Universidade do Minho
Escola de Economia e Gestão

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Tese de Mestrado em Finanças

Trabalho efectuado sob a orientação do
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Declaração

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Abstract

In this study, I analyzed the performance of 16 US green mutual funds during the period from May 1990 to September 2014. The green funds were identified by the US SIF website on January 31, 2016. I compared the performance of the green funds against the market, using two benchmarks, a general market benchmark (S&P500) and a benchmark of the sector (KLD400).

The findings of this study suggest a neutral performance to the green funds. Regarding the investment style, I found evidence that green funds are more exposed to small caps, value stocks and companies with poor past performance. I also found that green funds have a higher exposure to companies with robust profitability.

This study applies the single-factor model of Jensen (1968), the four-factor model from Carhart (1997) and the newest five-factor model from Fama & French (2015), in their unconditional and conditional form (applying the approach of Christopherson et al. (1998)). The results state that the multifactor models, with the inclusion of the risk factors, are superior in explaining mutual fund returns. The results also show that the conditional models increase the explanatory power of the models.

Keywords: Green Investment, Green Mutual Funds, Socially Responsible Mutual Funds, Mutual Funds Performance.

Resumo

Este estudo analisa o desempenho de 16 fundos de investimento verdes dos EUA durante o período de Maio de 1990 a Setembro de 2014. Os fundos verdes foram identificados através do *website* US SIF a 31 de Janeiro de 2016. Eu comparei o desempenho dos fundos verdes com o mercado, utilizando para isso dois *benchmarks*, um como referência geral do mercado (S&P500) e um como referência do sector (KLD400).

Os resultados sugerem um desempenho neutro para os fundos verdes. O estudo conclui que os fundos verdes estão mais expostos a ações de pequena capitalização, a ações de valorização e mais expostos a empresas com um mau desempenho passado. Os fundos verdes também estão mais expostos a empresas com uma rentabilidade robusta.

Este estudo aplica o modelo de Jensen (1968), o modelo quatro factores de Carhart (1997) e o mais recente modelo de cinco factores de Fama & French (2015), nas suas versões não condicional e condicional (aplicando a abordagem de Christopherson et al. (1998)). Os resultados indicam que os modelos multifactor, com a inclusão dos fatores de risco, são superiores a explicar a performance dos fundos. Os resultados também sugerem que os modelos condicionais aumentam o poder explicativo dos modelos.

Palavras-chave: Investimento Verde, Fundos de Investimento Verde, Fundos de Investimento Socialmente Responsáveis, Desempenho de Fundos de Investimento.

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1. Introduction

The world has become increasingly more concerned about environmental and social issues. The investors are changing their style of investment, becoming more socially and environmentally responsible when they make their investment decisions, taking into account some concerns like the global warming, recycling, civil rights and nuclear energy (Climent & Soriano (2011); Chung et al. (2012); Muñoz et al. (2014)).

Keefe (2007) defends that we are entering in a new world of sustainable investing, where there is a full integration of environmental, social and governance (EGS) factors into financial analysis and decision-making.

Historically, some efforts have been made to change mentalities. Important steps towards that occurred since the adoption of the Kyoto Protocol[1] at the Earth Summit in Rio de Janeiro, Brazil, in 1992, which is considered a milestone in the international negotiations on tackling climate change. This was the first time that the reduction of the greenhouse gas emissions were established as targets for industrialized countries. Then, the Kyoto Protocol in 1997 and the Copenhagen climate change conference in 2009 sought to alleviate or curb serious damage to the ecological system (Chung et al. 2012). More recently, other attempts were made in order to improve the main goals of the Kyoto Protocol, like the Doha Conference (Qatar) on 2012, the Climate Change Conferences in Warsaw, Poland, in 2013 and Lima, Peru, in 2014. In 2015, the COP21, also known as the 2015 Paris Climate Conference, was a pioneer in over 20 years of United Nations negotiations to achieve a legally binding and universal agreement on climate change, aiming to keep global warming below 2°C (UNFCCC COP 21 Paris France - 2015 Paris Climate Conference 2015) (COP 21, 2015).

Mutual funds are financial products, in which a group of investors apply their savings with the expectation of getting a positive return. The first mutual fund was founded in Netherlands, in 1774. However, just in 1824 appeared in the United States (Elton & Gruber, 2011).

This type of investment collects money from many investors with the purpose of investing in securities such as stocks, bonds and similar assets. The investors take advantage of many benefits

[1] The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (FCCC). The goal is to reach stabilization of greenhouse gas concentration in the atmosphere by restricting the level of greenhouse gas emissions by nations which have signed and ratified the protocol. (http://unfccc.int/kyoto_protocol/items/2830.php)

like risk diversification, professional management and a great liquidity. Individually, investors would not be able to achieve so many benefits. The portfolios of the mutual funds are constructed to match the investment objectives stated in its prospectus. The investors use those prospectus to see if the investment objectives of certain mutual fund are in line with their beliefs.

Today, due to the growing concerns about social and environmental issues, the beliefs of the investors are changing, bringing a new line of mutual funds: the socially responsible mutual funds.

The growing demand for long-term competitive financial returns along with positive societal and environmental impact reflects the dramatic growth in the assets and the number of mutual funds considering EGS criteria. In fact, according to US SIF[2] 2014 the value of assets under management using Socially Responsible Investing strategies in the United States expanded from $3.74 trillion at the start of 2012 to $6.57 trillion at the start of 2014, an increase of 76%. Another fact is that this type of assets represented nearly 18% of the $36.8 trillion in total assets under management in the United States, tracked by Cerulli Associates. Indeed, climate change is the most significant specific environmental factor taken into consideration by money managers and institutional investors in terms of assets under management, affecting $275.6 billion and $551.5 billion, respectively (US SIF 2014).

Despite the fact that it is a recent topic, there are many studies in finance literature discussing and analyzing the performance of the funds that invest with environmental and social concerns. It is suggested by the literature that these type of funds generally have a similar performance compared to conventional funds and even compared to the market (Hamilton et al. (1993); Statman (2000); Bauer et al. (2005); Bello (2005); Cortez et al. (2009); Cortez et al. (2012); Utz & Wimmer (2014)).

However, nowadays, a new concept has emerged – green investment. Chang et al. (2012) point that green investments are a subset of the Socially Responsible Investing, with more emphasis to environmental issues, like companies that minimize resource usage in production, companies that produce renewable energy and firms that produce ecologically friendly products. This way, green investing appeals to investors that desire to invest in areas that reflect their values on the

[2] US SIF – The Forum for Sustainable and Responsible Investment is the US membership association for professionals, firms, institutions and organizations engaged in sustainable, responsible, and impact investing. US SIF and its members advance investment practices that consider environmental, social and corporate governance criteria to generate long-term competitive financial returns and positive societal impact. (http://www.ussif.org/index.asp)

environment, climate change and a sustainable economy (Mallett & Michelson 2010). Problems such as climate change, energy shortage and global warming are making people further worried about this topic and, all over the world, people are taking extra attention to the green investment.

In this context, I intend to focus my dissertation in this topic by evaluating the performance of US green mutual funds. The main point is to compare the performance of the green funds with the market, following the line of the studies applied by White (1995), Statman (2000), Cortez et al. (2009) and Cortez et al. (2012). In order to do so, two benchmarks will be used, a conventional benchmark (S&P500) and a benchmark of the sector (MSCI KLD 400).

Currently, there is no clear answer on whether green funds have a performance that is statistically different from the market. This subject still raises some doubts to those who want to consider environmental issues in their investments. The motivation to conduct this study stems from the fact that only very few studies about the performance of green mutual funds were performed until now. This way, this research will provide updated results that can be useful to other academics and to those who want to consider environmental concerns in their investments.

For the performance evaluation, both single-factor and multi-factor models (Jensen (1968) one-factor model; Carhart (1997) four-factor model; Fama & French (2015) five-factor model) will be used. Moreover, the conditional approach of Christopherson et al. (1998) will be applied in order to allow for both alpha and beta to be time-varying.

This study is organized as follows. The next section discusses the performance of the conventional, socially responsible and green mutual funds. Section 3 presents the methodology used to assess fund performance. The subsequent section describes the data. Next, the results of the empirical analysis are provided and discussed and, finally, the last section summarizes the main results.

2. Literature review

The majority of studies in this area consider broad socially responsible investments. The literature review starts by presenting a brief history of socially responsible funds, followed by some literature on the performance of conventional mutual funds, socially responsible funds and finally green funds. As the green funds are a recent topic, the literature on the socially responsible funds will be mentioned in order to give us a good background about this theme.

2.1. A brief history on socially responsible investment

In the 16th century, in US, George Fox founded the Quakers. Their main goal was to apply social criteria to investing, like human equality and non-violence criteria (Bauer et al. 2005). In the 17th century the same group refused to profit from weapon and slave trade when they settled in North America. In the 1920s, the Methodist Church in the UK avoided investing in “sinful” companies, such as companies involved in the production of alcohol, tobacco and weapons and in gambling. In 1928, the first mutual fund named Pioneer Fund was created, incorporating screens based on religious traditions, avoiding companies involved in pork production, pornography, gambling and in interest-based financial institutions. This type of ethical investment, more based on religious traditions, evolved to investments more based on personal and social concerns. Since the 1960s, some social campaigns, such as the anti-war and the anti-racism movements, have made investors aware of the social consequences of their investments. This way, in 1971, the first open-end socially responsible (SR) mutual fund, the Pax World Fund, was founded in the United States. This fund was created for investors opposed to the Vietnam war with the purpose of avoiding investments in weapon contractors. The world has witnessed some events that got the investors’ attention. In the 1980s, the racist system of apartheid in South Africa, in 1986, the Chernobyl disaster and in 1989, the oil spill of the supertanker Exxon Valdez near Alaska. In the last twenty years, with these and other environmental and social disasters, investors have become more aware of the negative consequences of industrial development. Mainly, in the past decade, the world has observed a huge growth of the socially responsible funds, taking into account issues like environmental protection, human rights and labor relations (Renneboog et al. 2008a).

In fact, we have witnessed a huge growth of these types of funds all over the world. According to the US SIF 2005, the professional managed assets of SR portfolios, reached $2.3 trillion in 2005, growing by 1200% from the $162 billion a decade earlier, representing about 10% of total assets under management (US SIF 2005). More recently, the US SIF 2014 stated that the same type of funds expanded from $3.74 trillion at the start of 2012 to $6.57 trillion at the start of 2014, an increase of 76%, representing nearly 18% of the $36.8 trillion in total assets under management in the United States (US SIF 2014). In Europe, from 2005 to 2013, the European Sustainability theme assets have increased 11% per year to reach €59 billion in 2013. Since 2005, it has grown on average 30.7% (Eurosif 2014).

2.2. The performance of conventional mutual funds

The performance of mutual funds has been widely studied by academics. Several authors, such as Wermers (2000), Farnsworth et al. (2002) and Otten & Bams (2004), studied the US market. The first author stated that funds holding stocks outperform the market. Farnsworth et al. (2002), with a 188 sample of US mutual funds in stocks, through the stochastic discount factor model, found a neutral performance compared to the market. The last authors, Otten & Bams (2004), with a sample of 2436 domestic mutual funds, using conditional and unconditional models, also found a neutral performance.

Other studies were performed outside the US market. Otten & Bams (2002) studied a sample of 506 domestic mutual funds in the European market and, through conditional and unconditional models, they concluded that mutual funds were able to overperform the market and create value to investors. On the other hand, Christensen (2013) applying single and multi-factor models, found that Danish investment funds showed a neutral performance. Bialkowski & Otten (2011), applying the Carhart (1997) four-factor model, also found that domestic Polish mutual funds presented a neutral performance.

2.3. The performance of socially responsible investment funds

One of the first studies in this area is the study of Moskowitz (1972), which analyzes the financial performance of individual companies that have good records of social performance against companies that are less socially responsible. The author found a positive relationship between corporate social responsibility and financial performance, concluding that this type of behavior is good for companies to invest in. Margolis & Walsh (2003) and Orlitzky et al. (2003), for example, also stated there is a positive relationship between corporate social responsibility and financial performance. However, we must interpret these results with caution, as they suffer from several methodological limitations, such us risk control, multiple dimensions used to measure corporate financial performance and the data set, pointed out by, for example, McGuire et al. (1988) and Griffin & Mahon (1997).

The study of Moskowitz (1972) boosted the empirical studies on this topic. Some studies report a superior financial performance of certain SR criteria (Moskowitz (1972); Mallin et al. (1995); Derwall et al. (2005); Gil-Bazo et al. (2010)) and some state empirical evidence of a financial underperformance (Renneboog et al. (2008b); Cortez et al. (2012)). However, most of them report no significant differences between the financial performance of socially responsible investments and conventional investments (Hamilton et al. (1993); Guerard (1997); Goldreyer & Diltz (1999); Statman (2000); Bauer et al. (2005); Bello (2005); Renneboog et al. (2008a); Cortez et al. (2009); Cortez et al. (2012); Ortas et al. (2014); Utz & Wimmer (2014)).

Along the past years, researchers have provided a large number of studies concentrated in the question "Doing well while doing good?" by Hamilton et al. (1993)[3]. This study mentioned three alternative hypotheses about the relative returns of socially responsible portfolios and conventional portfolios. The third one stated that if the expected returns of socially responsible portfolios were higher than the expected returns of conventional portfolios, then the investors would be "doing well while doing good".

Cortez et al. (2009) mentioned three different lines about the studies focusing on the relationship between social and financial performance. The first approach consists in the differences between the financial performance of individual companies that have good records of social performance and those that are less socially responsible (Moskowitz (1972); Margolis & Walsh (2003); Orlitzky et al. (2003)). The second approach involves the differences between the performances of indices that exclude companies with lower social records with conventional market indices. These studies have found that the performance of social indices is comparable to the performance of broad market indices (Guerard (1997); Kurtz & DiBartolomeo (1996); Sauer (1997); Statman (2006); Ortas et al. (2014)). The third and last approach involves the difference between the performance of socially responsible mutual funds relative to the performance of conventional mutual funds. Empirically, studies have shown a similar behavior relative to the performance of socially responsible funds and conventional funds.

[3] There are several studies about this topic, the vast majority are concentrated in US and Europe (mostly in UK). Galema et al. (2008) and Renneboog et al. (2008a) offers an interesting review of the literature on the performance of the socially responsible investments.

However, based on portfolio theory, Rudd (1981) mentioned that portfolios constructed from a restricted universe of stocks, like socially responsible funds, will not be properly diversified due to the limited universe of such funds and, additionally, there will be filtering costs that would not be present in the construction of a portfolio of conventional funds (Cortez et al. 2012).

Conversely, Hill et al. (2007) and Kempf & Osthoff (2007), pointed out that portfolios composed of socially responsible stocks will benefit from improved performance in the long run, as a consequence of social screens representing filters that enable the identification and selection of firms with higher quality of management relative to their less responsible competitors. Cortez et al. (2009) also mentioned that screening practices allow fund managers to identify the best companies in terms of potential for profits, giving competitive returns to socially responsible funds (Cortez et al. 2012).

The growing concerns about the environmental and social issues have been a starting point to study the differences in the performance of the mutual funds when we adopt different investment strategies. The analysis of socially responsible funds is usually performed in a comparative perspective, namely relative to conventional mutual funds or market indices.

The majority of the studies focused on American funds concluded that socially responsible funds are not statistically different from the performance of the conventional funds. Hamilton et al. (1993), using Jensen´s (1968) alpha, found that for the period of 1981 to 1990, the performance of SR funds is similar to that of conventional ones, which may disappoint socially responsible investors who hope to do well while doing good. The study of Statman (2000), with a domestic sample of 31 socially responsible funds, and Bello (2005), with a domestic sample of 42 socially responsible funds, applying the Jensen (1968) alpha measure, for the 1990 – 1998 period and for the 1994 – 2001 period, respectively, also found no significant difference in investment performance between socially screened portfolios and conventional investments.

Evidence from the European market is similar to that of the American market. Leite & Cortez (2014) performed a multi-country (Austria, Belgium, France, Germany, Italy, the Netherlands, UK and Spain) study based on 54 international socially responsible funds, applying a conditional five-factor model (the four-factor model from Carhart (1997) plus an additional local factor) and they found a similar performance between socially responsible funds and conventional funds.

Using an international database, Bauer et al. (2005), between 1990 - 2001, also did not find evidence of significant differences in risk-adjusted returns between ethical and conventional funds using an international database containing 103 German, UK and US ethical mutual funds. This study applied a single-factor model (Jensen 1968) and a multi-factor model (Carhart (1997) four-factor model) and the authors concluded that a multi-factor approach was superior in explaining mutual fund returns. In terms of investment style, the authors stated that the ethical funds tend to be more exposed to small caps and to growth stocks than conventional funds. This exposure to growth stocks can be explained by the fact that value stocks often represent higher environmental risks, this way being more likely to be excluded from socially responsible funds (Cortez et al. 2012).

In the other perspective, there are studies that compare the socially responsible funds with the market indices. In this line, studies focused on American market, such as Statman (2000) and Bello (2005), both using S&P500 and Domini 400 Social Index[4] as benchmarks, found evidence that socially responsible funds underperform both benchmarks.

Differently from the American market, Cortez et al. (2009) performed a study focused on 88 socially responsible funds from Austria, Belgium, France, Germany, Italy, the Netherlands and UK, for the period of 1996 to 2007. Using both unconditional and conditional models (Christopherson et al. (1998)), the authors stated that the performance of socially responsible funds is similar to the performance of both conventional (MSCI AC World and MSCI AC Europe indices) and socially responsible (FTSE4Good Global and FTSE4Good Europe) benchmarks. The authors also observed that the conditional models lead to a slight improvement of performance estimates and the explanatory power of the models.

Cortez et al. (2012), using a sample composed of 39 funds for European markets (Austria, Belgium, France, Germany, Italy, the Netherlands and UK) and 7 funds for US market over the period from 1996 to 2008, found mixed results. For European markets global socially responsible funds showed similar performance compared to both conventional (MSCI AC World Index) and socially responsible (FTSE4Good Global) benchmarks. For US and Austrian funds, the authors showed evidence of underperformance. In line with the study of Cortez et al. (2009), the authors also found that using the conditional approach of Christopherson et al. (1998), in order to control for both time varying alphas and betas, the explanatory power of the models increases. In terms

[4] Now designated as MSCI KLD 400 Social Index (See section 4).

of investment style, studies have shown that socially responsible funds tend to be more exposed to small caps and to growth stocks than conventional funds, being consistent with Bauer et al. (2005).

2.4. The performance of green mutual funds

In this specific study, the focus will be the performance of green mutual funds, a subset of socially responsible funds. However, why should we expect the green funds' performance to be different from other types of funds?

Studies on the performance of socially responsible funds consider them as a homogenous group. However, SR funds consider various types of funds, such as religious funds and environmental funds, which have different investment strategies. Religious funds avoid industries considered sinful or unethical (alcohol or gambling, for example) and green funds seek industries with good records on environmental issues (Muñoz et al. 2014).

Climent & Soriano (2011) also observed that the growing concerns about the environmental issues on the part of investors, companies and governments, may lead to the possibility that one could anticipate profitable opportunities for businesses pursuing sustainable goals, which could make green funds different from the other type of funds. The industry factor is another important issue that should be taken into account in the analysis. It is typical that the constituent assets of environmental funds are highly concentrated within certain industries. Industries like mining, oil and gas may be underweighted and others like utilities overweighed in this kind of funds leading to performance biases. Green funds, SR funds and conventional funds will have a different industry composition. Benson et al. (2006) also concluded that the industry composition really matters and that green funds certainly have a different one. They might have a stronger weight on the natural resources or renewable industries.

In the finance literature, studies of green investing have been usually attached to a firm perspective, studying the linkage between corporate environmental behavior and corporate financial performance (Heinkel et al. (2001) for example).

At first, it may appear that companies applying measures to improve their environmental performance could suffer from additional costs and, consequently, a reduction in their financial results. Since we don't have much diversification, by restricting the investment set, the risk could be increased (Rudd 1981), as was already mentioned in relation to socially responsible funds.

However, there are reasons to think that a good environmental performance may lead to a good financial performance. Ambec & Lanoie (2008) outline seven arguments that support that the companies with good records on environmental issues could increase their income or reduce their costs. Precisely, the revenues could be increased by better access to certain markets, differentiating products and selling pollution-control technology. The costs could be reduced by risk management and relations with external stakeholders, costs of material, energy and services, cost of capital and cost of labor. Ambec & Lanoie (2008) provide empirical evidence for each one.

Derwall et al. (2005) conducted a study using two mutually exclusive stock portfolios from American companies over the period from 1995 to 2003. They found evidence that the "most eco-efficient"[5] portfolio largely outperformed the "less eco-efficient" portfolio. Their conclusions suggest that companies that consider environmental criteria in their investments may obtain considerable benefits. The author also concluded that the Carhart (1997) four-factor model, compared to the Jensen (1968) alpha, has a higher explanatory power of the performance.

Another study that investigated the effects of the application of green standards on companies' financial returns was performed by Puopolo et al. (2015). The authors aim to answer the question "Does the market reward for going green?". They analyzed the returns of a sample of 500 US companies adopting environmentally friendly standards from 2009 to mid-2014 and concluded that the "green-behavior" does not affect the financial returns required by investors.

In this line, considering that a company could have opportunities to generate a superior financial performance, it is interesting to analyze the performance of the green mutual funds from a comparative point of view.

As far as we know, White (1995) is the first study to analyze the performance of environmental funds, in the US and German markets. The author found that US green funds underperform the overall US market, while, in Germany, green funds do not perform differently from the German market.

Climent & Soriano (2011), with a sample of 7 US green funds, for the period of 1987-2009 and using the single-factor model (Jensen, 1968), found that US green mutual funds had lower performance compared to the market benchmark (S&P500). When the benchmark is the KLD400

[5] "Eco-efficiency can be defined as the ratio of the value a company adds to the waste the company generates by creating that value" (Derwall et al. 2005).

(SR equity index) the performance is negative but not statistically significant. With the four-factor model from Carhart (1997), the authors also found that green funds underperform the market. However, when the author focused on a more recent period (2001-2009), the green funds showed neutral performance. They also demonstrated that green mutual funds are more exposed to small caps and growth stocks. The authors also confirmed the expectation that the multi-factor models, compared to the one-factor CAPM model, are superior in explaining mutual fund returns.

In relation to the conventional and SR funds, Climent & Soriano (2011) found that green funds underperform conventional and SR funds with similar characteristics. Chang et al. (2012), with a sample of 131 green mutual funds identified by US SIF and for a similar period of time, stated the same underperformance. However, Climent & Soriano (2011) also revealed that if we focused only in the period of 2001-2009, green funds had a similar performance.

Mallett & Michelson (2010) and Chung et al. (2012), for the periods of 1998-2007 and 2000-2009, respectively, found no significant differences in performance between US green mutual funds and their conventional peers.

In the European market, Ibikunle & Steffen (2015) performed a study between 1991-2014 period, applying both the one-factor CAPM model and the four-factor model of Carhart (1997). For the first model, the authors found that, in general, green funds underperform the market[6], being consistent with Climent & Soriano (2011). For the four-factor model, the authors stated that same underperformance[7]. The authors also demonstrated that the multi-factor model does not improved the explanatory power of the model, which is against the findings of Climent & Soriano (2011).

In relation to the performance between green funds and conventional funds, Ibikunle & Steffen (2015) found that green mutual funds underperform conventional funds. However, over the last 5 years of the study, the green funds tend to show similar performance relative to conventional ones. In this study, the green mutual funds are more exposed to small caps and growth stocks, being consistent with Climent & Soriano (2011).

Another interesting study focused on both green European and US funds, for the period from 1994 to 2013, with a sample of 18 US and 89 European green funds, was performed by Muñoz

[6] The authors used the global MKT factor portfolio from the *Kenneth R. French data library*, the Stoxx Europe 600 Index and the S&P Global Alternative Energy Index as market proxy.

[7] The authors used the global and the European MKT factor portfolio from the *Kenneth R. French data library* as market proxy.

et al. (2014). The authors applied the Carhart (1997) four-factor model and stated that for the US market, with the domestic equity portfolio, green funds do not perform worse than the market, but with the global equity portfolio, green funds show evidence of underperformance.

These studies have shown inconclusive results. This is a very recent topic, with few studies analyzing the financial performance of the green mutual funds. Despite this, I aim to contribute to the discussion about this topic, comparing the performance of the green funds with the market.

3. Methodology

3.1. Introduction

In this third chapter, the methodology that will be applied in this study will be presented. First, Jensen´s (1968) alpha, the four-factor model of Carhart (1997) and the five-factor model of Fama & French (2015) in their unconditional form are implemented.

Jensen´s (1968) alpha captures the risk-adjusted average abnormal return in excess of a market benchmark. However, this model has been criticized by some authors (e.g. Fama & French (1992)), stating that the one-factor CAPM framework does not sufficiently explain the expected stock returns. In the literature there is a general agreement that multifactor models are a much more useful characterization of portfolio returns than single-index models (Carhart (1997); Bauer et al. (2005); Derwall et al. (2005); Climent & Soriano (2011)). However, several authors used the well-known Jensen (1968) alpha and a multi-factor model to measure the performance of the funds and I intend to follow the same methodology.

In this context, I will also implement the model that has become the standard measure for evaluating mutual fund performance, the model proposed by Carhart (1997), which is a further extension of both the original CAPM and the Fama & French (1993) three-factor model (Ibikunle & Steffen, 2015).

The application of the Fama & French (2015) five-factor model is very recent in the performance evaluation literature. This model is an extension of the Fama & French (1993) three-factor model, adding two risk factors, the investment (CMA) and the profitability (RMW). With this model, it has become possible to understand the investment strategies performed by the funds' managers, since the authors observed that much of the mean variation of returns related to the investment and the profitability is not explained by the Fama & French (1993) three-factor model. The authors also stated that the Fama & French (2015) five-factor model showed better performance estimates than their previous Fama & French (1993) three-factor model.

The unconditional models assume that the expected returns and risk are invariant over time, regardless of market conditions. As these models do not consider time-varying risk and returns over time, they might be biased, since their application may lead to incorrect performance estimates (Aragon & Ferson 2008, p.118). This way, the full conditional model of Christopherson et al. (1998) will be implemented as, for example, Cortez et al. (2009), Cortez et al. (2012) and Leite & Cortez (2014) also did.

Farnsworth (1997, pp.23) stated that the conditional performance evaluation method "refers to the measurement of performance of a managed portfolio taking into account the information that was available to investors at the time the returns were generated". The main point of the application of the conditional models is to incorporate the public information variables that affect the state of the economy to predict returns and risk. The approach of Christopherson et al. (1998) extends the model of Ferson & Schadt (1996) by allowing both alpha and beta to be time-varying. The conditional model of Ferson & Schadt (1996) only incorporates time-varying betas, but later, Ferson et al. (2008) showed that the time-varying alpha term should be included on the regression in order to obtain unbiased estimates of conditional models.

In order to determine the importance of the introduction of these conditional models, several studies applied the Wald test, such as Cortez et al. (2009), Cortez et al. (2012) and Leite & Cortez (2014). This test tests the null hypothesis that the coefficients of public information variables (conditional alphas, conditional betas and the joint of conditional alphas and betas) are jointly equal to zero. I will implement this test in this study to determine the existence of time-varying aphas and time-varying betas.

3.2. Unconditional Models

3.2.1. Jensen (1968) one-factor model

Jensen´s (1968) alpha is used as an unconditional measure of performance and is one of the most used by academics. This measure is the intercept (α_p) of the CAPM-based following regression:

$$r_{p,t} = \alpha_p + \beta_p r_{m,t} + \varepsilon_{p,t} \tag{1}$$

where $r_{p,t}$ represents the excess return of fund *p* over period *t*, β_p is the systematic risk of the fund *p*, $r_{m,t}$ represents the market`s excess return over the period *t*, and $\varepsilon_{p,t}$ is the error term. A statistically significant positive (negative) alpha indicates a superior (inferior) performance of the fund manager in relation to the market.

3.2.2. Carhart (1997) four-factor model

The four-factor Carhart (1997) model will be implemented. This performance model includes four risk factors: the three factors considered by Fama & French (1993), i.e., market $(r_{m,t})$, size

(SMB_t) and book-to-market (HML_t) factors, plus an additional factor that represents the 1-year momentum strategy (MOM_t). The model is expressed by the following equation:

$$r_{p,t} = \alpha_p + \beta_P r_{m,t} + \beta_{SMB}(SMB_t) + \beta_{HML}(HML_t) + \beta_{MOM}(MOM_t) + \varepsilon_{p,t} \quad (2)$$

where $r_{p,t}$ represents the excess return of fund *p*, $r_{m,t}$ represents the market`s excess return over the period *t*, SMB_t (small minus big) is the difference in returns between a portfolio of small stocks and a portfolio of large stocks, HML_t (high minus low) is the difference between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks, MOM_t (momentum) is the difference in return between a portfolio of past 1-year winners and a portfolio of past 1-year losers and the β_P, β_{SMB}, β_{HML} and β_{MOM} are the factor coefficients (betas on each of the factors).

3.2.3. Fama and French (2015) five-factor model

The five-factor model of Fama & French (2015) is one of the most recent model of performance evaluation. Fama & French (2015) stated that with the addition of profitability and investment factors, the value factor of the Fama & French (1993) three-factor model becomes redundant for describing average returns on the sample that the authors examined. The equation is the following:

$$r_{p,t} = \alpha_p + \beta_P r_{m,t} + \beta_{SMB}(SMB_t) + \beta_{HML}(HML_t) + \beta_{RMW}(RMW_t) + \beta_{CMA}(CMA_t) + \varepsilon_{p,t} \quad (3)$$

where $r_{p,t}$ represents the excess return of fund *p*, $r_{m,t}$ represents the market`s excess return over the period *t*, SMB_t (small minus big) is the difference in returns between a portfolio of small stocks and a portfolio of large stocks, HML_t (high minus low) is the difference between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks, RMW_t (profitability factor) is the difference between the returns on diversified portfolios of stocks with robust and weak profitability, CMA_t (investment factor) is the difference between the returns on diversified portfolios of the stocks of low and high investment firms (conservative and aggressive) and the β_P, β_{SMB}, β_{HML} , β_{RMW} and β_{CMA} are the factor coefficients (betas on each of the factors).

3.3. Conditional Models

In this study, only the full conditional model of Christopherson et al. (1998) will be applied. The conditional alphas and betas are defined as linear functions of a vector of predetermined information variables, Z_{t-1}, that represents the public information available at time *t-1* for predicting returns at time *t*.

This way the full conditional equation of Jensen`s (1968) alpha will be the following:

$$r_{p,t} = \alpha_p + A'_p z_{t-1} + \beta_p r_{m,t} + \beta'_p (z_{t-1} r_{m,t}) + \varepsilon_{p,t} \quad (4)$$

where the $r_{p,t}$ is the excess return of fund *p* over period *t*, the $r_{m,t}$ is the excess return of the market over period *t*, the α_p is an average alpha, the A'_p is a vector that measures the response of the conditional alpha to the information variables, $z_{t-1} = Z_{t-1} - E(Z)$ is a vector of deviations of Z_{t-1} from the (unconditional) average values, β_p is an average beta, which represents the (unconditional) mean of the conditional betas and β'_p is the vector that measures the response of the conditional beta of portfolio *p* to the public information variables. The conditional approach to multi-factor models is straightforward. Replacing the market return by a set of factor returns, the previous equation can be expressed as:

$$r_{p,t} = \alpha_p + A'_p z_{t-1} + \beta_p \lambda_{k,t} + \beta'_p (z_{t-1} \lambda_{k,t}) + \varepsilon_{p,t} \quad (5)$$

where $\lambda_{k,t}$ are the vector of factor returns.

To measure the state of the economy, Ferson & Schadt (1996) and Christopherson et al. (1998), among others, used five public information variables: the short term interest rate (TB) that is "a measure of expected inflation" (Fama & Schwert, 1977), the term spread (TS), which is a measure of the slope of the term structure of interest rates (economic conditions/cycles in a short term perspective (Fama & French, 1989)), the default spread (DS), that is the difference between the yields of high risk bonds and low risk bonds (economic conditions/cycles in a long term perspective (Fama & French, 1989)), the dividend yield (DY) of a market index (economic conditions/cycles in a long term perspective (Fama & French, 1989); Cochrane (2008)) and a variable dummy (D) for the month of January, resulting the evidence of higher returns in January (Keim & Stambaugh, 1986). The first four variables are considered as measures of the state of the economy, the January dummy aims to capture seasonality in returns and risk.[8]

[8] The January or turn-of-the-year effect is defined in the financial literature as positive risk-adjusted premium for holding a security in the month of January. Previous evidence seems to suggest that this January seasonality can be explained by the corresponding seasonality in the risk factor. (Cortez et al. 2009)

In this study, I follow Cortez et al. (2009) and use these five public information variables.

3.3.1. Conditional Jensen (1968) one-factor model

The full conditional model of the one-factor model is represented as:

$$r_{p,t} = \alpha_p + \alpha_{TB}(TB_{t-1}) + \alpha_{TS}(TS_{t-1}) + \alpha_{DS}(DS_{t-1}) + \alpha_{DY}(DY_{t-1}) + \alpha_D(D_t) + \beta_p r_{m,t} + \beta_{TB}(TB_{t-1} * r_{m,t}) + \beta_{TS}(TS_{t-1} * r_{m,t}) + \beta_{DS}(DS_{t-1} * r_{m,t}) + \beta_{DY}(DY_{t-1} * r_{m,t}) + \beta_D(D_t * r_{m,t}) + \varepsilon_{p,t} \quad (6)$$

where TB_{t-1}, TS_{t-1}, DS_{t-1} and DY_{t-1} represents the public information variables short-term interest rate, term spread, default spread and dividend yield, respectively, and D_t represents a dummy variable that assumes a value of 1 in the month of January and assumes a value of 0 in the other months. The same applies to the following two equations.

3.3.2. Conditional Carhart (1997) four-factor model

The full conditional model of the four-factor model is represented as:

$$r_{p,t} = \alpha_p + \alpha_{TB}(TB_{t-1}) + \alpha_{TS}(TS_{t-1}) + \alpha_{DS}(DS_{t-1}) + \alpha_{DY}(DY_{t-1}) + \alpha_D(D_t) + \beta_p r_{m,t} + \beta_{TB}(TB_{t-1} * r_{m,t}) + \beta_{TS}(TS_{t-1} * r_{m,t}) + \beta_{DS}(DS_{t-1} * r_{m,t}) + \beta_{DY}(DY_{t-1} * r_{m,t}) + \beta_D(D_t * r_{m,t}) + \beta_{SMB}(SMB_t) + \beta_{TB*SMB}(TB_{t-1} * SMB_t) + \beta_{TS*SMB}(TS_{t-1} * SMB_t) + \beta_{DS*SMB}(DS_{t-1} * SMB_t) + \beta_{DY*SMB}(DY_{t-1} * SMB_t) + \beta_{D*SMB}(D_t * SMB_t) + \beta_{HML}(HML_t) + \beta_{TB*HML}(TB_{t-1} * HML_t) + \beta_{TS*HML}(TS_{t-1} * HML_t) + \beta_{DS*HML}(DS_{t-1} * HML_t) + \beta_{DY*HML}(DY_{t-1} * HML_t) + \beta_{D*HML}(D_t * HML_t) + \beta_{MOM}(MOM_t) + \beta_{TB*MOM}(TB_{t-1} * MOM_t) + \beta_{TS*MOM}(TS_{t-1} * MOM_t) + \beta_{DS*MOM}(DS_{t-1} * MOM_t) + \beta_{DY*MOM}(DY_{t-1} * MOM_t) + \beta_{D*MOM}(D_t * MOM_t) + \varepsilon_{p,t} \quad (7)$$

3.3.4. Conditional Fama and French (2015) five-factor model

The full conditional model of the five-factor model is represented as:

$$r_{p,t} = \alpha_p + \alpha_{TB}(TB_{t-1}) + \alpha_{TS}(TS_{t-1}) + \alpha_{DS}(DS_{t-1}) + \alpha_{DY}(DY_{t-1}) + \alpha_D(D_t) + \beta_p r_{m,t} + \beta_{TB}\left(TB_{t-1} * r_{m,t}\right) + \beta_{TS}\left(TS_{t-1} * r_{m,t}\right) + \beta_{DS}\left(DS_{t-1} * r_{m,t}\right) + \beta_{DY}\left(DY_{t-1} * r_{m,t}\right) + \beta_D\left(D_t * r_{m,t}\right) + \beta_{SMB}(SMB_t) + \beta_{TB*SMB}(TB_{t-1} * SMB_t) + \beta_{TS*SMB}(TS_{t-1} * SMB_t) + \beta_{DS*SMB}(DS_{t-1} * SMB_t) + \beta_{DY*SMB}(DY_{t-1} * SMB_t) + \beta_{D*SMB}(D_t * SMB_t) + \beta_{HML}(HML_t) + \beta_{TB*HML}(TB_{t-1} * HML_t) + \beta_{TS*HML}(TS_{t-1} * HML_t) + \beta_{DS*HML}(DS_{t-1} * HML_t) + \beta_{DY*HML}(DY_{t-1} * HML_t) + \beta_{D*HML}(D_t * HML_t) + \beta_{RMW}(RMW_t) + \beta_{TB*RMW}(TB_{t-1} * RMW_t) + \beta_{TS*RMW}(TS_{t-1} * RMW_t) + \beta_{DS*RMW}(DS_{t-1} * RMW_t) + \beta_{DY*RMW}(DY_{t-1} * RMW_t) + \beta_{D*RMW}(D_t * RMW_t) + \beta_{CMA}(CMA_t) + \beta_{TB*CMA}(TB_{t-1} * CMA_t) + \beta_{TS*CMA}(TS_{t-1} * CMA) + \beta_{DS*CMA}(DS_{t-1} * CMA_t) + \beta_{DY*CMA}(DY_{t-1} * CMA_t) + \beta_{D*CMA}(D_t * CMA_t) + \varepsilon_{p,t} \quad (8)$$

4. Data

The fourth chapter will explain in detail the data that will be used to evaluate the performance of the green mutual funds.

Selecting the green funds was one of most important steps in this study. Despite the recent developments in green investing area, there still isn't one clarifying classification for this type of funds. One of the most used platforms used to identify the equity sector and the industry name is the Lipper Global Classification[9], however the environmental sector is not considered in this classification.

After analyzing the selection criteria used in previous studies on the performance of the green mutual funds, I chose to follow the methodology adopted by Chang et al. (2012) and Chung et al. (2012) to select the green funds. Chang et al. (2012) selected the green mutual funds that seek investments with positive (key: P) impact in at least one of the three areas of the "environment" category (climate/clean tech., pollution/toxics, environment/other) under Screening and Advocacy[10] provided by the US SIF. Chung et al. (2012) used the same method, but selected the green mutual funds with positive and restricted (key: R) investments in the same "environment" category. In this study only the funds with positive investments will be considered.

The green mutual funds of this study were identified by US SIF on January 31, 2016. The sample only includes US equity mutual funds and excludes bond funds, balanced and guaranteed funds, as well as index and institutional funds, as in Climent & Soriano (2011). Funds with less than 24-months of age were also excluded from the sample. The monthly returns and the total net asset (TNA) of the funds were obtained from the Center for Research in Security Prices (CRSP) Survivor-Bias-Free US Mutual Fund database. In case of funds with different share classes, only the oldest one was selected (Bello (2005); Cortez et al. (2012)). In case of this, I chose the fund with higher total net asset (TNA). In the end, the study included a sample of 16 US green mutual funds covering the period from May 1990 to September 2014. Although some funds have an

[9] The purpose of the Lipper Global Classification (LGC) is to create homogeneous groups of funds with comparable investment objectives. Funds within one LGC sector invest in the same financial markets or specific segments of those markets but may adopt different investment strategies or styles to achieve their investment objectives.
(https://lipperweb.com/docs/Research/Methodology/Lipper_Global_Classifications_Definitions2014.pdf accessed on December 14, 2016)

[10] http://charts.ussif.org/mfpc/

inception date before the time period of this study, May 1990 was selected because of the availability of the data of the benchmarks that are explained next.

To assess the performance of green funds, two portfolios were constructed: an equally weighted portfolio, with the average monthly returns of each fund, and a value weighted portfolio that also considers the size of the fund. Next we present both formulas (n represents the number of sample funds, which is 16 in this study):

$$Equally\ Weighted = \frac{\sum_i^n return_i}{n} \tag{9}$$

$$Value\ Weighted = \frac{\sum_i^n (return_i * TNA_i)}{\sum_i^n TNA_i} \tag{10}$$

In this study, two benchmarks were used, a conventional and a socially responsible benchmark, in order to analyze the exposure of green investing to each of these indices.

The conventional benchmark used in the study was the Standard & Poor`s 500 index (S&P500). This index includes the top 500 companies in various economic sectors in the US market and, therefore, is a very representative index of the US market. It is widely used in the literature on the investment fund context, namely by Statman (2000), Bello (2005) and Climent & Soriano (2011). The benchmark used to represent the green sector was the MSCI KLD 400 index[11]. This benchmark is typically used as a socially responsible index (Statman (2000); Bello (2005)) and a widely recognized benchmark for measuring the impact of social and environmental screenings on investment portfolios (Climent & Soriano 2011). This last author used the FTSE KLD Global Climate 100 Index (GC100)[12] to represent the green sector. However, this benchmark is

[11] The MSCI KLD 400 Social Index is a capitalization weighted index of 400 US securities that provides exposure to companies with outstanding Environmental, Social and Governance (ESG) ratings and excludes companies whose products have negative social or environmental impacts. The Index is designed for investors seeking a diversified benchmark comprised of companies with strong sustainability profiles while avoiding companies incompatible with values screens. Launched in May 1990 as the Domini 400 Social Index, it is one of the first SR indexes. Constituent selection is based on data from MSCI ESG Research. (https://www.msci.com/resources/factsheets/index_fact_sheet/msci-kld-400-social-index.pdf accessed on December 15, 2016)

[12] The MSCI Global Climate Index is an equal weighted index of companies that operate in three key environmental areas: clean technology and efficiency, renewable energy, and future fuels. The index is designed to include companies that are leaders in mitigating immediate and long-term factors that contribute to climate change and that may potentially benefit from the de-carbonization of the economy. (https://www.msci.com/resources/factsheets/index_fact_sheet/msci-global-climate-index.pdf accessed on April 20, 2016)

constituted by several countries, being a global index. As my study is concentrated only in the US market, the usage of this global index may lead to biased estimates of mutual fund performance. As far as we know, there is no other index available more appropriated to represent the US green sector.

The data on both benchmarks were extracted from Datastream database and discrete monthly returns were computed for each one, in order to maintain the consistency with the data extracted from the CRSP database and from the website of Professor Kenneth R. French[13].

The 1-month Treasury Bill from the website of Professor Kenneth R. French[14], will be used as a proxy of risk-free rate. The risk factors, such as the SMB factor, the HML factor, the MOM factor, the RMW factor and the CMA factor, were extracted from the same website.

In order to apply the conditional approach, five publicly available information variables were considered: the short-term rate, the term spread, the dividend yield, the default spread and the dummy variable for the month of January. Cortez et al. (2009) used the same variables. The short-term rate is the 1-month US Treasury bill yield from the website of Kenneth R. French. The term spread is calculated as the difference between a constant-maturity US Treasury bond yield and a constant-maturity 3-month US Treasury bill yield. The default spread is measured by the difference between the Moody`s US BAA-rated corporate bond yield and the Moody`s AAA-rated US corporate bond yield. The dividend yield is based on the S&P500 index. The information to compute term spread, the default spread and the dividend yield was extracted from the website Federal Reserve[15]. As these variables tend to be highly persistent, a potential problem that might arise is the bias resulting from the spurious regressions (Cortez et al. 2009). Therefore, I used the procedure of Ferson et al. (2003) to detrend these variables by subtracting a 12-month moving average. In order to minimize possible scale effects on the results, these variables are used in their corresponding mean zero values (Bernhardt & Jung 1979).

Table I shows the list of all green mutual funds used on this study.

[13] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

[14] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html (accessed on January 8, 2016)

[15] http://www.federalreserve.gov/releases/h15/data.htm (accessed on January 9, 2016)

TABLE I - List of US green mutual funds

Funds	Type	US Green Mutual Funds	Ticker	Inception Date
Fund 1	Equity Mid-Small Cap	Ariel Appreciation Fund	CAAPX	dez-89
Fund 2	All Cap	Ariel Focus Fund	ARFFX	jun-05
Fund 3	Equity Mid-Small Cap	Ariel Fund	ARGFX	nov-86
Fund 4	Equity Large-Cap	Brown Advisory Sustainable Growth Fund - Investor Class Shares	BIAWX	jun-12
Fund 5	Equity Large-Cap	Green Century Equity	GCEQX	set-95
Fund 6	Equity Large-Cap	Neuberger Berman Socially Resp R3	NRARX	mai-09
Fund 7	Equity Large-Cap	Parnassus Core Equity Fund	PRBLX	ago-92
Fund 8	Equity Specialty	Parnassus Endeavor Fund	PARWX	abr-05
Fund 9	All Cap	Parnassus Fund	PARNX	dez-84
Fund 10	Equity Mid-Small Cap	Parnassus Mid Cap Fund	PARMX	abr-05
Fund 11	Equity Mid-Small Cap	Praxis Small Cap Fund A	MMSCX	mai-07
Fund 12	Equity Large-Cap	Sentinel Sustainable Core Opportunities Fund (A Shares)	MYPVX	jun-96
Fund 13	Equity Mid-Small Cap	Sentinel Sustainable Mid Cap Opportunities Fund (A Shares)	WAEGX	fev-94
Fund 14	Equity Specialty	TIAA-CREF Social Choice Equity Retirement	TRSCX	out-02
Fund 15	Equity Mid-Small Cap	Walden Small Cap Innovations Fund	WASOX	out-08
Fund 16	Equity Mid-Small Cap	Walden SMID Cap Innovations Fund	WASMX	jun-12

This table shows the 16 US green mutual funds that were used in this study. This table also reports the type of each fund, the ticker and the inception date provided from US SIF.

5. Empirical Results

The fifth chapter presents the results of the regressions and discusses the performance of the US green mutual funds, applying all the methodologies referred previously. First, the unconditional one-factor and multi-factor models (Jensen (1968), Carhart (1997) and Fama & French (2015)) and then, the conditional approach suggested by Christopherson et al. (1998), applied to each model.

In order to adjust the errors of autocorrelation and heteroscedasticity of the excesses returns of the funds, the approach of Newey & West (1994) will be used, as in Climent & Soriano (2011).

5.1 Performance of the Unconditional Models

5.1.1. Jensen (1968) one-factor model

This model, despite being very criticized by many authors, is often used by researchers to evaluate the performance of the mutual funds.

TABLE II – Empirical results of the unconditional one-factor model

Panel A: Benchmark S&P500				Panel B: Benchmark KLD400			
Portfolios	α_P	β_p	$Adj. R^2$	Portfolios	α_P	β_p	$Adj. R^2$
Equally W.	0.000468	0.995514***	0.867893	Equally W.	0.000312	0.952817***	0.840800
Value W.	0.000537	0.989473***	0.784111	Value W.	0.000367	0.949232***	0.763167
N-	6 [0]	0 [0]	-	N-	6 [1]	0 [0]	-
N+	10 [3]	16 [16]	-	N+	10 [3]	16 [16]	-

This table presents regression estimates for equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10) for the US green mutual funds, obtained by the regression of the one-factor model (eq. 1) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj. R^2$). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

By observing Table II, it can be verified that all the alphas are positive, however, none of them are statistically significant. Individually (see Appendix 1), there are 6 funds (in both panel A and B) with negative alpha coefficient, however there is no evidence of statistical significance. The remaining funds present a positive performance with 3 funds statistically significant in each panel. This means that, in general, the performance is neutral and that the green funds cannot beat the market. The findings on Panel B corroborate the results of Climent & Soriano (2011). However, those authors showed that green funds underperform the market using the market benchmark (S&P500), which is against my findings in Panel A. White (1995), for US market and Ibikunle & Steffen (2015), for European market, also found evidence of underperformance. However, when Climent & Soriano (2011) focused on a more recent period (2001 – 2009), the environmental funds and the market did not perform differently.

The systematic risk of the portfolios that are using the market benchmark (S&P500) is higher comparing to the portfolios using the green benchmark (KLD400), implying that green funds are more exposed to the first one. In relation to $Adj. R^2$, the higher values are associated with the portfolios that use the market benchmark. These two findings corroborate the study of Climent & Soriano (2011).

5.1.2. Carhart (1997) four-factor model

Many authors defended that a multi-factor model improves the performance estimation (Bauer et al. (2005), Derwall et al. (2005) and Climent & Soriano (2011), for example). This multi-factor model added three risk factors to the previous model of Jensen (1968), the size factor (SMB), the book-to-market factor (HML) and the momentum factor (MOM).

Table III contains the results from the four-factor model and Appendix 2 contains the results for individual funds.

TABLE III – Empirical results of the unconditional four-factor model

Panel A: Benchmark S&P500						
Portfolios	α_P	β_p	β_{SMB}	β_{HML}	β_{MOM}	$Adj. R^2$
Equally W.	0.000315	0.956960***	0.369523***	0.099852***	-0.061663***	0.931682
Value W.	-0.000230	0.959135***	0.458813***	0.178666***	-0.051780***	0.880264
N-	5 [0]	0 [0]	0 [0]	10 [3]	12 [5]	-
N+	11 [4]	16 [16]	16 [14]	6 [4]	4 [1]	-

Panel B: Benchmark KLD400						
Portfolios	α_P	β_p	β_{SMB}	β_{HML}	β_{MOM}	$Adj. R^2$
Equally W.	-0.000006	0.922759***	0.340938***	0.149513***	-0.055273**	0.896464
Value W.	-0.000574	0.927239***	0.429880***	0.229273***	-0.044689*	0.850857
N-	6 [0]	0 [0]	1 [0]	7 [2]	10 [4]	-
N+	10 [3]	16 [16]	15 [13]	9 [5]	6 [1]	-

This table presents regression estimates for equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10) of the US green mutual funds, obtained by the regression of the four-factor model (eq. 2) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj. R^2$). Additionally, the regressions coefficients of size (SMB), book-to-market (HML) and momentum (MOM) factors are reported. The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

By observing Table III, with the additional three risk factors, I found that the performance estimates remain neutral, being consistent with the previous one-factor model. The introduction of those factors did not have a significant impact in the funds' performance. However, with this multi-factor model, the alphas are in general negative but not statistically significant. The alphas show a neutral performance compared to the market which corroborates Climent & Soriano (2011) and Muñoz et al. (2014) results. Individually, the alphas show a positive tendency. In Panel A there are 5 funds with negative alpha coefficient and 11 with positive alpha coefficient. Regarding Panel B, there are 6 funds with negative alpha coefficient and 10 with positive alpha coefficient. As for the funds with negative performance there is no evidence of statistical significance. On the other hand, there are 4 and 3 funds, in each panel, statistically significant.

Another important observation is related to $Adj. R^2$, that suffers an increase compared to the one-factor model. This finding corroborates the literature and confirms the expectation that multi-factor models are superior in explaining mutual funds returns. The same result was obtained by Bauer et al. (2005) and Climent & Soriano (2011). However, Ibikunle & Steffen (2015) showed that the multi-factor model does not improved the explanatory power of the model.

In relation to the market risk, once again, it presents higher values when the market benchmark (S&P500) is considered. This implies once again that the green mutual funds are still more exposed to the market benchmark.

With respect to the risk factors, the results show that green mutual funds are more exposed to the size (SMB) factor, presenting higher values than the book-to-market (HML) and momentum (MOM) factors, which corroborates Climent & Soriano (2011) and Chung et al. (2012) results. Individually, for the SMB factor, there are 16 funds with positive betas in Panel A and 14 of them are statistically significant. In Panel B there are 15 funds with positive betas, 13 of them being statistically significant. This means that green funds are more exposed to small cap stocks. Ibikunle & Steffen (2015) stated the same for the European green funds.

The same occurs to the HML factor, with positive values and all statistically significant, showing that green funds are more exposed to value stocks than to growth stocks, which is consistent with Climent & Soriano (2011). However, when Climent & Soriano (2011) focused on the period of 2001 – 2009, the HML factor turned to negative and statistically significant, showing a superior exposure to growth stocks. Ibikunle & Steffen (2015) also stated that European green funds are more exposed to growth stocks. Individually, in Panel A, there are 10 funds with negative betas, 3 of them being statistically significant, and 6 funds with positive betas, 4 being statistically significant. In Panel B, there are 7 funds with negative betas and 9 with positive betas, 2 and 5 of them, respectively, being statistically significant. The results of the individual analysis is not very conclusive. However, there is more evidence of funds with positive betas than funds with negative betas.

The MOM factor shows negative and statistically significant values, showing that green funds are more exposed to companies with poor past performance. This can also be confirmed by the individual results. There is a slight majority of the negative performances, 12 in Panel A and 10 in Panel B, 5 and 4 funds, respectively, being statistically significant. Climent & Soriano (2011) found negative but not statistically significant values for this risk factor.

5.1.3. Fama and French (2015) five-factor model

The results of the Fama & French (2015) five-factor model are presented in Table IV and Appendix 3 contains the results for individual funds. Comparing to the previous model, this approach excludes the momentum (MOM) factor and adds the profitability (RMW) and the investment (CMA) factors.

TABLE IV – Empirical results of the unconditional five-factor model

Panel A: Benchmark S&P500							
Portfolios	α_P	β_P	β_{SMB}	β_{HML}	β_{RMW}	β_{CMA}	$Adj.R^2$
Equally W.	-0.001015	1.004062***	0.415512***	-0.001232	0.161635***	0.022870	0.933572
Value W.	-0.001652*	1.006386***	0.538296***	0.073491*	0.209391***	0.002448	0.890748
N-	6 [0]	0 [0]	0 [0]	10 [1]	5 [1]	8 [3]	-
N+	10 [4]	16 [16]	16 [13]	6 [3]	11 [2]	8 [3]	-
Panel B: Benchmark KLD400							
Portfolios	α_P	β_P	β_{SMB}	β_{HML}	β_{RMW}	β_{CMA}	$Adj.R^2$
Equally W.	-0.000930	0.951185***	0.351179***	0.065411*	0.091869**	-0.004603	0.893692
Value W.	-0.001588	0.95534***	0.473953***	0.140128***	0.140341***	-0.023615	0.856652
N-	6 [0]	0 [0]	1 [0]	7 [1]	9 [1]	8 [3]	-
N+	10 [5]	16 [16]	15 [11]	9 [5]	7 [3]	8 [3]	–

This table presents regression estimates for equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10) of the US green mutual funds, obtained by the regression of the five-factor model (eq. 3) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014 It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj.R^2$). Additionally, the coefficients of size (SMB), book-to-market (HML), profitability (RMW) and investment (CMA) factors are reported. The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

The first observation of Table IV is related to the performance. With the inclusion of the two risk factors and compared to the previous four-factor model, the performance estimates, once again, remain neutral. However, in Panel A, the value weighted portfolio reports a negative and a statistically significant alpha. It is the first sign that green funds underperform the market. Despite this result, in general, the results show a neutral performance between the green funds and the market, being consistent with the one-factor model and the four-factor model. Individually, only the funds with positive alpha coefficient (10 in each panel) show evidence of statistical significance (4 funds in Panel A and 5 funds in Panel B).

The green mutual funds are more sensitive to the benchmark of the market than to the socially responsible benchmark, which is consistent with the previous findings.

The size factor remains the most relevant one, with positive values and all statistically significant at a level of 1%. Individually, there are 16 (Panel A) and 15 (Panel B) funds with positive betas and the majority (13 in Panel A and 11 in Panel B) are statistically significant. This means that the green funds are more exposed to small caps, being in line with the four-factor model.

The book-to-market factor shows, in general, positive and statistically significant values, indicating that green funds are more exposed to value stocks, which is consistent with Climent & Soriano (2011). However, once again, when Climent & Soriano (2011) focused on the period of 2001 – 2009, the green funds showed a superior exposure to growth stocks. By the individual analysis, the scenario is very similar to the previous four-factor model, where there is more statistical evidence of funds with positive betas.

In relation to the two additional factors, the profitability factor presents positive and statistically significant values, indicating that the green funds are more exposed to companies with robust profitability. Individually, the results are inconclusive. Otherwise, the investment factor shows neutral influence in explaining the performance of green funds.

Regarding $Adj.R^2$, the five-factor model produces similar results of those obtained from the four-factor model. However, a very slight increase is observable in the explanatory power of the model compared to the four-factor model. Concerning unconditional models, the explanatory power of the five-factor model from Fama & French (2015) is highest among the other models.

5.2. Performance of the Conditional Models

As mentioned in the methodology, the full conditional model of Christopherson et al. (1998) will be applied in both one-factor and multi-factor models, allowing alphas and betas to be time varying. The public information variables used are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D).

The conditional models have already been shown to be more capable to produce better estimations than the unconditional models by the increase of the $Adj.R^2$, as stated by Cortez et al. (2009) and Cortez et al. (2012), for example.

For each model the Wald Test was performed in order to test the null hypothesis that the coefficients of public information variables (conditional alphas, conditional betas and the joint conditional alphas and betas) are equal to zero.

5.2.1. Full Conditional Jensen (1968) one-factor model

The following regression presents the estimates of the full conditional model of Jensen (1968), with both performance (alpha) and risk (beta) to be time-varying. Appendix 4 contains the results for individual funds.

TABLE V – Empirical results of the full conditional one-factor model

Panel A: Benchmark S&P500															
Portfolios	α_P	α_{TB}	α_{TS}	α_{DS}	α_{DY}	α_D	β_p	β_{TB}	β_{TS}	β_{DS}	β_{DY}	β_D	W_1	W_2	W_3	$Adj.R^2$
Equally W.	0.001478	-6.492103***	-0.001850	0.002337	-0.008567	0.002461	0.963244***	31.767300	0.028229	0.072896	0.249229*	-0.112321	2.696460**	3.362912***	2.962025***	0.876238
Value W.	0.001661	-6.479545*	-0.000906	-0.001999	-0.008039	-0.002874	0.955869***	103.376400	0.060674	0.258398**	0.060245	-0.125195	1.621816	2.713887**	2.159468**	0.792383
N-	5 [1]	10 [1]	2 [0]	7 [0]	5 [0]	8 [1]	0 [0]	4 [0]	9 [0]	4 [0]	9 [2]	10 [0]				-
N+	11 [3]	6 [1]	14 [2]	9 [0]	11 [0]	8 [4]	16 [14]	12 [1]	7 [0]	12 [3]	7 [1]	6 [0]				-
Panel B: Benchmark KLD400																
Portfolios	α_P	α_{TB}	α_{TS}	α_{DS}	α_{DY}	α_D	β_p	β_{TB}	β_{TS}	β_{DS}	β_{DY}	β_D	W_1	W_2	W_3	$Adj.R^2$
Equally W.	0.001871	-3.608190	-0.001297	0.006257	-0.015760**	0.000425	0.906015***	-17.216770	0.022514	0.047651	0.305532**	-0.153086*	1.551277	3.950115***	2.842708***	0.850280
Value W.	0.002027	-3.608125	-0.000400	0.001561	-0.014262	-0.004762	0.901421***	38.672520	0.057482	0.222542*	0.100711	-0.168960	1.063638	2.822708**	2.121884**	0.771959
N-	4 [1]	7 [0]	3 [0]	3 [0]	12 [3]	9 [2]	0 [0]	4 [0]	7 [0]	4 [0]	6 [1]	10 [3]				
N+	12 [5]	9 [2]	13 [1]	13 [1]	4 [0]	7 [3]	16 [15]	12 [1]	9 [0]	12 [2]	10 [2]	6 [0]				

This table presents regression estimates for equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10) of US green mutual funds, obtained by the regression of the full conditional one-factor model (eq. 6) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj.R^2$). The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). W_1 tests the hypothesis that the additional factors resulting from time-varying alphas are equal to zero. W_2 tests the hypothesis that the additional factors resulting from time-varying betas are equal to zero. W_3 tests the hypothesis that the additional factors resulting from both time-varying alphas and betas are jointly equal to zero. N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

The first conclusion that can be drawn about Table V is an increase in $Adj. R^2$ compared to the unconditional one-factor model. This finding corroborates Cortez et al. (2009) and Cortez et al. (2012) results, who stated that a conditional approach has a higher explanatory power than an unconditional one.

The performance estimates remain neutral compared to the unconditional one-factor model. The alphas present positive but not statistically significant values. Individually, there are 11 (Panel A) and 12 (Panel B) funds with positive alpha coefficient but only 3 and 5 funds, respectively, are statistical significant. This means that the green funds have a neutral performance comparing to the market, being consistent with my previous findings in the unconditional models.

The green funds are still more sensitive to the benchmark of the market (S&P500) than to the benchmark of the sector (KLD400). These findings are in line with my previous results in the unconditional models.

By the observation of the Wald test, I cannot reject the null hypothesis that the conditional alphas are equal to zero (excepting for the equally weighted portfolio in Panel A), meaning that the performance of green funds does not vary throughout time according to the public information variables. Cortez et al. (2012) mentioned that this fact is not surprising, considering the restrictions imposed in this type of funds may contribute to more stable performance over time. However, the scenario changes for the conditional betas. In this case, I reject the null hypothesis that the conditional betas are equal to zero, meaning that risk varies over time according to the public information variables. Moreover, the same occurred to the joint coefficients of conditional alphas and betas.

5.2.2. Full Conditional Carhart (1997) four-factor model

Table VI presents the results of the regression of the full conditional model of Carhart (1997) four-factor model and Appendix 5 and 6 contains the results for individual funds.

TABLE VI – Empirical results of the full conditional four-factor model

	Panel A: Benchmark S&P500				Panel B: Benchmark KLD400			
Portfolios	Equaly-weighted	Value-weighted	N-	N+	Equaly-weighted	Value-weighted	N-	N+
α_P	0.000741	0.000808	3 [0]	11 [3]	0.000729	0.000738	1 [0]	13 [8]
α_{TB}	-3.4554*	-3.141435	6 [0]	8 [0]	-1.033705	-0.509804	5 [0]	9 [2]
α_{TS}	-0.003373*	-0.003593	8 [0]	6 [2]	-0.002609	-0.002837	9 [0]	5 [1]
α_{DS}	0.001182	-1.98E-05	7 [0]	7 [1]	0.004396	0.003113	2 [0]	12 [3]
α_{DY}	-0.006001	-0.007424	8 [3]	6 [0]	-0.013326**	-0.014295*	12 [7]	2 [0]
α_D	-0.004581*	-0.00795**	8 [2]	6 [1]	-0.005782*	-0.008848**	11 [3]	3 [0]
β_p	0.942971***	0.945834***	0 [0]	14 [14]	0.891184***	0.894543***	0 [0]	14 [14]
β_{TB}	32.01859	130.7212*	6 [0]	8 [1]	-40.83541	30.39265	9 [0]	5 [1]
β_{TS}	0.024488	0.089397	6 [0]	8 [2]	-0.005013	0.052263	6 [0]	8 [2]
β_{DS}	-0.048264	-0.00066	7 [1]	7 [1]	-0.034496	-0.007623	8 [1]	6 [1]
β_{DY}	0.260569**	0.244075	5 [1]	9 [2]	0.273287*	0.241295	3 [1]	11 [4]
β_D	-0.076087	-0.100524	8 [0]	6 [0]	-0.125885	-0.153285	9 [0]	5 [0]
β_{SMB}	0.339965***	0.442598***	2 [0]	12 [10]	0.328321***	0.430602***	1 [0]	13 [9]
β_{SMB*TB}	-87.59973	-26.33595	8 [0]	6 [0]	-217.5268***	-167.5295	6 [0]	8 [0]
β_{SMB*TS}	0.049713	0.11161	4 [0]	10 [0]	-0.113532	-0.058463	7 [1]	7 [0]
β_{SMB*DS}	-0.08189	0.065536	7 [0]	7 [1]	-0.117313	0.025954	8 [0]	6 [0]
β_{SMB*DY}	0.059439	0.089467	8 [0]	6 [1]	0.082025	0.124191	5 [0]	9 [2]
β_{SMB*D}	0.171637*	0.019919	8 [3]	6 [2]	0.135478	-0.0167	8 [3]	6 [1]
β_{HML}	0.032671	0.086905**	10 [4]	4 [2]	0.074987**	0.12822***	8 [2]	6 [4]
β_{HML*TB}	-0.672213	32.55139	4 [1]	10 [0]	-75.00694	-49.5722	2 [1]	12 [0]
β_{HML*TS}	-0.012976	0.036706	6 [1]	8 [0]	-0.126328	-0.075257	8 [1]	6 [1]
β_{HML*DS}	-0.351703***	-0.457802**	11 [3]	3 [0]	-0.422302**	-0.523184**	10 [4]	4 [0]
β_{HML*DY}	0.321561	0.807307***	2 [0]	12 [2]	0.246292	0.728368**	3 [0]	11 [2]
β_{HML*D}	0.226988**	0.211725	2 [0]	12 [1]	0.241492*	0.223685	1 [0]	13 [3]
β_{MOM}	-0.049669**	-0.072279**	12 [5]	2 [1]	-0.033297	-0.053469	9 [3]	5 [3]
β_{MOM*TB}	-74.7348*	-17.66919	11 [4]	3 [0]	-62.4277	-6.569847	11 [3]	3 [0]
β_{MOM*TS}	0.020027	0.074054	8 [1]	6 [2]	0.034152	0.089545	8 [1]	6 [2]
β_{MOM*DS}	-0.237625***	-0.23245***	13 [4]	1 [0]	-0.222936***	-0.223111**	12 [3]	2 [0]
β_{MOM*DY}	0.162034	0.496231***	4 [0]	10 [3]	0.077185	0.409019**	3 [1]	11 [4]
β_{MOM*D}	0.027884	0.110241	8 [1]	6 [2]	-0.013492	0.06509	10 [2]	4 [2]
W_1	1.273028	1.415326			1.570032	1.616686		
W_2	5.024230***	2.191811***			1.977912***	1.488622*		
W_3	4.938883***	2.014428***			1.876416***	1.510645*		
$Adj. R^2$	0.938729	0.890016	-	-	0.903832	0.85723	-	-

This table presents regression estimates for equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10) of the US green mutual funds, obtained by the regression of the full conditional four-factor model (eq. 7) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj. R^2$). Additionally, the conditional coefficients of size (SMB), book-to-market (HML) and momentum (MOM) factors are reported. The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). W_1 tests the hypothesis that the additional factors resulting from time-varying alphas are equal to zero. W_2 tests the hypothesis that the additional factors resulting from time-varying betas are equal to zero. W_3 tests the hypothesis that the additional factors resulting from both time-varying alphas and betas are jointly equal to zero. N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

Once more, the conditionality of the model did not improve the performance estimates. Table VI shows that green funds have a neutral performance comparing to the market. All the values of alpha are positive but not statistically significant, which remains consistent with my previous findings. Individually, there are more funds showing positive alpha coefficient than negative alpha coefficient (11 funds in the Panel A and 13 funds in the Panel B, being 3 and 8 funds statistically significant, respectively).

The green mutual funds remain more sensitive to the benchmark of the market than to the socially responsible benchmark.

The size and the book-to-market factors show positive and statistically significant values. Once again, according to the previous results on the unconditional four-factor model, the green funds are more exposed to small caps and more exposed to value stocks. The momentum factor presents negative values for both panels, although only with the benchmark of the market, these values are statistically significant. In general, the green funds are more exposed to companies with poor past performance, which is consistent with the results of the unconditional four-factor model.

The values of $Adj.R^2$ are higher compared to the full conditional one-factor model. Until now, this model is the one with the most explanatory power, presenting the highest value of $Adj.R^2$ of all models.

The conclusions about the Wald test are very similar to the results from the previous model. The performance of green funds does not vary over time according to the public information variables but risk does.

5.2.3. Full Conditional Fama & French (2015) five-factor model

Table VII presents the results of the regression of the full conditional model of Fama & French (2015) five-factor model and Appendix 7 and 8 contains the results from the individual analysis.

TABLE VII – Empirical results of the full conditional five-factor model

	Panel A: Benchmark S&P500				Panel B: Benchmark KLD400			
Portfolios	Equally-weighted	Value-weighted	N-	N+	Equally-weighted	Value-weighted	N-	N+
α_P	-0.00021	-0.001009	3 [0]	10 [2]	-0.0000349	-0.000918	3 [0]	10 [4]
α_{TB}	-1.369716	-0.197254	4 [0]	9 [0]	1.551551	3.049258	2 [0]	11 [1]
α_{TS}	-0.001451	-0.00158	6 [0]	7 [2]	-0.0000512	-0.0000419	3 [0]	10 [0]
α_{DS}	0.003046	-0.002727	6 [2]	7 [0]	0.007529	0.001897	2 [0]	11 [1]
α_{DY}	-0.004295	-0.002792	7 [1]	6 [1]	-0.011415*	-0.00924	10 [2]	3 [0]
α_D	-0.001655	-0.006765*	6 [1]	7 [2]	-0.003537	-0.008614**	8 [3]	5 [1]
β_p	0.958106***	0.986638***	0 [0]	13 [13]	0.900801***	0.928968***	0 [0]	13 [13]
β_{TB}	-32.03952	28.27363	8 [1]	5 [1]	-75.72066	-47.93622	8 [1]	5 [1]
β_{TS}	-0.017931	0.058298	8 [0]	5 [1]	-0.054851	0.011572	8 [0]	5 [1]
β_{DS}	-0.014188	0.113706	3 [0]	10 [0]	-0.01758	0.102193	5 [0]	8 [1]
β_{DY}	0.234832*	0.132227	10 [2]	3 [1]	0.214695	0.074416	7 [1]	6 [1]
β_D	-0.090332	-0.102409	7 [1]	6 [1]	-0.115808	-0.118735	7 [1]	6 [0]
β_{SMB}	0.405895***	0.532343***	0 [0]	13 [10]	0.349435***	0.4757***	1 [1]	12 [8]
β_{SMB*TB}	-61.08314	-31.13292	9 [3]	4 [0]	-200.3435**	-184.2124*	11 [0]	2 [2]
β_{SMB*TS}	0.02642	0.06058	10 [0]	3 [0]	-0.097836	-0.074881	10 [0]	3 [1]
β_{SMB*DS}	-0.023436	0.281039	6 [0]	7 [0]	0.024863	0.316006	4 [0]	9 [0]
β_{SMB*DY}	-0.018822	-0.202733	7 [1]	6 [0]	-0.173797	-0.348973	7 [0]	6 [0]
β_{SMB*D}	0.170293*	-0.144645	3 [0]	10 [1]	0.161874	-0.158002	6 [0]	7 [2]
β_{HML}	-0.016514	0.034679	8 [1]	5 [1]	0.037832	0.08806	5 [0]	8 [3]
β_{HML*TB}	214.9712***	289.305**	4 [0]	9 [1]	256.548**	335.7594**	3 [0]	10 [2]
β_{HML*TS}	0.160396**	0.098947	4 [0]	9 [0]	0.211369**	0.153055	6 [0]	7 [0]
β_{HML*DS}	0.269447*	0.212458	4 [0]	9 [2]	0.011665	-0.052415	6 [0]	7 [0]
β_{HML*DY}	-0.466672**	-0.270502	8 [2]	5 [1]	0.018419	0.227134	6 [1]	7 [0]
β_{HML*D}	0.02018	-0.039258	8 [1]	5 [0]	0.050156	-0.010855	7 [1]	6 [0]
β_{RMW}	0.170022***	0.233155***	3 [1]	10 [2]	0.108669**	0.171679***	7 [1]	6 [2]
β_{RMW*TB}	-10.83916	-122.3072	8 [1]	5 [0]	-46.02049	-170.2986	9 [1]	4 [0]
β_{RMW*TS}	-0.071299	-0.082946	9 [0]	4 [0]	-0.017833	-0.034968	9 [0]	4 [0]
β_{RMW*DS}	0.035344	0.330304	5 [0]	8 [1]	-0.046741	0.220529	5 [0]	8 [1]
β_{RMW*DY}	0.079441	0.128403	7 [2]	6 [0]	0.114336	0.137318	7 [2]	6 [0]
β_{RMW*D}	0.080271	-0.123855	5 [0]	8 [1]	0.007899	-0.202686	5 [0]	8 [4]
β_{CMA}	-0.016084	-0.019068	7 [2]	6 [2]	-0.041047	-0.042901	7 [2]	6 [2]
β_{CMA*TB}	-405.3014***	-420.7186**	7 [4]	6 [0]	-584.453***	-637.2508***	7 [4]	6 [1]
β_{CMA*TS}	-0.280641**	-0.045957	6 [3]	7 [0]	-0.594542***	-0.384142**	8 [4]	5 [0]
β_{CMA*DS}	-0.93339***	-0.91548***	8 [6]	5 [1]	-0.530792*	-0.497729	6 [2]	7 [1]
β_{CMA*DY}	0.7475**	0.711884	4 [2]	9 [2]	-0.149467	-0.240224	5 [0]	8 [0]
β_{CMA*D}	0.137579	0.262681	4 [0]	9 [1]	0.156783	0.29585	6 [0]	7 [1]
W_1	0.377519	1.334129			1.114093	1.478296		
W_2	3.940171***	3.950193***			5.254220***	1.525910*		
W_3	5.298572***	4.642682***			4.982266***	1.426759*		
$Adj. R^2$	0.942438	0.8963	-	-	0.906123	0.862774	-	-

This table presents regression estimates for equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10) of the US green mutual funds, obtained by the regression of the full conditional five-factor model (eq. 8) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj. R^2$). Additionally, the conditional coefficients of size (SMB), book-to-market (HML), profitability (RMW) and investment (CMA) factors are reported. The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). W_1 tests the hypothesis that the additional factors resulting from time-varying alphas are equal to zero. W_2 tests the hypothesis that the additional factors resulting from time-varying betas are equal to zero. W_3 tests the hypothesis that the additional factors resulting from both time-varying alphas and betas are jointly equal to zero. N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

As it was observable in the full conditional one-factor model and in the full conditional four-factor model, using the full conditional five-factor model did not improve the performance estimates of the funds. Green funds still have neutral performance compared to the market. This model presents negative but not statistically significant values. Individually, the scenario remains very similar comparing to the previous models. There are more funds with positive alpha coefficient (10 funds in each panel, being 2 (Panel A) and 4 (Panel B) funds statistically significant) than funds with negative alpha coefficient (3 funds in each panel and none of them statistically significant).

Once again, the green mutual funds tend to be more sensitive to the benchmark of the market than to the socially responsible benchmark.

In this model, the size factor presents positive and statistically significant values, meaning that the green funds are more exposed to small caps, which is consistent with my previous findings. With the individual analysis, I can conclude the same. There are 13 (Panel A) and 12 (Panel B) funds with positive betas, being 10 and 8 funds, respectively, being statistically significant. In terms of the book-to-market factor, with the five-factor model, this risk factor shows a neutral influence which is against my previous findings.

In relation to the profitability factor, the portfolios present positive and statistically significant values, indicating that the green funds are more exposed to companies with robust profitability. The individual analysis tell us that there are 10 funds with positive performance (2 funds with statistical significance) in Panel A, and 6 funds (2 funds with statistical significance) in Panel B. The investment factor presents negative but not statistically significant values, having a neutral influence. Individually, the scenario is exactly the same for both Panel A and Panel B. There are 6 funds with positive betas, 2 of them being statistically significant, and 7 funds with negative betas, 2 of them being statistically significant.

With this model I obtained the highest value of $Adj. R^2$, overcoming the conditional four-factor model result. This value is obtained using the equally-weighted portfolio and the benchmark of the market.

The conclusions about the Wald test are very similar with the results from the previous two models. The performance of the green funds does not vary over time according to the public information variables but risk does.

5.3. General analysis of the performance by model

Next I present a table that summarizes the general results of all models. It will give us a general vision about the performance of green funds.

TABLE VIII - An overview of the empirical results of all models

		Panel A: Benchmark S&P500			Panel B: Benchmark KLD400		
		α_P	β_p	$Adj.R^2$	α_P	β_p	$Adj.R^2$
Unconditional Jensen (1968)	Equally W.	0.000468	0.995514***	0.867893	0.000312	0.952817***	0.840800
	Value W.	0.000537	0.989473***	0.784111	0.000367	0.949232***	0.763167
	N-	6 [0]	0 [0]	-	6 [0]	0 [0]	-
	N+	10 [3]	16 [16]	-	10 [3]	16 [16]	-
Conditional Jensen (1968)	Equally W.	0.001478	0.963244***	0.876238	0.001871	0.906015***	0.850280
	Value W.	0.001661	0.955869***	0.792383	0.002027	0.901421***	0.771959
	N-	5 [1]	0 [0]	-	4 [1]	0 [0]	-
	N+	11 [3]	16 [14]	-	12 [5]	16 [15]	-
		α_P	β_p	$Adj.R^2$	α_P	β_p	$Adj.R^2$
Unconditional Carhart (1997)	Equally W.	0.000315	0.956960***	0.931682	-0.000006	0.922759***	0.896464
	Value W.	-0.000230	0.959135***	0.880264	-0.000574	0.927239***	0.850857
	N-	5 [0]	0 [0]	-	6 [0]	0 [0]	-
	N+	11 [4]	16 [16]	-	10 [3]	16 [16]	-
Conditional Carhart (1997)	Equally W.	0.000741	0.942971***	0.938729	0.000729	0.891184***	0.903832
	Value W.	0.000808	0.945834***	0.890016	0.000738	0.894543***	0.85723
	N-	3 [0]	0 [0]	-	1 [0]	0 [0]	-
	N+	11 [3]	14 [14]	-	13 [8]	14 [14]	-
		α_P	β_p	$Adj.R^2$	α_P	β_p	$Adj.R^2$
Unconditional Fama & French (2015)	Equally W.	-0.001015	1.004062***	0.933572	-0.00093	0.951185***	0.893692
	Value W.	-0.001652*	1.006386***	0.890748	-0.001588	0.95534***	0.856652
	N-	6 [0]	0 [0]	-	6 [0]	0 [0]	-
	N+	10 [4]	16 [16]	-	10 [5]	16 [16]	-
Conditional Fama & French (2015)	Equally W.	-0.00021	0.958106***	0.942438	-0.0000345	0.900801***	0.906123
	Value W.	-0.001009	0.986638***	0.896300	-0.000918	0.928968***	0.862774
	N-	3 [0]	0 [0]	-	3 [0]	0 [0]	-
	N+	10 [2]	13 [13]	-	10 [4]	13 [13]	-

This table presents a summary (α_p, β_p and $Adj.R^2$) of all models applied in this study, with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014 and for the equally weighted portfolio (eq. 9) and value weighted portfolio (eq. 10). It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj.R^2$). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented.

Table VIII illustrates a good perspective about the results obtained in this study. The first observation is related to the performance of the portfolios. In all the models (excluding the alpha of the Fama & French (2015), in the Value Weighted portfolio in Panel A), the alphas present a neutral performance compared to the market, which corroborates Mallett & Michelson (2010), Climent & Soriano (2011), Chang et al. (2012) and Muñoz et al. (2014) results. Another observation is that with the inclusion of the risk factors, the alphas tend to be negative. With the Jensen (1968) model, the alphas are positive. With the Carhart (1997) model, I observed one negative alpha and a decrease in the values, compared to the previous model. With the Fama & French (2015) model, the alphas are all negative. The same occurs in the conditional models. However, none of the alphas are statistically significant (except one), showing that the inclusion of the risk factors did not improve the performance estimates. With the application of the conditional approach, the performance estimates remain neutral, contradicting the findings of Cortez et al. (2009).

A second conclusion that can be drawn is related to the sensitivity to the market. The US green mutual funds are more exposed to the benchmark of the market (S&P500) than to the benchmark of the sector (KLD400). The coefficients of the systematic risk in Panel A shows superior values in all models compared to Panel B. These findings are in line with Climent & Soriano (2011).

A third conclusion is related to the explanatory power of the models. First, on Panel A and with the equally weighted portfolios, the values of $Adj.R^2$ presents higher values comparing to the models on Panel B and to the value weighted portfolios, respectively. The second observation confirms the expectation that multifactor models, with the inclusion of the risk factors, are superior in explaining mutual fund returns, which corroborates Bauer et al. (2005) Derwall et al. (2005) and Climent & Soriano (2011) results, for example. Another conclusion is that the conditional models also improved the explanatory power of the model, which corroborates with Cortez et al. (2009) and Cortez et al. (2012). However, the conditionality of the models does not bring big differences with respect to the green funds' performance. In this study the full conditional five-factor model from Fama & French (2015) is the model with the highest explanatory power with an $Adj.R^2$ of 94.2438%.

6. Conclusions

It is possible to do well while doing good? (Hamilton et al. 1993), Does it pay to be green? (Ambec & Lanoie 2008), Green and Good? (Climent & Soriano 2011), Do green mutual funds perform well? (Chang et al. 2012) and Does the market reward for going green? (Puopolo et al. 2015) are several examples of questions that investors and academics have been making along recent years.

My results suggest that the green investors may expect no superior or inferior returns by investing in green funds. The neutral performance of these type of funds, applying numerous methodologies and focusing in many countries, corroborates with the majority of the studies in this area.

In this study, I analyzed the performance of 16 US green mutual funds against the market, using for that both conventional and socially responsible indices. In terms of fund performance I concluded that green funds have a neutral performance compared to the market. As for fund characteristic, green mutual funds are more exposed to the benchmark of the market (S&P500) than to the benchmark of the sector (KLD400) and are more exposed to small caps. In relation to the book-to-market factor, my results suggest that green funds are more exposed to value stocks. However, in the literature, several studies stated that socially responsible and green funds are more exposed to growth stocks (Bauer et al. (2005); Climent & Soriano (2011); Cortez et al. (2012); Ibikunle & Steffen (2015)). I also concluded that green funds are more exposed to companies with poor past performance, due to the negative and statistically significant values of the momentum factor. In relation to the profitability and investment factor from the five-factor model, the first one shows that green funds are more exposed to companies with robust profitability and, otherwise, the investment factor shows neutral influence in explaining the performance of green funds.

In terms of methodology, my results confirmed the expectation that the multifactor models, with the inclusion of the risk factors, increase the explanatory power of the models, which corroborates Bauer et al. (2005) and Climent & Soriano (2011) results. My results also confirmed the expectation that the conditional models increases the explanatory power of the models, corroborating with Cortez et al. (2009) and Cortez et al. (2012). However, the performance estimates did not improve with the conditional approach, contradicting the findings of Cortez et al. (2009). Another interesting result suggested by my study comes from the observation of the evidence of time-varying betas, but not of time-varying alphas. Cortez et al. (2012) argues that this fact can be explained because fund managers in this type of funds have more constraints in terms of investments, which could lead to a more stable performance over time.

It is also important to mention that this study has limitations. As I referred in the data section, the selection of the green mutual funds was one of the most important steps to perform this study. Unfortunately, there is a lack of a formal list of green funds. I selected the green funds based on the environmentally category defined by US SIF, however, there may exist other green funds that are not listed. This problem was also stated by Chung et al. (2012).

Another limitation is related to the usage of a benchmark more orientated to socially responsible funds (KLD400) rather than to green funds. As the green universe sector is determined by environmental screens, it is important to consider a relevant environmental equity index to measure the performance of green funds.

Green investing is a philosophy gaining popularity not only in the US, but also in many other countries around the world (Chang et al. 2012). The world has witnessed a huge growth about the environmental and social issues. In one way or another, people are changing their mentalities, becoming more socially and environmentally responsible every day. The investors are changing their style of investment. They are becoming more socially and environmentally responsible when making their investment decisions, taking into account some concerns like global warming, recycling, civil rights and nuclear energy. This is not just a theory or a thought. There are several facts that justify this growth. The increasing number of conferences around the world debating the climate change and the dramatic growing in the assets and the number of mutual funds considering EGS criteria, are just two of those facts.

Climent & Soriano (2011) stated that green investors, by moving away the traditional utility function based on maximization of end-of-period wealth, could be seen as irrational investors. However, they also affirmed that some investors have a utility function based not only in the financial performance, but also in social and environmental concerns. And, if there is a general agreement of a neutral performance by the green funds, there are no reasons to think about the existence of a financial sacrifice that could affect those who want to consider green screens in their investments.

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Appendixes

Appendix 1 - Performance estimates using the unconditional one-factor model (Individual results)

Panel A: S&P500				Panel B: KLD400			
Fund	α_p	β_p	$Adj.R^2$	Fund	α_p	β_p	$Adj.R^2$
Fund 1	0.003987*	0.994095	0.697023	Fund 1	0.003904*	0.940687	0.659962
Fund 2	-0.000486	1.098084	0.898926	Fund 2	-0.000542	1.107578	0.900973
Fund 3	0.003687	0.991824	0.589982	Fund 3	0.003604	0.938673	0.558746
Fund 4	-0.001658	1.014707	0.762651	Fund 4	-0.002284	0.990291	0.779254
Fund 5	0.001199**	1.004391	0.971163	Fund 5	0.001018***	0.991167	0.998054
Fund 6	-0.000883	1.003167	0.897017	Fund 6	-0.000789	1.018053	0.906238
Fund 7	0.004579***	0.75364	0.801948	Fund 7	0.004603***	0.715734	0.771634
Fund 8	0.003617*	1.083246	0.873198	Fund 8	0.003468*	1.104186	0.89756
Fund 9	0.00294	1.152611	0.64367	Fund 9	0.002641	1.120722	0.643651
Fund 10	0.002216*	0.974663	0.875729	Fund 10	0.002173	0.978957	0.873732
Fund 11	-0.000729	1.079512	0.809818	Fund 11	-0.001131	1.094604	0.810955
Fund 12	0.001511	1.055983	0.815918	Fund 12	0.001511	1.002431	0.775924
Fund 13	0.001612	1.09649	0.636432	Fund 13	0.0016	1.060052	0.629086
Fund 14	0.001162**	1.023328	0.981704	Fund 14	0.001437**	1.022325	0.978742
Fund 15	-0.002037	1.095179	0.818099	Fund 15	-0.002094	1.106644	0.833737
Fund 16	-0.007175	1.198507	0.708461	Fund 16	-0.007956**	1.191695	0.757157

This table presents regression estimates for each US green mutual fund, obtained by the regression of the one-factor model (eq. 1) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj.R^2$). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates, respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level.

Appendix 2 - Performance estimates using the unconditional four-factor model (Individual results)

Panel A: S&P500							Panel B: KLD400						
Fund	α_P	β_p	β_{SMB}	β_{HML}	β_{MOM}	$Adj.R^2$	Fund	α_P	β_p	β_{SMB}	β_{HML}	β_{MOM}	$Adj.R^2$
Fund 1	0.002962**	0.987576	0.382819***	0.466124***	-0.099737*	0.811063	Fund 1	0.002613*	0.95412	0.353101***	0.518017***	-0.092613*	0.782798
Fund 2	-0.0000172	0.981022	0.138249	0.14564**	-0.154162***	0.929725	Fund 2	-0,0000689	1.005551	0.058166	0.179962***	-0.125504***	0.923647
Fund 3	0.001699	0.9934	0.573564***	0.651467***	-0.097596	0.777133	Fund 3	0.001342	0.960478	0.543584***	0.703922***	-0.090218	0.75355
Fund 4	0.000411	0.939731	0.283998**	-0.140914	0.236764*	0.853782	Fund 4	-0.000285	0.909964	0.230083*	-0.088487	0.257802	0.842445
Fund 5	0.001358***	0.996382	0.004345	-0.05584***	-0.002187	0.972722	Fund 5	0.000968***	0.993425	-0.0059	0.00478	0.002361	0.998072
Fund 6	-0.000124	0.931493	0.311948***	-0.035163	0.041458	0.920899	Fund 6	-0.000125	0.952542	0.25955***	-0.015443	0.049557	0.922074
Fund 7	0.004145***	0.755569	0.113715***	0.104616**	-0.004894	0.814261	Fund 7	0.004031***	0.725969	0.103125**	0.148161***	-0.009193	0.789722
Fund 8	0.003908***	0.970985	0.239006***	-0.107194	-0.220101***	0.917449	Fund 8	0.00381**	1.005342	0.151846**	-0.069489	-0.187587***	0.925385
Fund 9	0.003924*	1.045543	0.571928***	-0.088512	-0.147426**	0.75022	Fund 9	0.003509	1.015146	0.539869***	-0.031817	-0.138434*	0.73293
Fund 10	0.002292*	0.886474	0.303772***	-0.105123*	-0.127***	0.907619	Fund 10	0.002308	0.897216	0.237779***	-0.063352	-0.102048***	0.891249
Fund 11	-0.001344	0.932816	0.993207***	-0.152239***	0.006113	0.939965	Fund 11	-0.00159	0.948868	0.918416***	-0.141276***	0.02254	0.918749
Fund 12	0.002763	0.965069	0.195047***	-0.030599	-0.172744***	0.855939	Fund 12	0.002698	0.916907	0.189714***	0.01234	-0.18191***	0.818959
Fund 13	0.000693	1.090984	0.383239***	-0.318754***	0.147853**	0.812961	Fund 13	0.000694	1.040936	0.373425***	-0.262824***	0.139682**	0.779628
Fund 14	0.000974*	0.983635	0.165275***	0.013954	-0.003919	0.988253	Fund 14	0.001269*	1.001639	0.086333***	0.066741**	0.020571*	0.981633
Fund 15	-0.000772	0.875208	0.917378***	-0.00078	-0.016602	0.951499	Fund 15	-0.000647	0.886132	0.860088***	0.016308	-0.002825	0.945944
Fund 16	-0.002267	0.980334	0.843075***	0.092905	-0.09557	0.927908	Fund 16	-0.003048	0.958227	0.767598***	0.158672	-0.046164	0.929546

This table presents regression estimates for each US green mutual fund, obtained by the regression of the four-factor model (eq. 2) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj.R^2$). Additionally, the regressions coefficients of size (SMB), book-to-market (HML) and momentum (MOM) factors are reported. The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level.

Appendix 3 - Performance estimates using the unconditional five-factor model (Individual results)

Panel A: S&P500

Fund	α_P	β_P	β_{SMB}	β_{HML}	β_{MOM}	β_{CMA}	$Adj. R^2$
Fund 1	-0.001066	1.132811	0.495034***	0.138671**	0.524332***	0.276148***	0.82041
Fund 2	0.0000496	1.011163	0.140542	0.260758***	-0.020666	-0.116168	0.91149
Fund 3	-0.00267*	1.147502	0.696247***	0.293792***	0.624326***	0.211664**	0.788046
Fund 4	0.000957	0.951028	0.346581**	-0.366517*	0.070133	0.090613	0.827702
Fund 5	0.001274**	1.001819	0.033637*	-0.040347	0.037875	-0.025052	0.972133
Fund 6	-0.000246	0.935128	0.32972***	-0.06473	0.066109	-0.001618	0.918548
Fund 7	0.003458***	0.784223	0.116535**	-0.009134	0.048622	0.170017*	0.81603
Fund 8	0.003632*	1.028585	0.238625**	0.022873	0.017034	-0.084376	0.879269
Fund 9	0.002693	1.09814	0.600678***	-0.161161	0.016659	0.019702	0.73851
Fund 10	0.001889	0.929167	0.29515***	-0.099392	0.003854	0.120244	0.891291
Fund 11	-0.000269	0.883183	0.991593***	-0.124667	-0.069187	-0.400509**	0.949916
Fund 12	0.001536	1.042664	0.145094	-0.115812*	-0.050725	0.138208	0.826955
Fund 13	0.004833**	0.911816	0.404087***	-0.026247	-0.380478**	-0.413533**	0.780401
Fund 14	0.001065**	0.981835	0.169141***	0.012898	-0.007226	-0.072604**	0.988733
Fund 15	-0.001783	0.899284	0.963978***	-0.157689*	0.18819	0.248804**	0.959834
Fund 16	-0.002702	0.989124	0.815063***	0.179448	0.039575	-0.210295	0.921506

Panel B: KLD400

Fund	α_P	β_P	β_{SMB}	β_{HML}	β_{MOM}	β_{CMA}	$Adj. R^2$
Fund 1	-0.00092	1.068167	0.4221***	0.214266***	0.443379***	0.241392**	0.773021
Fund 2	0.000258	1.024001	0.051364	0.307247***	-0.06473	-0.192397	0.913311
Fund 3	-0.002519	1.081684	0.622344***	0.370395***	0.542172***	0.176204	0.746288
Fund 4	0.000696	0.911994	0.345938**	-0.302806*	0.176665	0.05035	0.819882
Fund 5	0.001013***	0.991309	-0.00498	0.009324**	-0.003504	-0.004659	0.998053
Fund 6	-0.00016	0.9514	0.269288***	-0.071381	0.01346	0.035244	0.919323
Fund 7	0.003575***	0.743352	0.069991	0.036688	-0.016324	0.176857**	0.787728
Fund 8	0.003737**	1.055574	0.142995	0.073923	-0.004947	-0.169949	0.899498
Fund 9	0.002654	1.05296	0.531211***	-0.089307	-0.05396	-0.000804	0.723097
Fund 10	0.002196	0.926404	0.220712***	-0.03955	-0.040914	0.032351	0.880411
Fund 11	-0.000145	0.880583	0.913979***	-0.106651	-0.144758	-0.430945**	0.931054
Fund 12	0.001711	0.98077	0.095869	-0.057318	-0.121405	0.12321	0.784827
Fund 13	0.004995**	0.869912	0.35677***	0.026981	-0.445073***	-0.412746**	0.767379
Fund 14	0.001649***	0.977757	0.089689***	0.090201***	-0.063819*	-0.164844***	0.98375
Fund 15	-0.001797	0.90895	0.895718***	-0.166172**	0.143451	0.305219**	0.954636
Fund 16	-0.003091	0.965867	0.783252***	0.247796	0.138371	-0.269854	0.928637

This table presents regression estimates for each US green mutual fund, obtained by the regression of the five-factor model (eq. 3) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports performance estimates (α_p), the systematic risk (β_p) and the adjusted coefficient of determination ($Adj. R^2$). Additionally, the coefficients of size (SMB), book-to-market (HML), profitability (RMW) and investment (CMA) factors are reported. The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level.

Appendix 4 - Performance estimates using the conditional one-factor model (Individual results)

Panel A: S&P500																
Fund	Fund 1	Fund 2	Fund 3	Fund 4	Fund 5	Fund 6	Fund 7	Fund 8	Fund 9	Fund 10	Fund 11	Fund 12	Fund 13	Fund 14	Fund 15	Fund 16
α_P	0.00721***	-0.00307	0.006707**	0.001457	0.00054	-0.008828**	0.006231***	-0.00031	0.000938	0.000871	0.000506	0.001623	0.00166	0.000638	-0.003302	-0.038931*
α_{TB}	-10.13465**	1.937225	-8.306016	-32.65045	-0.060728	86.65007***	-3.56663	-3.863384	-2.909596	-0.854168	-3.340575	4.911171	4.606987	0.669091	-0.656482	180.802
α_{TS}	-0.003828	0.007**	-0.003777	0.026373	0.001049	0.008086*	0.001096	0.00241	0.005356	0.001832	0.001619	0.001528	0.001646	0.001331	0.008784	0.037365***
α_{DS}	0.005717	-0.008495*	-0.000627	0.076039	0.000212	-0.006613	-0.002706	0.000877	0.003916	0.001633	0.003167	0.001284	0.005821	-0.003201	-0.006765	-0.005261
α_{DY}	-0.02351*	0.006115	-0.030673*	0.073059	-0.001669	0.003836	0.004379	0.010543	0.002712	0.004428	-0.016163	0.0066	-0.000581	0.005291	0.012797	0.04722
α_D	-0.012003**	0.013174*	-0.014218	-0.001716	0.003714**	-0.006639	-0.001374	0.016414***	0.023432***	0.015648***	-6.54E-05	0.008133	-0.003653	0.002439	-0.00543	0.004714
β_p	0.902772	1.127383	0.860478	0.78627	1.004803	0.99955	0.731418	1.182416	1.17625	1.003	1.040467	1.045007	1.114422	1.027333	1.129255	1.265538
β_{TB}	52.9074	141.0263	86.07683	3081.584	-29.66763	-343.8061	36.10723	-135.236	74.34106	52.83975	284.3415	-79.96173	69.71396	79.00429**	185.9666	2360.283
β_{TS}	0.05941	0.012142	0.049034	-0.159134	-0.027967	-0.015534	-0.068584	-0.006203	-0.093872	0.090482*	0.055887	-0.031527	0.184813	0.011573	-0.072473	-0.364019
β_{DS}	0.12137	0.465744**	0.512091	-1.346293	0.049687	-0.230424	-0.022575	0.592748**	0.463731*	0.169572	0.28807	-0.169389	0.174686	0.118051**	0.31395	0.363245
β_{DY}	0.42023	-0.588017*	0.025194	-0.359575	-0.151114**	0.594008*	0.465004**	-1.194288***	-0.174633	-0.135133	0.00545	0.337321	-0.213941	-0.058292	-0.398151	0.829221
β_D	0.06062	-0.022973	0.144593	-0.325232	0.067784*	0.12671	-0.073884	-0.178833	-0.408164*	-0.232864*	0.108445	-0.038912	-0.279234	0.024829	-0.062451	-0.189309
Adj. R^2	0.717432	0.906617	0.61902	0.753708	0.971671	0.903189	0.814535	0.906001	0.663979	0.886867	0.797476	0.813959	0.631001	0.98215	0.800666	0.712313
Panel B: KLD400																
Fund	Fund 1	Fund 2	Fund 3	Fund 4	Fund 5	Fund 6	Fund 7	Fund 8	Fund 9	Fund 10	Fund 11	Fund 12	Fund 13	Fund 14	Fund 15	Fund 16
α_P	0.007758***	-0.001085	0.007291**	0.008948	0.00121***	-0.010913***	0.007029***	0.001211	0.001404	0.002555	0.002455	0.003088	0.002573	0.002406***	-0.002536	-0.03235
α_{TB}	-7.224154	2.070935	-5.570158	-86.18277	0.957009**	115.2915***	-3.322155	-4.395084	0.151869	-1.411791	-1.477947	5.351358	4.906661	0.037341	10.71466	155.07
α_{TS}	-0.003312	0.005635	-0.003438	0.020633	0.00028	0.007476*	0.000371	0.000944	0.005974	0.000268	0.000271	0.000232	0.000504	-0.000998	0.008783	0.032054***
α_{DS}	0.009912	-0.001242	0.002983	0.078806	0.003004***	-0.001069	-0.000379	0.006749	0.007413	0.008207	0.011208	0.006134	0.00886	0.002133	0.002994	0.011837
α_{DY}	-0.031873**	-0.006936	-0.037681**	0.069999	-0.005424***	-0.006606	-0.000976	0.001101	-0.003055	-0.007404	-0.029937*	-0.003942	-0.005976	-0.006239	0.004264	0.041109*
α_D	-0.014294**	0.01085*	-0.016437**	-0.000605	-0.000288	-0.008674	-0.003056	0.014609**	0.021423***	0.013902***	-0.00404	0.003865	-0.00706	0.000656	-0.006605	0.0003
β_p	0.835416	1.088053	0.79691	0.62039	0.982382	1.054009	0.681911	1.164249	1.119402	0.967821	1.03573	0.972109	1.070865	0.988442	1.139566	1.429116**
β_{TB}	-15.49368	124.6904	4.363344	4637.869	2.947909	-650.6771	31.08421	-155.3773	35.68392	4.92518	384.5886**	-67.85655	90.58232	60.64129	150.9026	1060.317
β_{TS}	0.04486	0.027711	0.048161	0.007054	-0.001474	-0.041424	-0.055373	0.004618	-0.081863	0.100501	0.093677	-0.004347	0.220538*	0.015287	-0.107786	-0.285268
β_{DS}	0.062678	0.340415**	0.434458	-0.715234	0.003436	-0.108644	-0.065147	0.453656**	0.465757*	0.042479	0.235313	-0.264405*	0.113624	0.041005	0.224728	1.052857
β_{DY}	0.516698	-0.30846	0.121963	-0.835279	0.017676	0.434825	0.63186***	-0.913288***	-0.137805	0.118322	0.240882	0.628663**	-0.017135	0.134993	-0.390952	0.547221
β_D	0.012136	-0.003712	0.055801	-0.200222	0.006854	0.092544	-0.098388	-0.183684**	-0.426223**	-0.243732**	0.104399	-0.108048	-0.33369*	0.014086	-0.099468	-0.140243
Adj. R^2	0.685515	0.904448	0.592921	0.809566	0.998388	0.915634	0.790625	0.928837	0.660026	0.888347	0.806737	0.780281	0.629766	0.980359	0.819664	0.755115

This table presents regression estimates for each US green mutual fund, obtained by the regression of the full conditional one-factor model (eq. 6) with both S&P500 (Panel A) and KLD400 (Panel B) benchmarks, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj. R^2$). The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level, except for the Fund 4 and 16 (In the Panel A, the beta of both funds are not statistically significant; In Panel B, the beta of the Fund 4 is not statistically significant and the beta of the Fund 16 is statistically significant al 5% level).

Appendix 5 - Performance estimates using the conditional four-factor model (Individual results)

Panel A: S&P500														
Fund	Fund 1	Fund 2	Fund 3	Fund 5	Fund 6	Fund 7	Fund 8	Fund 9	Fund 10	Fund 11	Fund 12	Fund 13	Fund 14	Fund 15
α_P	0.004998***	-0.001226	0.003694**	0.000623	-0.005552	0.004887***	0.001283	0.000768	0.002776	0.003398	0.003399*	0.001477	0.000592	-0.000834
α_{TB}	-5.577512	7.761014*	-1.105817	-0.009147	42.6359	-3.764366	-1.315507	-0.982768	1.220368	1.668116	2.601382	3.920652	1.774499	19.08636
α_{TS}	-0.005074	0.009052**	-0.003619	-0.00013	0.014186**	0.000509	0.003113	-0.001256	0.001557	-0.002574	-0.000269	-0.001342	0.00069	-0.003617
α_{DS}	0.005806	-0.001559	0.002076	-0.000201	-0.004669	-0.005551	0.0003	-0.007126	0.008135	0.013244**	0.003089	0.006706	-0.003164	-0.001559
α_{DY}	-0.017322**	0.000539	-0.022477***	-0.003321	0.010064	0.009296	0.012807	0.007021	-0.012436	-0.031592***	-0.003544	-0.019177	0.003447	-0.000269
α_D	-0.014969*	0.003546	-0.017326***	0.001794	-0.003656	-0.001247	0.015135**	0.008122	0.011652*	-0.002758	-0.002663	-0.006307	0.001069	-0.012714**
β_p	0.946097	1.002902	0.928181	0.985715	1.102197	0.763827	1.067727	1.059258	0.887563	0.779532	0.994734	1.020593	0.972785	0.929879
β_{TB}	55.67084	269.2402*	80.01051	-37.42829	-1214.167	45.63078	-88.93739	115.4642	88.92365	-138.8268	-58.31102	52.38178	80.47892**	-616.5112
β_{TS}	0.077814	0.008935	0.057358	-0.015307	-0.101991	-0.101871*	-0.04378	-0.071154	0.129067*	0.041408	-0.090861	0.199746**	0.063692**	0.167436
β_{DS}	-0.186745	-0.27501*	0.030132	0.034306	-0.002134	-0.168548	0.057254	0.662851**	-0.233091	0.046212	-0.338979**	0.311083	0.005123	-0.225922
β_{DY}	0.585924**	0.523462*	0.387982	-0.213621**	0.061355	0.554922*	-0.416329	-0.631657	0.206336	-0.199336	0.617504**	-0.238661	0.111037	0.58014*
β_D	0.028974	0.12881	0.105905	0.086468*	0.072419	-0.086238	-0.140896	-0.25798	-0.150744	0.123687	-0.121721	-0.102061	-0.002713	-0.144029
β_{SMB}	0.406184***	0.180681**	0.610163***	-0.003167	-0.004973	0.075857*	0.148475	0.533437***	0.359142***	1.192087***	0.190344***	0.379709***	0.164314***	1.023327***
β_{SMB}*TB	-212.3377	19.29731	-116.364	-27.32539	1800.673	41.45883	-94.71552	-209.297	-143.4574	970.4419*	142.0828	-212.3521	-76.47809	277.0417
β_{SMB*TS}	-0.047804	0.202051	0.031831	0.052331	0.208114	0.111518	0.03864	-0.042126	0.03078	0.288477	0.097179	-0.104834	-0.107428*	-0.135324
β_{SMB*DS}	-0.190182	0.619156**	-0.449806*	-0.063204	-0.418585	0.242189	-0.506336	0.378127	0.131823	0.032674	-0.078984	0.018103	-0.003854	0.172285
β_{SMB*DY}	0.524888	-0.655284	1.101476**	0.087798	-0.092309	-0.512747	0.643623	-0.81717	0.053698	1.053022*	-0.265397	-0.046787	-0.07884	-0.096447
β_{SMB*D}	-0.220152*	-0.436371***	-0.284148*	0.068974	0.273207	0.270578	-0.045675	0.533315*	-0.223422	-0.649361***	0.141656	0.350069**	-0.01788	-0.98474**
β_{HML}	0.393225***	0.058957	0.515367***	-0.055821***	-0.144009	0.089906*	-0.088459	-0.135108	-0.26703***	-0.220386**	-0.067546	-0.398939***	-0.016551	-0.179378
β_{HML*TB}	93.9054	101.6481	225.3119	-15.41743	-168.4721	22.5164	88.85538	-415.4581**	-65.0475	292.0342	110.3504	45.23484	67.52538	672.2721
β_{HML*TS}	0.05888	0.07508	0.079483	0.067722	0.618244*	-0.050136	0.287715	-0.353214**	-0.087101	0.30262	-0.049851	-0.031078	0.106219*	-0.083474
β_{HML*DS}	-0.407543	0.066039	-0.441117	-0.059818	-0.053241	0.078884	0.236087	-0.944447**	-0.572097***	-0.191603	-0.125911	-0.7426***	-0.109896*	-0.376807
β_{HML*DY}	0.517639	0.224865	0.584779	0.205815	0.320056	-0.208701	-0.255167	0.318385	1.258352***	0.485793	0.433203	0.502238	0.296378***	0.048171
β_{HML*D}	0.145248	0.199367	0.418849**	-0.035634	1.160069	-0.089569	0.280157	0.154868	0.526766*	0.512223	0.093272	0.480409	0.096675	0.522216
β_{MOM}	-0.056245	-0.200664***	-0.031145	-0.002923	0.28597*	-0.00327	-0.151001**	-0.234221***	-0.128543**	-0.102529	-0.157833***	0.180077***	-0.005318	-0.126944
β_{MOM*TB}	0.340134	-127.1813	-37.01112	53.81751	-3051.841**	-128.8618*	-119.3294	-31.13269	-152.3172	-362.1112**	-345.1897***	91.96983	-9.096284	-986.06**
β_{MOM*TS}	0.151398*	-0.097707	0.118268	0.068377**	-0.183037	-0.074857	-0.059271	0.278002**	-0.183212*	-0.174182	-0.263131**	0.006461	0.050848	-0.075035
β_{MOM*DS}	-0.397934***	-0.079632	-0.676172***	0.008618	-0.305454	-0.187723*	-0.247532*	-0.007322	-0.166854	-0.157694	-0.248621*	-0.080132	-0.090209**	-0.740704***
β_{MOM*DY}	0.572117***	0.099538	1.106646***	-0.087654	0.823238	0.001805	0.045274	-0.63999*	0.080469	-0.128596	0.281963	-0.006001	0.169783*	0.993178***
β_{MOM*D}	-0.126138	-0.236068**	-0.167098*	-0.004945	-0.144218	0.162034**	0.201941	0.395852***	0.002095	-0.139759	-0.126523	0.085682	0.010975	-0.157503
Adj. R^2	0.829595	0.944481	0.813553	0.974343	0.943472	0.831607	0.921584	0.786454	0.91816	0.951374	0.87335	0.830578	0.989161	0.961733

This table presents regression estimates for each US green mutual fund, obtained by the regression of the full conditional four-factor model (eq. 7) with S&P500 (Panel A) benchmark, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj.R^2$). Additionally, the conditional coefficients of size (SMB), book-to-market (HML) and momentum (MOM) factors are reported. The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level. It was removed the Funds 4 and 16 because the number of the observations of these funds were less than the explanatory variables of the model.

Panel A: KLD400														
Fund	Fund 1	Fund 2	Fund 3	Fund 5	Fund 6	Fund 7	Fund 8	Fund 9	Fund 10	Fund 11	Fund 12	Fund 13	Fund 14	Fund 15
α_{P}	0.004973***	0.000418	0.003614**	0.001111***	-0.00826*	0.005683***	0.00232	0.000813	0.004123**	0.006062**	0.004837**	0.003191	0.002222***	0.000534
α_{TB}	-2.938811	6.86098	1.600687	0.881759**	83.9266**	-3.556955	-2.886987	1.299945	-0.005729	2.708054	2.839305	3.584555	-1.219301	36.43437*
α_{TS}	-0.00415	0.006278	-0.002831	0.000423	0.012223**	0.000665	0.000432	-0.000746	-0.001165	-0.005202	-0.000814	-0.001516	-0.002336*	-0.003783
α_{DS}	0.009472	0.006664	0.005299	0.003194***	0.000544	-0.002667	0.007828	-0.004823	0.01579**	0.021572***	0.008664	0.011061	0.001826	0.012576
α_{DY}	-0.025498***	-0.017207**	-0.029627***	-0.005227***	-0.001212	0.003952	-0.001598	0.002162	-0.028129**	-0.050033***	-0.014038	-0.028547*	-0.010536**	-0.017783
α_{D}	-0.016303***	-0.00036	-0.01851***	-0.000235	-0.009005	-0.002839	0.01355*	0.007233	0.009683	-0.006604*	-0.005096	-0.009979*	-0.001821	-0.017546***
β_{P}	0.897016	0.970172	0.881323	0.985892	1.135661	0.725347	1.070258	1.006452	0.854809	0.737301	0.94242	0.958153	0.955815	0.871212
β_{TB}	-32.82013	223.5406	-33.84228	-3.942902	-1816.213*	44.32214	-182.9751	20.0229	-9.424043	-18.14478	-77.88334	89.07701	96.22917**	-789.6692
β_{TS}	0.024191	0.04271	0.002375	-0.007783	-0.209567	-0.10872*	-0.036774	-0.079083	0.153672*	0.116145	-0.086139	0.227998**	0.095096**	0.042501
β_{DS}	-0.23593	-0.256633	-0.030323	0.002974	-0.020011	-0.204796	0.079646	0.713289**	-0.253232	0.103506	-0.449439**	0.241465	0.07176	-0.435006*
β_{DY}	0.670619**	0.613172	0.445853	0.008019	0.090749	0.783706***	-0.382257	-0.66511*	0.309333	-0.035853	0.955991***	0.131351	0.204863***	0.687035*
β_{D}	-0.019115	0.069028	0.037058	0.000825	0.024023	-0.107675	-0.247078	-0.312281*	-0.24466	0.147758	-0.211537	-0.14019	-0.021142	-0.219208
β_{SMB}	0.388124***	0.136629	0.596611***	-0.006004	0.049568	0.06066	0.070289	0.52922***	0.306788***	1.174138***	0.184255***	0.364352***	0.086075***	0.981026***
$\beta_{SMB}{*}TB$	-350.5746*	108.4487	-255.6919	11.48787	736.767	59.47529	60.26834	-345.3956*	-26.09116	1136.723*	134.7859	-190.8594	-62.12516	234.9309
β_{SMB*TS}	-0.213097	0.12909	-0.134637	0.013347	0.134049	0.082788	0.041086	-0.220303	-0.017135	0.213566	0.035083	-0.164645	-0.186051**	-0.118905
β_{SMB*DS}	-0.218186	0.577995	-0.482981	-0.012563	-0.278329	0.242601	-0.570583	0.320699	0.064797	0.027261	-0.053729	-0.023031	-0.105085	0.042631
β_{SMB*DY}	0.533191	-0.410228	1.138084**	0.025141	-0.199976	-0.486113	0.993339	-0.772932	0.357323	1.241122**	-0.245805	0.043095	0.146053	0.455205
β_{SMB*D}	-0.251229*	-0.459307**	-0.329348*	0.005547	-0.050241	0.289512	-0.044301	0.475499*	-0.239967	-0.74567***	0.141021	0.340658**	0.024023	-1.051949***
β_{HML}	0.433123***	0.149067*	0.554811***	0.001674	-0.043501	0.120984**	-0.020275	-0.080364	-0.2058**	-0.188284*	-0.054931	-0.380966***	0.064782**	-0.109698
β_{HML*TB}	11.12593	327.3171	131.814	-6.193665	220.7195	35.96644	305.385	-488.4376**	108.5936	329.4974	74.8915	90.34236	265.7554***	1168.034*
β_{HML*TS}	-0.060976	0.113555	-0.044202	-0.017257	0.587959**	-0.097906	0.329218	-0.470512**	-0.035345	0.289558	-0.146637	-0.072504	0.095564	0.132139
β_{HML*DS}	-0.492865	0.032418	-0.517532*	-0.00864	0.070594	0.014306	0.152052	-0.988406**	-0.662697***	-0.358723	-0.222978	-0.805963***	-0.124571**	-0.254328
β_{HML*DY}	0.486176	0.360923	0.525623	0.023489	-0.012861	-0.183702	-0.079999	0.146635	1.428825***	0.717351*	0.505164	0.515498	0.355345***	0.282577
β_{HML*D}	0.158409	0.310875	0.446335**	0.007917	1.087154	-0.046426	0.462092	0.184513	0.707575**	0.592518*	0.157215	0.579605*	0.14812**	0.743383
β_{MOM}	-0.036617	-0.164687**	-0.009616	0.003459	0.438581**	0.000292	-0.111209*	-0.21133**	-0.09921*	-0.108855	-0.157134**	0.172989***	0.014749	-0.100968
β_{MOM*TB}	12.04178	-64.93247	-34.55462	-8.987676	-3409.281***	-141.3053*	-112.1885	-25.84301	-143.2007	-350.5577**	-398.4158***	44.48446	50.52486	-554.2209
β_{MOM*TS}	0.153634	-0.016406	0.122673	-0.009551	0.119137	-0.11077	-0.004065	0.306947**	-0.116813	-0.110521	-0.32288**	-0.055269	0.11226**	0.239608
β_{MOM*DS}	-0.407645***	-0.065003	-0.69033***	-0.002157	0.036165	-0.211761*	-0.258851*	0.026698	-0.199476	-0.162158	-0.295161*	-0.123423	-0.047586	-0.546977**
β_{MOM*DY}	0.521192**	0.218331	1.043629***	-0.014546	0.575965	0.105961	0.166637	-0.755496**	0.223668	-0.031202	0.422669	0.130652	0.220183***	1.121631**
β_{MOM*D}	-0.166013*	-0.316593***	-0.213231**	-0.00957	-0.298723	0.159772**	0.109904	0.333429**	-0.073944	-0.11922	-0.122247	0.083522	-0.012008	-0.231875*
Adj. R^2	0.804306	0.932607	0.791941	0.9984	0.945373	0.812339	0.929363	0.769162	0.902924	0.940138	0.847994	0.807535	0.987877	0.959073

This table presents regression estimates for each US green mutual fund, obtained by the regression of the full conditional four-factor model (eq. 7) with S&P500 (Panel A) benchmark, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj. R^2$). Additionally, the conditional coefficients of size (SMB), book-to-market (HML) and momentum (MOM) factors are reported. The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level. It was removed the Funds 4 and 16 because the number of the observations of these funds were less than the explanatory variables of the model.

Appendix 7 - Performance estimates using the conditional five-factor model (Individual results)

Panel A: S&P500													
Fund	Fund 1	Fund 2	Fund 3	Fund 5	Fund 7	Fund 8	Fund 9	Fund 10	Fund 11	Fund 12	Fund 13	Fund 14	Fund 15
α_P	0.001055	-0.002983*	-0.001082	0.001175*	0.003817***	0.000537	0.000566	0.001281	0.002085	0.001804	0.006373**	0.000272	-0.004737
α_{TB}	-1.827059	6.302199*	0.798264	-0.177172	-1.438947	4.92008	4.863818	3.741915	-1.959101	2.962871	4.456288	1.787603	20.85147
α_{TS}	-0.001129	0.007335**	-0.000932	-0.000353	0.000394	0.010261**	0.004214	0.002464	-0.004763	0.004062	-0.001066	0.001016	-0.000793
α_{DS}	0.002303	-0.018275***	-0.003643	-0.000163	-1.05E-05	0.00777	0.008095	0.008126	0.006274	0.004159	0.010809	-0.003675**	-0.012758
α_{DY}	-0.007325	0.024512**	-0.004471	-0.004258	0.005533	0.019921	-0.003021	-0.007336	-0.009459	0.006215	-0.02563**	0.003644	0.011414
α_D	-0.007492	0.016896**	-0.00856	0.002263	-0.002261	0.015522	0.009791*	0.02089***	-0.000268	0.001422	-0.016084**	0.002127	-0.014079
β_P	1.053251	1.068045	1.068411	0.976216	0.778519	1.089791	1.039664	0.913365	0.819656	0.985501	0.858733	0.984912	1.028903
β_{TB}	-62.0455	108.5517	-44.6006	-35.08967	26.82091	-431.9684**	-3.955688	-100.0175	137.0674	-129.6842	168.3701	88.59992**	-939.3582
β_{TS}	-0.026659	-0.039836	-0.03279	-0.017729	-0.034351	-0.233178	-0.135591	0.11604	0.141515	-0.175596*	0.222577**	0.048626*	0.162904
β_{DS}	-0.036984	0.288773	0.329636	0.001254	-0.154785	0.327087	0.306475	0.077234	0.11998	-0.027498	0.441326*	0.014395	0.51537
β_{DY}	0.38313	-0.593842**	-0.081431	-0.094374	0.476334**	-1.090182***	-0.010889	-0.363241	-0.330117	-0.018992	-0.389638	0.093395	-0.650704
β_D	-0.063119	0.246807***	-0.012342	0.052268	-0.125148	-0.019773	-0.294582**	-0.216455*	0.161526*	-0.03842	0.157312	0.023289	0.13084
β_{SMB}	0.509018***	0.060321	0.736982***	0.03711*	0.097174**	0.128446	0.578303***	0.408511***	1.169671***	0.161704**	0.44447***	0.17943***	0.973524***
β_{SMB}*TB	-301.469**	-518.9725**	-211.0417	29.88564	21.04213	-241.4033	-62.98678	-314.2172	496.7115	-107.2142	55.58168	-107.9198**	-831.4973
β_{SMB*TS}	-0.183919	-0.163124	-0.139696	0.046817	0.115071	-0.101448	0.072827	-0.085582	-0.092558	-0.077097	-0.059861	-0.079874	-0.094305
β_{SMB*DS}	0.241167	0.498792*	0.20342	-0.104801	0.151267	-0.440084	0.184305	0.091842	-0.07656	-0.02574	-0.291273	0.114769	-0.450114
β_{SMB*DY}	-0.238669	-0.513299	-0.086494	0.224435	-0.359193	0.253338	-0.518334	0.275072	0.628436	-0.71916	0.506079	-0.43382***	1.067209
β_{SMB*D}	-0.208265	0.005636	-0.268549	0.018529	0.041784	0.260472	0.247905	0.155478	0.083103	1.00446**	0.017689	-0.032242	0.078707
β_{HML}	0.066767	0.305901***	0.127647	-0.037462	0.020391	0.11241	-0.12872	-0.223517**	-0.188644*	-0.03064	-0.149135	-0.028407	-0.290987
β_{HML*TB}	263.0933	-109.8558	145.6927	-63.47993	359.9223***	-184.4493	337.6616	-474.956*	212.5549	159.6392	55.06631	42.18933	2698.17
β_{HML*TS}	0.231713	0.223433	-0.077675	0.026361	0.135896	0.19493	0.269011	-0.226437	-0.023642	0.317796	-0.248614	0.020165	0.711771
β_{HML*DS}	0.492658	0.231806	0.646031	0.180604**	0.508358**	0.853587*	0.433763	-0.515648	-0.381944	-0.175605	-0.646357	0.028276	0.21611
β_{HML*DY}	-0.595954	-0.475684	-0.931744	-0.23932	-0.387309	-1.932535**	-1.267236**	0.243185	1.407312**	0.090376	0.211977	0.138068	-0.361399
β_{HML*D}	-0.179676	-1.220351***	-0.105644	-0.119348*	0.101908	-0.885309	0.310091	-0.17162	0.197551	-0.161454	0.012473	-0.045104	0.355096
β_{RMW}	0.527783***	-0.074352	0.640961***	0.038	0.097484	0.132504	0.097872	0.12471	-0.007621	-0.12744	-0.28602**	0.00599	-0.186057
β_{RMW*TB}	-100.5864	-656.597*	24.89871	47.38802	-132.486	-1282.891**	-148.4387	-96.72131	729.0899	255.4527	-396.0807	-46.99111	718.4226
β_{RMW*TS}	-0.242052*	-0.269116	-0.180728	-0.005685	0.106074	-0.990226*	-0.124386	-0.189144	0.123827	-0.146135	-0.18309	0.079194	0.816864
β_{RMW*DS}	0.351643	1.419681***	0.254792	0.226322	-0.162049	0.475562	0.287413	0.078755	-0.427646	-0.620367	0.295272	-0.080464	-0.324037
β_{RMW*DY}	0.099292	-2.632692***	0.083578	-0.259286	0.184572	-3.400218**	-0.584808	-1.122395	1.221558	-0.157224	-1.781813	0.194177	1.088806
β_{RMW*D}	-0.056156	0.820256**	-0.101795	0.125563	-0.304888	0.601896	0.007872	0.538895	-0.24608	0.230109	0.576274*	0.064001	-0.348495
β_{CMA}	0.311153***	-0.244968	0.363977***	-0.044744	0.124108	-0.017424	-0.105597	0.19011	-0.236924	0.118299	-0.398513***	-0.074058**	0.251858
β_{CMA*TB}	-573.7391**	-525.0183	-414.7716	118.3885	-446.4588**	84.70621	-814.7534**	613.1304	109.2444	-679.7879**	535.8607	119.3617	-3468.994*
β_{CMA*TS}	-0.322526	-0.456492*	0.1381	0.09569	-0.396706**	0.130166	-0.71785**	0.361951	0.041901	-0.800576***	0.513256*	0.090448	-0.741967
β_{CMA*DS}	-1.142005***	1.448744**	-1.087121**	-0.379736***	-1.077261***	-0.013764	-2.801949***	0.438047	0.504136	0.262575	-0.215456	-0.372039**	0.1199
β_{CMA*DY}	0.005464	-2.377768***	-0.440749	0.817038***	0.867437	0.35336	3.291841***	0.57463	-2.510235**	-0.376888	1.482496*	0.395781	0.150239
β_{CMA*D}	-0.08494	1.397065*	-0.055732	0.026256	-0.083387	1.149549	0.136751	1.048941	1.255488	-0.14881	0.976393***	0.136968*	0.758023
Adj. R^2	0.83868	0.947956	0.80699	0.973729	0.836352	0.919631	0.774452	0.917411	0.962563	0.852871	0.813686	0.989209	0.961489

This table presents regression estimates for each US green mutual fund, obtained by the regression of the full conditional five-factor model (eq. 8) with S&P500 (Panel A) benchmark, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj.R^2$). Additionally, the conditional coefficients of size (SMB), book-to-market (HML), profitability (RMW) and investment (CMA) factors are reported. The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level. I removed the Funds 4, 6 and 16 because the number of the observations of these funds were less than the explanatory variables of the model.

Appendix 8 - Performance estimates using the conditional five-factor model (Individual results) (Continued)

Panel A: KLD400													
Fund	Fund 1	Fund 2	Fund 3	Fund 5	Fund 7	Fund 8	Fund 9	Fund 10	Fund 11	Fund 12	Fund 13	Fund 14	Fund 15
α_P	0.001495	-0.000371	-0.000539	0.001184***	0.004448***	0.002045	0.000527	0.00341*	0.00417	0.003284	0.007314***	0.002188***	-0.002248
α_{TB}	1.560153	4.795525	4.2139	0.906669**	-0.946011	2.393382	7.678905	1.674798	3.237931	3.128158	4.634386	-1.030634	26.68622
α_{TS}	0.000407	0.005816	0.000387	0.000378	0.00093	0.007964*	0.005544	0.000885	-0.005398	0.003492	-0.000894	-0.001364	0.001281
α_{DS}	0.008682	-0.008228	0.002766	0.003098***	0.00283	0.014217	0.010328	0.016137*	0.014437	0.009881	0.014216*	0.000676	-1.92E-05
α_{DY}	-0.016703	0.008742	-0.013378	-0.00569***	0.000489	0.008741	-0.008197	-0.022348	-0.025658	-0.003924	-0.031229**	-0.008336	-0.003982
α_D	-0.009532**	0.022725*	-0.010729**	-0.000373	-0.004525	0.020274	0.008056	0.024944***	0.005846	-0.001993	-0.020313**	-7.52E-05	-0.009808
β_p	0.985424	1.010349	0.994828***	0.982196	0.737414	1.075809	0.980536	0.85653	0.765826	0.911989	0.825084	0.952781	0.963731
β_{TB}	-136.2943	90.68371	-156.066	-2.051588	32.89263	-447.6031**	-30.85597	-136.7279	154.1656	-158.4307	194.0064	89.51924*	-930.3064
β_{TS}	-0.081341	-0.050168	-0.08816	-0.010234	-0.038852	-0.257757*	-0.152099	0.108712	0.125859	-0.17402*	0.254157***	0.043001	0.06143
β_{DS}	-0.138825	0.094172	0.191013	-0.007414	-0.145544	0.220803	0.432435*	-0.061835	0.047911	-0.155264	0.419606**	0.067816	0.25898
β_{DY}	0.484378	-0.205266	0.031523	0.026727	0.575813**	-0.862894**	-0.18494	-0.044527	-0.055196	0.247424	-0.220292	0.140405	-0.407972
β_D	-0.097875	0.21035*	-0.061116	0.00705	-0.115073	-0.092188	-0.300802***	-0.245364*	0.146382	-0.065682	0.131102	0.031409	0.067925
β_{SMB}	0.447208***	0.01757	0.677272***	-0.007736**	0.049055	0.057476	0.518306***	0.359458***	1.125466***	0.123333	0.397041***	0.098478***	0.969164***
β_{SMB}*TB	-456.7867***	-318.0629	-369.7038**	7.509688	-16.5439	-39.4733	-215.2344	-155.1521	581.317	-153.671	-1.325663	-59.16535	-922.1743*
β_{SMB*TS}	-0.323387**	-0.144487	-0.281407	0.010515	0.068786	-0.038415	-0.055868	-0.087776	-0.030831	-0.139195	-0.132589	-0.125763*	0.108331
β_{SMB*DS}	0.297774	0.640379*	0.25243	-0.02269	0.215799	-0.396181	0.219511	0.195419	0.01108	0.040029	-0.239381	0.01798	-0.34885
β_{SMB*DY}	-0.401818	-0.649961	-0.215497	0.046867*	-0.493098	0.322684	-0.681029	0.143699	0.552771	-0.796501	0.375265	-0.205472	1.277752*
β_{SMB*D}	-0.222403	-0.345163	-0.292603	0.043238**	0.109434	0.043759	0.258224	-0.086825	-0.199411	1.064384**	0.081778	0.045183	-0.063329
β_{HML}	0.129183	0.412701***	0.18433*	0.006209	0.053000	0.197547**	-0.079878	-0.144271	-0.177322	8.18E-05	-0.114906	0.072992**	-0.308793
β_{HML*TB}	310.1873	126.0065	189.8427	-3.311726	419.2903***	-30.28355	378.6301	-334.2981	82.31083	207.5801	153.5158	176.7089**	2421.817
β_{HML*TS}	0.284556	0.284858	-0.03376	-0.01361	0.13000	0.189831	0.312638	-0.183571	-0.038503	0.295946	-0.22431	-0.030256	0.844295
β_{HML*DS}	0.246677	0.206312	0.409659	0.015461	0.369236	0.73341	0.10159	-0.581253	-0.526516	-0.289392	-0.7714*	-0.05142	-0.383455
β_{HML*DY}	-0.062604	-0.538527	-0.448229	0.011272	-0.197054	-1.831349**	-0.755997	0.183379	1.196698*	0.256437	0.346829	0.196231*	0.015505
β_{HML*D}	-0.155429	-0.470291	-0.059215	-0.04135**	0.126959	-0.302446	0.334976	0.372479	0.589888	-0.077214	0.099898	-0.001107	1.1113
β_{RMW}	0.464381***	-0.148304	0.577886***	-0.005882	0.037881	0.101823	0.027637	0.075742	-0.096079	-0.178455	-0.344785***	-0.037032	-0.388911
β_{RMW*TB}	-150.4692	-424.1979	-41.87331	-20.53327	-186.8058	-1103.962**	-174.2347	31.79251	510.5297	225.0897	-487.2023	-15.29509	1542.186
β_{RMW*TS}	-0.197647	-0.192422	-0.144321	-0.016811	0.083188	-0.923934*	-0.037571	-0.152266	0.17273	-0.146334	-0.2356	0.073062	1.178337
β_{RMW*DS}	0.219513	1.437295**	0.096203	-0.006123	-0.293204	0.565093	0.262933	0.168715	-0.395525	-0.767969	0.110735	0.006937	-0.703628
β_{RMW*DY}	0.232686	-2.90459***	0.166412	0.034798	0.298575	-3.630541**	-0.69784	-1.477375	0.840267	-0.021512	-1.60215	-0.027879	1.827819
β_{RMW*D}	-0.12873	1.202499**	-0.185338	0.055302***	-0.286719	0.832468	-0.060239	0.811838**	0.241601	0.213897	0.528274*	0.166672**	-0.170255
β_{CMA}	0.266242**	-0.287732*	0.32394**	-0.007345	0.136201*	-0.077464	-0.098402	0.145234	-0.197357	0.096944	-0.386619***	-0.101481**	0.343481*
β_{CMA*TB}	-800.8146***	-480.7133	-669.7725*	0.363488	-560.9722**	304.843	-983.6519**	760.8449**	853.8065*	-876.6707**	417.4077	164.6355	-2310.085
β_{CMA*TS}	-0.674579**	-0.51721*	-0.21457	-0.015378	-0.505024***	0.126083	-1.035394***	0.323935	0.20092	-0.943938**	0.407339	0.081666	-0.30376
β_{CMA*DS}	-0.800946	1.484626**	-0.762227	-0.056504	-0.914846**	0.190718	-2.227057***	0.5103	0.704738	0.325988	0.030075	-0.112734	1.15582
β_{CMA*DY}	-0.916246	-2.228341*	-1.264259	0.077002	0.476203	0.200728	2.247173*	0.747492	-2.131647*	-0.700393	1.091754	0.015112	0.598224
β_{CMA*D}	-0.04199	-0.083527	-0.009675	0.039828*	-0.043923	0.141845	0.133984	0.06121	0.298419	-0.093578	1.020195***	0.154701*	-0.295568
Adj. R^2	0.801068	0.938956	0.769875	0.998395	0.815066	0.932417	0.754731	0.904946	0.951518	0.816348	0.807894	0.987681	0.960143

This table presents regression estimates for each US green mutual fund, obtained by the regression of the full conditional five-factor model (eq. 8) with KLD400 (Panel B) benchmark, during the period from May 1990 to September 2014. It reports conditional alphas (α_p), the coefficients estimates for the conditional alpha function, conditional systematic risk (β_p), the coefficients estimates for the conditional beta function and the adjusted coefficient of determination ($Adj. R^2$). Additionally, the conditional coefficients of size (SMB), book-to-market (HML), profitability (RMW) and investment (CMA) factors are reported. The predetermined information variables are the short-term rate (TB), the term spread (TS), the dividend yield (DY), the default spread (DS) and the dummy variable for the month of January (D). The asterisks are used to identify the existence of statistical significance of the coefficients to a level of significance of 1% (***), 5% (**) and 10% (*). Standard errors are corrected, whenever appropriate, for the presence of autocorrelation and heteroscedasticity using the procedure suggested by Newey and West (1994). N- and N+ indicate the number of the funds that have negative and positive estimates respectively. Within brackets the number of funds whose estimates are statistically significant at a 5% significance level are presented. All the values of β_p are statistically significant at 1% level. I removed the Funds 4, 6 and 16 because the number of the observations of these funds were less than the explanatory variables of the model.