fuller (ADF) test, and the Phillips-Perron test of Phillips and Perron (1988), amongst others, can be used to test the stationarity of time series data.

When analysing panel data, the data should not be treated as individual time series in which the aforementioned time series unit root tests are performed on each of the series separately. Rather, for more reliable results, tests designed specifically for testing the stationarity of panel data should be utilised (Hsiao, 2003). These tests include the Levin-Lin-Chu test of Levin, Lin, and Chu (2002), the Im-Pesaran-Shin test of Im, Pesaran, and Shin (2003), and Fischer-type tests of Maddala and Wu (1999) and Choi (2001), amongst others. Generally, the Im-Pesaran-Shin test is more powerful than the Levin-Lin-Chu test and Fischer-type tests (Im et al., 2003). Notably, the majority of panel unit root tests assume a balanced panel data set, however, the Im-Pesaran-Shin test and Fischer-type tests allow for unbalanced panels. Hence, both of these tests are appropriate to test for stationarity in the present study. Given the improved power of the Im-Pesaran-Shin test over Fischer-type tests, the Im-Pesaran-Shin test is adopted to conduct unit root tests.

Under the Im-Pesaran-Shin test, separate unit root tests are computed for the  $N$  cross-sectional individuals which are then combined to determine whether the panel has a unit root. This test is based on ADF regressions for each cross section. The  $ADF(p_i)$  regressions for each cross section take the form:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \sum_{j=1}^{p_i} \rho_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad (28)$$

The Im-Pesaran-Shin test allows for a heterogeneous coefficient of  $y_{i,t-1}$ , and thus,  $\beta_i$  is not required to be homogeneous across  $i$ . The null hypothesis under this test specifies that each series in the panel contains a unit root:

$$H_0: \beta_i = 0 \text{ for all } i \quad (29)$$

The alternative hypothesis allows for some but not all of the individual series to have unit roots:

$$H_a: \begin{cases} \beta_i < 0 \text{ for all } i = 1, 2, \dots, N_1 \\ \beta_i = 0 \text{ for all } i = N_1 + 1, N_1 + 2, \dots, N \end{cases} \quad (30)$$

The Im-Pesaran-Shin  $t$ -bar statistic is defined as a simple average of the individual ADF statistics computed for each cross-sectional individual in the panel. The  $t$ -bar statistic is expressed as follows:

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^N t_{iT_i} \quad (31)$$

where  $t_{iT_i}$  represents the individual test statistics which are identically and independently distributed. If  $T_i$  differs across groups, however, the individual test statistics  $t_{iT_i}$  are independently but not identically distributed across  $i$ . This allows for the test to be extended to unbalanced panels. The corresponding standardised  $t$ -bar statistic is:

$$Z_{\bar{t}} = \frac{\sqrt{N} \{ \bar{t}_{NT} - N^{-1} \sum_{i=1}^N E(t_{iT_i}) \}}{\sqrt{N^{-1} \sum_{i=1}^N \text{Var}(t_{iT_i})}} \quad (32)$$

To determine the order of integration of the dependent and independent variables of the present study, the p-values of the individual ADF-regressions are examined. These p-values are generated using the 'purtest' function from the 'plm' package in *R*.

### 3.4.2 Multicollinearity

Multiple linear regression models use more than one independent variable to predict the outcome of a dependent variable. Multicollinearity occurs when two or more of these independent variables are correlated with one another (Brooks, 2008). An

assumption of OLS regression is that there is no linear relationship between the independent variables, and hence, no multicollinearity. When independent variables are highly correlated, the OLS assumption of no multicollinearity is violated since changes in one independent variable are associated with shifts in another. This is a problem due to the fact that independent variables should be 'independent' and not correlated with other explanatory variables. The presence of collinearity amongst independent variables weakens the statistical power of a regression model thereby compromising the reliability of the results (Brooks, 2008). If there is very high correlation between independent variables, a possible solution to fix the problem is to remove or drop one of the collinear variables. This could, however, result in an omitted variable bias if the removed variable is relevant in the data generating process for  $y_{it}$  (Brooks, 2008).

Two popular methods for detecting multicollinearity include a pairwise correlation matrix and variance inflation factors (Mansfield & Helms, 1982). When using the pairwise correlation matrix approach, correlation coefficients ranging between  $-1$  and  $+1$  are estimated to represent the linear interdependence of two variables. A correlation coefficient of  $0$  indicates no linear correlation between two variables whereas a correlation of  $\pm 1$  indicates a perfect positive or negative linear correlation between two variables. High correlation coefficients of greater than  $+0.8$  or less than  $-0.8$  generally indicate a multicollinearity problem since there is a strong association between the respective variables. Under the variance inflation factor approach, variance inflation factors ranging between  $1$  and  $\infty$  are generated for each independent variable in which a variance inflation factor of  $1$  indicates the absence of collinearity between the associated variable and the other independent variables in the model (Mansfield & Helms, 1982). High variance inflation factors of greater than  $10$  (or even greater than  $5$  in some cases) generally indicate the presence of multicollinearity.

To identify high correlations between the various independent variables in the present study, and hence, test for the presence of multicollinearity, a pairwise correlation matrix is generated using the 'cor' function from the *R* base package.

### 3.4.3 Heteroskedasticity

An important assumption of OLS regression is the assumption of homoskedasticity in which the idiosyncratic errors across observations in a regression model have equal variance. This can be expressed mathematically as  $Var(\varepsilon|X) = \sigma^2$  (Greene, 2002). If, however, the variance of the idiosyncratic errors is not constant across observations, this assumption is violated and the OLS regression model is said to have heteroskedastic errors. In the presence of heteroskedasticity, the estimated standard errors may be biased and inconsistent which could affect the reliability of the regression results and lead to invalid inferences being made (Baltagi, 2005; Greene, 2002). As such, if heteroskedasticity is detected in OLS regression, robust standard errors, otherwise known as heteroskedasticity-consistent standard errors or White-corrected standard errors developed by White (1980), should be computed to correct for such a presence. An alternative approach to correct the effects of heteroskedasticity includes modifying the regression equation in an attempt to eliminate the heteroskedasticity through the use of GLS (DeFusco et al., 2015b).

An informal approach to detect heteroskedasticity is to create residual plots where the least squares residuals are plotted against the fitted values of a regression model (Greene, 2002). If the variance of the residuals increase as the fitted values increase, a distinctive pattern, such as a fan or cone shape, will be present in the residual plot indicating the presence of heteroskedasticity. On the other hand, if the residuals are randomly dispersed, it can be said that the regression model is homoskedastic. An alternative approach to test for heteroskedasticity in a regression model is to use formal statistical tests (Greene, 2002). One such test is the Breusch-Pagan test of Breusch and Pagan (1979) which is based on the LM test. This test assesses whether the estimated variance of the idiosyncratic errors in a regression is dependent on the values of the independent variables. To illustrate the Breusch-Pagan test, consider a regression model of the form:

$$y_{it} = \beta_0 + \beta_1 X_{1it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (33)$$

The Breusch-Pagan test checks for the presence of a linear relationship between the square of the error term  $\varepsilon_{it}$  and the predictors. Therefore, the regression model  $y_{it}$  in Equation (33) can be rewritten in the form:

$$\varepsilon_{it}^2 = \alpha_0 + \alpha_1 X_{1it} + \dots + \alpha_k X_{kit} + u_{it} \quad (34)$$

The null hypothesis under this test states that there is constant error variance, and thus, homoskedasticity is present:

$$H_0: \alpha_1 = \alpha_2 = \dots = \alpha_k = 0 \quad (35)$$

The alternative hypothesis states that the variance of the idiosyncratic errors is not constant in which case heteroskedasticity is present:

$$H_a: \text{At least one of the } \alpha\text{'s is not zero} \quad (36)$$

The test statistic of the Breusch-Pagan test is calculated using the LM as follows:

$$LM = NR^2 \stackrel{H_0}{\sim} \chi_{p-1}^2 \quad (37)$$

where  $R^2$  is the coefficient of determination of the squared error term regression  $\varepsilon_{it}^2$  in Equation (34) and  $\stackrel{H_0}{\sim} \chi_{p-1}^2$  indicates that under the null hypothesis of homoskedasticity in Equation (35), the Breusch-Pagan test statistic follows an asymptotic  $\chi^2$  distribution with  $p - 1$  degrees of freedom.

To test for heteroskedasticity in the idiosyncratic errors in the panel regressions in the present study, the Breusch-Pagan test is conducted on each of the five datasets in which the dependent variable is treated as either total return, the Treynor ratio, Sharpe ratio, information ratio, or Jensen's alpha. In testing the presence of heteroskedasticity, the p-value of the test statistic for each dataset generated using the 'bptest' function from the 'lmtest' package in *R* is analysed.

#### 3.4.4 Serial correlation

A further assumption of OLS regression is that the idiosyncratic errors are uncorrelated across observations expressed mathematically as  $Cov(\varepsilon_i \varepsilon_j | X) = 0$  for all  $i \neq j$

(Greene, 2002). When this assumption is violated, the idiosyncratic errors are said to be serially correlated or autocorrelated (Brooks, 2008). Similar to heteroskedasticity, ignoring serial correlation results in inefficient and biased OLS regression coefficient standard errors which could lead to incorrect inferences being made (Baltagi, 2005; Brooks, 2008; Drukker, 2003). If serial correlation is identified in an OLS regression, robust standard errors should be generated to ensure the accuracy of results. A common method for adjusting standard errors to correct for serial correlation was developed by Newey and West (1987). An additional advantage of this method is that it simultaneously corrects for heteroskedasticity thereby generating heteroskedasticity- and autocorrelation-consistent standard errors. An alternative approach to correct for serial correlation includes modifying the regression equation in an attempt to eliminate the serial correlation through the use of GLS (DeFusco et al., 2015b). Notably, popular tests for serial correlation include the Durbin–Watson test of Durbin and Watson (1950, 1951), the Box-Pierce test of Box and Pierce (1970), the Breusch–Godfrey test of Breusch (1978) and Godfrey (1978a, 1978b), and the Ljung-Box test of Ljung and Box (1978).

Serial correlation in the idiosyncratic errors is a concern for macro panels with long time series (that is, large  $T$ ) (Hsiao, 2003). Since the number of time series points in the present study is equal to a maximum of 261 (covering a period of 21 years and 9 months), a test for serial correlation is performed. To do such, the Breusch-Godfrey test for serial correlation in panel models is conducted. This test is based on the LM test and allows for the testing of higher-order serial correlation up to any predesignated order  $p$ . Noteworthy, this test is applicable whether or not the regressors include lags of the dependent variable (Greene, 2002). The Breusch-Godfrey test is used to test for serial correlation in the present study since it is a general serial correlation test that can be applied to pooled OLS, fixed effects, and random effects models. Additionally, this test is appropriate to test for serial correlation in long panels as is the case in the present study (Greene, 2002). To illustrate the Breusch-Godfrey test, consider a linear regression of the form:

$$y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \varepsilon_{it} \quad (38)$$

The idiosyncratic errors in Equation (38) might follow an autoregressive process (AR( $p$ )) as follows:

$$\varepsilon_{it} = \rho_1 \varepsilon_{i,t-1} + \rho_2 \varepsilon_{i,t-2} + \dots + \rho_p \varepsilon_{i,t-p} + u_{it} \quad (39)$$

Under the Breusch-Godfrey test, the simple regression model in Equation (38) with idiosyncratic errors following an AR( $p$ ) process in Equation (39) is fitted by OLS to obtain a set of sample residuals which can be used in an auxiliary regression expressed as:

$$\hat{\varepsilon}_{it} = \alpha_0 + \alpha_1 X_{1it} + \alpha_2 X_{2it} + \rho_1 \hat{\varepsilon}_{i,t-1} + \rho_2 \hat{\varepsilon}_{i,t-2} + \dots + \rho_p \hat{\varepsilon}_{i,t-p} + u_{it} \quad (40)$$

The null hypothesis of this test states that there is no serial correlation at any order less than or equal to  $p$ :

$$H_0: \rho_1 = \rho_2 = \dots = \rho_p = 0 \quad (41)$$

The alternative hypothesis states that there is serial correlation at some order less than or equal to  $p$ :

$$H_a: \text{At least one of the } \rho\text{'s is not zero} \quad (42)$$

The test statistic of the Breusch-Godfrey test is calculated using the LM as follows:

$$LM = (N - p)R^2 \stackrel{H_0}{\sim} \chi_p^2 \quad (43)$$

where  $R^2$  is the coefficient of determination of the auxiliary regression  $\hat{\varepsilon}_{it}$  in Equation (40) and  $\stackrel{H_0}{\sim} \chi_p^2$  indicates that under the null hypothesis of no serial correlation in Equation (41), the Breusch-Godfrey test statistic follows an asymptotic  $\chi^2$  distribution with  $p$  degrees of freedom.

For the purposes of this study, the Breusch-Godfrey test is conducted to test for serial correlation in the idiosyncratic errors in each of the panel regressions. Particularly, the  $p$ -value of the test statistic for each model generated using the 'pbgttest' function from the 'plm' package in  $R$  is analysed.

### **3.5 RESEARCH METHOD LIMITATIONS**

The fund data analysed in this study is retrieved from the Morningstar Direct database. Thus, the data is classified as secondary data since it is not collected by the author of the present study but rather by a third party. Importantly, there are several benefits and limitations of utilising secondary data in a research study. Since the data has already been collected by a third party, an advantage of secondary data includes the researcher not having to collect the data themselves (Johnston, 2017; Vartanian, 2010). As such, making use of secondary data is very convenient as well as economical. Furthermore, the use of secondary data allows for a research study to be conducted in a quicker time and further results in larger data sets being obtained (Johnston, 2017; Vartanian, 2010).

A disadvantage of using secondary data is the fact that a researcher might struggle to find secondary data that meets all the objectives of their study (Johnston, 2017). In addition, the researcher does not know the exact methodology employed in the collection and processing of the secondary data. Therefore, the accuracy of this type of data is also unknown to the researcher (Johnston, 2017). If any mistakes have been made by the third party in processing the data, the errors will also be present in the researcher's study which could compromise the findings if major errors have been made (Johnston, 2017; Vartanian, 2010). These disadvantages may be applicable to this study, however, Morningstar is highly regarded for its investment research. Hence, the data retrieved from the Morningstar Direct database can be deemed reliable, and thus, the accuracy of this data is not a concern in the present study.

A further research limitation of the present study includes the imputation method applied to the fund expense ratio attribute. As mentioned in section 3.2.4, the fund expense ratio data retrieved from the Morningstar Direct database is only available from the beginning of 2007. Accordingly, data pertaining to the fund expense ratio attribute for the 44 funds that were in operation before 2007 is missing. Specifically, 2 550 observations of the expense ratios of these funds is unknown. To overcome this problem, the MICE method is employed to impute the missing data points. A disadvantage of using imputations instead of actual observations is that the imputed fund expense ratio data differs from the actual fund expense ratios that are missing. Nevertheless, as stated by van Buuren and Groothuis-Oudshoorn (2011), the MICE

framework should yield imputations that are statistically acceptable. This is because the MICE algorithm accounts for the process that created the missing data, preserves the relations in the data, and further preserves the uncertainty about these relations. Important to highlight is that the MICE method has been found to work well in a variety of simulation studies<sup>10</sup>. Since MICE is a robust method for imputing missing data, the imputed fund expense ratio data can be deemed reliable.

### **3.6 SUMMARY**

This chapter discussed the data used to analyse the impact that fund size, family size, age, and expense ratios have on the performance of South African–Equity–General CISs. Since the dataset is known as panel data as it combines both time series and cross-sectional data, panel data methodologies are employed in this study. As such, this chapter provided an explanation on the features of panel data, the different types of panel data, and the advantages associated with panel data. Furthermore, this chapter detailed the three panel data models that are estimated in the present study, namely the pooled OLS model, fixed effects model, and random effects model, as well as the robustness tests that are performed. The model specification tests that are utilised to choose between the different models were also outlined. Additionally, the diagnostic tests that are conducted to test the panel data for stationarity, multicollinearity, heteroskedasticity, and serial correlation were described. Following this, the research method limitations were elaborated on.

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<sup>10</sup> See, for example, Brand (1999), Giorgi, Belot, Gaudart, and Launoy (2008), Horton and Kleinman (2007), Horton and Lipsitz (2001), Moons, Donders, Stijnen, and Harrell Jr (2006), Schunk (2008), and van Buuren, Brand, Groothuis-Oudshoorn, and Rubin (2006).

## CHAPTER 4 – DATA ANALYSIS

### 4.1 INTRODUCTION

This chapter provides an overview of the results from the panel data analysis using the methodologies described in Chapter 3. The findings of the present study are outlined to ascertain whether a statistically significant relationship exists between the fund attributes under investigation and the performance of South African collective investment schemes (CISs). Moreover, if a significant relationship exists between the analysed fund attributes and the performance of South African CISs, the direction of these relationships are detailed. In particular, this chapter presents the descriptive statistics of the dependent and independent variables of the study. Thereafter, the series of diagnostic tests that are conducted on the panel data are examined. Following this, the results of the pooled ordinary least squares (OLS), fixed effects, and random effects regression analyses for each measure of fund performance are reported. The findings presented in this chapter will be further discussed in Chapter 5 to determine whether the identified fund attribute-performance relationships of South African CISs conform with that of international funds observed in other studies.

### 4.2 DESCRIPTIVE STATISTICS

Descriptive statistics pertaining to both the dependent and independent variables are summarised to provide important insights into the sample of CISs under investigation. Descriptive statistics of the dependent variables, namely the fund performance measures of total return, the Treynor ratio, Sharpe ratio, information ratio, and Jensen's alpha, are detailed in Table 12 below.

**Table 12: Descriptive statistics of the measures of fund performance**

<b>Descriptive statistic</b>	<b>Total return</b>	<b>Treynor ratio</b>	<b>Sharpe ratio</b>	<b>Information ratio</b>	<b>Jensen's alpha</b>
Observations	20 404	20 404	20 404	20 404	20 404
Mean	0.0091	0.0025	0.0651	0.0299	0.0015
Median	0.0102	0.0001	0.0210	0.0207	0.0012

Standard deviation	0.0418	0.2766	0.3428	0.3456	0.0144
Minimum	-0.2551	-2.9603	-1.6355	-1.9224	-0.1014
Maximum	0.3352	2.9481	1.5850	2.1608	0.1621

Source: Author's calculations

From Table 12, the number of observations for each panel is 20 404 indicating that a sufficiently large sample is examined in the present study. Regarding measures of central tendency, the mean and median monthly performance measures are positive for each measure of performance. Furthermore, the performance measures with the greatest variability include the information ratio and Sharpe ratio whereas Jensen's alpha is the measurement of performance with the lowest variability. Descriptive statistics of the independent variables, namely *Size*, *Family*, *Age*, and *Expense* defined in section 3.2.2 of Chapter 3, are presented in Table 13.

**Table 13: Descriptive statistics of the fund attributes**

<b>Descriptive statistic</b>	<i>Size</i>	<i>Family</i>	<i>Age</i>	<i>Expense</i>
Observations	20 404	20 404	20 404	20 404
Mean	20.0367	22.2114	7.6821	0.0137
Median	20.0641	22.6354	7.8344	0.0134
Standard deviation	1.6952	1.7397	1.1304	0.0053
Minimum	9.9147	13.4448	3.2189	0.0030
Maximum	24.5140	24.5707	9.9078	0.0433

Source: Author's calculations

Importantly, the summary statistics in Table 13 show that the fund attribute with the highest variability is *Family* while the fund attribute with the lowest variability is *Expense*.

### 4.3 DIAGNOSTIC TESTS

To ensure that the results of the regression analyses can be deemed reliable, several diagnostic tests are conducted to test the panel data for stationarity, multicollinearity, heteroskedasticity, and serial correlation. The results of these tests are discussed in the following subsections.

#### 4.3.1 Stationarity

To determine the order of integration of the dependent and independent variables, the Im-Pesaran-Shin unit root test is performed. As mentioned in section 3.4.1 in Chapter 3, the Im-Pesaran-Shin test conducts separate unit root tests for the  $N$  cross-sectional individuals and then combines these tests to determine whether the panel has a unit root. The null hypothesis of this test states that each series in the panel contains a unit root, and as such, the panel data is non-stationary. The alternative hypothesis allows for some but not all of the individual series to have unit roots. Table 14 shows the p-values of the individual augmented Dickey-Fuller regressions (ADF-regressions) based on the Im-Pesaran-Shin test for the dependent variables of the study. Evidently, the null hypothesis of a unit root is rejected for each of the dependent variables at the 1% level of significance. Therefore, all of the dependent variables are deemed to be stationary in levels and are thus  $I(0)$  processes.

Table 14: Im-Pesaran-Shin panel unit root test on dependent variables

Dependent variable	P-values of individual ADF-regressions	Result
Total return	1.0000e <sup>-4</sup>	Stationary at the 1% level of significance
Treynor ratio	1.0000e <sup>-4</sup>	Stationary at the 1% level of significance
Sharpe ratio	1.2565e <sup>-47</sup>	Stationary at the 1% level of significance
Information ratio	7.9062e <sup>-49</sup>	Stationary at the 1% level of significance

Jensen's alpha	1.6569e <sup>-36</sup>	Stationary at the 1% level of significance
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Source: Author's calculations

The p-values of the individual ADF-regressions based on the Im-Pesaran-Shin test for the independent variables of the study can be seen in Table 15. From Table 15, the null hypothesis of a unit root is also rejected for each of the independent variables at the 1% level of significance. As such, all of the independent variables are also deemed to be stationary in levels which indicates that they are  $I(0)$  processes.

**Table 15: Im-Pesaran-Shin panel unit root test on independent variables**

Independent variable	P-values of individual ADF-regressions	Result
<i>Size</i>	1.6760e <sup>-33</sup>	Stationary at the 1% level of significance
<i>Family</i>	2.8549e <sup>-28</sup>	Stationary at the 1% level of significance
<i>Age</i>	6.3865e <sup>-49</sup>	Stationary at the 1% level of significance
<i>Expense</i>	2.2531e <sup>-27</sup>	Stationary at the 1% level of significance

Source: Author's calculations

Non-stationarity is not a concern in the present study since all of the dependent and independent variables do not contain a unit root and are stationary in levels. Thus, the variables do not need to be transformed by taking the first differences.

#### **4.3.2 Multicollinearity**

In order to test the presence of multicollinearity in the sample, a pairwise correlation matrix is generated. As evidenced in Table 16, none of the independent variables are highly correlated with one another. The highest correlation is a moderate positive correlation of 0.5346 between *Size* and *Age*. This implies that the older a fund, the larger the value of its assets under management (AUM). A moderate positive

correlation of 0.4029 is also detected between *Size* and *Family* suggesting that the larger the family a fund belongs to, the larger the value of its AUM. Noteworthy, a low negative correlation is detected between *Size* and *Expense* as well as between *Family* and *Expense*. This finding is consistent with that of Filip (2018) and implies that the lower a fund's expense ratio, the larger the value of its AUM and the AUM of the family to which it belongs.

**Table 16: Pairwise correlation matrix of the independent variables**

<b>Variables</b>	<b><i>Size</i></b>	<b><i>Family</i></b>	<b><i>Age</i></b>	<b><i>Expense</i></b>
<b><i>Size</i></b>	1	0.4029	0.5346	-0.1250
<b><i>Family</i></b>	0.4029	1	0.2225	-0.1140
<b><i>Age</i></b>	0.5346	0.2225	1	0.0030
<b><i>Expense</i></b>	-0.1250	-0.1140	0.0030	1

Source: Author's calculations

Due to the pairwise correlation coefficients of the independent variables being moderate and relatively low in most cases, collinearity amongst the independent variables is not a serious problem in the present study. As a result, none of the explanatory variables need to be removed or dropped.

### **4.3.3 Heteroskedasticity**

The Breusch-Pagan test is conducted to test for heteroskedasticity in the idiosyncratic errors in the panel regressions. The null hypothesis under this test states that there is constant error variance, and thus, homoskedasticity is present. On the other hand, the alternative hypothesis states that the variance of the idiosyncratic errors is not constant in which case heteroskedasticity is present. The Breusch-Pagan test is performed on each of the five datasets in which the dependent variable is treated as either total return, the Treynor ratio, Sharpe ratio, information ratio, or Jensen's alpha. The results of the Breusch-Pagan test for each dataset can be seen in Table 17.

**Table 17: Breusch-Pagan test for heteroskedasticity**

Function	P-value	Result
Total return = $f(\text{Size}; \text{Family}; \text{Age}; \text{Expense})$	$< 2.2e^{-16}$	Heteroskedasticity
Treynor ratio = $f(\text{Size}; \text{Family}; \text{Age}; \text{Expense})$	$1.0000e^{-5}$	Heteroskedasticity
Sharpe ratio = $f(\text{Size}; \text{Family}; \text{Age}; \text{Expense})$	$3.3850e^{-3}$	Heteroskedasticity
Information ratio = $f(\text{Size}; \text{Family}; \text{Age}; \text{Expense})$	$< 2.2e^{-16}$	Heteroskedasticity
Jensen's alpha = $f(\text{Size}; \text{Family}; \text{Age}; \text{Expense})$	$< 2.2e^{-16}$	Heteroskedasticity

Source: Author's calculations

All of the p-values are less than 0.01, hence, the null hypothesis of homoskedasticity is rejected at the 1% level of significance. As such, the presence of heteroskedasticity in the idiosyncratic errors is a problem in each of the five datasets.

#### 4.3.4 Serial correlation

To test for serial correlation in the idiosyncratic errors in the panel regressions, the Breusch-Godfrey test is conducted. Specifically, this test is undertaken on the pooled OLS, fixed effects, and random effects models when each of the five measures of fund performance are treated as the dependent variable. As discussed in section 3.4.4 in Chapter 3, the Breusch-Godfrey test allows for the testing of higher-order serial correlation up to any predesignated order  $p$ . This test is, however, applicable whether or not the regressors include lags of the dependent variable. The null hypothesis of this test states that there is no serial correlation at any order less than or equal to  $p$ . The alternative hypothesis states that there is serial correlation at some order less than or equal to  $p$ . The results of the Breusch-Godfrey test conducted on each of the models is displayed in Table 18.

**Table 18: Breusch-Godfrey test for serial correlation**

Dependent variable	Panel model	P-value	Result
Total return	Pooled OLS model	0.1659	No serial correlation
	Fixed effects model	0.0079	Serial correlation
	Random effects model	0.1659	No serial correlation

Treydor ratio	Pooled OLS model	0.9221	No serial correlation
	Fixed effects model	0.1697	No serial correlation
	Random effects model	0.8889	No serial correlation
Sharpe ratio	Pooled OLS model	$< 2.2e^{-16}$	Serial correlation
	Fixed effects model	$< 2.2e^{-16}$	Serial correlation
	Random effects model	$< 2.2e^{-16}$	Serial correlation
Information ratio	Pooled OLS model	0.3650	No serial correlation
	Fixed effects model	0.4601	No serial correlation
	Random effects model	0.8295	No serial correlation
Jensen's alpha	Pooled OLS model	$< 2.2e^{-16}$	Serial correlation
	Fixed effects model	$< 2.2e^{-16}$	Serial correlation
	Random effects model	$< 2.2e^{-16}$	Serial correlation

Source: Author's calculations

From the results presented in Table 18, some of the p-values are less than 0.01, and thus, the null hypothesis is rejected in these cases at the 1% level of significance. Therefore, it can be concluded that serial correlation in the idiosyncratic errors is present in some of the models. In particular, when the Sharpe ratio and Jensen's alpha are treated as the dependent variable, the pooled OLS, fixed effects, and random effects models have serial correlation. Serial correlation is also a concern when total return is used as a measure of fund performance but only for the fixed effects model.

#### 4.3.5 Correcting for heteroskedasticity and serial correlation

Evident from sections 4.3.3 and 4.3.4 above, heteroskedasticity and serial correlation is present in the panel data. Heteroskedasticity and serial correlation are common in panel data sets since individual errors are expected to be correlated across time (Baltagi, 2005). Ignoring heteroskedasticity and serial correlation results in biased and inconsistent OLS regression coefficient standard errors which could influence the reliability of the regression results and lead to incorrect inferences being made (Baltagi, 2005; Greene, 2002). As explained in sections 3.4.3 and 3.4.4 in Chapter 3, the presence of heteroskedasticity and serial correlation can be addressed by computing robust standard errors or by modifying the regression equation in an

attempt to eliminate the heteroskedasticity and serial correlation through the use of generalised least squares (GLS) (DeFusco et al., 2015b).

To correct for both heteroskedasticity and serial correlation in the present study, the Newey and West (1987) method for adjusting standard errors is adopted. Newey-West standard errors, also referred to as heteroskedasticity- and autocorrelation-consistent standard errors, are an extension of heteroskedasticity-consistent standard errors or White-corrected standard errors developed by White (1980). Although Newey-West standard errors were initially proposed for addressing heteroskedasticity and serial correlation in time series data, panel versions of this test are also available. Since the pooled OLS and fixed effects models are estimated using OLS, all regressions in this regard are run assuming Newey-West standard errors in the present study. Despite the fact that the random effects model is estimated using GLS, Newey-West standard errors are still assumed for each regression. In the present study, Newey-West standard errors for panel models are generated using the 'coeftest' function in which the 'vcovNW' argument from the 'plm' package in *R* is specified.

#### **4.4 RESULTS**

The results of the pooled OLS, fixed effects, and random effects models are presented in this section for each measure of performance, namely when performance is measured as a fund's total return, the Treynor ratio, Sharpe ratio, information ratio, and Jensen's alpha. Importantly, all regressions are run assuming heteroskedasticity- and autocorrelation-consistent standard errors to account for the presence of heteroskedasticity and serial correlation in the panel data as discussed above.

##### **4.4.1 Total return**

The results of the regression coefficients and test statistics of the pooled OLS, fixed effects, and random effects models when total return is treated as the dependent variable are displayed in Table 19. Column (1) of the respective methodologies reports the results obtained when the control variable, *StockIndex*, is excluded from the models whereas column (2) reports the results obtained when the control variable is included in the models.

Table 19: The impact of fund attributes on fund performance measured as total return

Variables	Pooled OLS model		Fixed effects model		Random effects model	
	(1)	(2)	(1)	(2)	(1)	(2)
	<i>Size</i>	0.0056*** (0.0018)	0.0058*** (0.0018)	-0.0119*** (0.0041)	-0.0116*** (0.0041)	0.0060*** (0.0019)
<i>Family</i>	0.0326** (0.0014)	0.0308** (0.0014)	0.0339*** (0.0040)	0.0337*** (0.0040)	0.0332** (0.0015)	0.0311** (0.0014)
<i>Age</i>	0.0648*** (0.0023)	0.0640*** (0.0023)	-0.0180*** (0.0046)	-0.0185*** (0.0046)	0.0650*** (0.0023)	0.0643*** (0.0023)
<i>Expense</i>	0.5266 (0.3568)	0.5389 (0.3590)	-0.9214 (0.1055)	-0.6128 (0.1054)	0.5275 (0.3570)	0.5394 (0.3591)
<i>StockIndex</i>		-0.2326*** (0.0642)		-0.2553*** (0.0624)		-0.2331*** (0.0643)
$R^2$	0.0211	0.0240	0.0414	0.0438	0.0222	0.0247
Adjusted $R^2$	0.0209	0.0238	0.0412	0.0435	0.0220	0.0245
F-statistic	109.9241***	100.3180***	220.0259***	186.6841***	115.6249***	103.3181***

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

#### **4.4.1.1 Results overview**

Column (1) of the respective methodologies in Table 19 indicates that for both the pooled OLS and random effects models, *Size* and *Age* have a positive and statistically significant impact on the total return of the funds in the sample. This suggests that the larger the value of a fund's AUM or the older the fund, the greater its total return. Contrarily, a negative and statistically significant relationship is detected between *Size* and total return as well as between *Age* and total return for the fixed effects model. This relationship implies that the smaller the value of a fund's AUM or the younger the fund, the greater its total return. Moreover, it is observed that *Family* influences total return in a positive and statistically significant manner for all three models. This suggests that the larger the AUM of the family to which a fund belongs, the greater its total return. A statistically insignificant relationship is identified between *Expense* and total return for each of the models. As such, this result indicates that *Expense* is a fund attribute that does not impact a fund's total return.

The *F*-statistic values indicate that each model is statistically significant, and thus, *Size*, *Family*, *Age*, and *Expense* simultaneously have a significant effect on total return. The coefficients of determination for each model are low, however, with large panel data sets, individual significance of coefficients and overall significance of the model are more informative than the  $R^2$  and adjusted  $R^2$  values. It must be noted that panel data studies on the impact of fund attributes on performance, such as Filip (2018), report similarly low values of coefficients of determination to the present study.

#### **4.4.1.2 Robustness tests**

Column (2) of the respective methodologies in Table 19 shows that a negative and statistically significant relationship exists between *StockIndex* and total return. Notably, *StockIndex* is the most influential regressor on total return. Introducing the control variable in the pooled OLS, fixed effects, and random effects models yields very similar results compared to when *StockIndex* is excluded from each model in column (1). Including the control variable does not result in significantly higher  $R^2$  and adjusted  $R^2$  values. As such, *StockIndex* does not add significant explanatory power to each specification. This analysis supports the results obtained from the models in which *StockIndex* is excluded. Therefore, it can be said that the exclusion of

*StockIndex* does not influence the conclusions to be drawn from each model. In other words, the results in column (1) of the respective methodologies can be deemed to be robust.

#### 4.4.1.3 Model specification tests

To test whether the pooled OLS model or fixed effects model is superior, the *F*-test for fixed effects is performed. The result of this test is presented in Table 20 below. Failure to reject the null hypothesis of there being no fixed effects in the dataset indicates that the pooled OLS model is preferred over the fixed effects model.

**Table 20: *F*-test for fixed effects**

Model specification test	P-value	Result
<i>F</i> -test for fixed effects	0.7209	Pooled OLS model is superior

Source: Author's calculations

Following the *F*-test for fixed effects, the Breusch-Pagan test for random effects is conducted to ascertain whether random effects exist in the data. As can be seen in Table 21, the null hypothesis that the variance of the random effect  $\delta_i$  is equal to zero is rejected. Hence, random effects are present in the data in which case the random effects model is superior to the pooled OLS model.

**Table 21: Breusch-Pagan test for random effects**

Model specification test	P-value	Result
Breusch-Pagan test for random effects	2.08e <sup>-4</sup>	Random effects model is superior

Source: Author's calculations

The model specification tests suggest that the appropriate model to apply to the data when total return is treated as the dependent variable is the random effects model. Accordingly, the following relationships exist between the fund attributes and total return:

- *Size* is significantly positively related to total return at the 1% level of significance.

- *Family* is significantly positively related to total return at the 5% level of significance.
- *Age* is significantly positively related to total return at the 1% level of significance.
- *Expense* is positively related to total return, however, this relationship is statistically insignificant at the 10%, 5%, and 1% levels of significance.

#### 4.4.2 Treynor ratio

The results of the pooled OLS, fixed effects, and random effects models when the Treynor ratio is used as the measure of fund performance are reported in Table 22. The regression coefficients and test statistics when the control variable, *StockIndex*, is excluded from each model are displayed in column (1) of the respective methodologies. Column (2) of the respective methodologies depicts the results when the control variable is included in each model.

##### 4.4.3.1 Results overview

From the results presented in column (1) of the respective methodologies in Table 22, it is evident that *Size* has a statistically significant positive impact on the Treynor ratio for all three models. This finding implies that the larger funds in the sample outperformed the smaller funds. Moreover, for both the pooled OLS and random effects models, there is a statistically significant negative relationship between *Family* and the Treynor ratio. This suggests that funds belonging to families with less AUM generated superior fund performance. Contrarily, when the fixed effects model is applied, a statistically significant positive association is observed between *Family* and the Treynor ratio which indicates that funds from families with more AUM outperformed those with less AUM. Furthermore, the results show that *Age* impacts the Treynor ratio in a statistically significant negative manner for all three panel models. This association highlights that the younger funds in the sample performed better compared to the older funds. The relationship between *Expense* and the Treynor ratio is statistically insignificant for all three models suggesting that *Expense* is a fund attribute that does not influence a fund's performance.

Each model is statistically significant, evidenced by the *F*-statistic values, which indicates that *Size*, *Family*, *Age*, and *Expense* simultaneously have a significant effect

Table 22: The impact of fund attributes on fund performance measured as the Treynor ratio

Variables	Pooled OLS model		Fixed effects model		Random effects model	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Size</i>	0.0499*** (0.0617)	0.0505*** (0.0623)	0.0639** (0.0692)	0.0647** (0.0698)	0.0536*** (0.0625)	0.0548*** (0.0632)
<i>Family</i>	-0.0491*** (0.0280)	-0.0572*** (0.0283)	0.0344*** (0.0667)	0.0339*** (0.0667)	-0.0576*** (0.0281)	-0.0672*** (0.0283)
<i>Age</i>	-0.0865* (0.1196)	-0.0866* (0.1197)	-0.2682*** (0.1685)	-0.2712*** (0.1702)	-0.0926* (0.1205)	-0.0938* (0.1208)
<i>Expense</i>	-0.2376 (0.3826)	-0.2380 (0.3830)	-0.5293 (0.9613)	-0.5314 (0.9615)	-0.3895 (0.4000)	-0.3882 (0.3995)
<i>StockIndex</i>		-0.8655*** (1.4018)		-0.9456*** (1.4212)		-0.8716*** (1.4023)
$R^2$	0.0506	0.0507	0.0469	0.0475	0.0517	0.0520
Adjusted $R^2$	0.0504	0.0505	0.0467	0.0472	0.0515	0.0517
F-statistic	271.5515***	217.9684***	250.7793***	203.2513***	278.2241***	223.6757***

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

on the Treynor ratio. Low coefficients of determination are also observed when the Treynor ratio is used as the dependent variable. However, as mentioned previously, individual significance of coefficients and overall significance of the model are better indicators to evaluate the quality of model fit than the  $R^2$  and adjusted  $R^2$  values when the panel data set is large.

#### 4.4.3.2 Robustness tests

When the control variable is introduced in each model, the results in column (2) of the respective methodologies in Table 22 indicate that a statistically significant negative association exists between *StockIndex* and the Treynor ratio for all three models. Important to highlight is that *StockIndex* is the most influential regressor on the Treynor ratio. When comparing the results in column (2) to those in column (1) of each model, it is evident that the regression coefficients and test statistic values are similar. Therefore, *StockIndex* does not add significant explanatory power to each specification. The robustness tests suggest that the exclusion of *StockIndex* does not affect the conclusions to be drawn from each model, and thus, the results in column (1) of the respective methodologies can be regarded as reliable.

#### 4.4.3.3 Model specification tests

The  $F$ -test for fixed effects is performed to determine whether the pooled OLS model or fixed effects model is preferred. The result of this test reported in Table 23 indicates that the null hypothesis of no fixed effects is rejected. As such, the fixed effects model is deemed to be a better model compared to the pooled OLS model.

**Table 23:  $F$ -test for fixed effects**

<b>Model specification test</b>	<b>P-value</b>	<b>Result</b>
$F$ -test for fixed effects	1.852e <sup>-07</sup>	Fixed effects model is superior

Source: Author's calculations

The Hausman test is then conducted to choose between the fixed effects and random effects models. The result of this test is displayed in Table 24. Failure to reject the null hypothesis of the random effect  $\delta_i$  being uncorrelated or independent of the

explanatory variables  $X_{kit}$  suggests that the random effects model is superior in large samples because it produces more efficient estimators.

**Table 24: Hausman test**

Model specification test	P-value	Result
Hausman test	0.5723	Random effects model is superior

Source: Author's calculations

From the model specification tests above, when the Treynor ratio is used as the dependent variable, the random effects model is the appropriate model to apply to the dataset. Thus, the relationships that exist between the fund attributes and the Treynor ratio are as follows:

- *Size* is significantly positively related to the Treynor ratio at the 1% level of significance.
- *Family* is significantly negatively related to the Treynor ratio at the 1% level of significance.
- *Age* is significantly negatively related to the Treynor ratio at the 10% level of significance.
- *Expense* is negatively related to the Treynor ratio, however, this relationship is statistically insignificant at the 10%, 5%, and 1% levels of significance.

#### 4.4.3 Sharpe ratio

Table 25 displays the regression results of the pooled OLS, fixed effects, and random effects models when the Sharpe ratio is used as the measure of fund performance. The results when the control variable, *StockIndex*, is excluded from each model are presented in column (1) of the respective methodologies. When the control variable is included, the results of the regression analyses can be seen in column (2) for each model.

Table 25: The impact of fund attributes on fund performance measured as the Sharpe ratio

Variables	Pooled OLS model		Fixed effects model		Random effects model	
	(1)	(2)	(1)	(2)	(1)	(2)
	<i>Size</i>	0.0157*** (0.0034)	0.0159*** (0.0034)	-0.0240*** (0.0066)	-0.0239*** (0.0066)	0.0366 (0.0055)
<i>Family</i>	0.0115*** (0.0029)	0.0114*** (0.0029)	0.1080*** (0.0071)	0.1079*** (0.0071)	0.0486*** (0.0047)	0.0386*** (0.0043)
<i>Age</i>	0.0732*** (0.0065)	0.0732*** (0.0065)	-0.0328*** (0.0123)	-0.0334*** (0.0123)	0.0390*** (0.0099)	0.0501*** (0.0093)
<i>Expense</i>	1.9655*** (0.7530)	1.9720*** (0.7527)	2.4288 (1.6142)	2.4557 (1.6141)	3.0405** (1.3051)	2.9171** (1.2089)
<i>StockIndex</i>		-0.1436*** (0.0517)		-0.1875*** (0.0487)		-0.1658*** (0.0501)
$R^2$	0.0654	0.0657	0.0728	0.0735	0.0520	0.0502
Adjusted $R^2$	0.0652	0.0655	0.0727	0.0732	0.0519	0.0500
F-statistic	356.7048***	286.9710***	400.6194***	323.5239***	280.0112***	215.7738***

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

#### **4.4.2.1 Results overview**

Evident from the results displayed in column (1) of the respective methodologies in Table 25, the association between *Size* and the Sharpe ratio is different for each model. A positive and statistically significant relationship exists between *Size* and the Sharpe ratio for the pooled OLS model, however, a statistically significant negative relationship is observed when the fixed effects model is applied. Under the random effects model, *Size* has a statistically insignificant positive impact on the Sharpe ratio. In spite of these contrasting results, all three models found a statistically significant positive relationship between *Family* and the Sharpe ratio. This finding implies that the larger the AUM of the family to which a fund belongs, the better its performance. Both the pooled OLS and random effects models indicate that *Age* and *Expense* have a positive and statistically significant impact on the Sharpe ratio suggesting that older funds and funds with higher expense ratios generated superior performance. On the contrary, under the fixed effects model, *Age* impacts the Sharpe ratio in a negative and statistically significant manner which implies that the younger funds in the sample outperformed the older funds. Moreover, the results of the fixed effects model indicate that an insignificant positive association exists between *Expense* and the Sharpe ratio. This relationship suggests that a fund's performance is not affected by the *Expense* variable.

From the *F*-statistic values in Table 25, it can be said that all three models are statistically significant which suggests that *Size*, *Family*, *Age*, and *Expense* simultaneously have a significant effect on the Sharpe ratio. The coefficients of determination for each model are low when the Sharpe ratio is used as a measure of fund performance. Nevertheless, as discussed previously, individual significance of coefficients and overall significance are more informative than the  $R^2$  and adjusted  $R^2$  values for large panel data sets.

#### **4.4.2.2 Robustness tests**

Column (2) of the respective methodologies in Table 25 shows that a statistically significant negative relationship exists between *StockIndex* and the Sharpe ratio. Noteworthy, when the control variable is introduced into each model in column (2), the results obtained are consistent with those presented in column (1) of the respective

methodologies. Furthermore, the  $R^2$  and adjusted  $R^2$  values of the pooled OLS, fixed effects, and random effects models indicate that the explanatory power does not substantially increase when *StockIndex* is included in each of the models. It can be said that the exclusion of *StockIndex* does not influence the conclusions to be drawn from each model. Accordingly, the regression results in column (2) of the respective methodologies confirm the robustness of the results of each model displayed in column (1).

#### 4.4.2.3 Model specification tests

To establish whether the pooled OLS model or fixed effects model is more appropriate, the  $F$ -test for fixed effects is conducted. From the result presented in Table 26, the null hypothesis of there being no fixed effects in the dataset is rejected. Thus, the fixed effects model is deemed to be superior to the pooled OLS model.

**Table 26:  $F$ -test for fixed effects**

Model specification test	P-value	Result
$F$ -test for fixed effects	$< 2.2e^{-16}$	Fixed effects model is superior

Source: Author's calculations

To choose between the fixed effects and random effects models, the Hausman test is conducted. The result of this test presented in Table 27 reveals that the null hypothesis of the random effect  $\delta_i$  being uncorrelated or independent of the explanatory variables  $X_{kit}$  is rejected. As such, the fixed effects model is preferred over the random effects model.

**Table 27: Hausman test**

Model specification test	P-value	Result
Hausman test	$6.383e^{-15}$	Fixed effects model is superior

Source: Author's calculations

The above model specification tests indicate that the appropriate model to apply to the data when the Sharpe ratio is treated as the dependent variable is the fixed effects

model. Therefore, the following relationships exist between the fund attributes and the Sharpe ratio:

- *Size* is significantly negatively related to the Sharpe ratio at the 1% level of significance.
- *Family* is significantly positively related to the Sharpe ratio at the 1% level of significance.
- *Age* is significantly negatively related to the Sharpe ratio at the 1% level of significance.
- *Expense* is positively related to the Sharpe ratio, however, this relationship is statistically insignificant at the 10%, 5%, and 1% levels of significance.

#### **4.4.4 Information ratio**

Table 28 presents the results of the panel models when the dependent variable is treated as the information ratio. The results when the control variable, *StockIndex*, is excluded in the models are reported in column (1) of the respective methodologies. Column (2) of each model displays the results when the control variable is introduced.

##### **4.4.4.1 Results overview**

The results in column (1) of the respective methodologies in Table 28 indicate that there is a negative relationship between *Size* and the information ratio for each model. This relationship is, however, statistically insignificant for the pooled OLS and random effects models but statistically significant for the fixed effects model. These results imply that, under the fixed effects model, funds managing less assets are able to generate superior performance compared to funds managing more assets. Moreover, *Family* has a statistically significant positive impact on the information ratio for each model suggesting that funds from families with larger AUM achieved superior performance. A positive relationship is also identified between *Age* and the information ratio. Notably, this relationship is statistically significant for both the pooled OLS and random effects models whereas it is statistically insignificant for the fixed effects model. Therefore, the older funds in the sample outperformed the younger funds when the pooled OLS and random effects models are estimated. A statistically insignificant positive association is observed between *Expense* and the information ratio for each

Table 28: The impact of fund attributes on fund performance measured as the information ratio

Variables	Pooled OLS model		Fixed effects model		Random effects model	
	(1)	(2)	(1)	(2)	(1)	(2)
	<i>Size</i>	-0.0030 (0.0048)	-0.0019 (0.0046)	-0.0417*** (0.0144)	-0.0405*** (0.0140)	-0.0049 (0.0056)
<i>Family</i>	0.0290*** (0.0042)	0.0276*** (0.0041)	0.0970*** (0.0136)	0.0963*** (0.0133)	0.0326*** (0.0046)	0.0319*** (0.0045)
<i>Age</i>	0.0454*** (0.0101)	0.0452*** (0.0098)	0.0217 (0.0269)	0.0171 (0.0262)	0.0507*** (0.0109)	0.0508*** (0.0106)
<i>Expense</i>	0.7392 (0.9005)	0.8047 (0.8722)	0.5581 (3.0760)	0.7622 (2.9544)	0.7575 (0.9906)	0.8446 (0.9738)
<i>StockIndex</i>		-1.4516*** (0.0430)		-1.4252*** (0.0400)		-1.4451*** (0.0422)
$R^2$	0.0661	0.0714	0.0968	0.1016	0.0740	0.0750
Adjusted $R^2$	0.0659	0.0712	0.0966	0.1013	0.0738	0.0748
<i>F</i> -statistic	360.7186***	313.8032***	546.3818***	461.1090***	407.4205***	330.9834***

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

model which implies that *Expense* is a fund attribute that does not influence a fund's performance.

Evident from the *F*-statistic values, each of the models are statistically significant suggesting that *Size*, *Family*, *Age*, and *Expense* simultaneously have a significant effect on the information ratio. The  $R^2$  and adjusted  $R^2$  values are low when the information ratio is used as a measure of fund performance, however, the individual significance of coefficients and overall significance are more informative for large panel data sets such as that of the present study.

#### 4.4.4.2 Robustness tests

When the control variable is introduced in column (2) of the respective methodologies, *StockIndex* has a statistically significant negative impact on the information ratio. Additionally, *StockIndex* is the most influential regressor on the information ratio for each of the models. The regression coefficients and test statistics presented in column (2) for each model correspond well with that in column (1). Comparing the  $R^2$  and adjusted  $R^2$  values suggest that including *StockIndex* in the models does not result in a significant increase in the explanatory power. The robustness tests indicate that the exclusion of *StockIndex* does not affect the conclusions to be drawn from each model, and thus, the results in column (1) of the respective methodologies can be deemed to be robust.

#### 4.4.4.3 Model specification tests

The *F*-test for fixed effects is performed to test whether the pooled OLS model or fixed effects model is more suitable. From the result presented in Table 29, the null hypothesis of there being no fixed effects in the dataset is rejected. Accordingly, the fixed effects model is superior to the pooled OLS model.

**Table 29: *F*-test for fixed effects**

Model specification test	P-value	Result
<i>F</i> -test for fixed effects	$< 2.2e^{-16}$	Fixed effects model is superior

Source: Author's calculations

Since the result of the  $F$ -test for fixed effects indicates that the fixed effects model is preferred, this model is compared to the random effects model by conducting the Hausman test. As can be seen in Table 30, the null hypothesis of the random effect  $\delta_i$  being uncorrelated or independent of the explanatory variables  $X_{kit}$  is rejected. This implies that the fixed effects model is superior to the random effects model.

**Table 30: Hausman test**

<b>Model specification test</b>	<b>P-value</b>	<b>Result</b>
Hausman test	7.357e <sup>-9</sup>	Fixed effects model is superior

Source: Author's calculations

The above model specification tests reveal that the appropriate model to apply to the data when the information ratio is used as a measure of fund performance is the fixed effects model. As such, the relationships that exist between the fund attributes and the information ratio are as follows:

- *Size* is significantly negatively related to the information ratio at the 1% level of significance.
- *Family* is significantly positively related to the information ratio at the 1% level of significance.
- *Age* is positively related to the information ratio, however, this relationship is statistically insignificant at the 10%, 5%, and 1% levels of significance.
- *Expense* is positively related to the information ratio, however, this relationship is statistically insignificant at the 10%, 5%, and 1% levels of significance.

#### **4.4.5 Jensen's alpha**

The regression coefficients and test statistics of the pooled OLS, fixed effects, and random effects models when Jensen's alpha is used as a measure of fund performance can be seen in Table 31. The results presented in column (1) of the respective methodologies exclude the control variable, *StockIndex*, from each model. The results displayed in column (2) of each model include the control variable in the regression analyses.

Table 31: The impact of fund attributes on fund performance measured as Jensen's alpha

Variables	Pooled OLS model		Fixed effects model		Random effects model	
	(1)	(2)	(1)	(2)	(1)	(2)
	<i>Size</i>	0.0059*** (0.0015)	0.0059*** (0.0015)	-0.0122*** (0.0028)	-0.0121*** (0.0028)	0.0014 (0.0023)
<i>Family</i>	0.0278** (0.0012)	0.0277** (0.0012)	0.0328*** (0.0031)	0.0328*** (0.0031)	0.0121*** (0.0019)	0.0974*** (0.0018)
<i>Age</i>	0.0174*** (0.0030)	0.0174*** (0.0030)	-0.0109* (0.0057)	-0.0110* (0.0057)	0.0118*** (0.0045)	0.0140*** (0.0043)
<i>Expense</i>	0.4230 (0.3174)	0.4235 (0.3174)	-0.5837 (0.7385)	-0.5469 (0.7386)	0.3369 (0.5555)	0.3632 (0.5140)
<i>StockIndex</i>		-0.1117 (0.0213)		-0.2566 (0.0206)		-0.1822 (0.0210)
$R^2$	0.0267	0.0267	0.0304	0.0304	0.0188	0.0183
Adjusted $R^2$	0.0265	0.0264	0.0302	0.0302	0.0186	0.0181
F-statistic	139.7156***	111.8187***	159.7792***	128.1035***	97.9295***	76.1500***

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

#### **4.4.5.1 Results overview**

The results reported in column (1) of the respective methodologies in Table 31 indicate that the impact of *Size* on Jensen's alpha is different for each model. When the pooled OLS model is estimated, a statistically significant positive association is observed between *Size* and Jensen's alpha. However, *Size* influences Jensen's alpha in a statistically significant negative manner when the fixed effects model is applied. Despite this, an insignificant positive relationship exists between *Size* and Jensen's alpha when the random effects model is adopted. Furthermore, a positive and statistically significant association is identified between *Family* and Jensen's alpha for all three models. This suggests that funds belonging to families with more AUM generated superior fund performance. For both the pooled OLS and random effects models, *Age* impacted Jensen's alpha in a statistically significant positive manner implying that older funds performed better compared to younger funds. Contrarily, the relationship between *Age* and Jensen's alpha is significantly negative under the fixed effects model. Notably, the relationship between *Expense* and Jensen's alpha is statistically insignificant for all three models, albeit positive for the pooled OLS and random effects models and negative for the fixed effects model. Thus, *Expense* is a fund attribute that does not impact a fund's performance.

Table 31 further reports that each model is statistically significant as can be seen by the *F*-statistic values. This indicates that *Size*, *Family*, *Age*, and *Expense* simultaneously have a significant effect on Jensen's alpha. Low coefficients of determination are also observed when Jensen's alpha is treated as the dependent variable. However, since the panel dataset is large, individual significance of coefficients and overall significance of the models are better indicators to evaluate the quality of model fit, as discussed previously.

#### **4.4.5.2 Robustness tests**

The results in column (2) of the respective methodologies shows that *StockIndex* has an insignificant impact on Jensen's alpha. In addition, when *StockIndex* is included in the pooled OLS, fixed effects, and random effects models, similar results are obtained compared to when *StockIndex* is excluded from each model. When comparing the  $R^2$  and adjusted  $R^2$  values, it is evident that the *StockIndex* variable does not significantly

increase the explanatory power of the models. Based on the robustness tests, it can be said that the exclusion of *StockIndex* does not influence the conclusions to be drawn from each model. Thus, the regression coefficients and test statistics for each model in column (1) can be viewed as robust.

#### 4.4.5.3 Model specification tests

The *F*-test for fixed effects is performed to identify whether the pooled OLS model or fixed effects model is preferred. Table 32 reports the result of this test in which it is evident that the null hypothesis of no fixed effects is rejected. Hence, the fixed effects model is a better model compared to the pooled OLS model.

**Table 32: *F*-test for fixed effects**

Model specification test	P-value	Result
<i>F</i> -test for fixed effects	$< 2.2e^{-16}$	Fixed effects model is superior

Source: Author's calculations

Given the results of the *F*-test for fixed effects, the Hausman test is then conducted to choose between the fixed effects and random effects models. From the result of this test in Table 33, the null hypothesis of the random effect  $\delta_i$  being uncorrelated or independent of the explanatory variables  $X_{kit}$  is rejected. This suggests that the fixed effects model is superior to the random effects model.

**Table 33: Hausman test**

Model specification test	P-value	Result
Hausman test	$< 2.2e^{-16}$	Fixed effects model is superior

Source: Author's calculations

The results of the model specification tests reveal that the fixed effects model is a more suitable model to apply to the data when Jensen's alpha is treated as the dependent variable. Therefore, the following relationships exist between the fund attributes and Jensen's alpha:

- *Size* is significantly negatively related to Jensen's alpha at the 1% level of significance.

- *Family* is significantly positively related to Jensen's alpha at the 1% level of significance.
- *Age* is significantly negatively related to Jensen's alpha at the 10% level of significance.
- *Expense* is negatively related to Jensen's alpha, however, this relationship is statistically insignificant at the 10%, 5%, and 1% levels of significance.

#### **4.5 SUMMARY**

This chapter analysed the panel dataset to determine whether a relationship exists between the fund attributes under investigation and the performance of South African–Equity–General CISs. Specifically, an overview of the dependent and independent variables were provided through the analysis of descriptive statistics. Moreover, the results of the diagnostic tests that were performed on the panel data to test for stationarity, multicollinearity, heteroskedasticity, and serial correlation were reported. This chapter also detailed the findings of the pooled OLS, fixed effects, and random effects regression analyses that were conducted when performance was measured as either total return, the Treynor ratio, Sharpe ratio, information ratio, and Jensen's alpha. Noteworthy, introducing the control variable into each model confirmed the robustness of the results obtained when the control variable was excluded. Furthermore, the model specification tests identified the appropriate model to apply to the data when each of the performance measures were treated as the dependent variable. From the analyses conducted in this chapter, it can be said that statistically significant relationships exist between the fund attributes under investigation and the respective measures of performance. These results are discussed in more detail in the next chapter.

## CHAPTER 5 – DISCUSSION OF RESULTS

### 5.1 INTRODUCTION

This chapter details the main findings identified from the panel regression analyses conducted in Chapter 4. Specifically, the overall relationships observed between the fund attributes under investigation and the various performance measures are discussed. Following this, the findings of the present study are evaluated against that of prior studies to determine whether the fund attribute-performance relationships of South African collective investment schemes (CISs) are consistent with that of funds operating in international markets.

### 5.2 FUND SIZE

This section provides an overview of the present study's findings relating to fund size whereafter the results are compared to that of prior literature.

#### 5.2.1 Results of the present study

The findings of the present study on the impact that fund size has on the different fund performance measures of South African–Equity–General classified funds based on the respective models chosen from the model specification tests can be seen in Table 34 below.

**Table 34: Summary of the impact that fund size has on fund performance**

<b>Measure of performance</b>	<b>Chosen model</b>	<b>Regression coefficient</b>	<b>Relationship</b>
Total return	Random effects model	0.0060*** (0.0019)	Statistically significant positive relationship at the 1% level
Treynor ratio	Random effects model	0.0536*** (0.0625)	Statistically significant positive relationship at the 1% level

Sharpe ratio	Fixed effects model	−0.0240*** (0.0066)	Statistically significant negative relationship at the 1% level
Information ratio	Fixed effects model	−0.0417*** (0.0144)	Statistically significant negative relationship at the 1% level
Jensen's alpha	Fixed effects model	−0.0122*** (0.0028)	Statistically significant negative relationship at the 1% level

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

In general, there is a statistically significant negative relationship between fund size and performance. In particular, this association exists when performance is measured in terms of the Sharpe ratio, information ratio, and Jensen's alpha. A possible explanation for this association is that larger funds may incur diseconomies of scale (Yap & Pierce, 2008). Additionally, larger funds typically incur higher market impact costs due to transacting in larger quantities compared to smaller funds which may impede performance. Chan et al. (2009) found this to be true for large funds pursuing highly active trading strategies compared to those following passive trading strategies since the latter engage in less trading activity which reduces their market impact costs.

### 5.2.2 Comparison with previous studies

The relationship between fund size and performance discovered by prior studies differs depending on the period of analysis and market in which they were conducted. A negative<sup>11</sup> association has been documented by some studies implying that a fund's performance deteriorates as its assets under management (AUM) increases. On the other hand, a positive<sup>12</sup> relationship has also detected in which larger funds generated

<sup>11</sup> See, for example, Bessler et al. (2016), Blake et al. (2014), Chan et al. (2009), Chen et al. (2004), Ciccotello and Grant (1996), Ferreira et al. (2013), Grinblatt and Titman (1989), Sawicki and Finn (2002), Wessels (2019), Yan (2008), and Yap and Pierce (2008).

<sup>12</sup> See, for example, Ferreira et al. (2013), Filip (2018), and Otten and Bams (2002).

superior performance compared to their smaller peers. Studies have also found evidence of a concave<sup>13</sup> relationship existing between fund size and performance. This suggests that there is an optimal fund size in which performance decreases when a fund's size is above this level of AUM and increases when a fund's size is below this level of AUM. Moreover, an insignificant<sup>14</sup> relationship has also been identified by many studies which infers that a fund's size does not influence its ability to generate superior or inferior performance. In spite of the contrasting results from existing literature, there is more evidence in support of a negative or insignificant relationship between fund size and performance.

In the present study, a statistically significant negative association exists between fund size and performance measured using the Sharpe ratio, information ratio, and Jensen's alpha. A study that corresponds well with these findings is that of Yan (2008) who investigated a sample of U.S. actively managed equity mutual funds in existence between 1993 to 2002. When measuring performance as Jensen's alpha, a significant negative relationship was observed between fund size and performance. Yan (2008) also discovered this negative relationship when using the Fama-French three-factor model, the Carhart four-factor model, and a conditional version of the Carhart four-factor model as measures of fund performance. This significant negative association was particularly prominent for funds that held less liquid stocks or small capitalisation stocks in their portfolios. Likewise, a statistically significant negative relationship was also reported by Yap and Pierce (2008) when evaluating a sample of 168 Australian open-ended equity mutual funds over the period 2002 to 2006. When performance was measured utilising Jensen's alpha, a five-factor model obtained by introducing an illiquidity premium for small capitalisation stocks into the Carhart four-factor model, and a conditional Jensen's alpha model, the results showed that performance declined as funds increased their AUM. Although the results of Yan (2008) and Yap and Pierce (2008) are consistent with that of the present study, Low (2010) documented an insignificant relationship between fund size and risk-adjusted returns measured using

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<sup>13</sup> See, for example, Bodson et al. (2011), Indro et al. (1999), Pillay et al. (2010), and Tang et al. (2012).

<sup>14</sup> See, for example, Basso and Funari (2017), Gallagher and Martin (2005), Grinblatt and Titman (1989), Hibbert (2003), Low (2010), Molelekoa (2012), Sharpe (1966), Sing (2007), and van Andel (2014).

Jensen's alpha. This relationship was detected by Low (2010) when analysing a sample of 65 Malaysian unit trust funds operating during 1999 to 2004. A statistically significant negative association was, however, found to exist between the percentage growth in fund size and performance.

Other studies in support of a significant negative association between fund size and performance when using different risk-adjusted performance measures compared to the present study must also be mentioned. One such study is that of Chen et al. (2004) in which a sample of diversified U.S. equity mutual funds operating during 1962 to 1999 were examined. These authors identified that smaller funds outperformed their larger peers both before and after fees and expenses. This was particularly the case for funds that focused on investing in small capitalisation and illiquid stocks. Additionally, Bessler et al. (2016) also discovered that increasing fund size had an effect of lowering fund performance for a sample of 3 946 U.S. actively managed equity mutual funds operating over the period 1992 to 2007. In this study, performance was measured using the Carhart four-factor model.

When performance is measured as total return and the Treynor ratio in the present study, there is a statistically significant positive relationship between fund size and performance. This relationship could exist due to economies of scale or the cost advantages that larger funds typically have over smaller funds. These benefits include being able to spread expenses over a larger asset base, having access to more resources for research and investment opportunities as well as being able to negotiate better spreads (Ciccotello & Grant, 1996; Ferreira et al., 2013; Yap & Pierce, 2008). Fund size was also found to have a significant positive impact on performance by Otten and Bams (2002). These authors investigated the fund size-performance relationship for a sample of 506 open-ended equity mutual funds from France, Germany, the Netherlands, and the United Kingdom over the period 1991 to 1998. By doing so, a significant positive relationship was observed between fund size and risk-adjusted performance for funds from these countries when using the Carhart four-factor model as a measure of performance.

Another study that reported a statistically significant positive relationship between fund size and performance is that of Filip (2018). In this study, 152 Polish domestic and

foreign equity mutual funds in existence during the period 2002 to 2015 were evaluated. Notably, both fixed effects and random effects models were estimated to determine the impact that fund size had on performance. Consistent with the findings of the present study, fund size influenced the performance of the domestic funds in a significant positive manner when performance was measured using the Treynor ratio. In contrast to the present study, when the Sharpe ratio was used as a measure of performance, a significant positive relationship was detected. This relationship was also identified for the sample of domestic funds when the author measured performance using the Sortino ratio. Moreover, there was a significant positive relationship between fund size and the performance of the foreign funds when performance was estimated using the Sharpe ratio, Sortino ratio, and the Carhart four-factor model.

Other studies that have found conflicting results to that of the present study must also be highlighted. Bodson et al. (2011) discovered a concave quadratic relationship between fund size and performance measured using the Sharpe ratio, Treynor ratio, and Jensen's alpha for a sample of 2 926 mutual funds operating over the period 2000 to 2010. Such a relationship was also observed when performance was measured using the Carhart four-factor model as well as a further performance measure proposed by the authors themselves. Similarly, when the Sharpe ratio, Jensen's alpha, and the Fama-French three-factor model were used as measures of fund performance, Tang et al. (2012) documented the presence of an inverted U-shape relationship between fund size and performance for a sample of Chinese open- and closed-ended equity mutual funds over the period 2004 to 2009.

Comparing the results displayed in Table 34 to that of South African studies using similar risk-adjusted performance measures to the present study is also of importance. Contrary to the results of the present study, Hibbert (2003) detected an insignificant association between fund size and performance measured as total return, the Treynor ratio, Sharpe ratio, and Jensen's alpha. The sample used in this study comprised 14 South African equity funds operating over the period 1990 to 1999. In a similar light, Molelekoa (2012) found no evidence of fund size having an influence on a fund's total return for a sample of 104 South African equity funds in existence during the period 2001 to 2011. Nevertheless, a study that identified a significant negative relationship

between fund size and performance is that of Wessels (2019). This author analysed a sample of 46 equity funds and 19 balanced funds that were in continuous existence over the period 2009 to 2019. Important to note, however, is that the significant negative association was observed when performance was measured as total return which is in contrast to the present study.

Although the results of some studies contrast that of the present study, it can be said that the overall fund size-performance relationship identified in the present study corresponds with the majority of prior literature in which a significant negative relationship was also discovered.

### 5.3 FUND FAMILY SIZE

The impact of fund family size on performance detected in the present study is summarised in this section. Additionally, these results are contrasted to the findings of previous studies.

#### 5.3.1 Results of the present study

Table 35 displays the results of the present study on the influence that fund family size has on the different performance measures based on the respective models chosen from the model specification tests in Chapter 4.

**Table 35: Summary of the impact that fund family size has on fund performance**

Measure of performance	Chosen model	Regression coefficient	Relationship
Total return	Random effects model	0.0332** (0.0015)	Statistically significant positive relationship at the 5% level
Treynor ratio	Random effects model	-0.0576*** (0.0281)	Statistically significant negative relationship at the 1% level

Sharpe ratio	Fixed effects model	0.1080*** (0.0071)	Statistically significant positive relationship at the 1% level
Information ratio	Fixed effects model	0.0970*** (0.0136)	Statistically significant positive relationship at the 1% level
Jensen's alpha	Fixed effects model	0.0328*** (0.0031)	Statistically significant positive relationship at the 1% level

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

A statistically significant positive relationship is observed between fund family size and performance for all performance measures except for the Treynor ratio in which a statistically significant negative relationship is identified. This could be due to larger fund families benefiting from economies of scale which allows expenses, such as those related to research, administration, trading commissions, and lending fees, to be shared amongst funds that collectively have a larger asset base (Chen et al., 2004; Ferreira et al., 2013). Moreover, larger fund families have the opportunity of taking advantage of economies of scope from using the same or similar resources to manage many different kinds of funds (Chen et al., 2004; Ferreira et al., 2013). Consistent with the findings of Chen et al. (2004) and Yan (2008), the significant positive relationship discovered in the present study at the organisational level contrasts the findings at the individual fund level in which a significant negative association primarily exists. This suggests that investors should focus on investing in small funds of large families. Furthermore, these results imply that only considering size at the fund level when making an investment decision would be imprudent. Rather, size at the fund and organisational level should be considered in conjunction with one another.

### 5.3.2 Comparison with previous studies

Prior literature on the influence that fund family size has on performance is limited compared to that of the other attributes under investigation. Nonetheless, existing

literature primarily documents the existence of a positive<sup>15</sup> relationship which infers that funds belonging to larger fund families based on AUM outperform those belonging to smaller fund families. Fund family size has also been found to have an insignificant<sup>16</sup> impact on performance. This suggests that a fund's performance is not influenced by the size of the family to which it belongs. A negative association could also exist between fund family size and performance. Such a relationship indicates that the smaller the AUM of the family to which a fund belongs, the greater its performance will be.

A study that corresponds well with the findings of the present study is that of Tang et al. (2012). These authors evaluated a sample of Chinese open- and closed-ended equity mutual funds from 2004 to 2009 in which fund family size was significantly positively related to performance. Similar to the present study, this relationship was observed when performance was measured using the Sharpe ratio and Jensen's alpha. Tang et al. (2012) also detected such a relationship when the Fama-French three-factor model was used as a measure of fund performance. Fu and Liu (2015) reported similar results when conducting panel data regression analyses on a sample of 188 Taiwanese equity funds in existence during the period 1995 to 2014. In this study, medium sized funds from larger families were found to generate superior performance as measured by raw return and the Carhart four-factor model.

Consistent with the findings of the present study, a statistically significant positive association has been identified between fund family size and performance for funds operating in the United States. Chen et al. (2004) examined a sample of diversified U.S. equity mutual funds over the period 1962 to 1999 in which performance was measured in terms of both gross and net returns. The results of the study revealed that funds belonging to larger fund families significantly outperformed funds from smaller families. Likewise, fund family size was found to have a positive and statistically significant impact on performance by Yan (2008) when studying a sample of U.S. actively managed equity mutual funds operating over the period 1993 to 2002.

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<sup>15</sup> See, for example, Chen et al. (2004), Ferreira et al. (2013), Fu and Liu (2015), Tang et al. (2012), and Yan (2008).

<sup>16</sup> See, for example, Bessler et al. (2016), Blake et al. (2014), and Filip (2018).

Notably, this relationship was discovered when performance was calculated using Jensen's alpha, the Fama-French three-factor alpha, the Carhart four-factor alpha, and the conditional four-factor alpha. Moreover, Ferreira et al. (2013) also observed a significant positive relationship between fund family size and performance. These authors analysed a sample of 16 316 open-ended actively managed equity mutual funds from 27 countries operating during the period 1997 to 2007. Using the Carhart four-factor model as a measure of fund performance, fund family size positively affected the performance of funds from the United States in a similar manner to those operating outside the United States.

The findings of the present study detailed in Table 35 are, however, in contrast to that of Filip (2018). This author estimated fixed effects and random effects models for a sample of 152 Polish domestic and foreign equity mutual funds operating over the period 2002 to 2015. By doing so, Filip (2018) detected a statistically insignificant association between fund family size and performance when performance was measured using the Treynor ratio and Sharpe ratio. Such a relationship was also identified for both the domestic and foreign funds when performance was calculated in terms of the Sortino ratio and the Carhart four-factor model. Similarly, Blake et al. (2014) discovered that fund family size had an insignificant impact on performance for a sample of 561 open-ended equity mutual funds from the United Kingdom in existence over the period 1998 to 2008. This relationship was reported by Blake et al. (2014) when estimating fixed effects models in which performance was measured in terms of both gross and net returns. A further study that does not correspond with the findings of the present study is that of Bessler et al. (2016) who investigated a sample of 3 946 U.S. actively managed equity mutual funds operating during 1992 to 2007. These authors observed that funds belonging to families with greater AUM did not significantly outperform funds from smaller families when the Carhart four-factor model was used as a measure of fund performance. However, when family size was evaluated as the number of funds under supervision at the organisational level, funds from families that managed only a few funds significantly outperformed funds from families that managed many funds.

In spite of the studies with contrasting results, the above comparison confirms that the statistically significant positive relationship between fund family size and performance

in the present study is consistent with the majority of prior studies in which a significant positive relationship was also documented.

## 5.4 FUND AGE

This section outlines the present study's findings on the influence that fund age has on performance after which they are contrasted to the results of prior literature.

### 5.4.1 Results of the present study

The findings of the present study on the influence that fund age has on the respective fund performance measures based on the models chosen from the model specification tests are presented in Table 36.

**Table 36: Summary of the impact that fund age has on fund performance**

Measure of performance	Chosen model	Regression coefficient	Relationship
Total return	Random effects model	0.0650*** (0.0023)	Statistically significant positive relationship at the 1% level
Treynor ratio	Random effects model	-0.0926* (0.1205)	Statistically significant negative relationship at the 10% level
Sharpe ratio	Fixed effects model	-0.0328*** (0.0123)	Statistically significant negative relationship at the 1% level
Information ratio	Fixed effects model	0.0217 (0.0269)	Statistically insignificant positive relationship
Jensen's alpha	Fixed effects model	-0.0109* (0.0057)	Statistically significant negative relationship at the 10% level

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

In general, fund age has a statistically significant negative influence on fund performance. Specifically, this relationship exists when the Treynor ratio, Sharpe ratio, and Jensen's alpha are used as measures of fund performance. A possible reason for this negative relationship is that the managers of younger funds may be more alert and flexible to changing markets or more committed to achieve better performance in an effort to survive and obtain recognition in the initial phases of operation (Ferreira et al., 2013; Yap & Pierce, 2008).

#### **5.4.2 Comparison with previous studies**

The results from prior literature on the association between fund age and performance varies across countries and sample periods. Some studies have found evidence of a positive<sup>17</sup> relationship between fund age and performance suggesting that older funds perform better compared to younger funds. Contrarily, other studies have observed that fund age negatively<sup>18</sup> impacts performance. This relationship implies that an older fund is unable to generate superior returns compared to its younger peers. Moreover, some studies have discovered that fund age has an insignificant<sup>19</sup> impact on performance which infers that a fund's ability to generate superior or inferior performance is not influenced by the age of the fund. Despite the conflicting results from previous international studies, there is more evidence in support of a negative or insignificant relationship existing between fund age and performance compared to a positive relationship.

In the present study, there is a statistically significant negative relationship between fund age and performance measured using the Treynor ratio, Sharpe ratio, and Jensen's alpha. Filip (2018) identified similar results when investigating a sample of 152 domestic and foreign equity mutual funds in Poland operating during the period 2002 to 2015. Fund age negatively influenced the performance of the domestic funds in the sample when performance was measured as the Treynor ratio, Sharpe ratio,

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<sup>17</sup> See, for example, Eid Júnior and Rochman (2009), Kaur (2018), and Payne et al. (1999).

<sup>18</sup> See, for example, Ferreira et al. (2013), Filip (2018), Karoui and Meier (2009), Otten and Bams (2002), and Yap and Pierce (2008).

<sup>19</sup> See, for example, Afza and Rauf (2009), Annaert et al. (2003), Chen et al. (2004), Ferreira et al. (2013), Lee et al. (2008), Murcia (2011), and Prather et al. (2004).

and Sortino ratio. This relationship was also prevalent in the sample of foreign funds particularly when performance was estimated with the Carhart four-factor model. Furthermore, consistent with the findings of the present study, a statistically significant negative association has been reported in terms of an Australian perspective by Yap and Pierce (2008). When studying a sample of 168 Australian open-ended equity funds from 2002 to 2006, these authors identified an inverse relationship when performance was calculated using Jensen's alpha, a five-factor model obtained by introducing an illiquidity premium for small capitalisation stocks into the Carhart four-factor model, and a conditional Jensen's alpha model.

Other studies in support of a significant negative relationship between fund age and performance calculated using different risk-adjusted performance measures compared to the present study must also be discussed. For example, Otten and Bams (2002) found that younger funds performed better compared to older funds when investigating 506 European open-ended equity mutual funds over the period 1991 to 1998. This study adopted the Carhart four-factor model to measure risk-adjusted performance. The negative relationship was statistically significant for the sample of funds from Germany and the United Kingdom but insignificant for the sample of funds from the Netherlands and France. Likewise, when estimating fund performance using the Carhart four-factor model, Karoui and Meier (2009) also detected a statistically significant negative relationship between fund age and performance. This association was observed for a sample of 828 U.S. equity mutual funds operating during 1991 to 2005. Despite the newly launched funds exhibiting superior performance compared to older funds, the effect was found to fade away after five years. A further study to mention is that of Ferreira et al. (2013) who analysed the fund characteristics of 16 316 open-ended actively managed equity funds from 27 countries over the period 1997 to 2007. These authors discovered that younger non-U.S. funds performed better compared to older non-U.S. funds in which the Carhart four-factor model was used as a measure of performance. However, no relation was identified between fund age and performance for the U.S. funds from the sample.

When total return is used as a measure of performance in the present study, a statistically significant positive relationship exists between fund age and performance. Such a relationship may exist because younger funds typically incur higher costs

which could affect their ability to outperform their older peers. Additionally, managers of younger funds may also lack experience since funds gain experience with each year of operation, and as such, older funds may perform better due to the 'learning-by-doing' effect (Ferreira et al., 2013; Gregory et al., 1997; Yap & Pierce, 2008). Fund age was also found to have a significant positive impact on performance by Payne et al. (1999). These authors observed this relationship when evaluating a sample of 813 U.S. equity mutual funds operating during 1993 to 1995 through pooled ordinary least squares (OLS) regression. Notably, three-year risk-adjusted returns were used to measure performance in this study.

Moreover, a study that also detected a statistically significant positive association between fund age and performance for funds operating in an emerging economy is that of Eid Júnior and Rochman (2009). These authors analysed a sample of 699 Brazilian mutual funds over the period 2001 to 2006 from four main investment categories namely stocks, fixed income, hedge, and exchange rate funds. The results revealed that older mutual funds from the stocks and hedge fund investment categories generated superior performance. Important to note, however, is that this association was found to exist when performance was measured utilising Jensen's alpha which is in contrast to the present study. Similarly, Kaur (2018) examined a sample of diversified growth equity funds in India over the period 2004 to 2013 and found that fund age impacted performance in a positive manner. This relationship was statistically significant when performance was measured as gross average returns but statistically insignificant in terms of the Sharpe ratio and four-factor conditional Carhart alpha. Evidently, the insignificant relationship discovered when the Sharpe ratio was used as a measure of performance contradicts the present study's Sharpe ratio findings.

In the present study, there is an insignificant positive relationship between fund age and performance when performance is measured using the information ratio. Annaert et al. (2003) also found evidence of fund age having an insignificant impact on performance for a sample of 179 European equity mutual funds over the period 1995 to 1998. However, this insignificant association was identified when Jensen's alpha was used as the measure of fund performance which is in contrast to the present study's Jensen's alpha results. A further study that documented a statistically

insignificant relationship between fund age and performance for a sample of Asian funds is that of Lee et al. (2008). When investigating a sample of 122 Taiwanese open-ended equity mutual funds from 2001 to 2006, these authors observed an insignificant relationship when performance was measured as raw return, market-adjusted return, Jensen's alpha, and the Sharpe ratio. Another study to mention is that of Afza and Rauf (2009) in which open-ended mutual funds from Pakistan were evaluated over the period 1999 to 2006. A positive but statistically insignificant relationship was detected between fund age and performance when performance was measured using the Sharpe ratio. Similarly, when a sample of Spanish mutual funds operating over the period 2000 to 2009 was analysed by Murcia (2011), a statistically insignificant relationship was discovered between fund age and performance measured in terms of the net annual fund yield.

Despite the fact that the results of some studies contradicts that of the present study, the overall fund age-performance relationship identified in the present study is consistent with the findings of the majority of prior literature in which a significant negative relationship was also reported.

## **5.5 FUND EXPENSE RATIOS**

A synopsis of the present study's findings relating to the fund expense ratio attribute is presented in this section. Following this, the results are compared to that of previous studies.

### **5.5.1 Results of the present study**

Table 37 shows the results of the present study on the impact that fund expense ratios have on the different fund performance measures based on the models chosen from the model specification tests in Chapter 4.

**Table 37: Summary of the impact that fund expense ratios have on fund performance**

Measure of performance	Chosen model	Regression coefficient	Relationship
Total return	Random effects model	0.5275 (0.3570)	Statistically insignificant positive relationship
Treynor ratio	Random effects model	-0.3895 (0.4000)	Statistically insignificant negative relationship
Sharpe ratio	Fixed effects model	2.4288 (1.6142)	Statistically insignificant positive relationship
Information ratio	Fixed effects model	0.5581 (3.0760)	Statistically insignificant positive relationship
Jensen's alpha	Fixed effects model	-0.5837 (0.7385)	Statistically insignificant negative relationship

Note: \*, \*\*, \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels respectively. Standard errors are presented in parentheses.

Source: Author's calculations

For each measure of fund performance, a statistically insignificant relationship exists between fund expense ratios and performance. More specifically, a positive but statistically insignificant association is observed when total return, the Sharpe ratio, and information ratio are used as measures of performance. When the Treynor ratio and Jensen's alpha are used as performance measures, there is a negative but statistically insignificant relationship between fund expense ratios and performance. These results suggest that fund expense ratios do not affect the performance of South African–Equity–General CISs.

### 5.5.2 Comparison with previous studies

The majority of prior literature has documented a negative<sup>20</sup> relationship between fund expense ratios and performance implying that funds with lower expense ratios

<sup>20</sup> See, for example, Apap and Griffith (1998), Babalos et al. (2009), Carhart (1997), Dahlquist et al. (2000), Elton et al. (1993), Gil-Bazo and Ruiz-Verdú (2009), Malkiel (1995), Otten and Bams (2002), Pollet and Wilson (2008), Prather et al. (2004), Rehman et al. (2018), Sharpe (1966), Yap and Pierce (2008), and Yin-Ching and Mao-Wei (2003).

generate superior performance relative to funds charging higher expense ratios (Malkiel, 1995). In spite of this, some studies provide evidence in support of a positive<sup>21</sup> or insignificant<sup>22</sup> relationship. A positive association between fund expense ratios and performance infers that funds charging investors higher expenses are able to generate higher returns. An insignificant relationship, however, suggests that higher or lower expense ratios do not necessarily imply superior or inferior fund performance.

When total return is used as a measure of fund performance in the present study, fund expense ratios have a positive but statistically insignificant impact on performance. This is in contrast to the results of Apap and Griffith (1998) who also investigated the impact of fund expense ratios on total return. When analysing a sample of U.S. equity funds operating during the period 1983 to 1992, Apap and Griffith (1998) detected a significant negative relationship between fund expense ratios and total returns. On average, the results showed that a 1% increase in fund expense ratios resulted in a reduction in total return of between 2.07% to 6.37%.

Expense ratios also have an insignificant positive impact on performance in the present study when performance is measured as the Sharpe ratio and information ratio. These findings correspond well with the results of Carlson (1970) who analysed a sample of U.S. equity funds operating during the period 1958 to 1967. The positive but statistically insignificant association in this study was also discovered when fund performance was measured in terms of the Sharpe ratio. On the other hand, Kaur (2018) reported results that contrast the present study's Sharpe ratio findings. This author examined a sample of Indian diversified growth equity mutual funds operating over the period 2004 to 2013. In this study, the effect of expense ratios on performance was significantly positive when performance was measured as gross average returns and the Sharpe ratio. A significant positive association was also identified by Droms and Walker (1996) who evaluated U.S. equity mutual funds during the period 1971 to 1990. These authors made use of three performance measures adopted in the present study namely total return, the Treynor ratio, and Sharpe ratio. For each of these

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<sup>21</sup> See, for example, Droms and Walker (1996), Filip (2018), and Kaur (2018).

<sup>22</sup> See, for example, Carlson (1970), Chen et al. (2004), Ferreira et al. (2013), Grinblatt and Titman (1994), Ippolito (1989), and Korkeamaki and Smythe Jr (2004).

measures of performance, Droms and Walker (1996) observed a significant positive relationship between expense ratios and fund performance. Similarly, Filip (2018) found that expense ratios had a positive and statistically significant impact on the achieved returns of domestic mutual funds operating in Poland over the period 2002 to 2015. The measures of fund performance utilised in this study included the Treynor ratio, Sharpe ratio, and Sortino ratio. Evidently the abovementioned studies of Droms and Walker (1996) and Filip (2018) also contradicts the findings of the present study.

When performance is calculated using the Treynor ratio and Jensen's alpha in the present study, expense ratios have a statistically insignificant negative impact on performance. A study that contrasts the Jensen's alpha findings in the present study is that of Elton et al. (1993). These authors detected a significant negative relationship between expense ratios and performance for a sample of U.S. mutual funds operating during the period 1965 to 1984. Likewise, when investigating a sample of diversified U.S. equity mutual funds in existence during the period 1982 to 1991, Malkiel (1995) also discovered that expense ratios had a statistically significant negative impact on performance calculated in terms of Jensen's alpha. Nevertheless, a study that is consistent with the findings of the present study when using Jensen's alpha to measure fund performance is that of Grinblatt and Titman (1994). More specifically, these authors identified an insignificant relationship between expense ratios and mutual fund performance, measured using Jensen's alpha, for a sample of U.S. mutual funds that operated between 1974 and 1984.

Further studies in support of an insignificant negative association using different risk-adjusted performance measures compared to the present study must also be mentioned. One such study is that of Otten and Bams (2002) who examined the influence of expense ratios on fund performance for a sample of open-ended equity mutual funds operating over the period 1991 to 1998 from France, Germany, the Netherlands, and the United Kingdom. The risk-adjusted performance measure utilised by these authors included the Carhart four-factor model. A negative but statistically insignificant relationship was found to exist between expense ratios and fund performance for the sample of funds from France. However, there was a significant negative relationship between expense ratios and fund performance for the sample of funds from Germany, the Netherlands, and the United Kingdom. Chen et al.

(2004) also discovered a negative but statistically insignificant relationship in their sample of diversified U.S. equity mutual funds operating over the period 1962 to 1999. When fund performance was measured by adjusting the gross and net fund returns using a market model, the capital asset pricing model, the Fama-French three-factor model, and the Carhart four-factor model, a negative but statistically insignificant relationship between fund expense ratios and performance was identified.

Expense ratios also influenced fund performance in an insignificant negative manner in the study of Ferreira et al. (2013). This relationship was observed when performance was measured using the Carhart four-factor model for a sample of open-ended actively managed equity mutual funds from 27 countries in existence over the period 1997 to 2007. The negative relationship was statistically insignificant for the sample of U.S. mutual funds whereas it was found to be statistically significant for some specifications of non-U.S. mutual funds. Another study that supports the findings of an insignificant relationship existing between expense ratios and fund performance is that of Korkeamaki and Smythe Jr (2004). When analysing a sample of Finnish mutual funds over the period 1993 to 2000 by estimating both pooled OLS and random effects models, these authors documented an insignificant relationship between fund expense ratios and returns calculated using the Fama-French three-factor model.

From the above comparison, it can be said that the insignificant relationship between fund expense ratios and performance reported in the present study contrasts the results of the majority of prior literature in which a negative relationship was detected.

## **5.6 SUMMARY**

This chapter reviewed the relationships that exist between the fund attributes under investigation and the performance of South African–Equity–General CISs. In general, fund size and fund age have a statistically significant negative impact on performance. Furthermore, there is a statistically significant positive association between fund family size and performance. Fund expense ratios, however, do not influence the performance of South African CISs. When comparing the findings of the present study to that of existing literature, it is evident that the impact of fund size, family size, and age on the performance of South African CISs conforms with that of international

funds. Contrarily, the insignificant relationship discovered between fund expense ratios and performance in the present study does not conform with that of funds operating in foreign markets.

## CHAPTER 6 – CONCLUSION AND RECOMMENDATIONS

### 6.1 INTRODUCTION

This chapter provides a synopsis of the main findings that were gleaned from the present study and further draws several conclusions from these results to meet the research objectives. Additionally, the author's recommendations for future research are outlined.

### 6.2 SUMMARY OF RESULTS

The purpose of this study is to ascertain whether statistically significant relationships exist between various fund attributes, namely fund size, family size, age, and expense ratios, and the performance of South African–Equity–General classified collective investment schemes (CISs). Where significant relationships are observed, this study then establishes the direction of these relationships with the aim of identifying favourable fund attributes. To do such, a series of panel regression analyses are conducted. Particularly, pooled ordinary least squares (OLS), fixed effects, and random effects models are estimated when performance is measured as total return, the Treynor ratio, Sharpe ratio, information ratio, and Jensen's alpha. Following this, model specification tests are performed to identify the appropriate econometric model to apply to the panel data when each of the performance measures are treated as the dependent variable. This allows for the identification of the overall relationship prevalent between each fund attribute and the respective measures of performance. Table 38 summarises the general relationship observed for the fund attributes under investigation as well as the performance measures for which these associations are discovered.

**Table 38: Summary of main findings**

<b>Fund attribute</b>	<b>General relationship</b>	<b>Measure of performance</b>
Fund size	Statistically significant negative relationship	<ul style="list-style-type: none"><li>• Sharpe ratio</li><li>• Information ratio</li><li>• Jensen's alpha</li></ul>

Fund family size	Statistically significant positive relationship	<ul style="list-style-type: none"> <li>• Total return</li> <li>• Sharpe ratio</li> <li>• Information ratio</li> <li>• Jensen's alpha</li> </ul>
Fund age	Statistically significant negative relationship	<ul style="list-style-type: none"> <li>• Treynor ratio</li> <li>• Sharpe ratio</li> <li>• Jensen's alpha</li> </ul>
Fund expense ratios	Statistically insignificant relationship	<ul style="list-style-type: none"> <li>• Total return</li> <li>• Treynor ratio</li> <li>• Sharpe ratio</li> <li>• Information ratio</li> <li>• Jensen's alpha</li> </ul>

Source: Author's calculations

Table 38 highlights that fund size and fund age are attributes that influence performance in a significant negative manner. Fund family size, however, has a significant positive impact on performance. Evidently, the size relationship discovered at the organisational level contrasts that at the individual fund level. This implies that making an investment decision based only on size at the individual fund level would be imprudent. Moreover, a statistically insignificant relationship exists between fund expense ratios and performance. The results presented in Table 38 reveal that the most favourable South African–Equity–General CIS based on its fund attributes and the impact that such attributes have on its performance is a younger and smaller fund belonging to a larger fund family.

Notably, the associations identified in terms of the fund size, family size, and age attributes are consistent with that of the majority of prior international literature. Nonetheless, the insignificant impact that fund expense ratios have on performance identified in the present study contrasts the findings of other studies in which a statistically significant negative relationship was primarily reported. As such, the present study's findings suggest that, except for the fund expense ratio attribute, the fund size-, family size-, and age-performance relationships of South African CISs conform with that of funds operating in foreign markets as detected in other studies.

### **6.3 CONCLUSION**

CISs have become popular investment vehicles in financial markets around the world since these products offer investors with limited capital an opportunity to gain access to the capital markets to meet their investment objectives. Moreover, CISs provide the benefit of risk diversification whilst allowing investors access to professional portfolio management and oversight of their investment portfolios. The popularity of CISs in South Africa is evidenced by the exponential growth that the industry has seen over its 55 year history. Specifically, the South African CIS industry has grown from approximately R600 000 worth of assets under management (AUM) when the first CIS was launched in 1965 to approximately R2.96 trillion of AUM across 1 685 different local CISs as at Q3 2021.

Due to the increasingly important role that CISs play, many investors are faced with the task of having to screen and select the best funds to meet their respective needs. Therefore, the performance of CISs is of considerable importance to these investor. This is primarily due to the fact that financial market participants want to invest in funds with superior performance in order to maximise their expected returns. Hence, the factors that influence fund performance and the extent to which these factors affect fund performance has become of particular interest. One such aspect that has formed the basis of this study is the influence that fund attributes have on explaining better or worse future fund performance. Many scholars have focused on analysing fund attributes as determinants of fund performance especially in terms of funds operating in developed markets such the United States, Europe, and Australia. Contrarily, limited studies have been conducted in this regard within a South African context. To the author's knowledge, only restricted studies have investigated the impact that fund size has on the performance of South African CISs. Accordingly, this study seeks to be viewed as a first attempt to identify favourable fund attributes within the South African CIS environment by examining the fund attribute-performance relationships of South African CISs, particularly that of fund size, family size, age, and expense ratios, by employing panel data methodologies.

In meeting the first and second research objectives outlined in section 1.4 in Chapter 1, the findings indicate that fund size and age are significantly negatively related to the performance of South African–Equity–General CISs whereas family size impacts

performance in a significant positive manner. Fund expense ratios have an insignificant influence on the performance of South African CISs. Thus, for the sample of South African–Equity–General CISs, the favourable fund attributes include younger and smaller funds offered by larger fund families. The findings of the present study correspond well with the majority of existing international studies with the exception of the fund expense ratio attribute in which a significant negative relationship has generally been reported. Therefore, in meeting the third research objective detailed in section 1.4 in Chapter 1, it can be said that the association between the performance of South African CISs and fund size, family size, and age conform with that of international funds. However, the impact of fund expense ratios on performance for the sample of South African CISs does not conform with that of international funds.

The findings of the present study provide valuable insights to the existing body of knowledge on the fund attribute-performance relationships of South African CISs. In particular, this study identifies differences from and similarities to the fund attribute-performance relationships of other funds operating in more developed markets. Furthermore, the results may assist current and prospective investors of CISs in their investment decision-making process. Since statistically significant relationships are observed, the results suggest that investors should consider fund attributes when deciding between different CIS alternatives. Additionally, investors selecting CISs to form part of their investment portfolios can use the findings to identify funds with favourable characteristics in an attempt to enhance their returns. Moreover, CIS institutions and managers of funds that possess favourable attributes can use the results to their advantage in promoting their favourable fund characteristics.

#### **6.4 RECOMMENDATIONS FOR FUTURE RESEARCH**

The delimitations highlighted in section 1.6 in Chapter 1 leads to various recommendations for future research. The author's recommendations include increased fund scope, increased scope of factors that affect fund performance, and an explanation for the existence of the identified relationships. These recommendations are discussed in the following subsections.

#### **6.4.1 Increased fund scope**

This study only focused on investigating the fund attribute-performance relationships of South African–Equity–General classified funds as per the Association for Savings and Investment South Africa (ASISA) Fund Classification Standard. As such, not all of the South African CISs that operated during the period January 2000 to September 2021 are analysed. Hence, future research could be conducted on a sample of South African CISs classified as either Multi Asset, Real Estate, or Interest Bearing funds. These results could be compared to that of the present study to determine whether similar fund attribute-performance relationships exist across South African funds investing in different asset classes. CISs from the other sub-categories of Equity classified funds could also be examined. These include South African–Equity funds classified as Large Cap, Mid and Small Cap, Resources, Financial, Industrial, and Unclassified according to the ASISA third tier of classification detailed in section 2.4 in Chapter 2. This would enable a further comparison of the similarities and differences between the influence that fund attributes have on the performance of Equity classified CISs following different investment strategies.

#### **6.4.2 Increased scope of factors that affect fund performance**

This study examines the impact that fund size, family size, age, and expense ratios have on fund performance. International studies have also investigated other fund attributes such as fund holdings, turnover, flows, trading activity, past performance, and characteristics of the fund manager including tenure, education, number of funds under management, and management structure. Since the existing literature on fund attribute-performance relationships from a South African perspective is very limited, there is scope for future research to be conducted in this regard. In addition to fund attributes, other studies on the determinants of fund performance have also examined country characteristics as a way of explaining better or worse future fund performance. The country characteristics that have been investigated as potential determinants of fund performance include financial development, economic development, investor protection, and quality of legal institutions. Thus, future research could be undertaken to study the impact that country characteristics have on the performance of South African CISs.

### **6.4.3 An explanation for the existence of the identified relationships**

The reasons as to why the performance of South African–Equity–General CISs is significantly negatively related to fund size and age, significantly positively related to fund family size, and insignificantly related to fund expense ratios are not determined in the present study. Prior literature has alluded to possible reasons for such relationships existing as was briefly highlighted in the present study, however, these studies were conducted on funds operating in foreign markets. As such, these explanations might not be relevant to the unique South African CIS industry. Determining the reasons for the identified relationships in the present study would add significantly to the South African CIS repository of academic knowledge. Moreover, future research could investigate why the insignificant association observed between fund expense ratios and the performance of South African CISs contradicts the findings of the majority of international studies in which a significant negative relationship was detected.

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