The Investment Performance of Green versus Non-Green Stocks: A Cross-Sectional Analysis

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Abstract

The purpose of the research was to compare the investment performance of green and non-green stocks across four investment styles. Recent literature suggests a lack of consensus among researchers in respect of the performance of green investing, Environmental, Social and Governance (ESG) issues, or Socially Responsible Investing (SRI) relative to more traditional forms of investing. Previous research has focused predominantly on the performance of funds thereby taking into account the skills of fund managers in selecting stocks. Additionally, the existing literature's focus has been on SRI relative to traditional investing or green relative to SRI investing. This research therefore contributes to closing a gap in the literature by investigating the performance of green stocks versus non-green stocks in the market.

Monthly investment returns of green portfolios for four investment styles were compared to their non-green equivalent, over four different time periods. Time weighted returns and Sharpe ratios, to measure risk-adjusted returns, were also computed for further analysis.

The research indicated that there was no significant difference between the monthly returns of green portfolios versus non-green portfolios in the four investments styles over all periods investigated. Time weighted returns showed that green portfolios outperformed non-green portfolios in 14 of the 16 style/periods investigated. The Sharpe ratios showed risk-adjusted returns were consistent with the findings of the time-weighted returns. However, the non-green value/mid-cap portfolio was the only portfolio to have positive returns and Sharpe ratio for the 2008-2009 crisis period.

The importance of the research is to discover performance trends of green and non-green stocks within different investment styles, irrespective of fund manager skill, which may be informative and helpful for investors when choosing which stocks to invest in.

Keywords: Investment Performance, environmental, ESG, SRI, green stocks, risk-adjusted returns

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Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

AWCI	All World Country Index
CAPM	Capital Asset Pricing Model
ESG	Environment Social Governance
ETF	Exchange-Traded Fund
GGL	Green Growth Large-Cap
GGM	Green Growth Mid-Cap
GVL	Green Value Large-Cap
GVM	Green Value Mid-Cap
FTSE	Financial Times Stock Exchange
HML	High Minus Low
MPT	Modern Portfolio Theory
MSCI	Morgan Stanley Capital International
NGL	Non-green Growth Large-Cap
NGM	Non-green Growth Mid-Cap
NVL	Non-green Value Large-Cap
NVM	Non-green Value Mid-Cap
P/B	Price-to-book
S&P	Standard & Poor's
SMB	Small Minus Big
SPSS	Statistical Package for the Social Sciences
SQL	Structured Query Language
SR	Sharpe Ratio
SRI	Socially Responsible Investing

1 Introduction

According to the Social Investment Forum (2016), $8.72 trillion assets under professional management in the US utilise Environmental, Social and Governance (ESG) factors. Globally, the Socially Responsible Investing (SRI) market is estimated to be €21.4 trillion (Kłobukowska, 2017). Increasing awareness of environmental issues and climate change has led to policies, regulations and treaties such as the Kyoto Protocol (Chia, Goldberg, Owyong, Shepard & Stoyanov, 2009).

Przychodzen, Gómez-Bezares, Przychodzen & Larreina (2016) highlight the concerns of stakeholders about ESG issues and their demands that the markets address these issues. Kleiner (1991) pointed out over a quarter of century ago that environmental concerns and corporate interests were not mutually exclusive. More recently, Boulatoff & Boyer (2009) posit that environmentalism has increasingly become a part of society and as a strategy, can help organisations gain a competitive advantage. Incidents such as the Mexican Gulf oil spill in 2010 have brought to the attention of stakeholders the impact ESG factors can have on share prices when BP PLC lost 55% of its share value following the disaster (Hua, 2011). As the most recent SRI niche, green investing is growing at a fast rate (Chang, Nelson, & Witte, 2012), but as a subset of SRI, and therefore considered to be further restricted in stock selection, a key issue is whether or not there is a cost or benefit to holding stocks of green-friendly companies (Puopolo, Teti & Milani, 2015). It is clear therefore, that research on the outcome of green investment strategies would be of interest to investors to determine whether favouring green stocks in their investment portfolios comes at a financial cost.

While most studies have focused on either green investment funds versus non-green investment funds, SRI investing versus more traditional investing or the performance of green investing compared to SRI investing, this study attempts to contribute to closing the gap in the literature by comparing the performance of green stocks versus non-green stocks.

The paper is organised into the following chapters:

- **Chapter 1** introduces the topic, a brief background and rationale for research
- **Chapter 2** provides a literature review of relevant research, theory and concepts. Identification of research gap and relevance of literature to this research
- **Chapter 3** covers the development of research aim, objectives and hypotheses
- **Chapter 4** outlines the methodology used to collect and analyse data
- **Chapter 5** sets out the research findings
- **Chapter 6** provides a discussion on the research findings
- **Chapter 7** concludes by covering implications, limitations and suggestions for further research

2 Literature Review

2.1 Introduction

A literature review on SRI, ESG and green mutual funds and stocks will be undertaken in an attempt to draw out a definition of green investing. The different methods researchers have employed to measure and evaluate investment performance will then be identified. Next, a review of the different models employed to measure risk-adjusted returns will be conducted in an attempt to provide justification for splitting portfolios by size and style. Following on from that, the main findings in the literature of green fund performance versus more traditional funds will be reviewed. Finally, the main focus of existing literature will be discussed in an effort to identify any gaps of interest that can steer the focus of this study.

2.2 ESG, SRI and Green Investing

The terms ESG, SRI and green investing are often used interchangeably to distinguish from traditional finance but their differences are important (Hay, 2015). Lesser, Lobe & Walkshäusl (2014) highlight that the academic literature often mixes up terminology when discussing green investing and SRI. This section therefore will look at the existing literature to identify the similarities and differences between the three terms in an attempt to draw out a definition of green investing.

2.2.1 SRI

SRI is an ethical investing approach where moral criteria are applied which can sometimes allow the asset manager to sacrifice financial returns for ethics (Hay, 2015). SRI has moved from the fringes towards mainstream investment management

(Marlowe, 2014), with the global SRI market estimated to be €21.4 trillion (Kłobukowska, 2017). Napach (2016) describes SRI as a form of investment where the social or environmental concerns are to the forefront. Napach (2016) views both ESG and SRI as sitting somewhere along a continuum from traditional investing, where the sole aim is returns without care for the social dimension toward philanthropic and impact investing, where financial profit is not the primary goal.

SRI funds began by the exclusion of so-called "sin-stocks" issued by firms producing socially undesirable products such as weapons, tobacco and gambling (Berry & Junkus, 2013; Nofsinger & Varma, 2014). SRI is based largely on exclusion of companies, after analysing for certain criteria typically the bottom third would be considered off limits (Prudhomme, 2015). In an attempt to define stocks as SRI or non-SRI, Filbeck, Holzhauer & Zhao (2014) used socially responsible ratings from KLD Research and analytics, now MSCI ESG Research (Semonova & Hassel, 2015) with cut-off points of top 30% and bottom 30% to classify stocks into suitable SRI or non-SRI portfolios.

As no clear classification of whether a stock is green or non-green exists, this research will take a similar approach to the Filbeck et al. (2014) method of using a top 30%, bottom 30% of stock environmental scores from MSCI ESG ratings, to define stocks as green or non-green.

2.2.2 ESG

ESG investing takes environmental (E), social (S) and governance (G) issues into account when choosing stocks but not necessarily with any moral intent (Hay, 2015), i.e. so-called "bad" stocks may still be chosen and justified in financial terms. It attempts to measure the intangible non-financial performance metrics that contribute to market valuation (Boerner, 2007). ESG is not considered to be equivalent to ethical investing or

restricted to environmental issues. Napach (2016) describes ESG as prioritising profit first, with environmental, social and governance issues being a secondary concern.

The last decade has seen ESG become increasingly significant to policy makers and investors (Garcia, Medes-Da-Silva & Orsato, 2017). Companies that disclose their ESG practices were considered to have enhanced their reputation and improved investor confidence (Tarmuji, Maelah & Tarmuji, 2016). Responsible investing and good returns are not mutually exclusive, and how much weight a company puts on ESG issues highlights to investors not only the company's values but may also be an indication of how well a company is managed (Carlsson-Sweeny, 2014). Research by Tarmuji et al. (2016) show evidence that ESG practices have a positive impact on economic performance.

2.2.3 Green Investing

Green investing is the latest niche to come from SRI with fewer studies in comparison to other areas, and as a result there is no formal definition (Chang at al., 2012). Mallett & Michelson (2010) use the terms green and sustainable investing interchangeably and describe green investing as a form of investing that appeals to investors interested in climate change, the environment and a sustainable economy. Sabbaghi (2011) adds social and governance traits to the mix in defining green stocks whereas Climent & Soriano (2011) have a narrower definition, describing green funds as ones that seek environmentally responsible investments. Boulatoff & Boyer (2009) in a study of 310 green companies defined green investing as investing in stocks whose companies have a positive environmental impact. Their study focused on eleven environmental industries: Biofuels, Efficiency, Energy Storage, Fuel Cell, Geothermal, Recycling/Green Chemicals, Renewable Energy, Solar, Transportation, Water and Wind Power.

Chang et al. (2012) regard green investing as a smaller subset of both SRI and ESG which therefore impacts the diversification that can be achieved and so may expose investors

to more risk. However, Mallet & Michelson (2010) argue that from a stock diversification point of view, the overlap between green and SRI is unclear, in that if green investing is to be considered a subset of SRI then it would be less diverse. However, if green investing is considered to include environmentally conscious companies only and does not have to take the other social or ethical considerations of ESG into account, then a green fund actually has access to a larger universe of stocks.

2.2.4 MSCI ESG Ratings

In relation to this research, a challenge of how to classify stocks as green has emerged. In highlighting this challenge one particular study (Mallet & Michelson, 2010) determined that if a fund manager calls the fund green then it is green.

Stock market index provider MSCI conducts research on the companies which are listed on the MSCI All Country World Index (MSCI ACWI) with a view to ranking them versus their global industry peer groups on ESG issues. MSCI ESG Ratings is an industry adjusted score from 0 to 10, where 0 is the worst and 10 is the best rating. Individual rating for each of the three E, S and G pillars, without the industry adjustment, are also provided (MSCI, 2014; MSCI, 2017a). The environmental pillar rating is based on several environmental themes, including Climate Change, Natural Resources, Pollution & Waste and Environmental Opportunities (MSCI, 2017a).

MSCI ESG ratings have been used extensively in academic research to hypothesise on the performance of companies based on their environmental ratings (Semenova & Hassel, 2014). Kim & Statman (2012) use KLD ratings, now MSCI ESG Research (Semonova & Hassel, 2015) to measure the effect of ratings on a company's financial performance. Similarly, Albuquerque, Durnev & Koskinan (2013) use MSCI ESG ratings to study the effect of social and environmental risk factors on a company's financial performance and risk management.

In the challenge of categorizing and evaluating green investments, using the MSCI ESG environmental pillar ratings would represent a more objective approach than comparing green and non-green funds. To categorise stocks in their relevant green /non-green bucket therefore, this research will use the environmental pillar score of MSCI ESG Ratings. To decide on a cut-off, point for green and non-green, this research will adopt the same top 30% / bottom 30% method that Filbeck et al. (2014) used to categorise SRI and non-SRI investments. A green stock will be classified as all those stocks that are within the top 30% MSCI ESG environmental pillar ratings. A non-green stock will be classified as all those stocks that are within the bottom 30% MSCI ESG environmental pillar ratings.

2.3 Performance Evaluation Methods

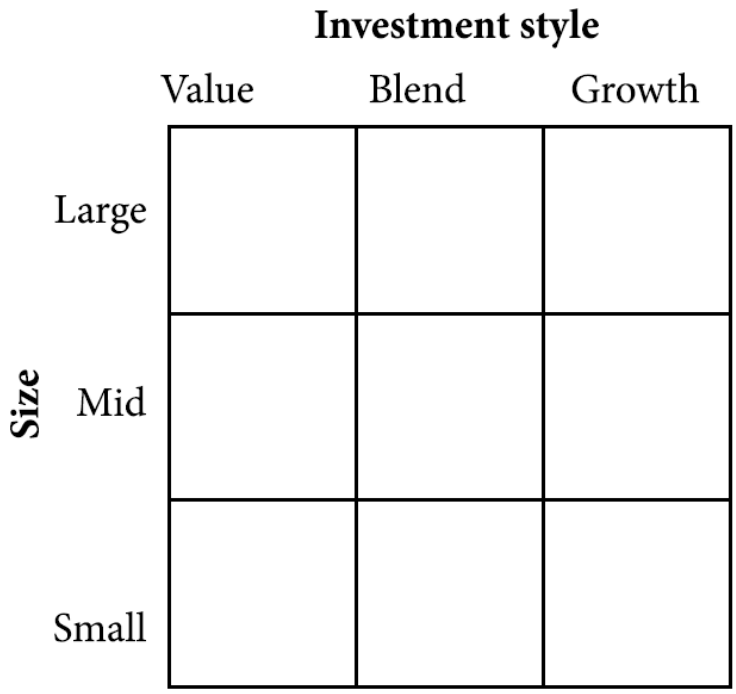
The following section will discuss the methods of data collection and performance measurement as evidenced in the academic literature. Where possible this research will focus mainly on socially responsible investing in general and green investing in particular. However, the methods employed in any research that evaluate and compare the performance of portfolios or funds is of relevance. The following section will discuss the two main directions researchers have focused on when evaluating green versus non-green investments, funds or stocks. Following on from that, the various models used to evaluate performance as evidenced in the literature, will be discussed. The remaining sections will discuss risk-adjusted returns, value/growth and cap-size investment styles in an attempt to justify this research's approach to performance evaluation and the categorisation of stocks within portfolios.

2.3.1 Funds or Stocks

A mutual fund is a form of collective investments managed by a Fund Manager who trades the underlying securities on behalf of individual shareholders (Gandhi & Perumal, 2016). Equity funds, whereby managers maintain a diversified portfolio of equities

(stocks) for investors, are the largest category of mutual funds (Vyšniauskas & Rutkauskas, 2014) and typically come in various types reflecting the different types of stocks that the fund holds (see Figure 2.1). Categories of investment styles for stocks can be formed by a combination of the stock's market capitalisation (small, mid and large) and the stock's price-to-book ratio (value, growth or blend) (Liu & Wang, 2010a). When evaluating the performance of funds, it is common to classify the fund based on its investment practices and risk characteristics so that it can be measured against an appropriate benchmark that represents the style of the fund, typically an index (Dor et al., 2008).

Figure 2.1: A Fund Style Box



Source: Vyšniauskas & Rutkauskas (2014)

The reviewed literature indicates that researchers focused mainly on the performance of funds versus the market as a whole or benchmarked against an index similar to the fund in question (Chang & Witte, 2010; Mallet & Michelson, 2010; Climent & Soriano,

2011; Sabbaghi, 2011; Chang et al., 2012; Muñoz, Vargas & Marco, 2012). Fund characteristics and returns are collected from databases such as Morningstar Principia (Chang & Witte, 2010; Mallet & Michelson, 2010; Chang et al., 2012; Muñoz et al., 2012) to analyse green or SRI funds categorised to an investment style such as large-cap blend, mid-cap value, small-cap growth etc., and compare with an average of Funds within the relevant categories (Chang et al., 2012) or against an index such as the S&P 500 Index (Mallet & Michelson, 2010). The usual periods of performance tested are one-year, three-year, five-year and ten-year with Chang et al. (2012) also testing 15-year returns. However, Mallet & Michelson (2010) note that as green funds are relatively new there is a small sample size of funds available with returns stretching back ten years.

In contrast, other researchers created sample portfolios of SRI or environmental stocks rather than use managed funds (Boulatoff & Boyer, 2009; Chia et al., 2009; Brzeszczyński & McIntosh, 2014; Lesser et al., 2014; Puopolo et al., 2015). However, the majority of research has focused on mutual funds rather than stocks (Lesser et al., 2014) thereby taking into account the fund manager's skill at picking stocks rather than evaluating the performance of green stocks in the market.

The outcome of this literature review is that a focus on stocks rather than funds would be a more suitable approach to examine the performance of green versus non-green investments, as this approach would take fund manager skill out of the equation. In this way, the performance of green stocks in the market can be evaluated against non-green stocks in the market without the impact of fund manager skill in the evaluation. The various approaches also illustrate the importance for this research to compare like with like when evaluating performance so that portfolios composed of green stocks of a particular investment style are evaluated against portfolios composed of non-green stocks of the same investment style.

2.3.2 Measuring Returns

Various standard market sources can be used to collect performance returns. Lesser et al. (2014) used Thomson Reuters DataStream to collect monthly returns, whereas Sabbaghi (2011) collected price data from Yahoo!Finance to calculate daily returns for a five-year period for 15 green ETF funds identified through SustainableBusiness.com.

Risk-adjusted returns to measure the excess return (alpha) is the appropriate standard when comparing alternative investments (Climent & Soriano, 2011). Statistics from portfolio theory are used to calculate an investment's expected return based on its beta or risk measure, allowing researchers to compare risk adjusted returns with a benchmark (Chang et al., 2012) or using simple regression analysis to compare performance of stocks with company characteristics (Boulatoff & Boyer, 2009). Various models can be used to measure the expected return, the main ones in use are CAPM 1-factor (Chang & Witte, 2010; Chang et al., 2012), Fama-French 3-factor model, Carhart 4-factor model (Puopolo et al., 2015) and Barra Global Equity Model2 (Chia et al., 2009).

As can been seen from the literature therefore, a wide variety of methods and models are used to rank and evaluate performance of green or SRI investments. The following sections therefore will discuss the various methods and models used in an attempt to ascertain a suitable approach to evaluating the performance of green and non-green portfolios.

2.3.3 Risk Adjusted Returns

Markowitz's (1952) Modern Portfolio Theory (MPT) assumes that markets are efficient and investors are risk averse, so when given two portfolios where expected returns are equal, they will favour the less risky portfolio (Lee, Cheng & Chong, 2016; Gasser, Rammerstorfer & Weinmayer, 2017). Based on MPT, the Capital Asset Pricing Model (CAPM) was developed by Sharpe, Litner and Mossin to explain the cross-section of stock returns, why one stock earns higher or lower returns to another (Fama & French,

2004). The assumption of CAPM is that there exists a relationship between market risk and expected returns (Lai & Stohs, 2015; Zaremba, 2016). The Sharpe ratio (Figure 2.2) is a practical method for classifying and measuring mutual fund performance, which measures the excess return of a fund or portfolio above the risk-free interest rate (Schröder, 2007; Statman & Glushkov, 2016).

Capelle-Blanchard & Monjon (2014) indicate that most academic research investigating SRI fund performance use the Sharpe ratio or a multifactor model such as the Fama-French three-factor model, to evaluate risk-adjusted returns. A high and positive Sharpe ratio indicates superior risk-adjusted returns whereas a low and negative ratio shows poor risk-adjusted returns (Gandhi & Perulam, 2016). The Fama-French three factor model is based on the claim that CAPM fails to take into account market cap size and price-to-book ratio, and is therefore considered a better tool for assessing portfolio performance (Panopoulou & Plastira, 2014). There are many more models that extend the Fama-French three-factor, but a three-factor model that includes cap-size and P/B ratio does as well as more elaborate methods (Chan, Hsiu-Lang & Lakonishok, 2002).

Figure 2.2: Sharpe Ratio

$$\mathrm{SR}_i = \frac{\mu_i - r_f}{\sigma_i}$$

SR_i = Sharpe ratio of investment portfolio, μ_i = annualised return of investment portfolio, r_f = risk-free interest rate, σ_i = standard deviation of returns of investment portfolio
Source: Schröder (2007)

This research will therefore use the Sharpe ratio when comparing the returns of green portfolios with non-green portfolios so as to evaluate the portfolios' risk-adjusted returns. As the Sharpe ratio is a measurement of the portfolio's excess return per unit of risk as defined by the portfolio's standard deviation, its use will enable a better

comparison of portfolio performance on a risk-adjusted basis. Further, to take into account the elements of Fama-French three factor model, portfolios will be split by size and style. These elements will be discussed in the following two sections.

2.3.4 Value or Growth (Price-to-book ratio)

Value and growth are two opposing investment styles where investors consider value stocks to be under-valued by the market, whereas growth stocks, not usually under-valued, are considered to have strong growth potential (Hodnett & Hsieh, 2012). Price-to-book (P/B) ratio is the market value of a firm's equity divided by the book value of its equity (Nezlobin, Rajan & Reichelstein, 2016). The P/B ratio can be used to classify stocks as either value or growth, where stocks with a low P/B ratio been defined as value stocks, conversely stocks with high P/B ratios been defined as growth stocks (Bauer, Denva & Otten, 2006; Kempf & Osthoff, 2007; Kim & Mulvey, 2009).

The Fama-French three-factor model (see Figure 2.3) attempts to account for the return variance between value and growth stocks and large and small stocks (Bauer et al., 2006). Its premise being that CAPM fails to take into account cross-sectional variation of stock returns, and therefore the three-factor model expands CAPM by including the return difference between a portfolio of small-cap stocks and a portfolio of large-cap stocks (SMB) and the return difference between a portfolio of high P/B and a portfolio of low P/B (HML) to the market risk premium (MRP) (Pratt, 2011; Dolinar, 2013; Panopoulou & Plastira, 2014; Vo, 2015).

Figure 2.3: Fama-French three factor model

$$R_{p,t} - R_{f,t} = \alpha_p + \beta(R_{m,t} - R_{f,t}) + s \times SMB_t + h \times HML_t \quad (1)$$

where:

- $R_{p,t} - R_{f,t}$ represents an excess return for a portfolio;
- $(R_{m,t} - R_{f,t})$ is the MRP; and
- β, s, h are the estimated coefficients for the MRP; the mimicking size portfolio and the mimicking book-to-market portfolios.

Source: Vo (2015)

The available literature indicates that researchers employing the Fama-French three-factor model have found evidence that there are performance differences between growth and value portfolios. Borys & Zemčik (2011) constructed portfolios based on P/B and cap-size to demonstrate that markets in Eastern European countries are similar to US and other developed world markets in relation to size and value explaining expected returns. Research by Capual, Rowley & Sharpe (1993) demonstrated that portfolios composed of low P/B ratios (value stocks) outperformed portfolios composed of high P/B ratios (growth stocks) over a ten-year period. Later, studies by Bauman, Conover & Miller (1998), covering 28,000 annual stock returns found that value stocks outperformed growth stocks in both total and risk-adjusted returns over a ten-year period. More recently, Liu & Wang's (2010b) research, shows that in the short term, value stocks have greater risk and returns in comparison to growth stocks, but lower risk and greater returns in the long term. In contrast, Chan et al. (2002) found that growth fund managers outperform their value counterparts by 1.2% per year on average.

This research will therefore split stocks into separate portfolios by using the P/B ratio to identify value and growth stocks. This will enable green value portfolios to be evaluated against non-green value portfolios, and green growth portfolios to be evaluated against non-green growth portfolios. Therefore, the HML element of the Fama-French three-factor model will be catered for in the portfolio split and will not need to be included in the return calculations.

2.3.5 Market Cap Size

Market capitalization is calculated by multiplying the price of a single share of a company's stock by the number of outstanding shares. Small-cap stocks typically carry greater risk than mid or large-cap, and although they are often able to increase earnings more rapidly than larger companies they also tend to fall harder in a bear market (Eisinberg, 2000). A large-cap firm is one with a market cap of greater than $10 billion, mid-cap between $2 and $10 billion and small cap below $2 billion (Zacks, 2014).

Investing at specific times in either value or growth stocks or large cap or small cap is a type of "style investing" that can be an important strategy for an investor to maximise returns (Moerloose & Giot, 2011). Kim & Mulvey (2009) note that many researchers have found a size effect where market capitalization can account for cross-sectional expected returns, with small stocks performing better and large stocks performing worse than the CAPM predicted returns. Liu & Wang's (2010a) research show that large-cap growth style is the least risky over the short term but small-cap value style is the least risky for longer term investments, with small-growth being the riskiest style. The most advanced type of research on comparisons of SRI and non-SRI funds, employ a like-for-like matching approach, where funds with similar characteristics such as size and style are compared (Schröder, 2007).

This research will therefore further split stocks into separate portfolios by market cap-size. This will enable green portfolios to be evaluated against non-green portfolios based on their corresponding cap size. Therefore, the SMB element of the Fama-French three-factor model will be catered for in the portfolio split and will not need to be included in the return calculations.

2.4 How have SRI and green stocks measured up?

This section will discuss the findings of the reviewed literature with regards to how investment performance of SRI and green investments have compared with more traditional investments.

2.4.1 Lack of Consensus

Most research in the evaluation of performance between SRI and non-SRI investing has shown no significant difference between the two. Studies (Mallet & Michelson, 2010; Climent & Soriano, 2011) have shown that divergence of risk adjusted returns between

green, SRI and conventional funds is not significant. In a recent paper reviewing research on SRI, Junkus & Berry (2014), found most studies reported no significant difference between SRI performance and traditional investing. This is further backed up by Przychodzen et al. (2016) who argue that the existing literature offers no consensus on a correlation of investment performance with a policy of incorporating ESG into an investment strategy.

Other studies have shown differences between green and non-green stocks versus a market index, however results are not necessarily in agreement. For example, research concentrating on renewable energy (Chia et al, 2009) display statistically significant superior performance of international green stocks versus the MSCI All Country World Index, in contrast Boulatoff & Boyer (2009) reveal that the Nasdaq outperforms international environmental stocks.

Differences in performance have been explained in some instances by the impact of market cycles. Muñoz et al. (2014) found that green and SRI funds relative performance has been statistically insignificant to the market in times of crisis, but underperform in normal periods. Lesser et al. (2014), extending Climent & Soriano (2011) studies on US Environmental Funds to international markets, found that green outperformed SRI between 2003 and 2007 and underperformed between 2008 and 2012, owing mainly to particular portfolio weighting, leading the researchers to conclude that green investing can be considered a sector bet on renewable energies.

Other research shows differences in portfolio performance depending on investment styles. Chang & Witte (2010) show that US SRI funds have inferior returns to the average return of funds within the same categories with the exception of mid-cap value funds and small-cap blend funds. Chang et al. (2012) show that US green mutual funds in the main underperform, displaying lower risk-adjusted returns than category averages over 5-Year and 10-Year periods, with results over 3-year and 15-year being statistically insignificant. However, areas where green funds outperformed the category averages

were in large blend and mid-cap blend over five and ten years and large growth over a ten-year period. These longer time frames and investment styles therefore, are areas that this study would look at to determine if green stocks can show superior performance.

In an attempt to overcome the lack of consensus in previous literature, Reveilli & Viviani (2015) undertook a meta-analysis study of 85 previous studies and 190 experiments and found that there was no real cost or benefit to investing in SRI and that any performance differences by previous researchers were mainly due to methodological choice or the management skills of specific fund managers to outperform the market. Further, Muñoz et al. (2014) posit that an explanation for the differences between their findings and those of Climent & Soriano (2011) may be explained by the different periods under consideration and the different sample of funds.

Ideally therefore, research of this nature would include a period covering as many crisis/non-crisis periods as possible. By examining peak and troughs of the S&P 500 Index, Nofsinger & Vargo (2014) identify two stock market crisis periods: the 2001 dot-com collapse and the 2008 financial crisis. Petajisto (2013), show how different categories of mutual funds performed over the two year-period 2008-2009, indicating that subsequent to a financial crash, different investment styles can affect investment performance over the market. Accordingly, for this research, a deeper analysis would be possible if environmental ratings of stocks could be analysed over as great a time frame as possible, ideally prior to the 2001 dot-com bubble.

2.5 Conclusion & Gap in Literature

As can be seen from the existing body of literature, the many measurements and time periods under investigation fail to clearly identify trends. Although some research concentrates on the performance of green stocks, the main focus of the reviewed literature has been the performance of green funds in comparison to either SRI or to the

market as a whole. The literature has also identified a challenge in categorizing funds as green or non-green. Additionally, given that green funds are relatively new, sampling enough green funds over a long enough period to detect trends is also a challenge. A further challenge, identified in the literature, with using funds to analyse trends in green investing is the factor of fund manager skill.

This study therefore, should evaluate stocks over as great a timeframe as possible facilitating the evaluation of investment performance over several crisis/non-crisis periods. Also, to remove the element of skill of fund managers in picking stocks, portfolios of stocks selected from a market index should be used to evaluate the behaviour of green stocks rather than evaluating funds. This will have the benefit of being able to evaluate the performance of green stocks in the market, as opposed to evaluating the performance of fund managers. Additionally, using environmental pillar scores from MSCI ESG research to identify what is green and non-green would be a more objective approach to the research than attempting to pick a sample of green stocks or funds. Portfolios should be further split to cater for cap-size and value/growth characteristics to cater for the SMB and HML elements of the Fama-French three-factor model. This will enable a cross-sectional comparison of a portfolio composed of green stocks versus one composed of non-green stocks.

The literature review has helped steer the focus of this study and enabled a clear research aim to be established. The research aim and objectives will be discussed in the next section.

3 Research Question

3.1 Research Aims & Objectives

The purpose of the dissertation is to construct and analyse portfolios comprised of green and non-green stocks, based on the MSCI ESG Environmental pillar scores and categorised within appropriate investment styles, with the objective of comparing their performances over 3-Year, 5-Year and 10-Year periods, and over the 2-Year crisis-period 2008-2009.

The importance of the research is to discover trends in green investment performance which may be informative and helpful for investors when determining their stock selection strategies.

3.2 Hypotheses

Having reviewed the published literature in this field, the following hypotheses have been developed:

Hypothesis 1
H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the last 3 years?

Hypothesis 2
H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the last 5 years?

Hypothesis 3

H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the last 10 years?

Hypothesis 4

H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

Hypothesis 5

H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the last 3 years?

Hypothesis 6

H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the last 5 years?

Hypothesis 7

H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the last 10 years?

Hypothesis 8

H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

Hypothesis 9

H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the last 3 years?

Hypothesis 10

H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the last 5 years?

Hypothesis 11

H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the last 10 years?

Hypothesis 12

H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

Hypothesis 13

H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the last 3 years?

Hypothesis 14

H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the last 5 years?

Hypothesis 15

H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the last 10 years?

Hypothesis 16

H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

The following chapter will discuss the methodology used to test the hypotheses.

4 Methodology

The research seeks to understand if portfolios of green stocks, in different investment style categories, can outperform portfolios of non-green stocks when evaluated within the same investment style categories. This research used a method to rebalance portfolios similar to one used in a study on the effect of socially responsible investing on portfolio performance (Kempf & Osthoff, 2007). Kempf & Osthoff (2007) constructed two portfolios, by taking an SRI rating at the end of each year to determine if a stock was to be classified in the SRI or non-SRI portfolio for the following year, rebalancing every year, and then generating a time series of monthly returns for a 12-year period for the two portfolios.

For this research, therefore, portfolios of stocks from the MSCI All World Index were constructed using the MSCI ESG Research environmental pillar ratings, stock style (growth or value) and cap-size (large and small). Portfolios were rebalanced for each of the ten-year sub-periods. A time-series of monthly returns was generated for each of the ten-year sub-periods for the portfolios constructed. Periodic (3-year, 5-year, 10-year and 2008-2009 crisis period) returns of each green portfolio were compared with their non-green equivalent.

This chapter will outline the methodological choices encountered, any assumptions made, data collection, data analysis and statistical analysis undertaken. SQL procedures and tables were used in the data analysis and are available on request from the author.

4.1 Methodological Choice

Quantitative research implies quantification in data collection and analysis, requiring a process of deduction adopting practices of the natural scientific model, positivism and objectivism. Qualitative research on the other hand is often associated with interpretive

philosophy, where data collection is often non-standard and employing non-probability sampling techniques (Bryman & Bell, 2011).

Research Philosophy relates to the development and nature of knowledge with epistemology, ontology and axiology being three major philosophical research assumptions (Bryman & Bell, 2011; Quinlan, 2015; Saunders et al., 2015). This paper's research is concerned with data collection and objective analysis, focusing on facts rather than impressions and therefore will take a positivist epistemological position rather than realism or interpretivism one. The research seeks to identify and compare the investment performance of green and non-green portfolios and the results are not dependent on the researcher's view of reality. This study's ontological position therefore, is one of objectivism rather than subjectivism. This research evaluates investment performance from existing secondary data and is carried out independently of the values of the researcher who should be detached, neutral and independent. From an axiology view point therefore, the research is carried out in a value-free manner.

This research collects and objectively analyses numeric data to evaluate green investing, thereby taking a positivist epistemological position, implying quantitative research (Saunders et al. 2015). The evaluation of performance returns of stocks based on their investment style, size and historic MSCI environmental ratings is objective in nature and concerned with numbers rather than words. The methodological choice most suitable therefore, is a quantitative one and is in keeping with studies of this nature (Boulatoff & Boyer, 2009; Sabbaghi, 2011; Chang & Witte, 2012; Lesser et al., 2014;).

4.2 Data Collection

4.2.1 Stocks or Funds

This research compared the performance of green stocks versus non-green stocks in the market as opposed to the performance of green funds versus non-green funds. The majority of research undertaken in this field thus far has focused on mutual funds rather than stocks, thereby taking into account fund manager skills at picking stocks, rather than evaluating the performance of green stocks in the market (Lesser et al., 2014). Other research however, has created sample portfolios of SRI or environmental stocks rather than use managed funds (Schröder, 2007; Boulatoff & Boyer, 2009; Chia et al., 2009; Brzeszczyński & McIntosh, 2014; Lesser et al., 2014; Puopolo et al., 2015). Schröder (2007) argues that concentrating on the constituents of indices rather than funds removes obscurities such as transaction costs, management skills and timing activities of the fund manager which are not relevant to the question at hand.

This research therefore adopted the method of building sample portfolios of green and non-green stocks rather than use managed funds. With this approach, the performance of stocks over the relevant periods were evaluated for the full period, as stocks were not removed from a portfolio based on a fund manager's stock selection skill, nor were there any transaction costs or management fees associated with the portfolio performance.

4.2.2 MSCI Index

The use of the constituents of indices to identify and classify market stocks is the norm in research papers of this nature. Brzeszczyński & McIntosh (2014) use the FTSE100 index and FTSE4GOOD index as benchmarks to compare with the performance of portfolios composed of British SRI stocks. In other research, Zaremba (2016), examining the relationship between risk and return of stocks based on international stock markets, argues that the selection of MSCI indices is justified as it aligns the research with

investment practice. Zaremba (2016) reasons that MSCI indices are maintained with the purpose of being fully investable from an international perspective and contain approximately 85% of all stock market capitalizations globally. Additionally, MSCI is considered one of the top three financial service agencies that provide ESG scores (Tarmuji et al., 2016). Use of the MSCI ACWI in this study is valid as it is in keeping with previous research of this nature. The MSCI ACWI is an index of the global stock market and currently contains over 2,400 large and mid-cap stocks with a geographic reach across both developed and emerging investment markets.

The constituents of MSCI ACWI along with monthly P/B ratio, market capitalisation and environmental ratings were downloaded to three separate Excel files from FactSet Research Systems, a licensed provider of MSCI historic data (MSCI, 2017a). The Excel files were uploaded to three SQL tables for further manipulation, which will be discussed in the following section on Data Analysis.

4.3 Data Analysis

4.3.1 Portfolio Rebalancing

The data collection facilitated the construction of green and non-green portfolios of four investment styles: large-cap growth, large-cap value, mid-cap growth and mid-cap value. There were therefore eight portfolios (Figure 4.1) constructed based on investment style, cap-size and environmental ratings.

Table 4.1: Green and Non-Green Portfolios

Portfolio	Portfolio Description
GGL	Green Growth Large-Cap
GGM	Green Growth Mid-Cap
GVL	Green Value Large-Cap
GVM	Green Value Mid-Cap
NGL	Non-Green Growth Large-Cap
NGM	Non-Green Growth Mid-Cap
NVL	Non-Green Value Large-Cap
NVM	Non-Green Value Mid-Cap

Portfolio rebalancing refers to the need to maintain and re-adjust the constituents of a portfolio's stock allocation to keep it in line with its original strategic allocation (Kohler & Wittig, 2014). The constituents of the MSCI ACWI index and the classifications of stocks are not static. A stock's environmental rating changes and may change enough for it to be reclassified from green to non-green or vice-versa. A stock's investment style may change from value to growth or vice versa. The market capitalisation of a stock changes as its share price or share issuance changes, and may change enough for it to be reclassified from large-cap to mid-cap or vice versa. Therefore, each portfolio was required to be reconstructed periodically to allow for any changes to the MSCI ACWI index constituents, classification and environmental rating.

Each of the eight portfolios were rebalanced yearly rather than monthly for the ten annual sub-periods from 2007 to 2016. Portfolios were rebalanced based on the previous year-end value for each of the three categories of cap-size, P/B ratio and environmental ratings stored in the three SQL tables. This therefore, meant that there were 80 portfolio/year combinations for which investment performance returns were required, as opposed to 960 portfolio/month combinations that would have been required if portfolios were rebalanced on a monthly basis. This not only ensured that

the data analysis was more manageable, but was also in keeping with the methods applied in research of this type (Brzeszczyński & McIntosh, 2014).

The starting position for environmental ratings for any given year was based on the last environmental rating for each stock from the previous year. The starting position for cap-size for any given year was based on the last cap-size for each stock from the previous year. The starting position for P/B for any given year was based on the last P/B for each stock from the previous year.

To rebalance the portfolios, a cut-off point was calculated for environmental ratings and value/growth style for each year. The cap-size cut off point to determine mid-cap or large-cap remains the same at $10 billion, for each year. There are no small-cap stocks in the MSCI ACWI. Stocks with a cap-size below $10 billion are mid-cap, and above $10 billion are large-cap (Zacks, 2014). This research therefore classified any stock with cap-size of $10 billion or larger as large-cap and any stock with a cap-size of less than $10 billion as mid-cap. This classification was used in determining which portfolio a stock will be assigned to for each year's rebalancing.

To calculate a value/growth style cut-off, a dividing line based on P/B ratio can be calculated to determine whether a stock is a value stock or a growth stock (Capual, Rowley & Sharpe, 1993). Anything above the dividing line is considered a growth stock, anything below the line is considered a value stock. Fisher (1992) defines stocks above the median P/B at any given point in time as a growth stock and anything below the median as a value stock. For this research, the median P/B ratio for each of the 10 yearly sub-periods was calculated at the end of each year and used as the cut-off point for classifying stocks as either growth or value for the following year. This classification was used in determining which portfolio a stock was assigned to for each year's rebalancing.

To calculate an environmental rating cut off point, a similar approach to the Filbeck et al. (2014) method is used, the top 30% and bottom 30% of stock environmental scores

from the MSCI ESG ratings determines if a stock is classified as green or non-green. For this research, top 30% and bottom 30% cut-off points for each of the 10 yearly sub-periods were calculated at the end of each year and used as the cut-off point for classifying stocks for the following year, with any stock in the top 30% classified as green and any stock in the bottom 30% classified as non-green. This classification was used to determine which portfolio a stock was assigned to for each year's rebalancing. Figure 4.2 below displays a table listing of the number of stocks in each rebalanced portfolio for each year.

Table 4.2: Number of stocks per portfolio per year

Portfolio	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GGL	150	176	147	147	147	133	187	263	268	280
GGM	82	80	123	97	79	97	158	167	167	193
GVL	161	143	65	108	144	117	133	142	158	137
GVM	158	150	209	155	136	168	207	175	173	174
NGL	133	139	65	113	129	121	149	136	147	103
NGM	175	161	215	158	124	130	193	206	181	209
NVL	96	86	35	62	83	65	101	108	111	93
NVM	149	162	229	175	168	193	255	325	346	387

4.3.2 Generate Returns

Each Portfolio was uploaded to Thomson Reuters Eikon to generate monthly returns for 2007. The portfolios were then reconstructed and reloaded to get monthly returns for the following year and so on until returns for all portfolios up to 2016 were retrieved, giving a total of 120 monthly returns for each of the eight portfolios. Thomson Reuters Eikon is an industry standard tool used to monitor and analyse financial information. The reliability of Thomson Reuters Eikon has not been questioned in the academic or

corporate community (Garcia, Mendes-Da-Silva & Orsato, 2017), and so was an appropriate choice of tool for research of this nature.

The monthly returns were statistically analysed to see how each green portfolio based on style, size and environmental ratings compared with its non-green counterpart. Independent-sample t-tests are used to compare the mean score on a continuous variable for two groups (Pallant, 2016) and are based on the assumptions of level of measurement, random sampling, independence of observations, normal distribution and homogeneity of variance. Independent-sample t-tests therefore, were appropriate for this research as each green portfolio was evaluated against one other portfolio i.e. its non-green equivalent. Levene's test for equality of variance was used to determine which result-set to use from the Independent-sample t-test.

Shapiro Wilk test was used to test for normal distribution between each group. Mann-Whitney U Test is a non-parametric alternative to the t-test where the distributions are not normal (Pallant, 2016) and so was used in this research for any test where one of the groups being tested had a $p<0.05$ in the Shapiro Wilk test.

Similar to the Brzeszczyński & McIntosh (2014) approach, the time-series of monthly returns were chain linked to calculate an annualised geometric time weighted returns for the 3-year, 5-year and 10-year periods for the purpose of comparison between different periods. As the geometric method, also called time-weighted return (see Figure 4.1), does not ignore compounding, it is a preferred measurement to the arithmetic method when evaluating past performance (Lee, 2012). Time weighted-returns are an appropriate choice therefore in this research for investment performance evaluation.

Figure 4.1: Time Weighted Returns

$$\mathrm{TWR} = \left(\prod_{t=1}^{T} (1 + r_t) \right)^{1/T} - 1$$

TWR is the time-weighted return, r_t is the return in period t and T is the number of time periods.

Source: Lee (2012)

Sharpe ratios were calculated for each portfolio over 3-year, 5-year, 10-year and 2008-2009 sub-periods. Explica investment analysis software was used to calculate Sharpe ratios, using the 3-month Inter-bank Libor EUR rate as the risk-free rate. Explica software is used by financial companies (Royal Bank of Scotland, AIB, Bank of Ireland, AXA and Bloxham) to generate a range of statistical analyses (Enterprise Ireland, 2006), and so was a suitable choice of tool for research of this nature. Using 3-month rates as the risk-free rate to calculate Sharpe ratios is common practice in research of this nature (Brzeszczyński & McIntosh, 2014; Gang & Qian, 2016) and so was appropriate for this research.

4.3.3 Limitations

The MSCI ACWI is an index of the global stock market and currently contains over 2,400 large and mid-cap stocks with a geographic reach across both developed and emerging investment markets. Small-cap stocks are available in the MSCI All Country World Small Cap Index, however, the environmental ratings from MSCI ESG Research do not cover the small cap index. Additionally, there were no environmental ratings available for stocks prior to 2007 via MSCI ESG research. This highlights two limitations to the study, first, the exclusion of small-cap stocks from the research due to the lack of environmental ratings for small-cap stocks, and second, the timeframe is limited to a ten-year period from 2007 to 2016, thereby excluding the 2001 dot-com collapse. This meant that only one crisis period, the 2008 financial crisis, was covered by the research and so the results can not imply any particular trend in the investment performance

returns subsequent to a market crash. Additionally, no conclusions regarding the performance of green small stocks versus non-green small stocks can be drawn given the absence of small stocks from the research.

4.4 Methodology Summary

The MSCI ESG environmental ratings, market cap-size and P/B ratio of stocks in the MSCI ACWI were used to compile four green portfolios and four non-green portfolios. The eight portfolios were reconstructed for each year from 2007 to 2016 based on a stock's environmental rating, cap-size and P/B ratio as of the end of the previous year. Thomson Reuters Eikon was used to generate monthly performance returns for each portfolio for each year. The monthly investment returns of each green portfolio for each investment style were compared to its non-green equivalent over 3-Year, 5-Year, 10-Year and the 2008-2009 periods. A geometric time weighted return was also computed and annualised for each portfolio and sub-period for further analysis. Additionally, a Sharpe ratio was computed to compare risk-adjusted returns.

The following chapter will present the findings of the research.

5 Research Findings

5.1 Introduction

This section outlines the analysis and findings of the performance returns of green portfolios compared to non-green portfolios across the four styles of large/growth, large value, mid/growth and mid/value. The four sub-periods, 3-year, 5-year, 10-year and 2008-2009 geometric returns for each style will be detailed graphically. The Sharpe ratio of each portfolio in each of the four sub-periods will also be detailed.

The purpose of the dissertation was to construct and analyse portfolios comprised of green and non-green stocks based on the MSCI ESG Environmental pillar scores and categorised within appropriate investment styles with the objective of comparing their performance with each other over 3-Year, 5-Year and 10-Year periods, and over the 2-Year crisis-period 2008-2009.

5.2 Hypotheses Testing

The monthly returns were analysed using the statistical software package SPSS. Tests were carried out corresponding to each of the 16 hypotheses. Each test was carried out to determine differences between the means of two independent groups, a green and non-green group. A Shapiro Wilk's test of normality was carried out between each group to determine which test to use. An independent Samples t-Test was used where Shapiro Wilk's test found no significant deviations from normality for both groups. A Mann-Whitney U-Test was carried out as a non-parametric alternative to the Independent Samples t-Test. The p-value is the Sig. (2-tailed) of each test and is used to determine statistically significant differences between the means of two groups. A p-value of less than or equal to 0.05 indicates a statistically significant difference between the means of the two groups. A p-value of greater than 0.05 will indicate no statistically significant difference between the means of the two groups.

5.2.1 Growth / Large-Cap 3-Year Returns

Hypothesis 1, H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the last 3 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.1.1 Test of Normality

The sample data for the 3-year returns for the groups Green Growth Large-Cap (GGL) and Non-Green Growth Large-Cap (NGL) were first analysed to test that each group was normally distributed. The null hypothesis for this test is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.1: Test of normality for Green and Non-Green Growth/Large Cap Portfolios 3-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGL	.130	36	.131	.977	36	.628
	NGL	.141	36	.068	.967	36	.348

a. Lilliefors Significance Correction

Table 5.1 shows that the results of the Shapiro Wilk test of normality for GGL and NGL for the 3-Year period show that there were no significant deviations from normality (**W_{GGL} = .977, df = 36, p = .628**), (**W_{NGL} = .967, df = 36, p = .348**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GGL and NGL in the 3-Year sub-period.

5.2.1.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.3) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .156, p = .694)**. The results of the Independent Samples t-Test (Table 5.3) show there is insufficient evidence to suggest that the monthly returns are different between the GGL portfolio **(M=1.07, SD=3.33, n=36)** and the NGL portfolio **(M=.85, SD=3.17, n=36)** (Table 5.4) over a 3-Year period **(t (70) = .290, p = .773)**, therefore, the research fails to reject the null hypothesis.

Table 5.2: Groups Statistics – GGL versus NGL 3-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GGL	36	1.0727553	3.33315604	.55552601
	NGL	36	.8505314	3.16796790	.52799465

Table 5.3: Independent Samples t-Test – GGL versus NGL 3-Year period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.156	.694	.290	70	.773	.22222389	.76641209	-1.30633683	1.75078461
	Equal variances not assumed			.290	69.820	.773	.22222389	.76641209	-1.30640615	1.75085392

5.2.2 Growth / Large-Cap 5-Year Returns

Hypothesis 2, H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the last 5 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.2.1 Test of Normality

The sample data for the 5-year returns for the groups Green Growth Large-Cap (GGL) and Non-Green Growth Large-Cap (NGL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.4: Test of normality for Green and Non-Green Growth/Large-Cap Portfolios 5-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGL	.081	60	.200*	.976	60	.294
	NGL	.117	60	.041	.968	60	.114

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.5 shows that the results of the Shapiro Wilk test of normality for GGL and NGL for the 5-Year period show that there were no significant deviations from normality (**W_{GGL} = .976, df = 60, p = .294**), (**W_{NGL} = .968, df = 60, p = .114**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GGL and NGL in the 5-Year sub-period.

5.2.2.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.6) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .109, p = .742)**. The results of the Independent Samples t-Test (Table 5.6) show there is insufficient evidence to suggest that the monthly returns are different between the GGL portfolio **(M=1.19, SD=2.89, n=60)** and the NGL portfolio **(M=.94,**

SD=2.83, n=60) (Table 5.5) **over** a 5-Year period **(t (118) = .5, p = .618).** Therefore, the research fails to reject the null hypothesis.

Table 5.5: Groups Statistics – GGL versus NGL 5-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GGL	60	1.1989175	2.89611193	.37388644
	NGL	60	.9375393	2.83045341	.36540996

Table 5.6: Independent Samples t-test – GGL versus NGL 5-Year period

5.2.3 Growth / Large-Cap 10-Year Returns

Hypothesis 3, H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the last 10 years?

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.109	.742	.500	118	.618	.26137817	.52279586	-.77389997	1.29665631
	Equal variances not assumed			.500	117.938	.618	.26137817	.52279586	-.77390561	1.29666194

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.3.1 Test of Normality

The sample data for the 10-year returns for the groups Green Growth Large-Cap (GGL) and Non-Green Growth Large-Cap (NGL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.7: Test of normality for Green and Non-Green Growth/Large Cap Portfolios 10-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGL	.093	120	.013	.962	120	.002
	NGL	.129	120	.000	.957	120	.001

a. Lilliefors Significance Correction

Table 5.7 shows that the results of the Shapiro Wilk test of normality for GGL and NGL for the 10-Year period show that there were significant deviations from normality (**W_{GGL} = .962, df = 120, p = .002**), (**W_{NGL} = .957, df = 120, p = .001**).

As both p-values are less than 0.05 the null hypothesis is rejected and therefore as a deviation from normality is indicated, a Mann Whitney U-test is used to test if there are significant differences between the monthly returns of GGL and NGL in the 10-Year sub-period.

5.2.3.2 Test of Significance

The results of the Mann Whitney U-test (Tables 5.8 and 5.9) show there is insufficient evidence to suggest that the monthly returns are different between the GGL portfolio with a mean rank score of **121.39** and the NGL portfolio with a mean rank score of **119.61** over a 10-Year period **(U=7093, p=.842).** The research therefore, fails to reject the null hypothesis.

Table 5.8: Mean Rank – GGL versus NGL 10-Year period

Ranks

	PortfolioType	N	Mean Rank	Sum of Ranks
PortfolioReturns	GGL	120	121.39	14567.00
	NGL	120	119.61	14353.00
	Total	240		

Table 5.9: Mann Whitney U test – GGL versus NGL 10-Year period

Test Statistics[a]

	PortfolioReturns
Mann-Whitney U	7093.000
Wilcoxon W	14353.000
Z	-.199
Asymp. Sig. (2-tailed)	.842

a. Grouping Variable: PortfolioType

5.2.4 Growth / Large-Cap 2008-2009

Hypothesis 4, H0: There is no difference between the investment performance of a growth/large-cap styled portfolio composed of green stocks and a growth/large-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.4.1 Test for Normality

The sample data for the 2008-2009 returns for the groups Green Growth Large-Cap (GGL) and Non-Green Growth Large-Cap (NGL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.10: Test of normality for Green and Non-Green Growth/Large Cap Portfolios 2008-2009

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGL	.150	24	.172	.952	24	.303
	NGL	.129	24	.200*	.954	24	.332

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.10 shows that the results of the Shapiro Wilk test of normality for GGL and NGL for the 2008-2009 period show that there were no significant deviations from normality (**W_{GGL} = .952, df = 24, p = .303**), (**W_{NGL} = .954, df = 24, p = .332**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GGL and NGL in the 2008-2009 sub-period.

5.2.4.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.12) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .112, p = .739)**. The results of the Independent Samples t-Test (Table 5.12) show there is insufficient evidence to suggest that the monthly returns are different between the GGL portfolio **(M=-.565, SD=5.77, n=24)** and the NGL portfolio **(M=-.938, SD=6.22, n=24)** (Table 5.11) **over** the 2008-2009 period **(t (46) = .215, p = .830).** The research therefore, fails to reject the null hypothesis.

Table 5.11: Groups Statistics – GGL versus NGL 2008-2009 period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GGL	24	-.5646646	5.76918576	1.17763011
	NGL	24	-.9378675	6.22067129	1.26978921

Table 5.12: Independent Samples t-Test – GGL versus NGL 2008-2009 period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.112	.739	.215	46	.830	.37320292	1.73181330	-3.11275646	3.85916229
	Equal variances not assumed			.215	45.741	.830	.37320292	1.73181330	-3.11328858	3.85969441

5.2.5 Value / Large-Cap 3-Year Returns

Hypothesis 5, H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the last 3 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.5.1 Test of Normality

The sample data for the 3-year returns for the groups Green Value Large-Cap (GVL) and Non-Green Value Large-Cap (NVL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.13: Test of normality for Green and Non-Green Value/Large Cap Portfolios 3-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVL	.132	36	.116	.953	36	.133
	NVL	.150	36	.040	.967	36	.341

a. Lilliefors Significance Correction

Table 5.13 shows that the results of the Shapiro Wilk test of normality for GVL and NVL for the 3-Year period show that there were no significant deviations from normality (**W_{GVL} = .953, df = 36, p = .113**), (**W_{NVL} = .967, df = 36, p = .341**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GVL and NVL in the 3-Year sub-period.

5.2.5.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.15) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .011, p = .916)**. The results of the Independent Samples t-Test (Table 5.15) show there is insufficient evidence to suggest that the monthly returns are different between the GVL portfolio **(M=1.02, SD=3.71, n=36)** and the NVL portfolio **(M=.96, SD=3.79, n=36)** (Table 5.14) over a 3-Year period **(t (70) = .071, p = .944).** The research therefore, fails to reject the null hypothesis.

Table 5.14: Groups Statistics – GVL versus NVL 3-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GVL	36	1.0229503	3.71420658	.61903443
	NVL	36	.9605736	3.79002822	.63167137

Table 5.15: Independent Samples t-Test – GVL versus NVL 3-Year period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.011	.916	.071	70	.944	.06237667	.88442769	-1.70155875	1.82631208
	Equal variances not assumed			.071	69.971	.944	.06237667	.88442769	-1.70157141	1.82632474

5.2.6 Value / Large-Cap 5-Year Returns

Hypothesis 6, H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the last 5 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.6.1 Test of Normality

The sample data for the 5-year returns for the groups Green Value Large-Cap (GVL) and Non-Green Value Large-Cap (NVL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.16: Test of normality for Green and Non-Green Value/Large Cap Portfolios 5-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVL	.122	60	.027	.945	60	.009
	NVL	.105	60	.163	.979	60	.393

a. Lilliefors Significance Correction

Table 5.16 shows that the results of the Shapiro Wilk test of normality for GVL and NVL for the 5-Year period show that there were significant deviations from normality for GVL (**W_{GVL} = .945, df = 60, p = .009**), and no significant deviations from normality for NVL (**W_{NVL} = .979, df = 60, p = .393**).

As one of the group's p-value is less than 0.05 the null hypothesis is rejected and therefore as a deviation from normality is indicated, a Mann Whitney U-test is used to

test if there are significant differences between the monthly returns of GVL and NVL in the 5-Year sub-period.

5.2.6.2 Test of Significance

The results of the Mann Whitney U-test (Figures 5.17 and 5.18) show there is insufficient evidence to suggest that the monthly returns are different between the GVL portfolio with a mean rank score of **62.82** and the NVL portfolio with a mean rank score of **58.18** over a 5-Year period **(U=1661, p=.466).** The research therefore, fails to reject the null hypothesis.

Table 5.17: Mean Rank – GVL versus NVL 5-Year period

Ranks

	PortfolioType	N	Mean Rank	Sum of Ranks
PortfolioReturns	GVL	60	62.82	3769.00
	NVL	60	58.18	3491.00
	Total	120		

Table 5.18: Mann-Whitney U-test – GVL versus NVL 5-Year period

Test Statistics[a]

	PortfolioReturns
Mann-Whitney U	1661.000
Wilcoxon W	3491.000
Z	-.730
Asymp. Sig. (2-tailed)	.466

a. Grouping Variable: PortfolioType

5.2.7 Value / Large-Cap 10-Year Returns

Hypothesis 7, H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the last 10 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.7.1 Test of Normality

The sample data for the 10-year returns for the groups Green Value Large-Cap (GVL) and Non-Green Value Large-Cap (NVL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.19: Test of normality for Green and Non-Green Value/Large Cap Portfolios 10-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVL	.109	120	.001	.940	120	.000
	NVL	.069	120	.200*	.977	120	.037

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.19 shows that the results of the Shapiro Wilk test of normality for GVL and NVL for the 10-Year period show that there were significant deviations from normality (**W_{GVL} = .940, df = 120, p = .000**), (**W_{NGL} = .977, df = 120, p = .037**).

As both p-values are less than 0.05 the null hypothesis is rejected and therefore as a deviation from normality is indicated, a Mann Whitney U-test is used to test if there are significant differences between the monthly returns of GGL and NGL in the 10-Year sub-period.

5.2.7.2 Test of Significance

The results of the Mann Whitney U-test (Figure 5.20 and 5.21) show there is insufficient evidence to suggest that the monthly returns are different between the GVL portfolio

with a mean rank score of **122.33** and the NGL portfolio with a mean rank score of **118.67** over a 10-Year period **(U=6980, p=.682).** The research therefore, fails to reject the null hypothesis.

Table 5.20: Mean Rank – GVL versus NVL 10-Year period

Ranks

	PortfolioType	N	Mean Rank	Sum of Ranks
PortfolioReturns	GVL	120	122.33	14680.00
	NVL	120	118.67	14240.00
	Total	240		

Table 5.21: Mann Whitney U test – GVL versus NVL 10-Year period

Test Statistics[a]

	PortfolioReturns
Mann-Whitney U	6980.000
Wilcoxon W	14240.000
Z	-.409
Asymp. Sig. (2-tailed)	.682

a. Grouping Variable: PortfolioType

5.2.8 Value / Large-Cap 2008-2009

Hypothesis 8, H0: There is no difference between the investment performance of a value/large-cap styled portfolio composed of green stocks and a value/large-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.8.1 Test of Normality

The sample data for the 2008-2009 returns for the groups Green Value Large-Cap (GVL) and Non-Green Value Large-Cap (NVL) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.22: Test of normality for Green and Non-Green Value/Large Cap Portfolios 2008-2009

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVL	.094	24	.200*	.939	24	.155
	NVL	.083	24	.200*	.993	24	1.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.22 shows that the results of the Shapiro Wilk test of normality for GVL and NVL for the 2008-2009 period show that there were no significant deviations from normality (**W_{GVL} = .939, df = 24, p = .155**), (**W_{NVL} = .993, df = 24, p = 1.000**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GVL and NVL in the 2008-2009 sub-period.

5.2.8.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.24) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .004, p = .948)**. The results of the Independent Samples t-Test (Table 5.24) show there is insufficient evidence to suggest that the monthly returns are different between the GVL portfolio **(M=-.308, SD=7.47, n=24)** and the NGL portfolio **(M=-.619, SD=7.08, n=24)** (Table 5.23) over the 2008-2009 period **(t (46) = .948, p = .883).** The research therefore, fails to reject the null hypothesis.

Table 5.23: Groups Statistics – GVL versus NVL 2008-2009 period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GVL	24	-.3078013	7.47437392	1.52570019
	NVL	24	-.6191779	7.07729938	1.44464769

Table 5.24: Independent Samples t-Test – GVL versus NVL 2008-2009 period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.004	.948	.148	46	.883	.31137667	2.10113493	-3.91798859	4.54074192
	Equal variances not assumed			.148	45.864	.883	.31137667	2.10113493	-3.91832804	4.54108137

5.2.9 Growth / Mid-Cap 3-Year Returns

Hypothesis 9, H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the last 3 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.9.1 Test of Normality

The sample data for the 3-year returns for the groups Green Growth Mid-Cap (GGM) and Non-Green Growth Mid-Cap (NGM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.25: Test of normality for Green and Non-Green Growth/Mid Cap Portfolios 3-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGM	.101	36	.200*	.977	36	.640
	NGM	.140	36	.073	.957	36	.179

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.25 shows that the results of the Shapiro Wilk test of normality for GGM and NGM for the 3-Year period show that there were no significant deviations from normality (**W_{GGM} = .977, df = 36, p = .640**), (**W_{NGL} = .957, df = 36, p = .179**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GGM and NGM in the 3-Year sub-period.

5.2.9.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.27) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .139, p = .711)**. The results of the Independent Samples t-Test (Table 5.27) show there is insufficient evidence to suggest that the monthly returns are different between the GGM portfolio **(M=.98, SD=3.56, n=36)** and the NGM portfolio **(M=.89, SD=3.28, n=36)** (Table 5.26) over a 3-Year period **(t (70) = .114, p = .711).** The research therefore, fails to reject the null hypothesis.

Table 5.26: Groups Statistics – GGM versus NGM 3-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GGM	36	.9787814	3.55581404	.59263567
	NGM	36	.8867864	3.28062867	.54677145

Table 5.27: Independent Samples t-Test – GGM versus NGM 3-Year period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.139	.711	.114	70	.909	.09199500	.80633495	-1.51618935	1.70017935
	Equal variances not assumed			.114	69.551	.909	.09199500	.80633495	-1.51637203	1.70036203

5.2.10 Growth / Mid-Cap 5-Year Returns

Hypothesis 10, H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the last 5 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.10.1 Test of Normality

The sample data for the 5-year returns for the groups Green Growth Mid-Cap (GGM) and Non-Green Growth Large-Cap (NGM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.28: Test of normality for Green and Non-Green Growth/Mid-Cap Portfolios 5-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGM	.084	60	.200*	.978	60	.343
	NGM	.105	60	.095	.969	60	.129

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.28 shows that the results of the Shapiro Wilk test of normality for GGM and NGM for the 5-Year period show that there were no significant deviations from normality (**W_{GGM} = .978, df = 60, p = .343**), (**W_{NGM} = .969, df = 60, p = .129**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GGM and NGM in the 5-Year sub-period.

5.2.10.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.30) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .254, p = .615)**. The results of the Independent Samples t-Test (Table 5.20) show there is insufficient evidence to suggest that the monthly returns are different between the GGM portfolio **(M=1.18, SD=3.14, n=60)** and the NGM portfolio **(M=.92, SD=2.87, n=60)** (Table 5.29) over a 5-Year period **(t (118) = .476, p = .635).** The research therefore fails to reject the null hypothesis.

Table 5.29: Group Statistics – GGM versus NGM 5-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GGM	60	1.1826483	3.13990600	.40536012
	NGM	60	.9211603	2.86597430	.36999569

Table 5.30: Independent Samples t-Test – GGM versus NGM 5-Year period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.254	.615	.476	118	.635	.26148800	.54882934	-.82534350	1.34831950
	Equal variances not assumed			.476	117.030	.635	.26148800	.54882934	-.82543681	1.34841281

5.2.11 Growth / Mid-Cap 10-Year Returns

Hypothesis 11, H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the last 10 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.11.1 Test of Normality

The sample data for the 10-year returns for the groups Green Growth Mid-Cap (GGM) and Non-Green Growth Mid-Cap (NGM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.31: Test of normality for Green and Non-Green Growth/Mid Cap Portfolios 10-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGM	.084	120	.038	.948	120	.000
	NGM	.102	120	.004	.947	120	.000

a. Lilliefors Significance Correction

Table 5.31 shows that the results of the Shapiro Wilk test of normality for GGM and NGM for the 10-Year period show that there were significant deviations from normality (**W_{GGM} = .948, df = 120, p = .000**), (**W_{NGM} = .947, df = 120, p = .000**).

As both p-values are less than 0.05 the null hypothesis is rejected and therefore as a deviation from normality is indicated, a Mann Whitney U-test is used to test if there are significant differences between the monthly returns of GGM and NGM in the 10-Year sub-period.

5.2.11.2 Test of Significance

The results of the Mann-Whitney U-test (Figures 5.32 and 5.33) show there is insufficient evidence to suggest that the monthly returns are different between the GGM portfolio with a mean rank score of **121.318** and the NGL portfolio with a mean rank score of **119.82** over a 10-Year period **(U=7118, p=.879).** The research therefore, fails to reject the null hypothesis.

Table 5.32: Mean Rank – GGM versus NGM 10-Year period

Ranks

	PortfolioType	N	Mean Rank	Sum of Ranks
PortfolioReturns	GGM	120	121.18	14542.00
	NGM	120	119.82	14378.00
	Total	240		

Table 5.33: Mann Whitney U test – GGM versus NGM 10-Year period

Test Statistics[a]

	PortfolioReturns
Mann-Whitney U	7118.000
Wilcoxon W	14378.000
Z	-.152
Asymp. Sig. (2-tailed)	.879

a. Grouping Variable: PortfolioType

5.2.12 Growth / Mid-Cap 2008-2009

Hypothesis 12, H0: There is no difference between the investment performance of a growth/mid-cap styled portfolio composed of green stocks and a growth/mid-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.12.1 Test of Normality

The sample data for the 2008-2009 returns for the groups Green Growth Mid-Cap (GGM) and Non-Green Growth Mid-Cap (NGM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.34: Test of normality for Green and Non-Green Growth/Mid Cap Portfolios 2008-2009

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GGM	.153	24	.150	.973	24	.748
	NGM	.112	24	.200*	.983	24	.939

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.34 shows that the results of the Shapiro Wilk test of normality for GGM and NGM for the 2008-2009 period show that there were no significant deviations from normality (**W_{GGM} = .973, df = 24, p = .748**), (**W_{NGM} = .983, df = 24, p = .939**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GGM and NGM in the 2008-2009 sub-period.

5.2.12.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.36) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .022, p = .883)**. The results of the Independent Samples t-Test (Table 5.36) show there is insufficient evidence to suggest that the monthly returns are different between the GGM portfolio **(M=-.250, SD=7.67, n=24)** and the NGM portfolio **(M=-.337, SD=7.44, n=24)** (Table 5.35) over the 2008-2009 period **(t (46) = .040, p = .968).** The research therefore, fails to reject the null hypothesis.

Table 5.35: Groups Statistics – GGM versus NGM 2008-2009 period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GGM	24	-.2499742	7.67396261	1.56644106
	NGM	24	-.3374079	7.44286524	1.51926851

Table 5.36: Independent Samples t-Test – GGM versus NGM 2008-2009 period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.022	.883	.040	46	.968	.08743375	2.18218111	-4.30506900	4.47993650
	Equal variances not assumed			.040	45.957	.968	.08743375	2.18218111	-4.30517976	4.48004726

5.2.13 Value / Mid-Cap 3-Year Returns

Hypothesis 13, H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the last 3 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.13.1 Test of Normality

The sample data for the 3-year returns for the groups Green Value Mid-Cap (GVM) and Non-Green Value Mid-Cap (NVM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.37: Test of normality for Green and Non-Green Value/Mid Cap Portfolios 3-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVM	.140	36	.071	.967	36	.344
	NVM	.145	36	.052	.975	36	.566

a. Lilliefors Significance Correction

Table 5.37 shows that the results of the Shapiro Wilk test of normality for GVM and NVM for the 3-Year period show that there were no significant deviations from normality (**W_{GVM} = .967, df = 36, p = .344**), (**W_{NVL} = .975, df = 36, p = .566**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GVM and NVM in the 3-Year sub-period.

5.2.13.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.39) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = 1.232, p = .271)**. The results of the Independent Samples t-Test (Table 5.39) show there is insufficient evidence to suggest that the monthly returns are different between the GVM portfolio **(M=.98, SD=3.68, n=36)** and the NVM portfolio **(M=1.0, SD=4.28, n=36)** (Table 5.38) over a 3-Year period **(t (70) = -0.23, p = .982).** The research therefore, fails to reject the null hypothesis.

Table 5.38: Groups Statistics – GVM versus NVM 3-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GVM	36	.9795714	3.67656786	.61276131
	NVM	36	1.0009653	4.27778782	.71296464

Table 5.39: Independent Samples t-Test – GVM versus NVM 3-Year period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	1.232	.271	-.023	70	.982	-.02139389	.94010372	-1.89637163	1.85358385
	Equal variances not assumed			-.023	68.453	.982	-.02139389	.94010372	-1.89711666	1.85432889

5.2.14 Value / Mid-Cap 5-Year Returns

Hypothesis 14, H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the last 5 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.14.1 Test of Normality

The sample data for the 5-year returns for the groups Green Value Mid-Cap (GVM) and Non-Green Value Large-Cap (NVM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.40: Test of normality for Green and Non-Green Value/Mid-Cap Portfolios 5-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVM	.117	60	.039	.970	60	.148
	NVM	.100	60	.200*	.982	60	.533

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.40 shows that the results of the Shapiro Wilk test of normality for GVM and NVM for the 5-Year period show that there were no significant deviations from normality (**W_{GVM} = .97o, df = 60, p = .148**), (**W_{NVM} = .982, df = 60, p = .533**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GVM and NVM in the 5-Year sub-period.

5.2.14.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.42) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .957, p = .330)**. The results of the Independent Samples t-Test (Table 5.42) show there is insufficient evidence to suggest that the monthly returns are different between the GVM portfolio **(M=1.12, SD=3.44, n=60)** and the NVM portfolio **(M=.99, SD=3.76, n=60)** (Table 5.41) over a 5-Year period **(t (118) = .186, p = .853).** The research therefore, fails to reject the null hypothesis.

Table 5.41: Group Statistics – GVM versus NVM 5-Year period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GVM	60	1.1181453	3.44127625	.44426685
	NVM	60	.9956633	3.76365440	.48588569

Table 5.42: Independent Samples t-Test – GVM versus NVM 5-Year period

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.957	.330	.186	118	.853	.12248200	.65837523	-1.18128020	1.42624420
	Equal variances not assumed			.186	117.066	.853	.12248200	.65837523	-1.18138793	1.42635193

5.2.15 Value / Mid-Cap 10-Year Returns

Hypothesis 15, H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the last 10 years?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.15.1 Test of Normality

The sample data for the 10-year returns for the groups Green Value Mid-Cap (GVM) and Non-Green Value Mid-Cap (NVM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.43: Test of normality for Green and Non-Green Value/Mid Cap Portfolios 10-Year

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVM	.121	120	.000	.923	120	.000
	NVM	.060	120	.200*	.949	120	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.43 shows that the results of the Shapiro Wilk test of normality for GVM and NVM for the 10-Year period show that there were significant deviations from normality (**W_{GVM} = .923, df = 120, p = .000**), (**W_{NVM} = .949, df = 120, p = .000**).

As both p-values are less than 0.05 the null hypothesis is rejected and therefore as a deviation from normality is indicated, a Mann Whitney U-Test is used to test if there are significant differences between the monthly returns of GVM and NVM in the 10-Year sub-period.

5.2.15.2 Test of Significance

The results of the Mann-Whitney U-test (Figures 5.44 and 5.45) show there is insufficient evidence to suggest that the monthly returns are different between the GVM portfolio with a mean rank score of **118.93** and the NVL portfolio with a mean rank score of **112.07** over a 10-Year period **(U=7012, p=.727).** The research therefore, fails to reject the null hypothesis.

Table 5.44: Mean Rank – GVM versus NVM 10-Year period

Ranks

	PortfolioType	N	Mean Rank	Sum of Ranks
PortfolioReturns	GVM	120	118.93	14272.00
	NVM	120	122.07	14648.00
	Total	240		

Table 5.45: Mann Whitney U Test – GVM versus NVM 10-Year period

Test Statistics[a]

	PortfolioReturns
Mann-Whitney U	7012.000
Wilcoxon W	14272.000
Z	-.350
Asymp. Sig. (2-tailed)	.727

a. Grouping Variable: PortfolioType

5.2.16 Value / Mid-Cap 2008-2009

Hypothesis 16, H0: There is no difference between the investment performance of a value/mid-cap styled portfolio composed of green stocks and a value/mid-cap styled portfolio composed of non-green stocks over the two-year crisis-period of 2008 and 2009?

The null hypothesis for this test is that there is no statistically significant difference between the tested groups.

5.2.16.1 Test of Normality

The sample data for the 2008-2009 returns for the groups Green Value Mid-Cap (GVM) and Non-Green Value Mid-Cap (NVM) were analysed to test that each group was normally distributed. The null hypothesis is that the data sample is normally distributed and the alternative hypothesis is that the data is not normally distributed.

Table 5.46: Test of normality for Green and Non-Green Value/Mid Cap Portfolios 2008-2009

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PortfolioType	Statistic	df	Sig.	Statistic	df	Sig.
PortfolioReturns	GVM	.104	24	.200*	.937	24	.138
	NVM	.106	24	.200*	.956	24	.364

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.46 shows that the results of the Shapiro Wilk test of normality for GVM and NVM for the 2008-2009 period show that there were no significant deviations from normality (**W_{GVM} = .937, df = 24, p = .138**), (**W_{NVM} = .983, df = 24, p = .364**).

As both p-values are higher than 0.05 the null hypothesis is not rejected and therefore given the lack of identified deviations in normality, an Independent Samples t-Test can be relied upon to test if there are significant differences between the monthly returns of GVM and NVM in the 2008-2009 sub-period.

5.2.16.2 Test of Significance

The result of Levene's test for equality of Variance (Table 5.48) shows that there is insufficient evidence to reject the assumption of equal variances and so equal variances are assumed (**F = .046, p = .831)**. The results of the Independent Samples t-Test (Table 5.48) show there is insufficient evidence to suggest that the monthly returns are different between the GVM portfolio **(M=.291, SD=8.72, n=24)** and the NVM portfolio **(M=.867, SD=8.76, n=24)** (Table 5.47) over the 2008-2009 period **(t (46) = -.228, p = .821).** The research therefore, fails to reject the null hypothesis.

Table 5.47: Groups Statistics – GVM versus NVM 2008-2009 period

Group Statistics

	PortfolioType	N	Mean	Std. Deviation	Std. Error Mean
PortfolioReturns	GVM	24	.2913700	8.71500193	1.77894232
	NVM	24	.8666425	8.75764365	1.78764652

Table 5.48: Independent Samples t-Test – GVM versus NVM 2008-2009 period

Independent Samples Test

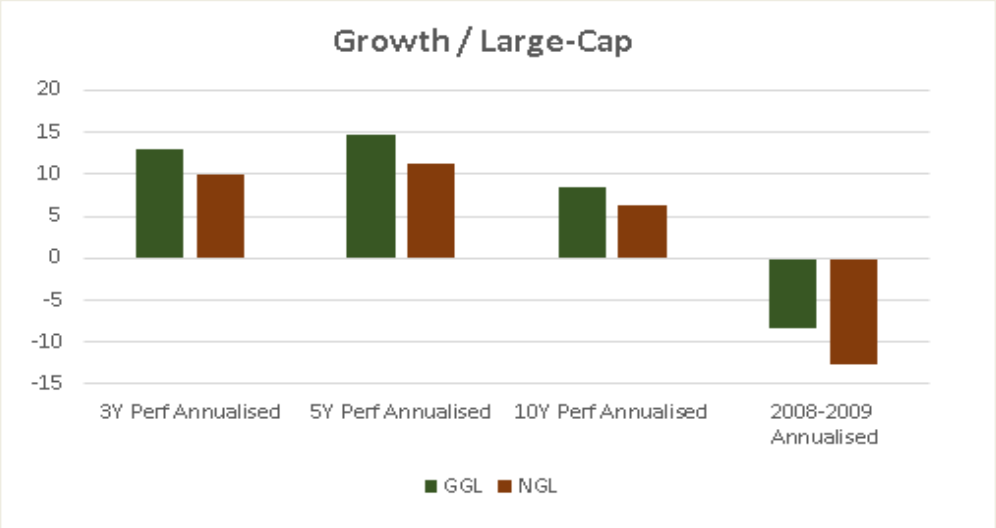
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PortfolioReturns	Equal variances assumed	.046	.831	-.228	46	.821	-.57527250	2.52196667	-5.65172811	4.50118311
	Equal variances not assumed			-.228	45.999	.821	-.57527250	2.52196667	-5.65173137	4.50118637

5.3 Time-Weighted Returns

This section looks at the results of 3-year, 5-year and 10-year performance returns of green and non-green portfolios across the four styles of growth/large-cap, value/large-cap, growth/mid-cap and value/mid-cap. The time-weighted returns were calculated by chain-linking the monthly returns generated by Eikon to produce 3-year, 5-year, 10-year returns and 2008-2009. The returns were then annualised for the purpose of comparison.

5.3.1 Growth / Large-Cap

Figure 5.1: Geometric Returns: Green versus Non-Green for Growth/Large-Cap portfolios



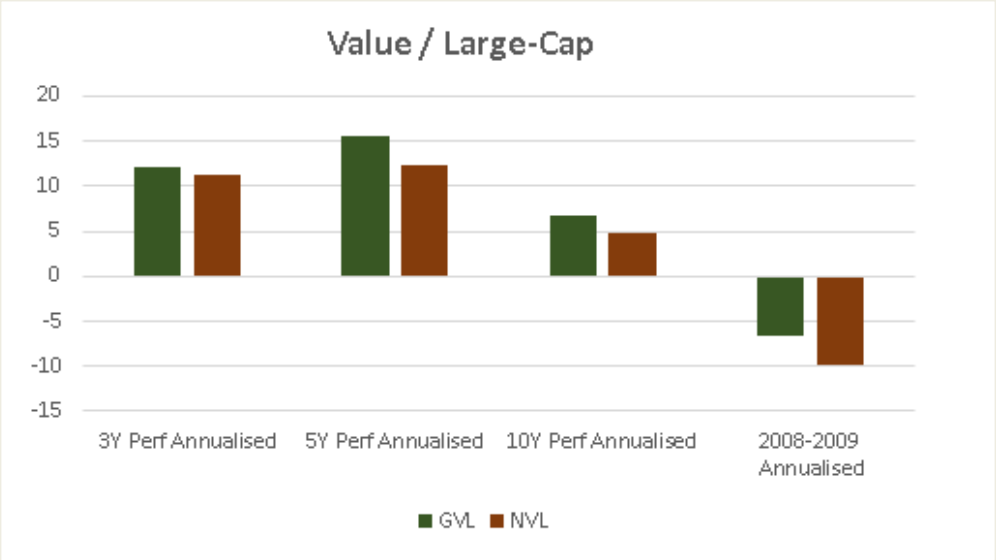
GGL= Green Growth Large-Cap, NGL= Non-Green Growth Large-Cap

Figure 5.1 shows the 3-Year, 5-Year, 10-Year and 2008-2009 returns of Green Growth Large-Cap and Non-Green Growth Large-Cap portfolios. The green portfolio outperforms the non-green portfolio in all four sub periods. The 3-Year annualised return for the green portfolio was 12.93%, compared to 10.06% for the non-green portfolio. The 5-Year annualised return for the green portfolio was 14.81%, compared

to 11.33% for the non-green portfolio. The 10-Year annualised return for the green portfolio was 8.43%, compared to 6.41% for the non-green portfolio. The 2008-2009 annualised return for the green portfolio was -8.38%, compared to -12.72% for the non-green portfolio. The highest return for growth/large-cap portfolios was the green portfolio's 5-year return of 14.81%. The lowest return for growth/large-cap portfolios was the non-green portfolio's 2008-2009 return of -12.72%.

5.3.2 Value / Large-Cap

Figure 5.2: Geometric Returns: Green versus Non-Green for Value/Large-Cap portfolios



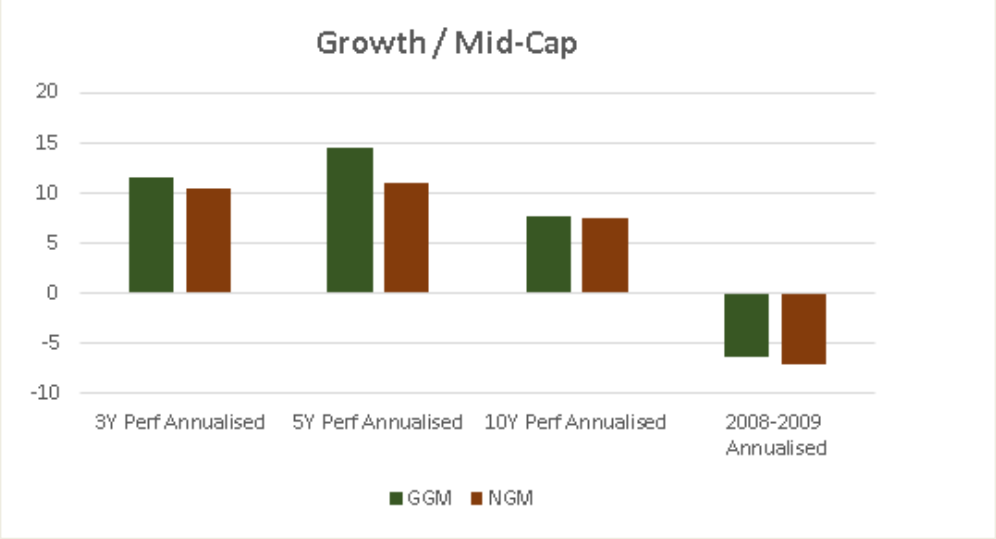
GVL= Green Value Large-Cap, NVL= Non-Green Value Large-Cap

Figure 5.2 shows the 3-Year, 5-Year, 10-Year and 2008-2009 returns of Green Value Large-Cap and Non-Green Value Large-Cap portfolios. The green portfolio outperforms the non-green portfolio in all three sub periods. The 3-Year annualised return for the green portfolio was 12.09%, compared to 11.22% for the non-green portfolio. The 5-Year annualised return for the green portfolio was 15.68%, compared to 11.22% for the non-green portfolio. The 10-Year annualised return for the green portfolio was 6.71%,

compared to 4.81% for the non-green portfolio. The 2008-2009 annualised return for the green portfolio was -6.6%, compared to -9.85% for the non-green portfolio. The highest return for value/large-cap portfolios was the green portfolio's 5-year return of 15.68%. The lowest return for value/large-cap portfolios was the non-green portfolio's 2008-2009 return of -9.85%.

5.3.3 Growth / Mid-Cap

Figure 5.3: Geometric Returns: Green versus Non-Green for Growth/Mid-Cap portfolios



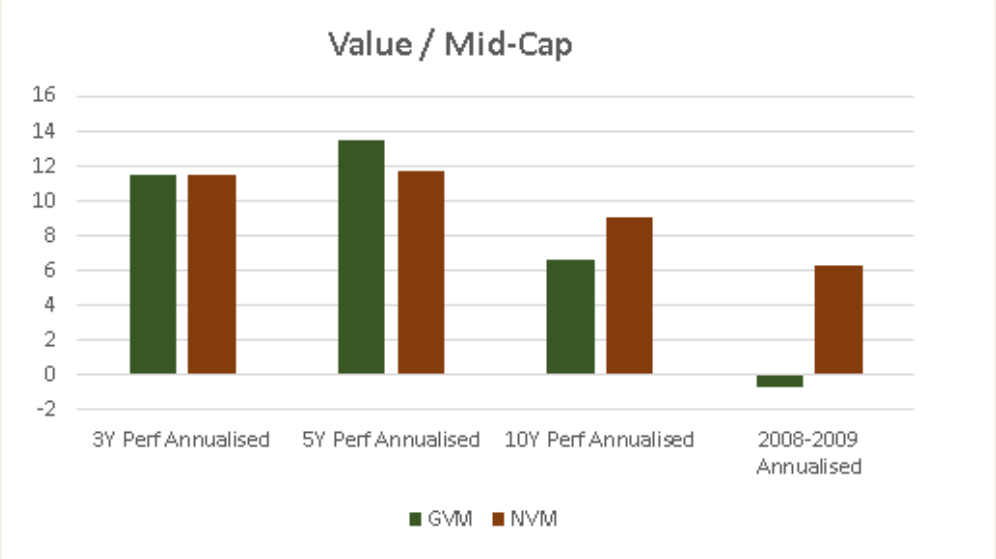
GGM= Green Growth Mid-Cap, NGM= Non-Green Growth Mid-Cap

Figure 5.3 shows the 3-Year, 5-Year, 10-Year returns and 2008-2009 of Green Growth Mid-Cap and Non-Green Growth Mid-Cap portfolios. The green portfolio outperforms the non-green portfolio in all three sub periods. The 3-Year annualised return for the green portfolio was 11.59%, compared to 10.48% for the non-green portfolio. The 5-Year annualised return for the green portfolio was 14.49%, compared to 11.09% for the non-green portfolio. The 10-Year annualised return for the green portfolio was 7.77%, compared to 7.45% for the non-green portfolio. The 2008-2009 annualised return for

the green portfolio was -6.29%, compared to -7.06% for the non-green portfolio. The highest return for growth/mid-cap portfolios was the green portfolio's 5-year return of 14.49%. The lowest return for growth/mid-cap portfolios was the non-green portfolio's 10-year return of -7.06%.

5.3.4 Value / Mid-Cap

Figure 5.4: Geometric Returns: Green versus Non-Green for Value/Mid-Cap portfolios



GVM= Green Value Mid-Cap, NVM= Non-Green Value Mid-Cap

Figure 5.4 shows the 3-Year, 5-Year, 10-Year and 2008-2009 returns of Green Value Mid-Cap and Non-Green Value Mid-Cap portfolios. The green portfolio outperforms the non-green portfolio in the 3-Year and 5-year period. The non-green portfolio outperforms the green portfolio in the 10-Year period. The 3-Year annualised return for the green portfolio was 11.54%, compared to 11.51% for the non-green portfolio. The 5-Year annualised return for the green portfolio was 13.49%, compared to 11.70% for the non-green portfolio. The 10-Year annualised return for the green portfolio was 6.66%, compared to 9.03% for the non-green portfolio. The 2008-2009 annualised return for

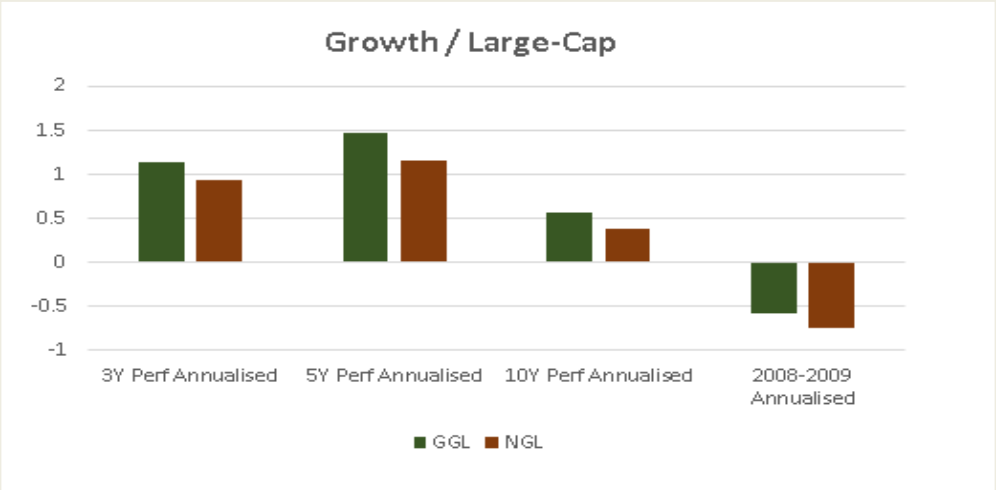
the green portfolio was -0.67%, compared to 6.32% for the non-green portfolio. The highest return for value/mid-cap portfolios was the green portfolio's 5-year return of 13.49%. The lowest return for value/mid-cap portfolios was the green portfolio's 2008-2009 return of -0.67%.

5.4 Sharpe Ratio

This section looks at the results of 3-year, 5-year, 10-year and 2008-2009 period's Sharpe ratio of green and non-green portfolios across the four styles of large/growth, large value, mid/growth and mid/value.

5.4.1 Growth / Large-Cap

Figure 5.5: Sharpe ratio - Green versus Non-Green for Growth/Large-Cap portfolios



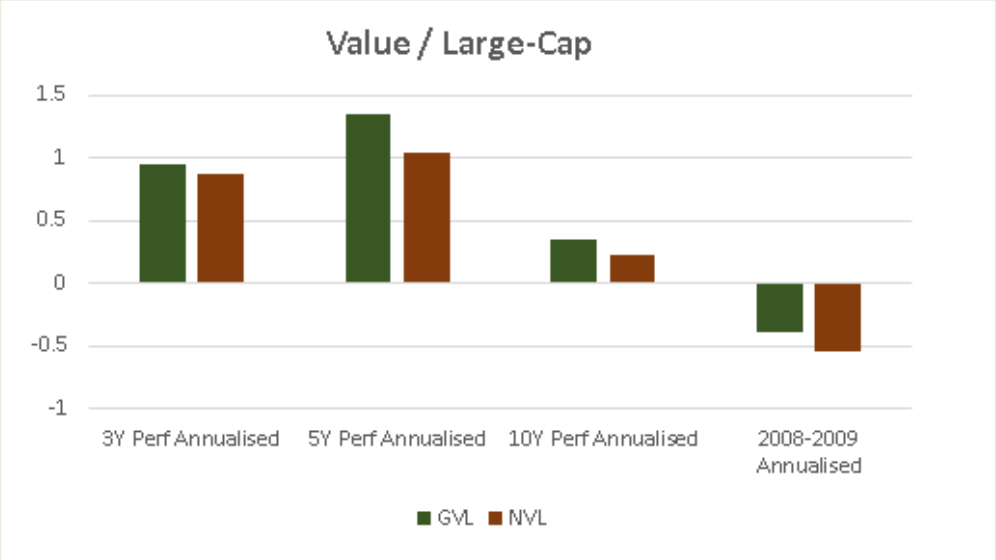
GGL= Green Growth Large-Cap, NGL= Non-Green Growth Large-Cap

Figure 5.47 shows the 3-Year, 5-Year, 10-Year and 2008-2009 Sharpe ratio of Green Growth Large-Cap and Non-Green Growth Large-Cap portfolios. The green portfolio show a better Sharpe ratio than the non-green portfolios in all three sub periods. The 3-Year Sharpe ratio for the green portfolio was 1.14, compared to .93 for the non-green portfolio. The 5-Year Sharpe ratio for the green portfolio was 1.48, compared to 1.15 for the non-green portfolio. The 10-Year Sharpe ratio for the green portfolio was .56

compared to .38 for the non-green portfolio. The 2008-2009 Sharpe ratio for the green portfolio was -0.58 compared to -0.75 for the non-green portfolio. The highest Sharpe ratio for growth/large-cap portfolios was the green portfolio's 5-year ratio of 1.48. The lowest Sharpe ratio for growth/large-cap portfolios was the non-green portfolio's 2008-2009 ratio of -0.75.

5.4.2 Value / Large-Cap

Figure 5.6: Sharpe ratio - Green versus Non-Green for Value/Large-Cap portfolios



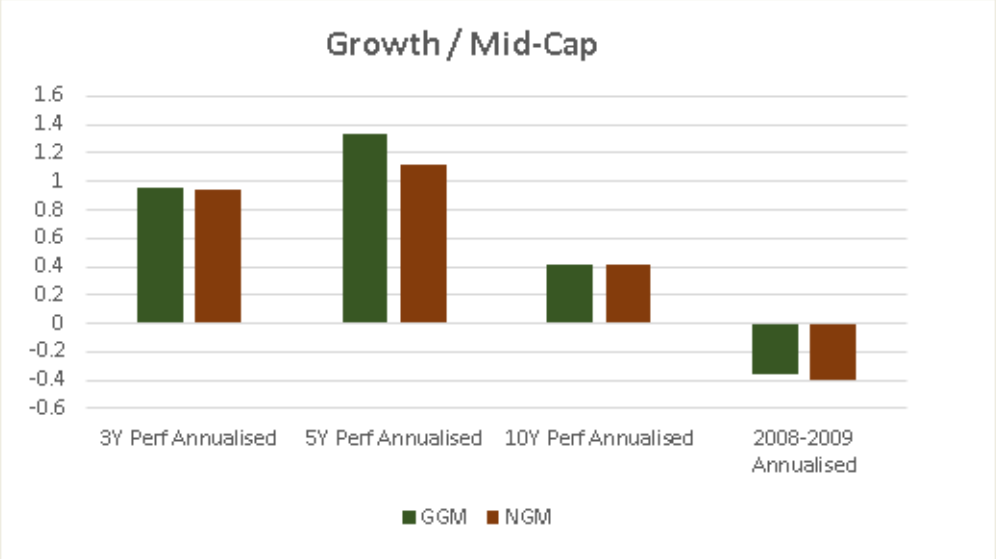
GVL= Green Value Large-Cap, NGL= Non-Green Value Large-Cap

Figure 5.8 shows the 3-Year, 5-Year, 10-Year and 2008-2009 Sharpe ratio of Green Value Large-Cap and Non-Green Value Large-Cap portfolios. The green portfolio show a better Sharpe ratio than the non-green portfolios in all three sub periods. The 3-Year Sharpe ratio for the green portfolio was 0.96, compared to .87 for the non-green portfolio. The 5-Year Sharpe ratio for the green portfolio was 1.36, compared to 1.05 for the non-green portfolio. The 10-Year Sharpe ratio for the green portfolio was .35 compared to .23 for the non-green portfolio. The 2008-2009 Sharpe ratio for the green portfolio was -0.38

compared to -0.54 for the non-green portfolio. The highest Sharpe ratio for growth/large-cap portfolios was the green portfolio's 5-year ratio of 1.36. The lowest Sharpe ratio for growth/large-cap portfolios was the non-green portfolio's 2008-2009 ratio of -0.54.

5.4.3 Growth / Mid-Cap

Figure 5.7: Sharpe ratio - Green versus Non-Green for Growth/Mid-Cap portfolios



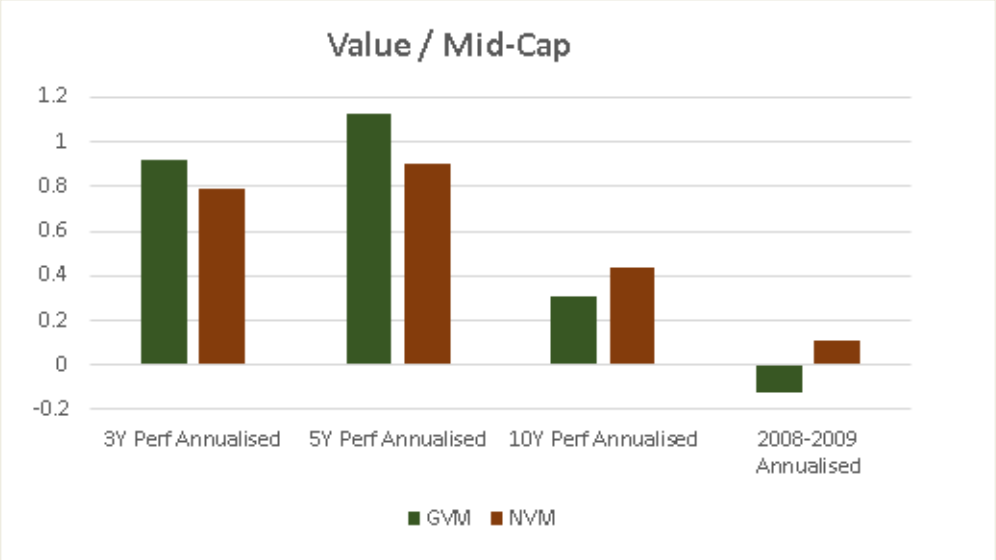
GGM= Green Growth Mid-Cap, NGM= Non-Green Growth Mid-Cap

Figure 5.9 shows the 3-Year, 5-Year, 10-Year and 2008-2009 Sharpe ratio of Green Growth Mid-Cap and Non-Green Growth Mid-Cap portfolios. The green portfolio show a better Sharpe ratio than the non-green portfolios in all three sub periods. The 3-Year Sharpe ratio for the green portfolio was 0.96, compared to .94 for the non-green portfolio. The 5-Year Sharpe ratio for the green portfolio was 1.33, compared to 1.12 for the non-green portfolio. The 10-Year Sharpe ratio for the green portfolio was .42 compared to .41 for the non-green portfolio. The 2008-2009 Sharpe ratio for the green portfolio was -0.36 compared to -0.4 for the non-green portfolio. The highest Sharpe

ratio for growth/mid-cap portfolios was the green portfolio's 5-year ratio of 1.33. The lowest Sharpe ratio for growth/mid-cap portfolios was the non-green portfolio's 2008-2009 of -0.4.

5.4.4 Value / Mid-Cap

Figure 5.8: Sharpe ratio - Green versus Non-Green for Value/Mid-Cap portfolios



GVM= Green Value Mid-Cap, NGM= Non-Green Value Mid-Cap

Figure 5.10 shows the 3-Year, 5-Year, 10-Year and 2008-2009 Sharpe ratio of Green Value Mid-Cap and Non-Green Value Mid-Cap portfolios. The green portfolio show a better Sharpe ratio than the non-green portfolios in the 3-Year and 5-Year periods. The non-green portfolio shows a better Sharpe ratio than the green portfolios in the 10-Year period. The 3-Year Sharpe ratio for the green portfolio was 0.92, compared to .79 for the non-green portfolio. The 5-Year Sharpe ratio for the green portfolio was 1.13, compared to 0.9 for the non-green portfolio. The 10-Year Sharpe ratio for the green portfolio was .31 compared to .44 for the non-green portfolio. The 2008-2009 Sharpe ratio for the green portfolio was -0.12 compared to .11 for the non-green portfolio. The

highest Sharpe ratio for growth/mid-cap portfolios was the green portfolio's 5-year ratio of 1.13. The lowest Sharpe ratio for growth/mid-cap portfolios was the green portfolio's 2008-2009 ratio of -0.12.

6 Discussion

In this chapter, the findings of the statistical analysis for differences between green and non-green portfolios in the four investment styles of growth/large-cap, growth/mid-cap, value/large-cap and value/mid-cap for the 3-year, 5-year and 10-year periods along with the 2008-2009 crisis period will be discussed. Additionally, the time-weighted geometric returns for the four sub-periods will also be discussed. The Sharpe ratio, indicating risk adjusted returns, will also be looked at in order to identify if any difference in portfolio performance between portfolios is due to risk. Finally, limitations of the research will be discussed.

From the literature, most studies have reported no significant difference between SRI performance and traditional investing (Junkus & Berry, 2014). This study however focuses on the behaviour of environmental stocks to discover if there is a significant difference in the investment performance of green and non-green stocks. The results from this test suggest that there are no statistically significant differences between the performance of green stocks versus non-green stocks over all four investment styles of growth/large cap, growth mid-cap, value large-cap, value mid-cap for the 3-year, 5-year and 10-year periods and the crisis-period 2008-2009. The findings therefore suggest alignment with Reveilli & Viviani (2015) meta-analysis of 85 previous studies, in that as with SRI investments, there is no real cost or benefit to investing in green stocks.

Although the results indicate no significant difference in the performance of green stocks and non-green stocks across the four investments styles and sub-periods, the results of the geometric time-weighted returns show the investment performance of portfolios composed of green stocks outperformed those composed of non-green stocks in all investment styles and sub-periods with the exception of the 10-Year and 2008-2009 returns for value/mid-cap. These findings are in contrast with Muñoz et al. (2014) study on green funds who found that green underperformed in normal periods, however their study was comparing green funds with SRI funds as opposed to green

stocks versus non-green stocks. The research is aligned with the results from Lesser et al. (2014) who found green funds out performed SRI funds in non-crisis period, again however, their study was comparing green funds with SRI funds as opposed to green stocks versus non-green stocks. However, in contrast to Lesser et. al (2014) who showed that green funds underperformed in crisis-period, this study shows that green stocks underperformed in crisis-period in only one of the investment styles, value/mid-cap.

The geometric returns as outlined in the findings in the previous chapter are organised per investment style detailing performance for green versus non-green for the four different sub-periods. However, this section will discuss the cross-sectional returns for all investment styles per sub-period to determine best and worst investment styles per period. The 3-Year period's best return was the GGL portfolio with 12.93% and the worst performance for 3-Year period was the NGL portfolio return of 10.06%. The 5-Year period's best return was the GVL portfolio return of 15.68%, whereas the worst performance for the 5-Year period was the NVM portfolio return of 11.09%. The 10-Year period's best return was the NVM portfolio return of 9.03% and the worst performance for the 10-Year period was the NVL portfolio return of 4.81%. The 2008-2009 period's best return was the NVM portfolio return of 6.32% and the worst performance for the 2008-2009 period was the NGL portfolio return of -12.72%. The returns indicate that green large-cap portfolios in both value and growth were the best performers in the 3-Year and 5-Year periods whereas the non-green value mid-cap was the best performer in the 10-Year and 2008-2009 period. The non-green value/mid-cap portfolio was the only portfolio to show positive returns in the 2008-2009 period with 6.32% and the non-green value/mid-cap portfolio with -0.67% meant that both green and non-green value/mid-cap portfolios outperformed all other styles in the 2008-2009 period with the nearest best performer being the green growth/mid-cap portfolio with -6.29%.

In the non-crisis periods therefore, this study shows that the green large-cap portfolios were the best performers, and in the crisis period the value-mid cap portfolios were the

best performers with the non-green value-mid cap being the only portfolio to have positive returns for the 2008-2009 period.

As the Sharpe ratio is a measurement of the portfolios excess return per unit of risk as defined by the portfolios standard deviation, its use will enable a better comparison of portfolio performance on a risk-adjusted basis (Schröder, 2007; Statman & Glushkov, 2016). As can be seen from Figures 5.5 to 5.8 in the Findings section, Sharpe ratios are consistent with the geometric time-weighted returns in that they indicate that after returns are adjusted for risk, the investment performance of portfolios composed of green stocks outperform those composed of non-green stocks in all investment styles and sub-periods with the exception of the 10-Year and 2008-2009 returns for value/mid-cap. This indicates that whether a green portfolio outperforms or underperforms its non-green equivalent in the findings above is not due to the element of risk.

However, a closer look at the geometric returns and the Sharpe ratio indicate that the amount by which a portfolio outperforms or underperforms is affected by the element of risk. This is evident in the 2008-2009 period where standard deviation of returns for all portfolios is high, with green value/mid-cap and non-green value/mid-cap being the highest at 8.72 and 8.76 respectively (see Appendix A for statistical descriptives for all portfolios). This would suggest that the level of outperformance would be reduced once returns are adjusted for risk. As can be seen from comparing the 2008-2009 geometric returns with 2008-2009 Sharpe ratios in Figures 5.4 and 5.8, the level of outperformance of the non-green portfolio over the green portfolio is reduced once the returns are adjusted by risk. The Sharpe ratio of .11 for the non-green value/mid-cap portfolio however, is still the only portfolio for the 2008-2009 period to be positive even after returns are risk-adjusted. The negative Sharpe ratio for all other portfolios in the 2008-2009 period indicates that investment performance was worse for these portfolios than investing in the risk-free rate alone.

7 Conclusion

The main research objective was to construct and analyse portfolios comprised of green and non-green stocks based on the MSCI ESG Environmental pillar scores and categorised within appropriate investment styles with the objective of comparing their performance with each other over 3-Year, 5-Year and 10-Year periods, and over the 2-Year crisis-period 2008-2009. The drivers for this research were the gaps in the literature based on studies analysing performance of funds rather than the performance of stocks in the market and on the existing literature's focus on SRI and ESG rather than green stocks. The importance of the research is to discover if investing solely in green stocks comes at a cost to investment performance returns and also to identify any trends in the performance returns of green stocks within a cross-sectional analysis across four investment styles, which may be informative and helpful for investors when choosing stocks to invest in.

The research findings indicate no statistically significant difference between the performance of green stocks and non-green stocks across the four investment styles of growth/large-cap, value/large-cap, growth/mid-cap and value/mid-cap within the 3-Year, 5-Year, 10-Year and 2008-2009 periods. These results suggest no benefit or cost to investors who wish to invest solely in green stocks. The implication of this is that investors who wish to positively allocate stocks with better environmental credentials than their peers, would not be penalised in performance terms for so doing.

The research also revealed that the time-weighted returns of green stocks out-performed non-green stocks in growth/large-cap, value/large-cap, growth mid-cap, investment styles over 3-Year, 5-Year, 10-Year and 2008-2009 periods. The time-weighted returns of green stocks also outperformed non-green stocks in the value/mid-cap style over the 3-Year and 5-year periods. However, the time-weighted returns of non-green stocks outperformed the green stocks in the value/mid-cap style over the 10-Year and 2008-2009 periods.

The research also demonstrated that the risk-adjusted returns were consistent with the time-weighted returns. Sharpe ratios showed that risk-adjusted returns of green stocks out-performed non-green stocks in growth/large-cap, growth mid-cap, value/large-cap, investment styles over 3-Year, 5-Year, 10-Year and 2008-2009 periods. Sharpe ratios also showed that risk-adjusted returns of green stocks outperformed non-green stocks in the value/mid-cap style over the 3-Year and 5-year periods. However, the Sharpe ratios showed that risk-adjusted returns of non-green stocks outperformed the green stocks in the value/mid-cap style over the 10-Year and 2008-2009 periods.

Limitations of the research include the exclusion of small-cap stocks from the research. The research used the constituents of the MSCI ACWI which includes large-cap and mid-cap stocks but not small-cap stocks. Another limitation of the research was that it covered only one crisis-period, the 2008 financial crisis. It is not possible therefore to draw any conclusions regarding the possible existence of trends of investment performance of green and non-green stocks post crisis periods.

Some obvious recommendations therefore emerge from the limitations of the research. A more comprehensive analysis could be achieved if similar research was carried out which included the constituents of an index containing small-cap stocks, such as MSCI ACWI Small Cap Index. Additionally, further research which covered more than one crisis-period would allow for deeper analysis. Finally, cut-off points of top 30% and bottom 30% were used to determine green and non-green stocks, various different cut-off points could be used to investigate whether there was an optimal point where environmental ratings positively affected investment performance.

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Appendices

Appendix A: Descriptive Statistics

Table 9.1: GGL versus NGL 3-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGL	Mean		1.0727553	.55552601
		95% Confidence Interval for Mean	Lower Bound	-.0550225	
			Upper Bound	2.2005330	
		5% Trimmed Mean		1.1426710	
		Median		1.1658200	
		Variance		11.110	
		Std. Deviation		3.33315604	
		Minimum		-8.06519	
		Maximum		8.35359	
		Range		16.41878	
		Interquartile Range		4.02747	
		Skewness		-.458	.393
		Kurtosis		.731	.768
	NGL	Mean		.8505314	.52799465
		95% Confidence Interval for Mean	Lower Bound	-.2213547	
			Upper Bound	1.9224175	
		5% Trimmed Mean		.9316069	
		Median		.7536200	
		Variance		10.036	
		Std. Deviation		3.16796790	
		Minimum		-7.20636	
		Maximum		6.77526	
		Range		13.98162	
		Interquartile Range		3.42809	
		Skewness		-.505	.393
		Kurtosis		.194	.768

Table 9.2: GGL versus NGL 5-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGL	Mean		1.1989175	.37388644
		95% Confidence Interval for Mean	Lower Bound	.4507725	
			Upper Bound	1.9470625	
		5% Trimmed Mean		1.2662852	
		Median		1.4664400	
		Variance		8.387	
		Std. Deviation		2.89611193	
		Minimum		-8.06519	
		Maximum		8.35359	
		Range		16.41878	
		Interquartile Range		3.88407	
		Skewness		-.518	.309
		Kurtosis		1.064	.608
	NGL	Mean		.9375393	.36540996
		95% Confidence Interval for Mean	Lower Bound	.2063557	
			Upper Bound	1.6687230	
		5% Trimmed Mean		1.0110980	
		Median		.7113900	
		Variance		8.011	
		Std. Deviation		2.83045341	
		Minimum		-7.20636	
		Maximum		6.77526	
		Range		13.98162	
		Interquartile Range		3.20294	
		Skewness		-.440	.309
		Kurtosis		.390	.608

Table 9.3: GGL versus NGL 10-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGL	Mean		.7442895	.33596061
		95% Confidence Interval for Mean	Lower Bound	.0790539	
			Upper Bound	1.4095251	
		5% Trimmed Mean		.8850286	
		Median		1.2707250	
		Variance		13.544	
		Std. Deviation		3.68026410	
		Minimum		-10.15129	
		Maximum		9.76388	
		Range		19.91517	
		Interquartile Range		4.41947	
		Skewness		-.650	.221
		Kurtosis		.922	.438
	NGL	Mean		.5968060	.35921787
		95% Confidence Interval for Mean	Lower Bound	-.1144813	
			Upper Bound	1.3080933	
		5% Trimmed Mean		.7658527	
		Median		.7861200	
		Variance		15.484	
		Std. Deviation		3.93503458	
		Minimum		-12.79405	
		Maximum		9.20588	
		Range		21.99993	
		Interquartile Range		4.14728	
		Skewness		-.774	.221
		Kurtosis		1.119	.438

Table 9.4: GGL versus NGL 2008-2009 Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGL	Mean		-.5646646	1.17763011
		95% Confidence Interval for Mean	Lower Bound	-3.0007781	
			Upper Bound	1.8714489	
		5% Trimmed Mean		-.5901525	
		Median		.2431450	
		Variance		33.284	
		Std. Deviation		5.76918576	
		Minimum		-10.15129	
		Maximum		9.76388	
		Range		19.91517	
		Interquartile Range		8.80801	
		Skewness		-.185	.472
		Kurtosis		-1.036	.918
	NGL	Mean		-.9378675	1.26978921
		95% Confidence Interval for Mean	Lower Bound	-3.5646266	
			Upper Bound	1.6888916	
		5% Trimmed Mean		-.8468981	
		Median		.1583400	
		Variance		38.697	
		Std. Deviation		6.22067129	
		Minimum		-12.79405	
		Maximum		9.20588	
		Range		21.99993	
		Interquartile Range		9.94018	
		Skewness		-.283	.472
		Kurtosis		-.928	.918

Table 9.5: GVL versus NVL 3-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVL	Mean		1.0229503	.61903443
		95% Confidence Interval for Mean	Lower Bound	-.2337564	
			Upper Bound	2.2796570	
		5% Trimmed Mean		1.1731191	
		Median		1.6047050	
		Variance		13.795	
		Std. Deviation		3.71420658	
		Minimum		-7.92231	
		Maximum		7.88602	
		Range		15.80833	
		Interquartile Range		3.99520	
		Skewness		-.672	.393
		Kurtosis		.485	.768
	NVL	Mean		.9605736	.63167137
		95% Confidence Interval for Mean	Lower Bound	-.3217874	
			Upper Bound	2.2429347	
		5% Trimmed Mean		1.0463788	
		Median		1.4397150	
		Variance		14.364	
		Std. Deviation		3.79002822	
		Minimum		-8.67651	
		Maximum		9.17196	
		Range		17.84847	
		Interquartile Range		3.92853	
		Skewness		-.530	.393
		Kurtosis		.529	.768

Table 9.6: GVL versus NVL 5-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVL	Mean		1.2758543	.42974464
		95% Confidence Interval for Mean	Lower Bound	.4159373	
			Upper Bound	2.1357714	
		5% Trimmed Mean		1.4167026	
		Median		1.8735300	
		Variance		11.081	
		Std. Deviation		3.32878767	
		Minimum		-7.92231	
		Maximum		7.88602	
		Range		15.80833	
		Interquartile Range		3.64231	
		Skewness		-.790	.309
		Kurtosis		.822	.608
	NVL	Mean		1.0250018	.43409257
		95% Confidence Interval for Mean	Lower Bound	.1563846	
			Upper Bound	1.8936191	
		5% Trimmed Mean		1.0911143	
		Median		1.4114650	
		Variance		11.306	
		Std. Deviation		3.36246662	
		Minimum		-8.67651	
		Maximum		9.17196	
		Range		17.84847	
		Interquartile Range		3.70455	
		Skewness		-.441	.309
		Kurtosis		.743	.608

Table 9.7: GVL versus NVL 10-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVL	Mean		.6417330	.41060813
		95% Confidence Interval for Mean	Lower Bound	-.1713121	
			Upper Bound	1.4547781	
		5% Trimmed Mean		.6787404	
		Median		.9837250	
		Variance		20.232	
		Std. Deviation		4.49798669	
		Minimum		-11.03146	
		Maximum		21.48895	
		Range		32.52041	
		Interquartile Range		5.29265	
		Skewness		.266	.221
		Kurtosis		3.485	.438
	NVL	Mean		.4892132	.40210515
		95% Confidence Interval for Mean	Lower Bound	-.3069952	
			Upper Bound	1.2854215	
		5% Trimmed Mean		.5590764	
		Median		1.1029150	
		Variance		19.403	
		Std. Deviation		4.40484126	
		Minimum		-15.26974	
		Maximum		15.54707	
		Range		30.81681	
		Interquartile Range		4.73085	
		Skewness		-.278	.221
		Kurtosis		1.687	.438

Table 9.8: GVL versus NVL 2008-2009 Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVL	Mean		-.3078013	1.52570019
		95% Confidence Interval for Mean	Lower Bound	-3.4639526	
			Upper Bound	2.8483501	
		5% Trimmed Mean		-.8183965	
		Median		-.1985900	
		Variance		55.866	
		Std. Deviation		7.47437392	
		Minimum		-11.03146	
		Maximum		21.48895	
		Range		32.52041	
		Interquartile Range		10.89737	
		Skewness		.901	.472
		Kurtosis		1.680	.918
	NVL	Mean		-.6191779	1.44464769
		95% Confidence Interval for Mean	Lower Bound	-3.6076593	
			Upper Bound	2.3693035	
		5% Trimmed Mean		-.6952806	
		Median		-1.5725750	
		Variance		50.088	
		Std. Deviation		7.07729938	
		Minimum		-15.26974	
		Maximum		15.54707	
		Range		30.81681	
		Interquartile Range		10.56976	
		Skewness		.192	.472
		Kurtosis		.087	.918

Table 9.9: GGM versus NGM 3-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGM	Mean		.9787814	.59263567
		95% Confidence Interval for Mean	Lower Bound	-.2243330	
			Upper Bound	2.1818958	
		5% Trimmed Mean		1.0539112	
		Median		1.2526800	
		Variance		12.644	
		Std. Deviation		3.55581404	
		Minimum		-8.41112	
		Maximum		8.72171	
		Range		17.13283	
		Interquartile Range		4.04090	
		Skewness		-.354	.393
		Kurtosis		.705	.768
	NGM	Mean		.8867864	.54677145
		95% Confidence Interval for Mean	Lower Bound	-.2232187	
			Upper Bound	1.9967914	
		5% Trimmed Mean		.9950607	
		Median		.9361200	
		Variance		10.763	
		Std. Deviation		3.28062867	
		Minimum		-7.93010	
		Maximum		7.16734	
		Range		15.09744	
		Interquartile Range		3.39400	
		Skewness		-.680	.393
		Kurtosis		.784	.768

Table 9.10: GGM versus NGM 5-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGM	Mean		1.1826483	.40536012
		95% Confidence Interval for Mean	Lower Bound	.3715246	
			Upper Bound	1.9937721	
		5% Trimmed Mean		1.2322189	
		Median		1.4632700	
		Variance		9.859	
		Std. Deviation		3.13990600	
		Minimum		-8.41112	
		Maximum		8.72171	
		Range		17.13283	
		Interquartile Range		3.50555	
		Skewness		-.385	.309
		Kurtosis		1.054	.608
	NGM	Mean		.9211603	.36999569
		95% Confidence Interval for Mean	Lower Bound	.1808007	
			Upper Bound	1.6615200	
		5% Trimmed Mean		1.0087865	
		Median		.9914000	
		Variance		8.214	
		Std. Deviation		2.86597430	
		Minimum		-7.93010	
		Maximum		7.16734	
		Range		15.09744	
		Interquartile Range		2.96504	
		Skewness		-.601	.309
		Kurtosis		1.149	.608

Table 9.11: GGM versus NGM 10-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGM	Mean		.7265368	.40757655
		95% Confidence Interval for Mean	Lower Bound	-.0805055	
			Upper Bound	1.5335791	
		5% Trimmed Mean		.8746099	
		Median		1.4246500	
		Variance		19.934	
		Std. Deviation		4.46477745	
		Minimum		-18.06888	
		Maximum		15.43051	
		Range		33.49939	
		Interquartile Range		4.80244	
		Skewness		-.720	.221
		Kurtosis		3.066	.438
	NGM	Mean		.6942598	.39393029
		95% Confidence Interval for Mean	Lower Bound	-.0857615	
			Upper Bound	1.4742812	
		5% Trimmed Mean		.8452907	
		Median		.9949750	
		Variance		18.622	
		Std. Deviation		4.31529012	
		Minimum		-16.80142	
		Maximum		15.21151	
		Range		32.01293	
		Interquartile Range		4.27128	
		Skewness		-.681	.221
		Kurtosis		2.910	.438

Table 9.12: GGM versus NGM 2008-2009 Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GGM	Mean		-.2499742	1.56644106
		95% Confidence Interval for Mean	Lower Bound	-3.4904044	
			Upper Bound	2.9904560	
		5% Trimmed Mean		-.1364688	
		Median		1.7635550	
		Variance		58.890	
		Std. Deviation		7.67396261	
		Minimum		-18.06888	
		Maximum		15.43051	
		Range		33.49939	
		Interquartile Range		10.34966	
		Skewness		-.345	.472
		Kurtosis		.175	.918
	NGM	Mean		-.3374079	1.51926851
		95% Confidence Interval for Mean	Lower Bound	-3.4802543	
			Upper Bound	2.8054384	
		5% Trimmed Mean		-.2752179	
		Median		1.3435600	
		Variance		55.396	
		Std. Deviation		7.44286524	
		Minimum		-16.80142	
		Maximum		15.21151	
		Range		32.01293	
		Interquartile Range		10.53959	
		Skewness		-.256	.472
		Kurtosis		.017	.918

Table 9.13: GVM versus NVM 3-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVM	Mean		.9795714	.61276131
		95% Confidence Interval for Mean	Lower Bound	-.2644002	
			Upper Bound	2.2235430	
		5% Trimmed Mean		1.0297667	
		Median		1.1489250	
		Variance		13.517	
		Std. Deviation		3.67656786	
		Minimum		-8.79546	
		Maximum		10.05055	
		Range		18.84601	
		Interquartile Range		3.68386	
		Skewness		-.145	.393
		Kurtosis		1.194	.768
	NVM	Mean		1.0009653	.71296464
		95% Confidence Interval for Mean	Lower Bound	-.4464299	
			Upper Bound	2.4483604	
		5% Trimmed Mean		1.0649457	
		Median		1.0381400	
		Variance		18.299	
		Std. Deviation		4.27778782	
		Minimum		-8.85773	
		Maximum		9.45151	
		Range		18.30924	
		Interquartile Range		6.54371	
		Skewness		-.385	.393
		Kurtosis		-.218	.768

Table 9.14: GVM versus NVM 5-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVM	Mean		1.1181453	.44426685
		95% Confidence Interval for Mean	Lower Bound	.2291694	
			Upper Bound	2.0071213	
		5% Trimmed Mean		1.1951085	
		Median		1.3175900	
		Variance		11.842	
		Std. Deviation		3.44127625	
		Minimum		-8.79546	
		Maximum		10.05055	
		Range		18.84601	
		Interquartile Range		3.15511	
		Skewness		-.301	.309
		Kurtosis		1.193	.608
	NVM	Mean		.9956633	.48588569
		95% Confidence Interval for Mean	Lower Bound	.0234083	
			Upper Bound	1.9679184	
		5% Trimmed Mean		1.0467309	
		Median		.9031700	
		Variance		14.165	
		Std. Deviation		3.76365440	
		Minimum		-8.85773	
		Maximum		9.45151	
		Range		18.30924	
		Interquartile Range		4.01786	
		Skewness		-.334	.309
		Kurtosis		.080	.608

Table 9.15: GVM versus NVM 10-Year Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVM	Mean		.6597898	.45635889
		95% Confidence Interval for Mean	Lower Bound	-.2438464	
			Upper Bound	1.5634259	
		5% Trimmed Mean		.5961304	
		Median		.8618750	
		Variance		24.992	
		Std. Deviation		4.99916115	
		Minimum		-12.90925	
		Maximum		26.36477	
		Range		39.27402	
		Interquartile Range		4.57502	
		Skewness		.799	.221
		Kurtosis		5.632	.438
	NVM	Mean		.8482010	.46343798
		95% Confidence Interval for Mean	Lower Bound	-.0694525	
			Upper Bound	1.7658545	
		5% Trimmed Mean		.8209947	
		Median		.8293600	
		Variance		25.773	
		Std. Deviation		5.07670870	
		Minimum		-14.19001	
		Maximum		25.31976	
		Range		39.50977	
		Interquartile Range		5.58385	
		Skewness		.592	.221
		Kurtosis		4.270	.438

Table 9.16: GVM versus NVM 2008-2009 Descriptive Statistics

Descriptives

	PortfolioType			Statistic	Std. Error
PortfolioReturns	GVM	Mean		.2913700	1.77894232
		95% Confidence Interval for Mean	Lower Bound	-3.3886526	
			Upper Bound	3.9713926	
		5% Trimmed Mean		-.2895693	
		Median		-1.0199150	
		Variance		75.951	
		Std. Deviation		8.71500193	
		Minimum		-12.90925	
		Maximum		26.36477	
		Range		39.27402	
		Interquartile Range		9.52840	
		Skewness		1.023	.472
		Kurtosis		2.196	.918
	NVM	Mean		.8666425	1.78764652
		95% Confidence Interval for Mean	Lower Bound	-2.8313861	
			Upper Bound	4.5646711	
		5% Trimmed Mean		.4374880	
		Median		-.7755300	
		Variance		76.696	
		Std. Deviation		8.75764365	
		Minimum		-14.19001	
		Maximum		25.31976	
		Range		39.50977	
		Interquartile Range		10.56397	
		Skewness		.711	.472
		Kurtosis		1.371	.918

Appendix B: Letter of Permission from MSCI

Standalone-ESGA_00229961.0

August 9, 2017

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MBA Student
National College of Ireland
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