Politecnico di Milano – School of Industrial and Information Engineering

Master of Science in Management Engineering

# The effect of Carbon involvement on funds' performance

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# Abstract

The challenges of the globalization process (climate change, waste of natural resources, social-demographic and ecological problems) promote people and business to become more conscious. As a result, sustainable investing has gained importance in recent years. Sustainable investing is born as socially responsible investing (SRI), an investment process based on an exclusionary screening to eliminate some types of product or industries (alcohol, tobacco, guns…). Over the time, this process gave way to the so called ESG issues (Environmental, Social, Governance) a new method which assesses companies with a 360° view.

The environmental risks, such as natural disasters and dramatic climate events, are perceived by the investors as the most potentially dangerous and probable, nowadays. To help investors to take into consideration the climate specific risk, and so to compare and to select the investment funds according to their expose to risks deriving by polluting emissions, Morningstar created the Low Carbon Designation: an indicator based on the Morningstar Portfolio Carbon Risk Score and the Morningstar Portfolio Fossil Fuel Involvement.

The purpose of this paper is to analyse the performances of a sample of 133 mutual funds present in three different geographical regions (Europe, US and Asia-Pacific) to find if there are correlations between returns and the Low Carbon Designation.

The analysis is divided in two parts: in the first one, it is verified the correlation between the returns and the two variables composing the Low Carbon Designation (Carbon Risk Score and Fossil Fuel Involvement); in the second one, it is assessed if the publication of the Low Carbon Designation as an event has affected the returns.

Given all the results, it is possible to conclude that the funds' returns are definitively affected by both the Carbon Risk Score and the Fossil Fuel Involvement: environmental issues matter, the fund's

management must take them into account and the relative policies during the investment process in order to obtain higher returns.

Furthermore, it is observed that the publication of the Low Carbon Designation has positively affected the returns of the related funds, consolidating the supported thesis, according to which "environmental issues matter" and they have to be taken into account by the financial industry.

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# 1.CLIMATE CHANGE

The Earth's climate has changed during the history. The modern climate Era has begun around 7,000 years ago after the end of the last ice-age but, in the last 650,000 years, there have been on the Earth seven cycles of glacial advance and retreat. According to the scientists, (Earth Science Communication Team, 2018) almost all these glacial Eras, are caused by changes in the amount of solar energy received by our planet, due to very small variations in Earth's orbit. Today, the problem that affects our planet is not related to glacial advance but to the Global warming.

The actual warming is particularly relevant since, with a probability higher than 95%, it is the result of the so called "greenhouse effect" due to the human activities which is defined as "the process by which radiation, from a planet's atmosphere, warms the planet's surface to a temperature above what it would be without its atmosphere" (IPCC, 2007) (Earth Science Communications Team, 2018).

Long-lived greenhouse gases like carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$), are chemically stable and remain semi-permanently in the atmosphere from years to centuries or longer, so that their emission has a long-term influence on climate and they are described as "forcing" climate change. Therefore, the Earth's average surface temperature has increased around 1.1°C since the 19th century (Earth Science Communication Team, 2018). Most of the warming occurred in the past 35 years during which 16 of the 17 warmest years of record since 2001 have occurred.
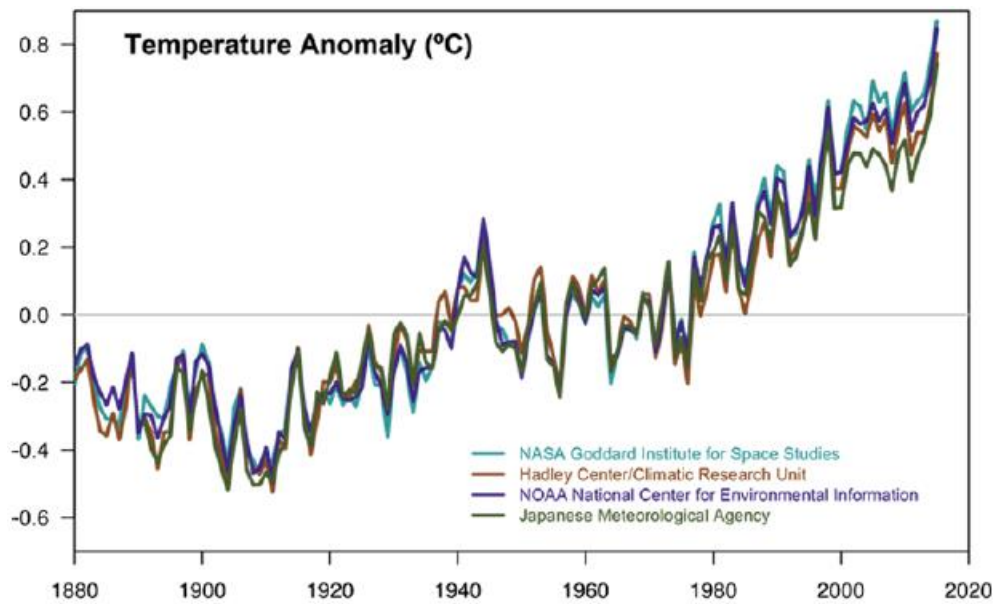
*Figure 1. Temperature anomaly in the last two centuries (Earth Science Communication Team, 2018)*

The concentration of carbon dioxide on the atmosphere has increased over the last century due to the massive burning of fossil fuels and, generally, all the industrial human activities have increased the concentration of greenhouse gases, changing the atmosphere natural composition (Earth Science Communications Team, 2018).

The effects of the Global climate change on the environment are already well observable: the temperatures are rising over the years, the ice on lakes and rivers is withdrawing, the precipitations have increased due to elevated temperatures that cause more evaporation of glaciers, the frequency of the extinctions of animals and trees is growing, the sea level rise is accelerating and more intense heat waves are happening. All these effects were predicted by scientists over the time and now are occurring. Scientists agreed on the fact that global temperatures will continue to rise for long time.

The Intergovernmental Panel on Climate Change (IPCC), forecasts a temperature rise from 2.5 to 10°F over the next century, and confirmed that there is a more than 95% probability that human activities over the past 50 years have warmed our planet (Earth Science Communications Team, 2018). The industrial activities that our modern civilization depends upon have raised atmospheric carbon dioxide levels from 280ppm to 400ppm in the last 150 years (BBC, 2017).

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According to the Third National Climate Assessment Report, some of the long-term effects of global climate change in the United States are as follows:

- Change will continue through this century and beyond;

- Temperatures will continue to rise;

- Frost-free season (and growing season) will lengthen: this will affect ecosystems and agriculture;

- Changes in precipitation patterns;

- More droughts and heat waves;

- Hurricanes will become stronger and more intense;

- Sea level will rise from 30 cm to 1.2 meters by 2100: this is the result of added water from melting land ice and the expansion of seawater as it warms.

## 1.1 Effects on the economy

According to The Global Risks Report 2018 13th Edition (World Economic Forum, 2018), a survey based on 1000 investor members all over the World, our planet is going to the brink and we should, as citizen and as investors, try to change this road. The environmental risks, such as natural disasters and dramatic climate events, are perceived by the investors as the most potentially dangerous and probable, nowadays. The ranking of the risks is changed a lot over the time and the growth of environmental risks has been persistent over the 13-year history of The Global Risks Report. 10 years ago, at the top of the ranking we would have found the risk of a financial crisis with a collapse of prices and, in the second position, the risk of a war in the Middle East. Today, 3 of the first 5 positions are occupied by environmental-related risks.

*Table 1. Top 5 risks in terms of likelihood in the years 2010-2018 (World Economic Forum, 2018)*

| Position | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Asset price collapse | Storms and cyclones | Severe income disparity | Severe income disparity | Income disparity | Interstate conflict with regional consequences | Large-scale involuntary migration | Extreme weather events | Extreme weather events |
| 2 | Slowing Chinese economy | Flooding | Chronic fiscal imbalances | Chronic fiscal imbalances | Extreme weather events | Extreme weather events | Extreme weather events | Large-scale involuntary migration | Natural Disaster |
| 3 | Chronic disease | Corruption | Rising greenhouse gas emissions | Rising greenhouse gas emissions | Unemployment and underemployment | Failure of national governance | Failure of climate-change mitigation and adaption | Major natural disasters | Cyberattacks |
| 4 | Fiscal crises | Biodiversity loss | Cyberattacks | Water supply crises | Climate change | State collapse or crisis | Interstate conflict with regional consequences | Large-scale terrorist attacks | Data fraud or theft |
| 5 | Global governance gap | Climate change | Water supply crises | Mismanagement of population ageing | Cyberattacks | High structural unemployment or underemployment | Major natural catastrophes | Massive incident of data fraud/theft | Failure on climate-change mitigation and adaption |

*Table 2. Top 5 risks in terms of impact in the years 2010-2018 (World Economic Forum, 2018)*

| Position | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Asset price collapse | Fiscal crises | Major systemic financial failure | Major systemic financial failure | Fiscal crises | Water crises | Failure of climate-change mitigation and adaption | Weapons of mass destruction | Weapons of mass destruction |
| 2 | Retrenchment from globalization | Climate change | Water supply crises | Water supply crises | Climate change | Rapid and massive spread of infectious diseases | Weapons of mass destruction | Extreme weather events | Extreme weather events |
| 3 | Oil price spikes | Geopolitical conflict | Food shortage crises | Chronic financial imbalances | Water crises | Weapons of mass destruction | Water crises | Water crises | Natural Disaster |
| 4 | Chronic disease | Asset price collapse | Chronic financial imbalances | Diffusion of weapons of mass destruction | Unemployment and underemployment | Interstate conflict with regional consequences | Large-scale involuntary migration | Major natural disasters | Failure of climate-change mitigation and adaption |
| 5 | Fiscal crises | Extreme energy price volatility | Extreme volatility in energy and agriculture prices | Failure of climate-change mitigation and adaption | Critical information infrastructure breakdown | Failure of climate-change mitigation and adaption | Severe energy price shock | Failure of climate-change mitigation and adaption | Water crises |

So, the change has been very relevant. All the environmental risks have an impact and a probability level higher than the average on a 10-years horizon.

During the 2017 we had a lot of natural disasters, very high temperature and the level of $CO_2$ in the atmosphere has increased and it is increasing as time goes by. The atmospheric concentration of $CO_2$ is today about 403 parts per million respect the 280 parts per million in the pre-industrial period. The extreme temperatures have characterized the 2017 and it has been one of the three hottest years on record from the Southern Europe to US, Africa, Russia and China. Temperatures have increased over 1.1°C above the average. According to the U.S. Billion-Dollar Weather and Climate Disasters (NCEI, 2018), which tracks and evaluates climate events in the US and globally that have great societal and economic impacts, the 2017 has been a historic year of weather and climate disasters. The cumulative expense due to events during in 2017 was $309.5 billion, much more than the previous record reached in 2005 of $219.2 billion. Three strong hurricanes happened in the US: Harvey, Irma and Maria and made landfall in rapid succession and, according to the Accumulated Cyclone Energy Index, September 2017 was the most intense month on record and the most expensive season ever at the same time in terms of climate damages. The US experienced 219 climate disasters since 1980 with a total cost higher than $1.5 trillion.

**1980-2018 Year-to-Date United States Billion-Dollar Disaster Event Cost (CPI-Adjusted)**

Event statistics are added according to the date on which they ended.
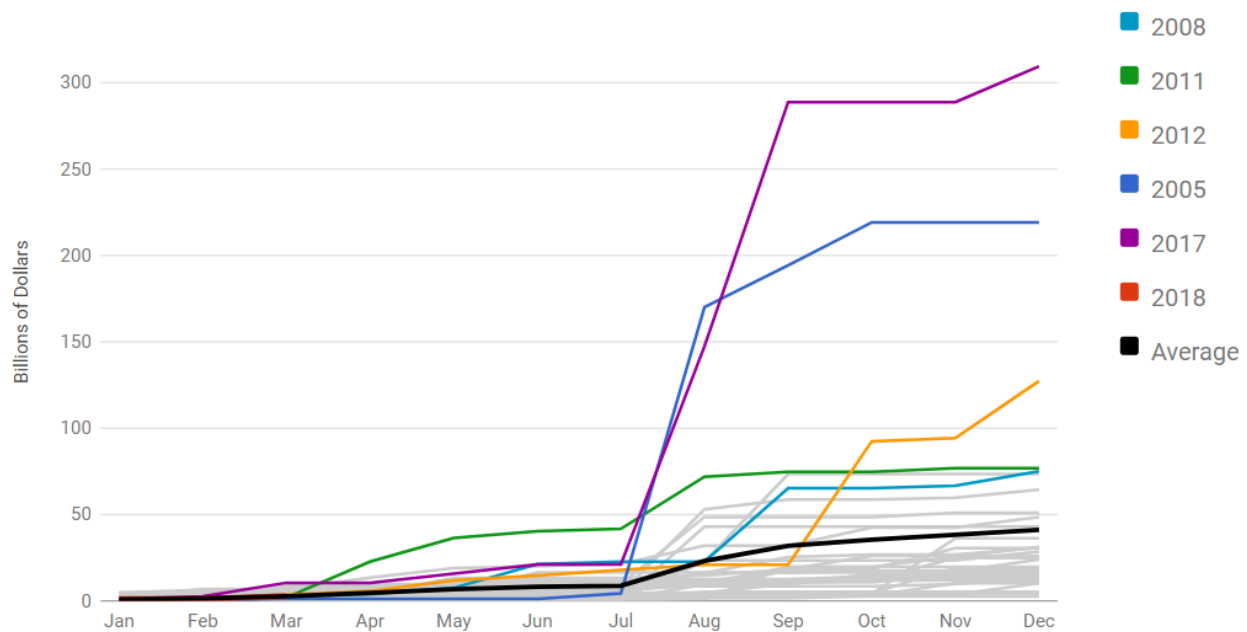


Statistics valid as of April 6, 2018.

*Figure 2. Disaster event cost in the U.S. from 1980 to 2018 (NCEI, 2018)*

In Europe, it is estimated that, by the year 2100, around 351 million of people will be exposed every year to weather-related disasters and the number of fatal accidents will be 50 times the actual ones (3000 ca). So, as this shocking research has found, more than 150,000 people could die in Europe by the end of this century because of the climate change. This information clearly shows the need of new worldwide policies to change and prevent these problems which must be addressed as a matter of urgency. We must work to decrease the damage to the environment and to make the World more resilient (Elsevier, 2017).

The first World conference to face the climate change "United Nations Conference on Environment and Development" (UNCED) has been in 1992, Rio de Janeiro. The results were the agreement for the United Nations Framework Convention on Climate Change and then, after some years, the creation of the Kyoto protocol. After the first conference, there have been others during the time with unsuccessful results until the one in Paris where, in December 2015, during the conference COP 21, it was signed by 195 countries the first universal agreement on the World climate which limits the

average Global warming behind 2°C in order to reduce in a significant way the risks and the impacts of climate changes.

The damages on the planet are clearer as time goes by: the lowering of biodiversity, the increasing pollution of the air and the water which are dangerous for the human health. According to the World Health Organization (WHO, 2016) outdoor and indoor pollution are responsible for more than one tenth of the globally deaths each year and more than 90% of the total World's population live in cities where the pollution level of the air is too high. Furthermore, we have a lot of political situations in which the nationalism is emerging: a trend that is in contrast with the need to face these problems globally. In 2017 the US President, Donald Trump, announced plans to withdraw the U.S. from the Paris Agreement.

The European commission asked the participation of the financial industry, without which it would be impossible to cover the 180 billion€ gap needed to reach the climate targets. The importance of the management and reduction of the exposition to polluting emissions is growing.

## 1.2 Highlights of the sustainability development in the World

On September 25th, 2015, many countries agreed on a set of goals to protect the planet, end poverty and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years (United Nations, n.d.).

Everyone needs to do its part to reach those goals: governments, the private sector, civil society and every individual.



*Figure 3. The sustainable development goals (United Nations, n.d.)*

### *1: No poverty*

Poverty rates have been reduced by more than half since 1990. This represents for sure an important achievement, but 767 million people still live below the international poverty line of $1.90 a day in developing regions, there are millions more who gain little more than this daily amount, and many people risk slipping back into poverty.

Poverty is much more than the low incomes and the poor quantity of resources to ensure a sustainable livelihood. Its manifestations include hunger and malnutrition, very limited access to education and many other basic services, social discrimination and exclusion as well as the lack of participation in

decision-making. Economic growth must be inclusive to provide sustainable jobs and promote equality all over the World.

Most people living below the poverty line belong to two regions: Southern Asia and sub-Saharan Africa. Every day, in 2014, 42,000 people had to abandon their homes to seek protection due to conflicts.

## *2: Zero Hunger*

Today, one in nine people in the world (815 million) are undernourished; poor nutrition causes nearly half (45 per cent) of deaths in children under five. If managed in the right way, agriculture, forestry and fisheries can provide nutritious food for all the people in the World and they can generate great incomes, while supporting people-centred rural development and protecting the environment.

As of today, our soils, freshwater, oceans, forests and biodiversity are being rapidly degraded and disrupted. The climate change is creating very high pressure on the resources we depend on, increasing risks associated with disasters such as droughts and floods. Many people can no longer make ends meet on their land, forcing them to migrate to cities in search of opportunities.

A huge change of the global food and agriculture system is needed if we are to nourish today's 815 million hungry and the additional 2 billion people expected by 2050.

The food and agriculture sector offer key solutions for development and are central for hunger and poverty solutions.

## *3: Good health well-being*

Ensuring healthy lives and promoting the well-being for all, at all ages, is essential to sustainable development. Significant improvements have been made in increasing life expectancy and reducing some of the common killers associated with child and maternal mortality (17,000 fewer children die each day than in 1990, but more than six million children still die before their fifth birthday each year and maternal mortality has fallen by almost 50 per cent since 1990). Major progress has been made

on increasing access to clean water and sanitation, reducing tuberculosis, malaria, polio and the spread of HIV/AIDS. However, many more efforts are needed to fully eradicate a wide range of diseases and address many different persistent and emerging health issues.

### 4: Quality education

Obtaining a quality education is the foundation to improve people's lives and to increase the sustainable development. Lots of progress has been made towards increasing access to education at all levels and increasing enrolment rates in schools particularly for women and girls (Enrolment in primary education in developing countries has reached 91% but 57 million children remain out of school. More than half of children that without school education live in sub-Saharan Africa). Basic literacy skills have improved tremendously, but other efforts are needed to make even greater strides for achieving universal education goals.

### 5: Gender equality

While progress towards gender equality has been achieved and women's empowerment is grow under the Millennium Development Goals (About two thirds of countries in the developing regions have achieved gender parity in primary education), women and girls continue to suffer discrimination and violence in every part of the world.

Gender equality should not be only a basic human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

Providing women and girls with equal access to all the resources like education, health care, decent work, and representation in political and economic decision-making processes will be great for sustainable economies, societies and humanity at large.

### 6: Clean water and sanitation

Safe water and adequate sanitation are indispensable for healthy ecosystems, reducing poverty, and achieving inclusive growth, social well-being and sustainable livelihoods. Clean water for all the people is an essential part of the sustainable world we would to live. There is sufficient fresh water

on the planet to achieve this goal (At the moment, almost the 70% of all water abstracted from rivers, lakes and aquifers is used for irrigation). Due to bad economics and poor infrastructure, every year millions of people, mainly children, die from diseases associated with inadequate water supply, sanitation and hygiene. At least 1.8 billion people globally use a source of drinking water that is contaminated.

Water scarcity, poor water quality and inadequate sanitation have also a negative impact on food security, livelihood choices and educational opportunities for poor families across the world. Drought afflicts some of the world's poorest countries, worsening hunger and malnutrition.

By 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water.

### 7: Affordable and clean energy

Energy is the dominant contributor to climate change, accounting for around 60 per cent of total global greenhouse gas emissions

Sustainable energy is opportunity – it transforms lives, economies and the planet.

Energy is a central resource needed to all the major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, access to energy for all is essential. As of today, one in five people still lacks access to modern electricity and 3 billion people rely on wood, coal, charcoal or animal waste for cooking and heating. Reducing the carbon intensity of energy is a key objective in long-term climate goals.

### 8: Decent work and economic growth

Almost the 50% of the world's population still lives on the equivalent of about US$2 a day. In many places, having a job doesn't mean to have the ability to escape from poverty. This slow progress requires us to rethink and retool our economic and social policies aimed at eradicating poverty.

A big lack of decent work opportunities, insufficient investments and under-consumption lead to an erosion of the basic social contract underlying democratic societies. The creation of quality jobs will remain a major challenge for almost all economies well beyond 2015.

Sustainable economic growth will require states to create the conditions that allow people to have quality jobs that stimulate the economic growth while not harming the environment. Job opportunities and decent working conditions are also required for the whole working age people since global unemployment increased from 170 million in 2007 to nearly 202 million in 2012, of which about 75 million are young women and men.

### *9: Industry, innovation and infrastructure*

Investments in infrastructure (transport, irrigation, energy…) are fundamental to achieve sustainable development and empowering communities in many countries. It is clearly known that quality infrastructure is positively related to the achievement of social, economic and political goals.

Inclusive and sustainable industrial development is the main source of income generation, allows for rapid and sustained increases in living standards for all people, and provides the technological solutions to environmentally sound industrialization.

Technological progress is the foundation of efforts to achieve environmental objectives, such as increased resource and energy-efficiency. Without technology and innovation, industrialization will not happen, and without industrialization, development will not happen.

Nowadays, in countries where data are available, the number of people employed in renewable energy sectors is around 2.3 million. Due to a strong rising interest in energy alternatives, the possible total employment for renewables by 2030 is 20 million jobs.

### 10: Reduce inequality

Even if the international community has made significant strides towards lifting people out of poverty and the most vulnerable nations continue to make inroads into poverty reduction, inequality persists, and large disparities remain in access to health and education services and other assets.

Furthermore, inequality within countries has risen (On average income inequality increased by 11 per cent in developing countries between 1990 and 2010 and an about the 75% of households in developing countries are living today in societies where income is more unequally distributed than it was in the 1990s) while income inequality between countries have been reduced. There is growing consensus that economic growth to be sufficient to reduce poverty must involve all the three dimensions of sustainable development – economic, social and environmental.

To reduce inequality, policies should be universal in principle paying attention to the needs of disadvantaged and marginalized populations.

### 11: Sustainable cities and communities

Half of humanity – 3.5 billion people – lives in cities today and by 2030, almost 60 per cent of the world's population will live in urban areas. Cities are hubs for ideas, culture, productivity, social development and much more.

Even if across the time cities have enabled people to advance socially and economically, many challenges exist to maintaining cities in a way that continues to create jobs and prosperity while not damaging lands and resources. The high density of cities can bring efficiency gains and technological innovation while reducing resource and energy consumption.

The future we want includes cities of opportunities for all, with access to basic services, energy, housing, transportation and more.

## 12: Responsible production and consumption

Sustainable production and consumption mean to promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all the people. Its implementation helps to achieve overall development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty.

It involves many different stakeholders and it aims at "doing more and better with less," increasing net welfare gains from economic activities by reducing resource use, degradation and pollution along the whole lifecycle, while increasing quality of life.

It also requires a systemic approach and cooperation among all the actors operating at each level of the supply chain, from producer to the final consumer. It involves consumers through awareness-raising and education on sustainable consumption and lifestyles, providing consumers with adequate information through standards and labels and engaging in sustainable public procurement.

## 13: Climate action

Climate change is affecting every part of the World. It is affecting lives and disrupting national economies, costing people, communities and countries. Its impact is expected to increase in the future.

People are facing significant impacts of climate change like changing weather patterns, rising sea level, and even more extreme weather events. The human activities are the responsible of greenhouse gas emissions which continue to rise and are driving climate change. They are now at their highest levels ever, global emissions of carbon dioxide ($CO_2$) have increased by almost 50% since 1990. If we do not manage this problem in a proper way, the world's average surface temperature is projected to rise over the 21st century and is likely to surpass 3 degrees Celsius this century, with some areas of the world expected to warm even more. As usually, the poorest populations are more vulnerable.

Climate change is not a matter of a single state; emissions anywhere affect people everywhere. It is a problem that requires solutions that need to be coordinated at the international level and it requires

international cooperation to help developing countries move toward a low-carbon economy. To address climate change, countries signed the Paris Agreement at the COP21 in Paris on 12 December 2015. The Agreement started on 4 November 2016. In the agreement, all countries agreed to work to limit global temperature rise to well below 2 degrees Celsius, and given the grave risks, to strive for 1.5 degrees Celsius.

The change is now starting as more people are turning to renewable energy and innovative technologies that will reduce emissions. Affordable, scalable solutions are now available to enable countries to participate for the creation of a cleaner, more resilient World.

### 14: Life below water

The life on the Earth is possible thanks to the oceans, which make the planet habitable for humankind. Oceans cover three quarters of the Earth's surface, contain 97% of the Earth's water, and represent 99 per cent of the living space on the planet by volume.

The sea, provide and regulate our rainwater, drinking water, weather, climate, coastlines, much of our food, and even the oxygen in the air we breathe. During the history, oceans and seas have been also vital conduits for trade and transportation.

A careful and smart management of this essential global resource is a key feature of a sustainable future.

### 15: Life on land

The Earth's surface is covered for the 30% by forests that are key to combating climate change, protecting biodiversity and are the homes of the indigenous population and more than 80% of all animal species. Around 13 million hectares of forests are being lost every year while the persistent degradation of drylands has led to the desertification of 3.6 billion hectares.

Deforestation and desertification, mostly caused by climate change and human activities, have affected the lives and livelihoods of millions of people in the fight against poverty and are part of the

major challenges to sustainable development. Efforts are being made to manage forests and combat desertification.

## *16: Peace, justice and strong institutions*

Another important goal is to promote peaceful and inclusive societies for sustainable development, the provision of access to justice for all, and building effective, accountable institutions at all levels and to reduce the corruption. The rule of law and development have a significant role and are mutually reinforcing, making it essential for sustainable development at both national and international level.

## *17: Partnership for the goals*

To build a successful sustainable development agenda it is necessary to create partnerships between governments, the private sector and civil society. These partnerships are needed at the global, regional, national and local level and must be built upon principles and values, a shared vision, shared goals that place people and the planet at the centre.

Long-term investment in sustainable energy, infrastructure and transport, as well as information and communications technologies, including foreign direct investment, are needed in critical sectors, especially in developing countries. Also, the public sector will need to set a clear direction. National oversight mechanisms such as supreme audit institutions and oversight functions by legislatures should be strengthened.

## 1.3 Highlights of the green finance market in the World

### *China*

China is recognized as the largest emitter of greenhouse gases. They agreed with COP 21 to reduce their emissions from today's level to the 60/65 percent of the GDP by 2030, a goal which require annual investments around $320-640 billion. The decarbonisation is urgent in China since their coal-intensive economic growth has compromised public health. Nowadays, China has become the world's largest issuer of climate-aligned bonds with $220 billion in issuances.

China, as the largest developing countries in the world, has always place development as the priority. In the next years, China will make efforts on innovative development and improve the quality and efficiency of development. China will pursue green development by promoting a green and low-carbon model and lifestyle, protecting ecological system. Shared development will be facilitated to improve people's well-being. China will seek coordinated development in the economic, political, cultural, social and ecological fields to build a prosperous society in all respects as planned.

China gives a great importance to the implementation of the 2030 Agenda and believes that the principles should be followed in building a new type of international relations featuring win-win cooperation, establishing all-round partnership, and achieving economic, social and environmental development in a balanced manner. Countries should be encouraged to formulate their domestic development strategies and take measures to implement the 2030 Agenda according to the national conditions and respective characteristics.

China has fixed 9 key areas should be prioritized in the implementation of the 2030 Agenda. These areas are:

1. Stop poverty and hunger through targeted measures, enhancing agricultural production capacities and food security;

2. Implementing new development strategies for sustainable, healthy and stable economic growth;

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3. Evolving industrialization to coordinate development between urban and rural areas and among the three dimensions of sustainable development;

4. Increasing the social security level and social services;

5. Safeguarding equity and social justice to improve people's well-being and promoting all-round human development;

6. Protecting the environment;

7. Addressing climate change actively and integrating climate change response into national development strategies;

8. Promoting efficiency and sustainable energy;

9. Improving national governance and ensuring economic and social development in line with the rule of law.

## *United States*

The US is the second world's largest emitter of greenhouse gases. Their goal is to reduce the greenhouse gas emissions by 26/28 percent by 2025. The Obama administration lunched the Clean Power Plan, a state-by-state standard to reduce emissions from electric power plants 32% from 2005 levels by 2030. Even if the regulations are facing legal battles from pro-fossil fuel states and the hostility from the Trump administration, other federal policies to increase renewable energy production remain in place. The United States is the second largest issuer of climate-aligned bonds with $110 billion in issuances.

### *Europe*

The goal of European Union is to cut greenhouse gas emissions by at least 40% by 2030, from the levels of 2005. To keep the European Union competitive, in 2016 it was presented by the European Commission a package of measures called "Clean Energy of All Europeans" according to which an extra 177 billion€ is needed annually to reach the 2030 climate goals. The European green bond market is growing a lot and it is expected to continue to growth in the years to come, attracting new issuers and new investors. Western Europe as a whole, accounted for $195 billion EU climate-aligned issuances.

The European commission has fixed 10 sustainable priorities for 2015-2019:

1. Jobs, growth and investment: the financial crisis of 2008 has caused a decreasing of the investment and for this reason it is necessary a continuous economic recovery;

2. Digital single market: the internet and all the innovative digital technologies are changing our World. It is time to create a single European digital market to tearing down the existing barriers and regulatory walls;

3. Energy union and climate: if we move to a European energy union we will have a more secure, affordable and climate-friendly energy;

4. Internal market: the internal market is an engine for building a stronger and fairer EU economy, giving to people the possibility to have new opportunities:

5. A deeper and fairer economic and monetary union: it is necessary to combine stability with fairness and democratic accountability;

6. A balanced and progressive trade policy to harness globalization: today, in our modern economy, trade is essential for jobs, growth and competitiveness and so the EU has to maintain and to pen a rules-based trading system;

7. Justice and fundamental rights: the values of equality, inclusion, human dignity, freedom and democracy are fortified and protected by the rule of law in the "Charter of Fundamental Rights";

8. Migration: no EU country can or should be left alone to address huge migratory pressures;

9. A stronger global actor: bringing together the tools of Europe's external action;

10. Democratic change: European people have the right to know who Commissioners and Commission staff, Members of the European Parliament and representatives of the Council meet in the context of the legislative process. The Commission is committed to bringing a new lease of life to the relationship with the European Parliament, as well as to working more closely with national parliaments.

## *Canada*

Canada agreed to COP 21 with the goal to reduce their greenhouse gas emissions by 30% by 2030, from the level of 2005. Investments related to climate mitigation efforts, clean innovation, jobs and growth and renewed infrastructure, are growing. With $27 billion in climate-aligned issuances, Canada is the fifth larger issuer of the world.

## *Australia and New Zealand (Pacific area)*

In the last two years, Australia has been characterized by a huge growth of the green finance. After a lot of years passed thinking about investment opportunities in green finance and making detailed assessments of their environmental exposures, capital is now starting to move into green finance. By 2030, they want to ensure access to affordable, reliable sustainable and modern energy for all and create sustainable cities and communities. Furthermore, Australia is integrating climate change measures into national policies, strategies and planning.

# 2.GREEN INVESTMENTS

## 2.1 Introduction

The modern origins of socially responsible investments started in the 1960s with the topics of civil rights, feminism, environmentalism and complain against the Vietnam War (Slapikaitė & Tamošiūnienė, 2015).

In the decade of 1980s, the number of socially concerned investors drastically increased, mainly because of the Chernobyl disaster and Bhopal[1]. Moreover, the information about global warming and ozone depletion came to the attention of the world and issues of environment, human rights, working conditions and resource management became important aspects for many investors.

During the whole XX century, financial performance of sustainable mutual funds remained one of the main empirical questions for most of the scientists and researchers. Then, in the XXI century, sustainable investments became a steadily growing market segment and ESG criteria were incorporated into the investment process.

The challenges of the globalization process (climate change, waste of natural resources, social-demographic and ecological problems) promote people and business to become more conscious. As a result, sustainable investing has gained importance in recent years. Just over one investor in 10 (11%) do not know what a sustainable investment fund is; 78 percent of people feel sustainable investing is more important to them now than five years ago and almost two thirds (64%) have increased their sustainable investments over the same period (Schroders, 2017). Despite this growing trend, there is still some way to go before the majority recognises sustainable investing as an effective means of having a positive impact on the world.

Various tags are used to describe investments that consider ESG issues: from the relatively traditional *socially responsible investing* to the more recent *responsible investing* and *sustainable investing*. A

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[1] Gas disaster in India

lack of consistency has been found in the use of such names; different tags can be used to refer to the same idea of responsible investing. In this report, sustainable investments (socially responsible investing, sustainable investing or responsible investing) are intended as a long-term investment approach, which integrates ESG factors in the research, analysis and selection process of securities within an investment portfolio (Eurosif, 2016). Individuals who invest sustainably choose to invest in companies, organizations and funds with the purpose of generating measurable social and environmental impact alongside a financial return.

Sustainable investments deal with many factors. Figure 4 shows what these factors are.
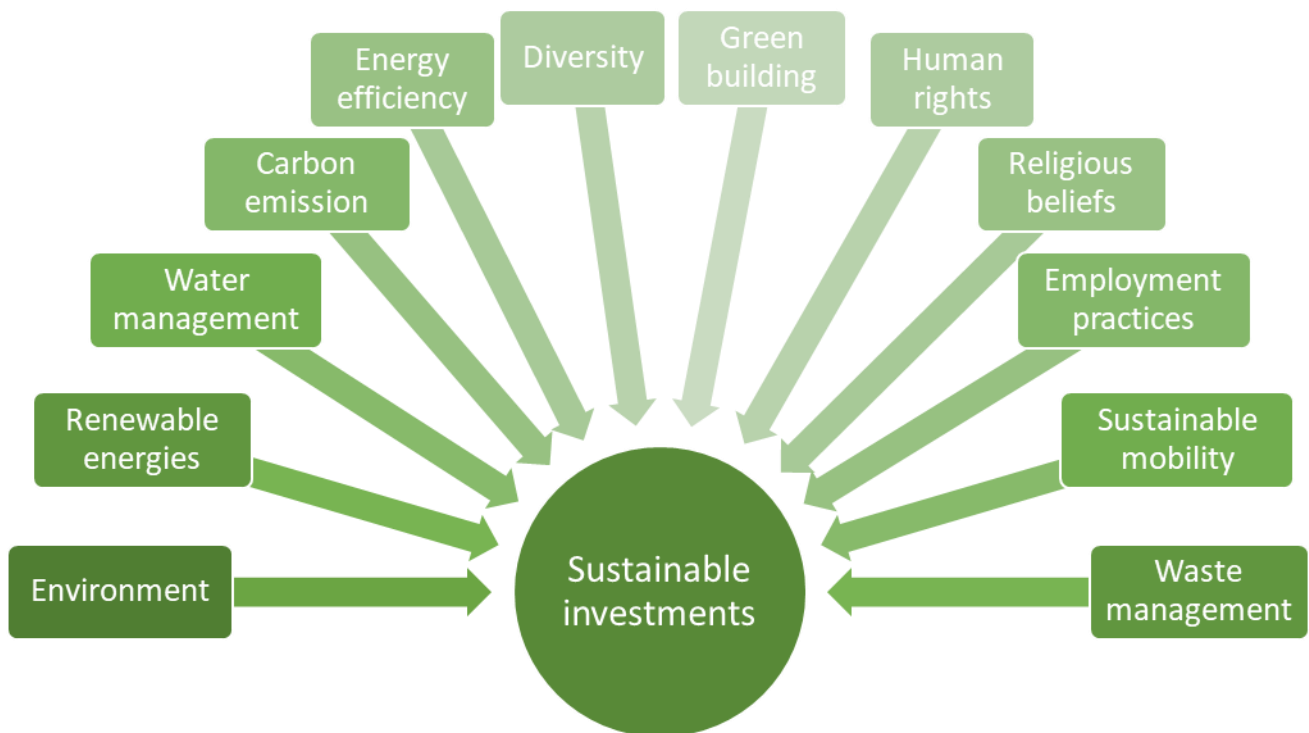


*Figure 4. Factors that deal with sustainable investments*

Investors consider sustainable investing for various reasons: some may see them as a source of economic value, others could also focus on them because of moral values. A study from Harvard Business School (Amel-Zadeh & Serafeim, 2017) highlighted how the use of ESG information has primarily financial rather than ethical motives. In line with that, when investors are asked the main reasons for their sustainable investments, the most common answers are about the risk management

and the explicit requests from clients or investors (see Table 3). This response is consistent with the literature on sustainable investments, which tend to describe them primarily as risk factors.

*Table 3. Reasons why investors consider sustainable investing (CFA Institute, 2015)*

| SURVEY RESPONSE | RESPONDENTS |
|---|---|
| *To help manage investment risks* | 63% |
| *Clients/investors demand it* | 44% |
| *ESG performance is a proxy for management quality* | 38% |
| *It is my fiduciary duty* | 37% |
| *To help identify investment opportunities* | 37% |
| *My firm derives reputational benefit* | 30% |
| *Regulation requires it* | 7% |
| *Other* | 5% |

## 2.2 Market trends

Sustainable investments assets under management have grown dramatically over the last two decades. From 1995 to 2014, the global market of responsible investments has increased of 929%, with a CAGR[2] of 13.1% (PNC, 2015). The assets under management considering sustainability criteria have had a strong growth also in recent years, having a global expansion of more than 25% (see Table 4). More in detail, sustainable investing has experienced a CAGR of 107.4%, increasing assets under management from $1.0trillion in 2012 to $4.3trillion in 2014 (EY, 2017). Europe leads markets with about half of managed assets considering sustainability criteria. Canada and US interest continues to grow, while Japan is rising rapidly on government governance and pension fund efforts.

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[2] Compound Annual Growth Rate

24

*Table 4. Growth of sustainable investments assets by region 2014-2016 (GSIA, 2016)*

| Region | 2014 | 2016 | Growth |
|---|---|---|---|
| **Europe** | $ 10,775bn | $ 12,040bn | 11.7% |
| **United States** | $ 6,572bn | $ 8,723bn | 32.7% |
| **Canada** | $ 729bn | $ 1,086bn | 49.0% |
| **Australia – New Zealand** | $ 148bn | $ 516bn | 247.5% |
| **Asia (without Japan)** | $ 45bn | $ 52bn | 15.7% |
| **Japan** | $ 7bn | $ 474bn | 6,689.6% |
| **TOTAL** | **$ 18,276bn** | **$ 22,890bn** | **25.2%** |

The number of available sustainable investing funds confirms this growing trend: it has nearly tripled since the pre-crisis period, as shown in Figure 5.



| | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|
| # of funds | 200 | 231 | 338 | 493 | 720 | 925 |
| New openings | 0 | 31 | 107 | 155 | 227 | 205 |
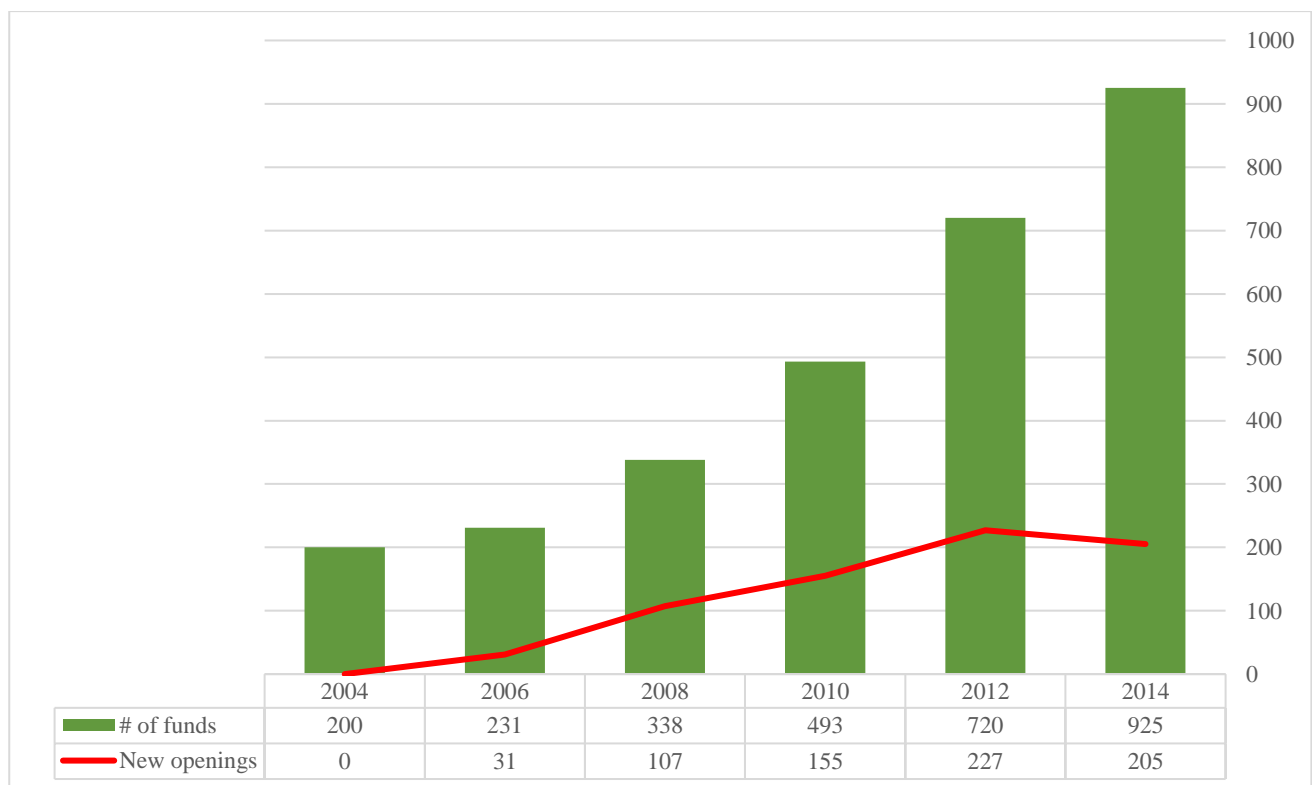
*Figure 5. Growth in sustainable investing funds (EY, 2017)*

According to the Global Investor Study (Schroders, 2017), investments in sustainable funds will continue to grow, encouraged by closing the current knowledge gap around how these types of investment can achieve both potential profit and positive impact.

The climate and renewable energy themes are often extended to include other environmental sectors. Figure 6 shows what are the themes more considered by socially responsible investments.
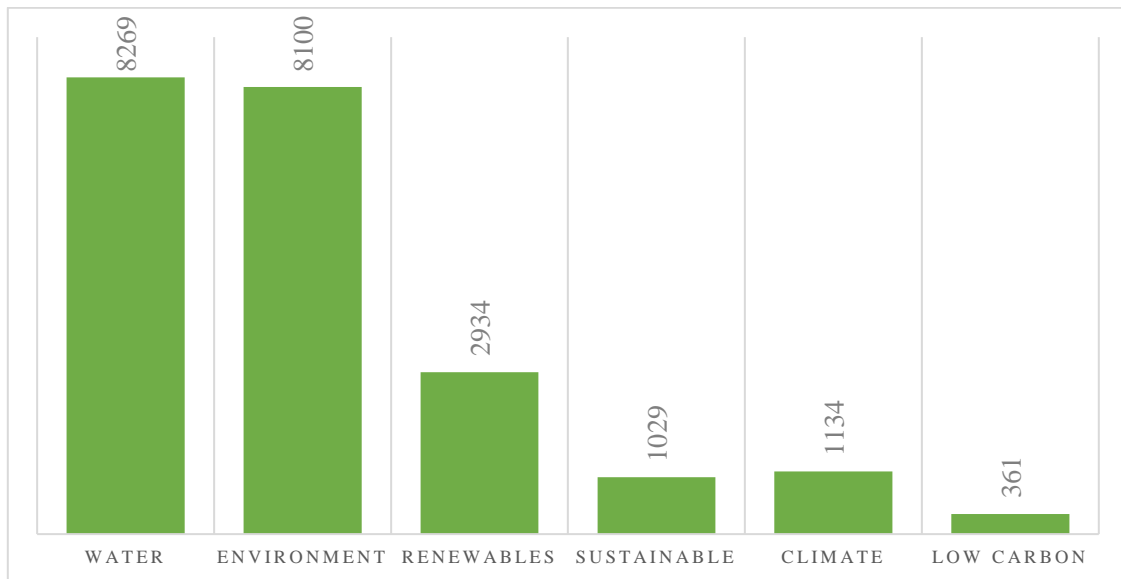


*Figure 6. Volumes by themes in million € (Novethic, 2017)*

Sustainable investing demand and corporate focus on sustainability go together: as previously said, European investors are the ones that invest more in sustainable investments. It is not accidental the fact that European companies, in average, score best in sustainability data reporting and ranking.

## 2.3 The drivers in a nutshell

In recent years, numerous drivers have driven the evolution and growth of sustainable investing. According to the Report on US Sustainable, Responsible and Impact Investing Trends, 85% of the managers cited "client demand" as the main motivation for sustainable investing (US SIF, 2016). Another strong motive is climate change, which remains the most significant overall environmental factor in terms of assets – the number of assets invested in this environmental factor has tripled in the period 2014-2016 (US SIF, 2016). Other researchers say that the main drivers for sustainable

investing according to the investors are enhancing returns, strengthening risk management and alignment of strategies with the priorities of the stakeholders (Bernow, Klempner, & Magnin, 2017). According to CFA Institute, 37% of the respondents to their survey answered that one of the main drivers is their fiduciary duty and, among the interviewed who do not consider sustainable investments, 22% suggested that they would do so if they had clarity that doing so does not conflict with their fiduciary duty (CFA Institute, 2015). Other factors that drive the growth of sustainable investing are the search of stable long-term return, generational transfer of wealth and contribute to local community development (Eurosif, 2016).

## 2.4 Environmental, Social and Governance (ESG) criteria

More than one-quarter of assets under management globally are now being invested according to the premise that environmental, social and governance (ESG) factors can materially affect a company's performance and market value.

*Table 5. Factors involved in the ESG definition (CFA Institute, 2015)*

| ENVIRONMENTAL | SOCIAL | GOVERNANCE |
|---|---|---|
| Climate change and carbon emissions | Customer satisfaction | Board composition |
| Air and water pollution | Data protection and privacy | Audit and committee structure |
| Biodiversity | Gender and diversity | Bribery and corruption |
| Deforestation | Employee engagement | Lobbying |
| Energy efficiency | Community relations | Political contributions |
| Waste management | Human rights | Whistle-blower schemes |
| Water scarcity | Labour standards | Transparency |

During the last years, the consideration of ESG factors has become more common. A growing awareness of ESG issues in investing has been registered (CFA Institute, 2015): 73% of the respondent of a survey made by CFA Institute consider at least environmental, social or governance issues in investment decisions (Figure 7).
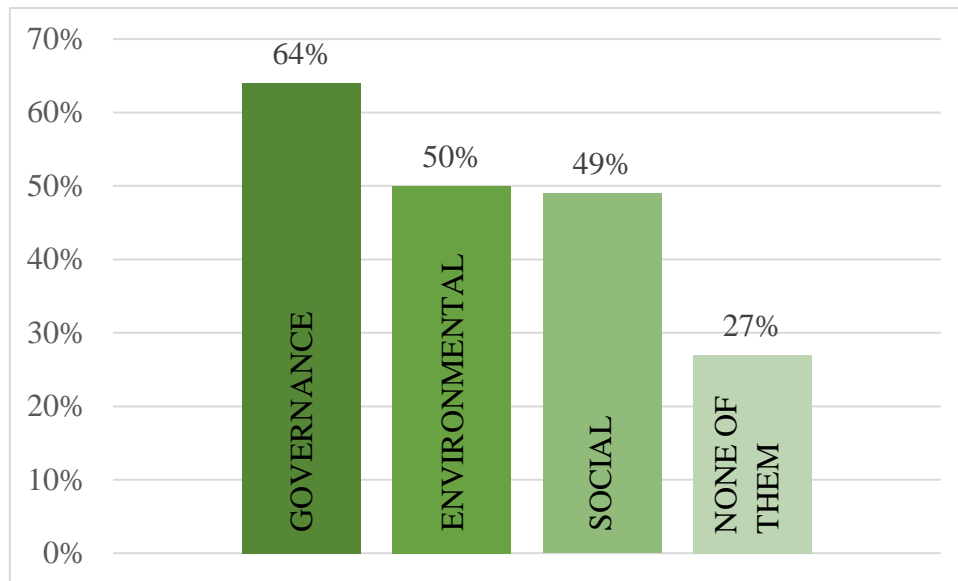
*Figure 7. ESG factors considered in investments (CFA Institute, 2015)*

The growing attention to the ESG factors is testified by the growing number of companies that, together with the traditional documents, publish additional information regarding their "sustainable behaviour" and by the growing number of institutional investors that explicitly take into account these factors in their investment decisions: while in the early 1990s, fewer than 20 companies disclosed ESG data, in 2016 this number has increased to nearly 9,000 companies (450x) (Amel-Zadeh & Serafeim, 2017).

Another indicator that suggests that ESG criteria have been always more considered during the last years is the availability and usage of ESG data and professional services. There is an always growing number of data and research providers as well as rankings and ratings from both mainstream and specialized providers (Reuters, MSCI, Sustainalystics, Morningstar, Bloomberg, etc.).

Regarding how the ESG information is used, more than one-third of the investors use ESG information to engage with firms or as an input into their valuation models (37% and 34% respectively) and a significant percentage of the respondents use the information to define the investment universe through a screening process. (Amel-Zadeh & Serafeim, 2017).

The integration of best practices according to the ESG factors represents a tool able to discriminate the long-term sustainability of a company, thus, the competitive advantage (Giudici & Bonaventura, 2018). One of the main things that have been noticed about the integration of ESG factors of leading institutions is that sustainable investing is more effective when its core activities are integrated into existing processes, rather than carried out in parallel (Bernow, Klempner & Magnin (2017), Mercer (2014)) and that ESG practices are more effective when all the three fields together – Environmental, Social and Governance – rather than only one or a combination of two of them is considered in the investment evaluation.

The diffusion of ESG practices is fed by policy makers: some researches and articles (Giudici & Bonaventura (2018), Sandrin (2018)) state that the 2015 publication of the Sustainable Development Goals[3] (SDGs) from ONU has been a fundamental milestone for the ESG practices development and diffusion.

## 2.5 Investments strategies

An investment strategy that embraces sustainability "consists of building blocks familiar to institutional investors: a balance between risk and return and a thesis about which factors strongly influence corporate financial performance" (Bernow, Klempner, & Magnin, 2017)

The techniques used in sustainable investing have advanced together with the evolution of sustainable investments. The 2016 Global Sustainable Investment Review (GSIA, 2016) presented 7 strategies for socially responsible investing: (i) Sustainability themed investing, (ii) Positive or Best-in-Class screening, (iii) Norms-based Screening, (iv) Negative or Exclusionary screening, (v) Corporate engagement and shareholder action, (vi) ESG Integration and (vii) Impact or Community investing.

    i.    Sustainability themed investing is based into focusing on or more themes directly related to sustainability, like clean energy, green technology, sustainable forestry or sustainable

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[3] A list of 17 objectives and 169 targets that have to be reached by 2030

agriculture. Thanks to events such as COP21, investors have sought to highlight how finance can redirect capital and help push forward the transition to a low carbon economy. In Europe, this strategy has had a +146% growth in the years 2013-2015 (Eurosif, 2016).

ii.    Positive or Best-in-Class screening is an approach that entails the selection of the top investments based on the best ESG criteria and financial analysis combination. In the period 2014-2016, in Europe, this investment strategy has grown by 40% with AuM[4] reaching almost € 493bn (Eurosif, 2016).

iii.   Norms-based screening allows investors to assess the degree to which each company in their portfolios respects issues that impact ESG criteria by adhering to global norms on human rights, anti-corruption, labour standards and environmental protection.

iv.    ESG integration strategy consists in the systematic and explicit inclusion of environmental, social and governance factors into financial analysis by investment managers. Unlike the Best-in-Class method, ESG integration does not necessarily require peer group benchmarking or overweighting the leaders. Similarly, ESG integration does not require any ex-ante criteria for inclusion or exclusion.

v.     Negative or Exclusionary screening adopts various filters that exclude a priori certain companies or sectors from the investment portfolio based on specific ESG criteria, e.g. companies that produce alcohol, tobacco or gambling products. This strategy has seen exponentially consistent growth throughout the years.

vi.    Corporate engagement and shareholder action includes responsible ownership through engagement with companies and voting shares at general meetings. This strategy can be also called Shareholder Advocacy, where the shareholders put pressure on big corporations to be more socially responsible. The goal of the Engagement strategy is to make an impact on the company's policies.

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[4] Assets under Management

vii.   Impact or Community investing refers to investing with the disclosed intention to generate and measure social and environmental benefits alongside a financial return. It spans a large range of social issues and topics that are classified into two categories: social integration and sustainability related projects. The former includes access to some basics like affordable housing, health, finance, education. The latter deals with projects related to renewable energy, food, water, etc. Impact investing is the strategy that had the most impressive growth in the last years: it recorded a +385% growth from 2013 to 2015 and a CAGR of 120% (Eurosif, 2016).

While early ethics-based approaches such as negative screening remain relevant today, the newer strategies typically put less emphasis on ethical concerns and are designed instead to achieve a conventional investment aim: maximizing risk-adjusted returns (Bernow, Klempner, & Magnin, 2017).

The growth of these newer strategies is undeniable: 62 percent of the money managers that responded to a survey about their ESG incorporation strategies made by US SIF Foundation responded that they use some combination of negative screening, positive screening and ESG integration strategy within their funds. More than half reported using strategies of impact investing and nearly half used sustainability themed investing as a strategy. The incorporation strategy that affected the highest number of assets was ESG integration (1.51trillion$) (US SIF, 2016). The most widely applied sustainable investment strategy globally (used for two-thirds of sustainable investments) is negative screening, but ESG integration has been growing at 17% per year being used in 2017 in nearly half of sustainable investments and growing with at a faster pace than negative screening (Figure 8) (Bernow, Klempner, & Magnin, 2017). In addition to that, investors believe that, among different investment styles, ESG integration, positive screening and active ownership will become more important in the future, while negative screening, sustainability themed investing, best-in-class and corporate engagement are expected to become less relevant (Amel-Zadeh & Serafeim, 2017).

| | Impact investing | Sustainab. themed screening | Positive screening | Norms-based screening | Corporate engagement | ESG integration | Negative screening |
|---|---|---|---|---|---|---|---|
| 2014 | 101,0 | 138,0 | 890,0 | 4385,0 | 5919,0 | 7527,0 | 12046,0 |
| 2016 | 248,0 | 331,0 | 1030,0 | 6210,0 | 8365,0 | 10369,0 | 15023,0 |

■ 2014  ■ 2016
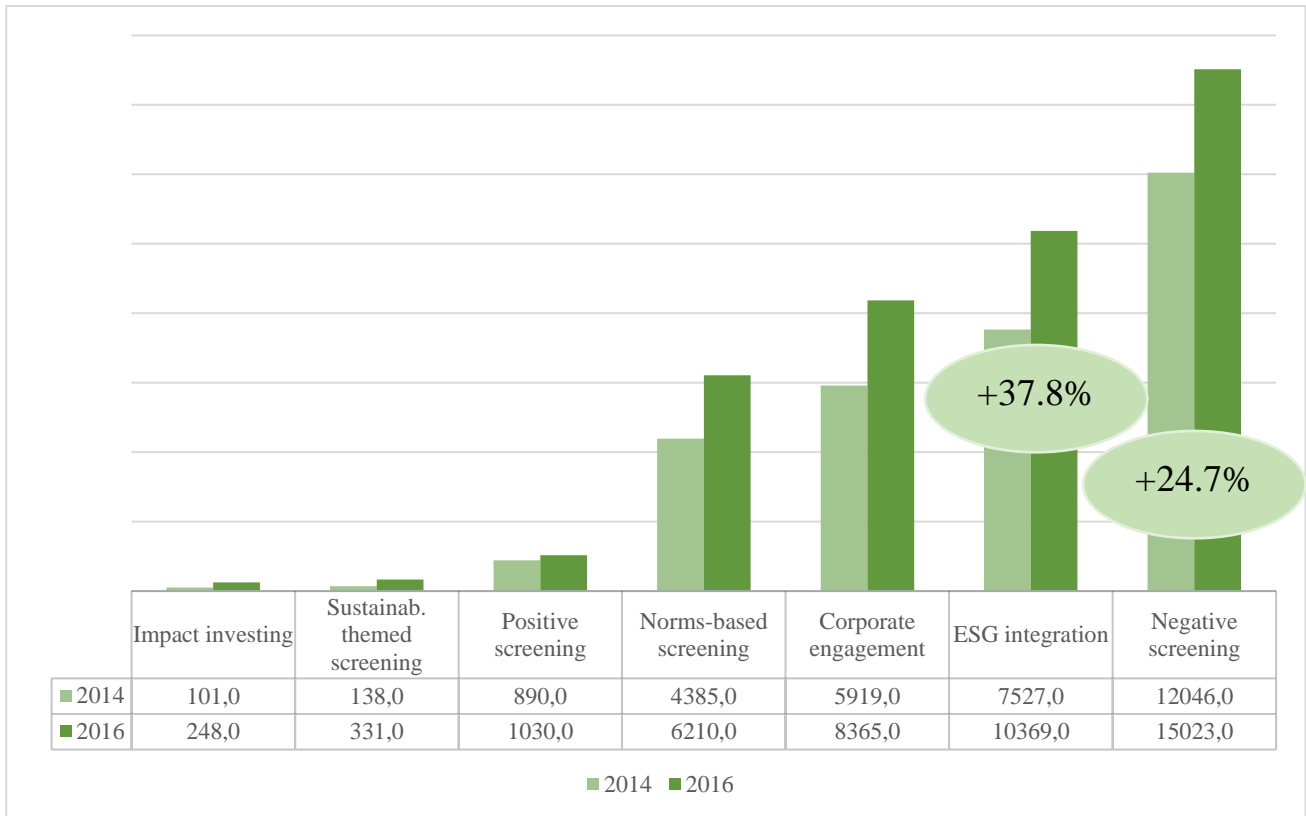
*Figure 8. Strategies growth (GSIA, 2016). The numbers represented are in US $billion. The percentages represent the growth of ESG integration strategies and Negative screening strategies*

As shown in Figure 8, all the strategies continued to experience growth between 2014 and 2016. The fastest growing strategies, although also the smallest in financial terms, were impact investing (146%) and sustainability themed screening (140%). Norms-based screening (42%) and corporate engagement (41%) are continuing to grow at a fast pace as well. On the other hand, positive screening is the one with the lowest growth between 2014 and 2016 (16%).

There is geographical difference in the investment strategies adopted in the world (CFA Institute (2015), GSIA (2016), Eurosif (2016)). Norms-based screening, sustainability themed investing and negative screening are most used in Europe, while ESG integration and impact investing, on the other hand, are more used in the US (Figure 9 shows more detailed information).
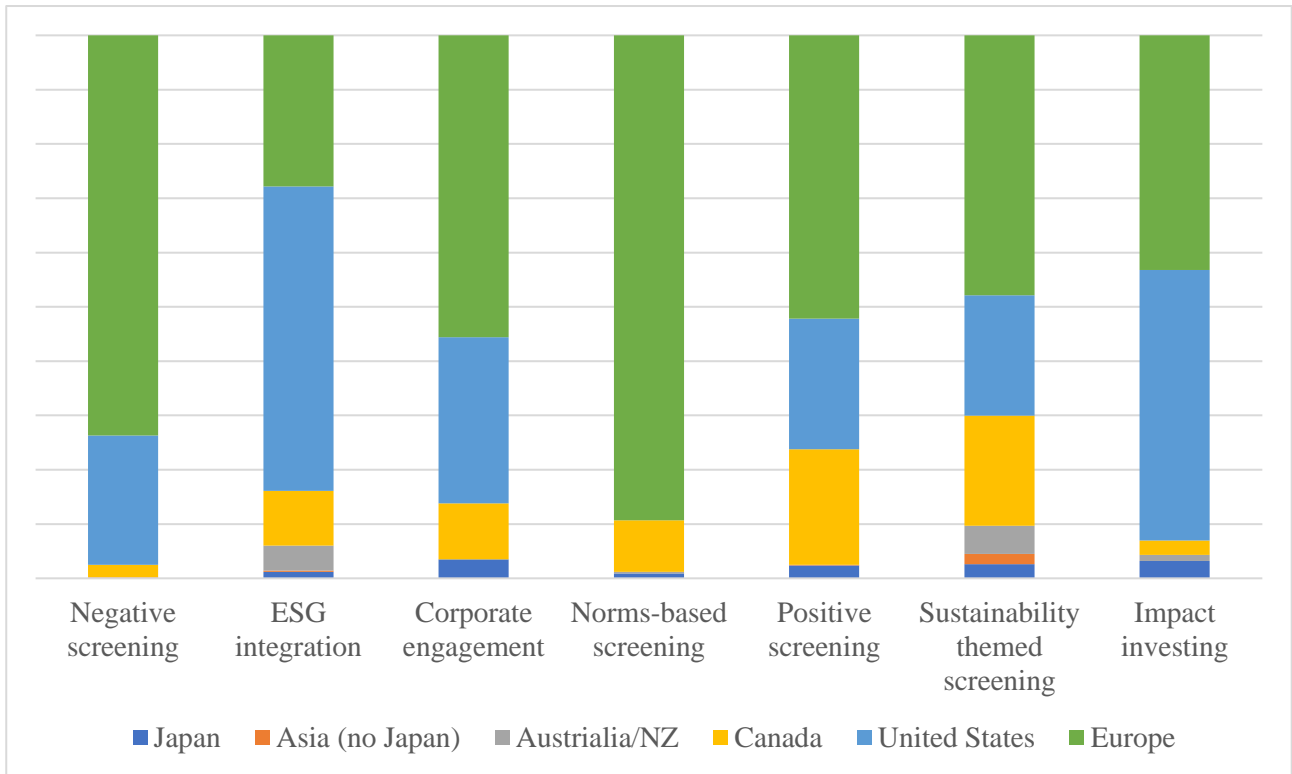
*Figure 9. Regional share in global use of the different strategies (GSIA, 2016)*

However, there is not a "right" mix to follow for having "the perfect" investment strategy. Looking at the top 13 European countries in terms of investment, it is possible to see the different strategies adopted (Figure 10).
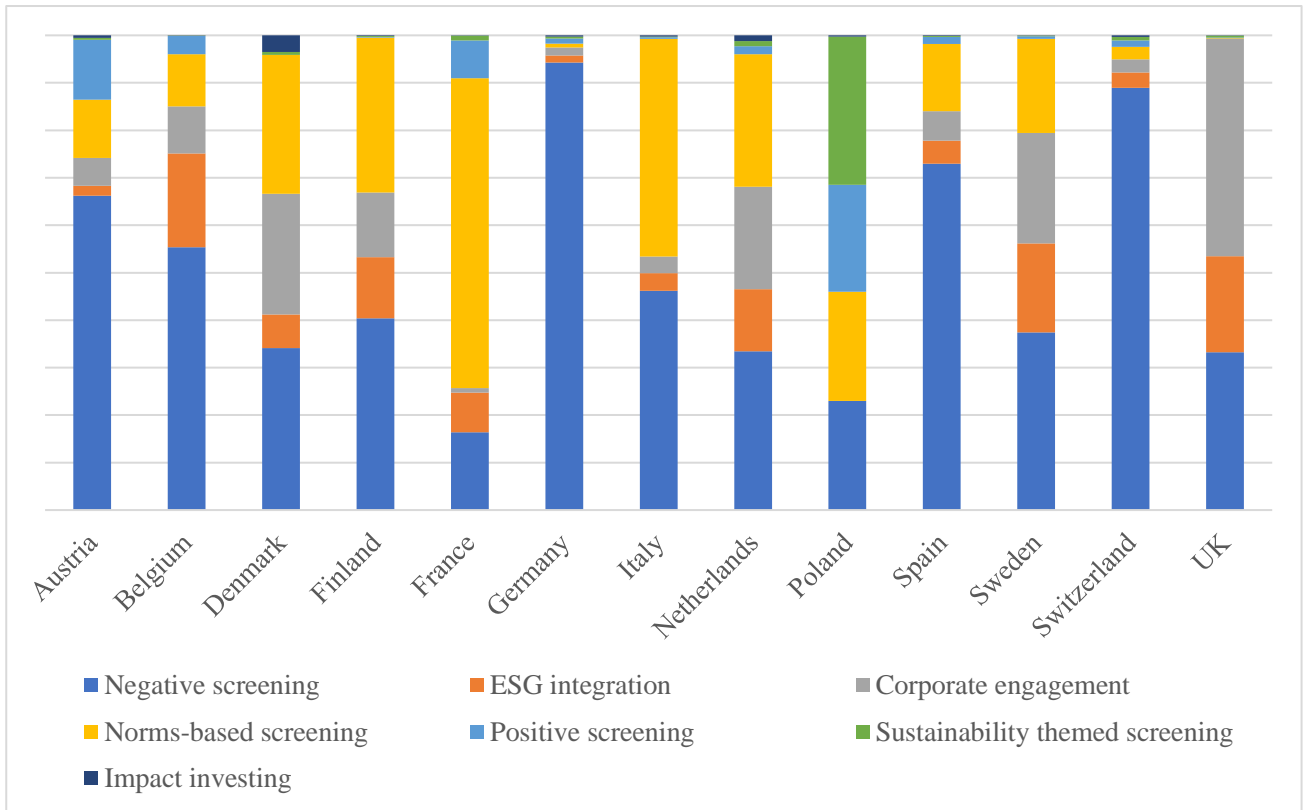
*Figure 10. Different investment strategies per European country (Eurosif, 2016)*

The top 3 investors among the ones illustrated are UK (5,622,342 million €), France (4,059,654 million €) and Netherlands (3,361,091 million €). UK adopts for 99.3% of its assets a combination of negative screening, ESG integration and corporate engagement; France is mainly focused (65.3%) on norms-based screening; Netherlands, in the end, adopts a mix of the four of them (96% of its assets). Focusing on these numbers, it is possible to see how different the investment strategies of these three countries are. The conclusion that can be drawn is that there is not a unique solution that ensures the maximum returns and the best performances in terms of sustainability, but different investors believe that different strategies are the best considering the trade-off returns/sustainable impact.

## 2.6 Investors

Multiple studies (Eurosif (2016), GSIA (2016)) analysed the growth of retail and institutional investors in sustainable investments along the years. The findings highlight that there are interesting and changing patterns in terms of players and types of investments: looking at the split between retail and institutional assets, there is a significant increase in favour of retail investors who seem to be taking the lead in some countries like Belgium (more than 60%), Sweden and Poland (more than 40%) and Finland (almost 40%).
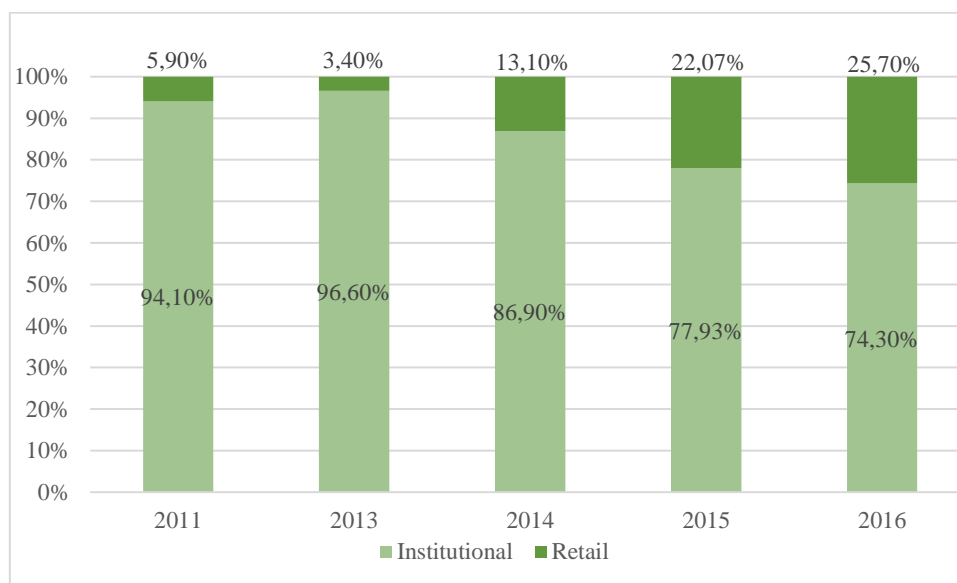


*Figure 11. Type of investors - global (2011-2015) (Eurosif, 2016) (GSIA, 2016)*

Individual investors are beginning to factor sustainability into their investment decisions, but there is room to grow. According to a survey (Morgan Stanley, 2015), individual investors have a positive view of sustainable investing: 71% of individual investors are interested in sustainable investing, and many of them (58%) see sustainability as an obligation. Additionally, 72% of individual investors believe that companies with good ESG practices can achieve higher profitability and are better long-term investments. Despite this, more than half of the individual investors (53%) believe that sustainable investing requires a financial trade-off, but according to the subsequent survey of 2017 (Morgan Stanley, 2017), it has not slowed the growth of interest in sustainable investing.

Individual investors say that 46% of their total portfolio should be invested sustainably, and two out of three investors (65%) believe sustainable investing will become more prevalent in the coming years (Morgan Stanley, 2015).

## 2.6.1 The millennial investor

Generational differences in overall sustainable behaviour are distinctive. Several studies confirm that Millennials[5] are driving the growth of sustainable investing and will be the main driver for the growth of green investments (Accenture (2017), Schroders (2017), Neil (2017), EY (2017)).

The population of millennials has had a constant growth in the last years and, in 2015, it has become the largest generation ever. Whilst being the largest adult segment, as the time goes by, millennials will also grow their wealth significantly since, with an age ranging from 18 (born in 2000) to 36 (born in 1982) at present, they are about to enter their prime earning years, resulting in a large increase of liquid assets. According to a report from Deloitte, until 2020, the net worth of millennials is predicted to more than double compared to 2015 (Ernst, Hauber, & Kobler, 2015). Combining these two facts, it is clear that in future, the economy of the world will be driven by this generation. It is then important to understand the behaviour of millennials towards sustainable investing to understand if and how the trends can be shaped.

Millennials' behaviour differs significantly compared to the previous generations. According to Schroders "Millennials are more clued up on sustainable investments funds than Generation X[6] and Baby Boomers[7]. […] Boomers are four times as likely as millennials not to know what a sustainable fund is (19% vs 5%). Generation X sit between the two" (Schroders, 2017).

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[5] Born from the first 1980s and 2000
[6] Approximately born from the first 1960s to the first 1980s
[7] Born from 1945 to 1964

36
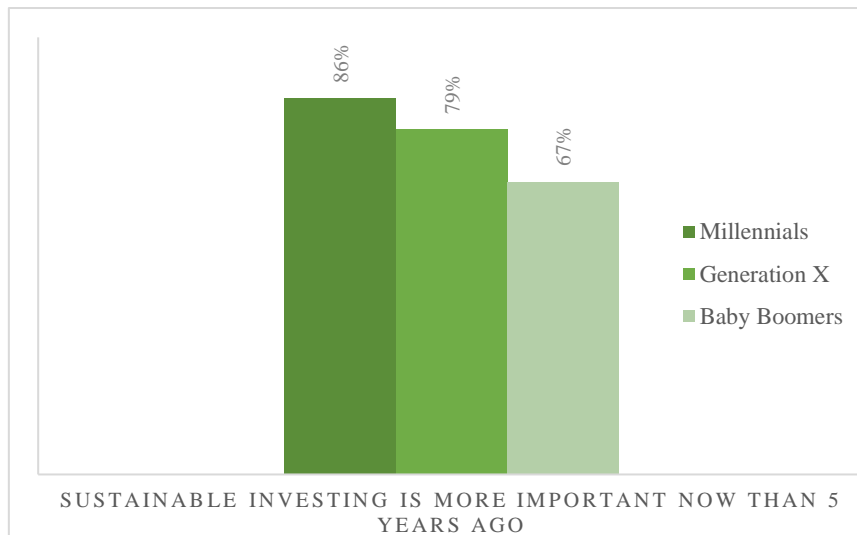
*Figure 12. Importance of sustainable investing according to the last three generations (Schroders, 2017)*

To this, Millennials demonstrate to give more value to brands and employers who act socially responsible and they refuse to consider money as sole success factors. This behaviour has been likely forged by the 2008 financial crisis: it made millennials relatively cautious and conservative in regard to financial matters. As a result, recent studies (EY, 2017) have demonstrated that millennials more consistently select investment that align with their values than previous generations: if compared to non-millennials investors, almost twice of millennials indicate (i) they seek to invest in companies that use high quality ESG practices (17% vs 9%) and (ii) they would rather buy products from a sustainable brand than from another one (15% vs 7%).

Morgan Stanley, in its surveys (Morgan Stanley (2015) and Morgan Stanley (2017)), found some interesting facts about the behaviour of millennials if compared to the rest of the individual investor population, that help to understand why millennials will drive the growth of individual investments in future:

- They are nearly twice as likely to invest in companies or funds that target specific social or environmental outcomes (22% vs 12%);

- They are nearly twice as likely to invest in companies or funds that aim to use environmental, social or governance practices to create a value differentiator (17% vs 9%);

- They are over twice as likely to exit an investment position because of objectionable corporate activity (15% vs 7%).

- In the update report of 2017 (Morgan Stanley, 2017), it was found that the interest of millennials has grown recently: in 2015, 28% of millennials responded to be "very interested" in sustainable investment; in 2017, this number increased to 38%, confirming the emerging trends.

Figure 13 and Figure 14 show the difference in interest in sustainable investments between millennials and the rest of the population.
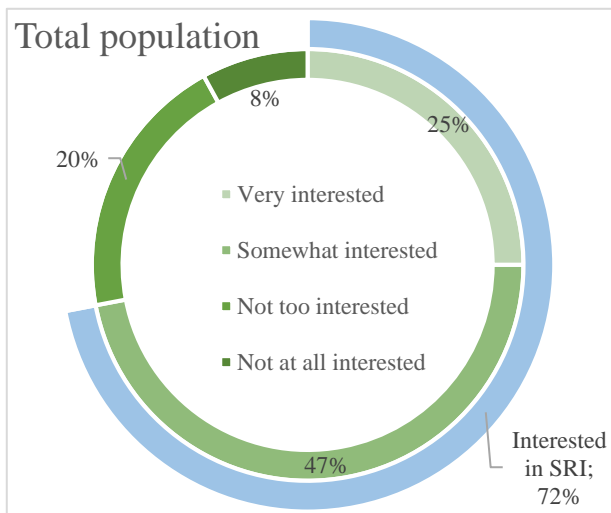


*Figure 13. Total population (millennials excluded) interest towards sustainable investing (Morgan Stanley, 2017)*
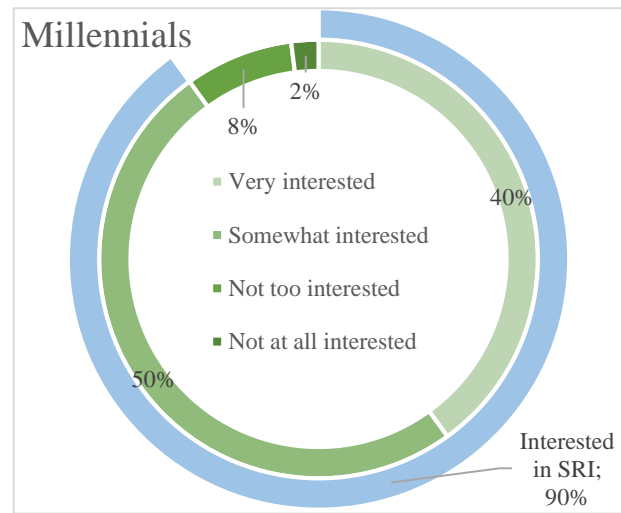
*Figure 14. Millennials interest towards sustainable investing (Morgan Stanley, 2017)*

The different behaviours derived from the personal values of millennials and the imminent intergenerational wealth transfer implicate new challenges to wealth management firms. They have the opportunity to redefine the standard for investment options in an industry that will be soon dominated by the socially responsible millennial investor, trying to adopt value-based investment options to serve a new era of investors.

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# 3. LITERATURE REVIEW – PERFORMANCES OF SUSTAINABLE INVESTING

The relation between sustainable investing and corporate financial performance (CFP) has been investigated since the beginning of the 1970s. More than 2000 studies have been published about this topic during the years and the results that have been obtained are spread.

As previously explained, sustainable investments' assets under management have strongly grown over the last two decades and, together with the investments, also the number of sustainable funds has increased (see Figure 5) (EY, 2017) (Schroders, 2017).

To keep up with this growth, the number of studies that have been published has increased with the increasing consciousness and importance of sustainable investments.
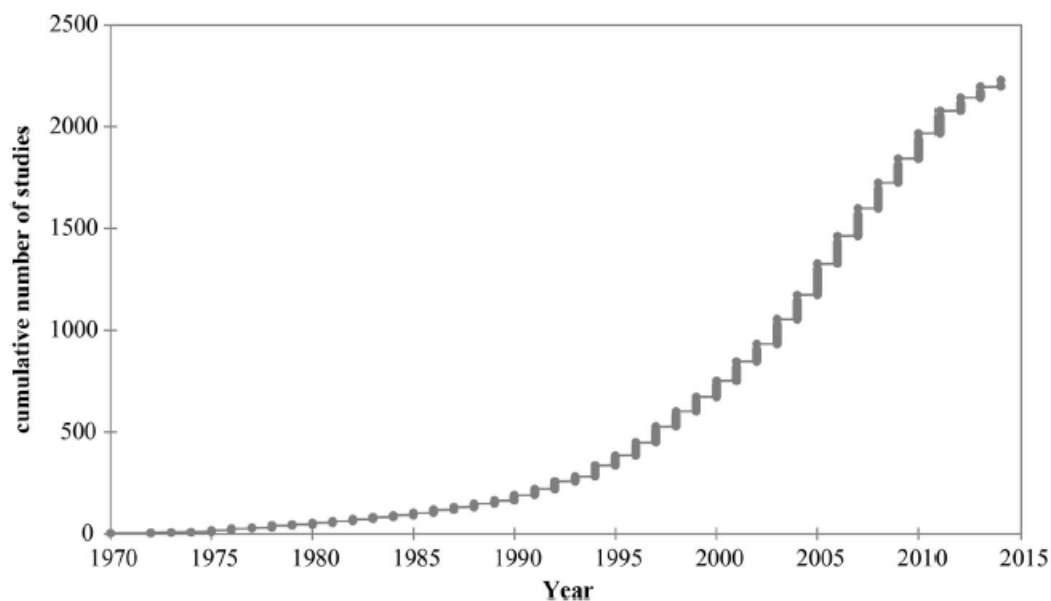


*Figure 15. Estimated number of empirical studies on the ESG-CFP relation over time. Source: (Friede, Busch, & Bassen, 2015)*

The results that have been obtained by these studies are often conflicting and strongly variable based on the methodology that is adopted in the evaluation of the performances of the funds. The conventional wisdom about environmental protection is that is comes at an additional cost on firms, which may erode their global competitiveness. However, several studies show that, in practice, this is not true. Adamo, Federico and Notte (2014) studied the performances and risks of 257 green funds

all over the world in the period 1985-2012, finding that green funds have an increasing importance, even in times of financial crisis, and that they continue to have a positive performance, resisting to the negative financial context. Other authors (Ambec & Lanoie, 2007) examine if sustainable investing shows a different performance from funds in a more general investment context. In their paper, of the sixteen studies analysed, eleven concluded that there is not statistically significant difference between the performance of SRI funds and conventional ones, while the remaining five show results confirming that sustainable funds outperform conventional ones. As a general result, according to the study, it is fair to say that the performance of SRI funds is comparable the one of conventional funds and not worse. In the following update of the report (Ambec & Lanoie, 2008), the researchers studied how the economic expenses incurred to become more sustainable can be partly or completely offset by gains made else-where. In particular, they found three *Opportunities for Increasing Revenues* ([i] better access to certain markets, [ii] differentiating products and [iii] selling pollution-control technologies) and four *Opportunities for Reducing Costs* ([iv] better risk management, [v] lower cost of materials, energy and services thanks to lower waste, [vi] lower cost of capital and [vii] lower cost of labour).

Other authors found results that are similar to the one mentioned (Adamo, Federico Notte (2014) and Ambec and Lanoie (2007)). Ito, Managi, & Matsuda, (2013) have studied the performance of sustainable funds in the period from 2000 to 2009, with a more in-depth focus on the years 2006-2009. Their findings show that socially responsible funds outperformed conventional ones in EU and US in the whole period considered, suggesting the existence of a business case for sustainability.

On the other hand, there are also studies that demonstrate that a positive correlation between ESG and Corporate Financial Performance (CFP) does not exist and, in some cases, sustainable investments come with an additional price. Bauer, Koedikj, & Otten (2005) studied the performances of ethical mutual funds present in an international database of 103 German, UK and US fund in the 1990-2001 period. The result suggests that, although the ethical mutual fund market witnessed an

unpredicted growth during the final years of the studied period, there is no evidence of significant differences in risk-adjusted returns between them and conventional funds. Moreover, the paper highlights that ethical mutual funds exhibit distinct investment styles in comparison to conventional funds (e.g. they are less exposed to market return variability compared to conventional funds). The analysis has gone more in depth, looking at the results in three sub-periods: what was found is that after having significantly underperformed their conventional peers in the beginning of the 1990s, ethical funds provided average risk-adjusted returns matching those of conventional funds over the 1998-2001 period; this trend suggests that ethical mutual funds went through a so-called catching-up phase in the first sub-period, possibly due to learning.

Edward Chang, Walt, & Doug Witte (2012) and Climent and Soriano (2011) have found that green investing has some limitations, since it has been demonstrated that green mutual funds have generated lower returns and similar risks compared to traditional mutual funds, thus they have underperformed on a risk-adjusted basis. To consider the growth that green funds have had during the last years, the authors have also considered more recent sub-periods. The evidence shows that in the considered sub-period (from 2001 to 2009), sustainable mutual funds achieved adjusted returns not significantly different from conventional mutual funds. However, Climent and Soriano (2011) suggest that this non-underperformance that sustainable funds have had in the considered period is not due to a growth in their performances in those years, but that it is because green-oriented investments could fare better than traditional ones during market downturns like the financial crisis. In accordance with the general results obtained by these studies, Galema, Plantinga and Scholtens (2008) show a non-positive correlation between sustainable investing performances and conventional funds' performances. Their comparison between US portfolio returns, book-to-market values and excess stock returns of "green" and traditional funds in the period 1992-2006 shows that the former impacts on stock returns by lowering the book-to-market ratio and not by generating positive alphas.

A slightly better result is shown by Hamilton, Jo and Statman (1993): by analysing funds in the period 1981-1990, they found that the market does not price social responsibility characteristics. Socially responsible mutual funds do not earn statistically significant excess returns if compared to traditional ones and that the performance of these funds is not statistically different from the performance of conventional mutual funds. Thus, according to the study, investors can expect to lose nothing by investing in socially responsible mutual funds but cannot expect to earn more than investing in their traditional counterparties.

Consistent with Hamilton, Jo and Statman (1993), Cortez, Silva and Areal (2008) and Muñoz, Vargas and Marco (2014) have found that that socially responsible funds present, in general, a performance which is comparable to the performance of conventional benchmarks, indicating that investors who wish to invest in mutual funds can add social screens to their investment choices without compromising the financial performance. Renneboog, Ter Horst and Zhang (2008) found that this result holds only for some countries. In fact, according to the authors, in France, Ireland, Sweden and Japan the general result that sustainable funds have similar performances to conventional ones is not true and, thus, in these countries, investors have to pay a price for ethics.

A broader analysis has been carried out by Ibikunle and Steffen (2017). They have studied the performances of green funds and have compared them with the performances of the other fund typologies: conventional and black funds[8]. The period they have studied goes from 1991 to 2014 and, over the full sample period, green mutual funds have significantly underperformed the relative conventional funds while they have had similar performances if compared to black funds. However, as noticed in other previously mentioned studies, the green funds' risk-adjusted return profile has progressively improved over time until no difference in the performance of the green and the

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[8] Black funds are "*mutual funds investing in carbon intensive equities of entities involved in the exploitation and depletion of natural resources and natural capital*" (Ibikunle & Steffen, 2017)

conventional classes could be discerned over the last years. Further evidence suggests that green funds, over the 2012-2014 period have significantly outperformed their black peers.

Meir Statman, one of the top experts in this field, has demonstrated in his studies that socially responsible mutual funds have a difference in performances if compared to the traditional counterparties that is not statistically significant, suggesting that the two typologies of funds guarantee similar risk-adjusted returns (Statman (2000) and Statman (2006)). In a more recent study (Statman & Glushkov, 2016) the authors came up with the same result (no statistically significant difference in performances), but they have been able to draw more detailed conclusions: the authors have "defined" two typologies of socially responsible funds: the so-called TMB[9] and the so-called AMS[10]. There is significant difference in the results of these two categories: social responsibility improves performance when it is in the form of high TMB, reflecting socially responsible investors' preference for stock companies with high ratings on indicators such as employee relations; on the other hand, social responsibility detracts from performance when it is in the form of high AMS, reflecting socially responsible investors' preference against shunned companies' stock, such as that firms associated with tobacco.

Other studies (Ziegler, Schröder, & Rennings, 2007) have analysed the effect of sustainability performance of European corporations on their stock performance, dividing the sustainability performance in *environmental performance* and *social performance*. The results of the study show that the average environmental performance of the industry has significantly positive influence on stock performance; on the other hand, the average social performance of the industry has significantly negative influence on stock performance. Thus, the aggregate result is that the sustainability

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[9] TMB (top-bottom factor) consists of the difference between the returns of stocks of companies ranked in the top third and the bottom third by five social responsibility criteria: employee relations, community relations, environmental protection, diversity and products (Statman & Glushkov, Classifying and Measuring the Performance of Socially Responsible Mutual Funds, 2016).

[10] AMS (accepted-shunned factor) consists of the difference between returns on stocks of companies commonly accepted by socially responsible investors and the returns of stocks of companies they commonly shun. Shunned stocks include those of companies in the alcohol, tobacco, gambling fire arms, military, and nuclear industries (Statman & Glushkov, Classifying and Measuring the Performance of Socially Responsible Mutual Funds, 2016).

performance of a corporation (seen as a combination of environmental and social performance) has no significant effects on the stock performance.

Furthermore, several studies have analysed the existing literature on performances comparison between sustainable funds and traditional ones, trying to understand which is the main finding that has been drawn in the studies. Friede, Busch and Bassen (2015), Clark, Feiner and Viehs (2015) and Revelli and Viviani (2013) among others come up with similar results: the existing literature shows that a business case for ESG investing exists. These findings are in contrast with the common perceptions of investors that they have to pay a price for investing in sustainable funds.

According to Friede, Busch and Bassen (2015), approximately 90% of the studies find a non-negative ESG-CFP relation, of which 62.6% yield positive findings: in contrast with the common perception among investors, there is a business case for ESG investing. Moreover, the stability over time of the ESG-CFP relation has been confirmed: it does not change over time and does not grow/decline as the years go by.

Given the increasing importance that sustainability has gained in investments, some authors have empirically studied the effect that the cultural characteristics of a country have on the ESG-CFP relationship.

Some studies state that the ESG-CFP relationship seems to be extremely negative in countries with a high assertiveness and gender egalitarianism; nevertheless, those with a higher future orientation reveal a slightly positive correlation, that increases if the maximum values of the institutional collectivism and humane orientation are grater in those countries with high uncertainty avoidance (del Mar Miras-Rodríguez, Carrasco-Gallego, & Escobar Pérez, 2015).

According to Dixon-Fowler, Slater, Johnson Ellstrand (2013), smaller firms benefit from environmental performance as much or more than large firms. Moreover, the study states that US

firms seem to benefit more than their international counterpart, even if this theory has been contested by other researchers that found the opposite result (Albertini, 2013).

Friede, Busch and Bassen (2015) have tried to analyse the regional effect by comparing the existing literature on that topic. What they found can be divided in two: first, regarding the developed countries they found that all the developed markets excluding North America exhibit a smaller share of positive results. Second, the emerging markets sample shows a considerable higher share of positive outcomes over developed markets (65.4% positive against a share of 27.8% for the developed markets). Figure 16 shows the results of the study for the five regions considered in the study.
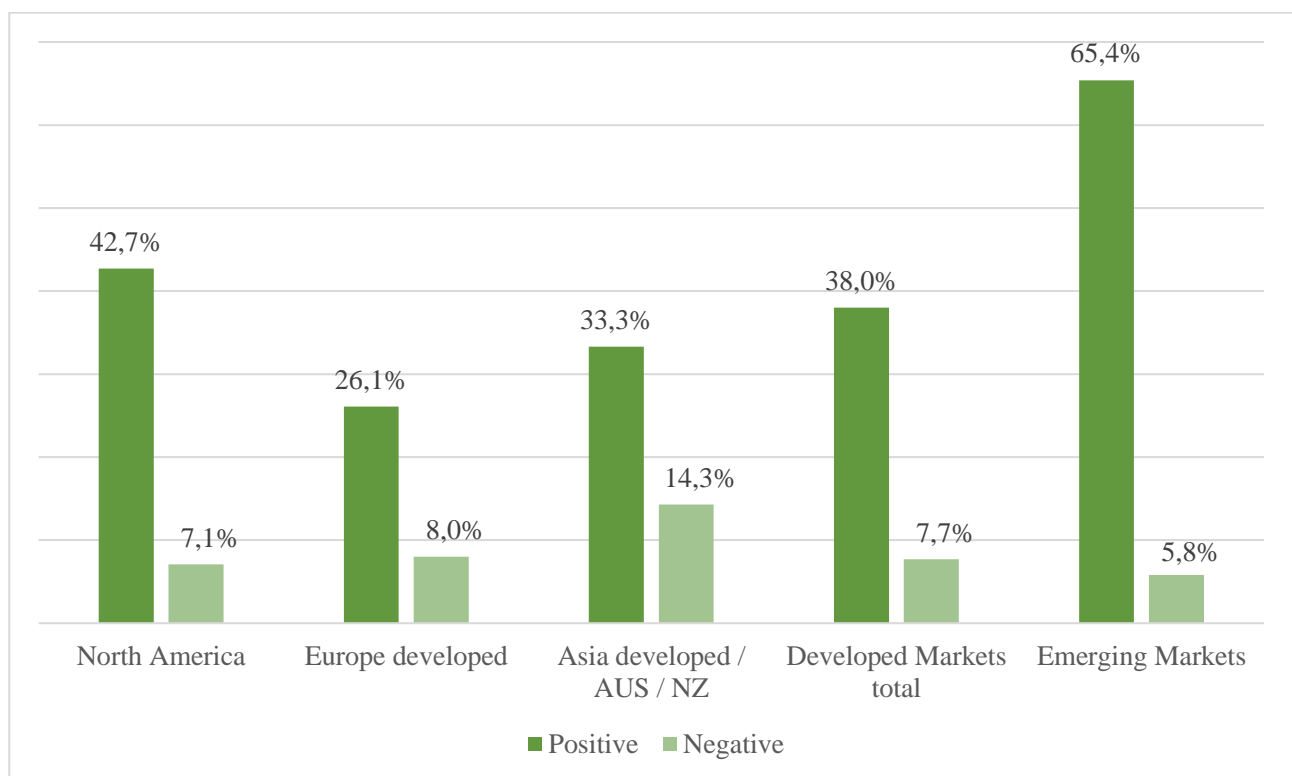


*Figure 16. ESG-CFP relation in various regions. Source: (Friede, Busch, & Bassen, 2015)*

As it is possible to see, several studies have focused their attention on the correlation between sustainability and good funds' performances. The general outcome, there is not a unique result that comes out from the studies. The results that have been found do not go in the same direction, even if most of the studies highlights a non-negative ESG-CFP correlation. There is a high number of studies

on this topic (Friede, Busch, & Bassen, 2015), therefore, in this field, it is difficult to find brand new conclusions that highlight new and interesting results.

On the other hand, a gap in the literature has been found: none of the analysed studies considers the relation between only carbon performances of the mutual funds and the returns. The analysis of the carbon performances of funds is an unexplored field that has not been studied yet. It is a new and emerging issue (for example, Morningstar published its Low Carbon Designation in April 2018) and research is needed to understand how funds behave if compared to this new field.

This study wants to contribute in this field that will likely be a dominant one in the coming years, due to its importance.

# 4. SUSTAINABILITY RATING & LOW CARBON DESIGNATION

As explained, investors and scientists agree on the fact that climate-related risks will be the biggest economic challenges of this century. Climate-related risks vary from the low-carbon economic transition, necessary to mitigate the worst effect of global warming, as agreed in Paris 2015, to the increasingly evident physical effect of global warming (Morningstar, 2018).

In Paris, December 2015, it was signed by 195 countries the first universal agreement on the World climate of which the main goals are two: to keep the average Global warming of this century behind 2°C and to pursue efforts to limit the rise in temperature to 1.5 °C, to reduce, in a significant way, the risks and the impacts of climate changes. To achieve the EU's 2030 targets agreed in Paris, around €180 billion of additional investments a year are needed and to achieve more sustainable growth, everyone should play a role in the society. The financial system is not an exception, and it is participating to the cause: the 8 of March 2018 the action plan for a clean economy has been published by the European Commission (European Commission, 2018). It proposes an EU strategy on sustainable finance, which includes:

- Establishing a unified EU taxonomy to define what is sustainable and identify areas where sustainable investments can have big impacts;
- Creating EU labels for green financial instruments to allow investors to easily identify investments with green or low-carbon criteria;
- Clarifying the duty of asset managers and institutional investors to put sustainability on the top of the investment process;
- Requiring insurance and investment firms to advise customers considering their sustainability preferences;
- Incorporating sustainability in prudential requirements;
- Enhancing transparency in corporate reporting.

Under the investors' point of view, the main risks dimensions are three: (i) the $CO_2$ emissions, (ii) the fossil sources that risk remaining unused and (iii) the ability to manage the transaction towards clean energy, which represents also a great opportunity.

Morningstar started providing information related to these issues in 2016 with the launch of the Morningstar Sustainability Rating.

## 4.1 Morningstar Sustainability Rating

As many individual and institutional investors want to express their concerns about sustainability through their investments, interest in sustainable investing is growing.

From the 2014 Global Survey of Corporate Social Responsibility (Nielsen, October 2015), a survey made in 60 countries across the globe to more than 30,000 consumers, it is possible to get that many of them have adopted more sustainable behaviours over the time. The willingness to pay more for sustainable companies is increasing (from 50% in 2013 and 55% in 2014, to 66% in 2015) and two thirds of the respondents said they would prefer to be employed from socially responsible companies. Among the 66% of respondents willing to pay more, over the 50% of them are influenced by key sustainability factors.

*Table 6. Top sustainability purchasing drivers (Nielsen, October 2015)*

|  | **Global respondents** | **Those willing to pay more** |
|---|---|---|
| The products are made by a brand/company that I trust | 62% | 72% |
| The product is known for its health & wellness benefits | 59% | 70% |
| The product is made from fresh, natural and/or organic ingredients | 57% | 69% |
| The product is from a company known for being environmentally friendly | 45% | 58% |
| The product is from a company known for its commitment to social value | 43% | 56% |
| The product's packaging is environmentally friendly | 41% | 53% |
| The product is from a company known for its commitment to my community | 41% | 53% |
| I saw an ad on television about the social and/or environmental good product's company is doing | 34% | 45% |

It is also possible to note some differences in willingness to pay more due to age and regions: The Millennials and the Generation Z[11] are the most promising generations, while it is generally harder to influence consumers in developed markets to pay premiums.

As people are trying to become responsible citizen of the World, they expect the same from companies and so, before investing in a specific company, they take a deep look to all the information available on the market.

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[11] People born after the 2000

The growing interest in sustainable investing can be seen in a strong way among young investors and women and, also, in the increasing assets under management in sustainable portfolios. Many companies that are really and effectively addressing the ESG factors outperform in the long run, that is why sustainable investing is an effective strategy to get return and enhance the transition to a more sustainable global economy.

Sustainable investing is born as socially responsible investing (SRI), an investment process based on an exclusionary screening to eliminate some types of product or industries (alcohol, tobacco, guns…). Over the time, this process gave way to the so called ESG issues (Environmental, Social, Governance) a new method to evaluate company under the sustainability's lens: it is not possible to simply exclude some industries, it is necessary to assess the companies with a 360° view.

Companies' requirements to provide sustainable reports are becoming stricter, making it easier to evaluate the ESG related risks and opportunities of an investment in a company.

Given the growing interest in sustainable investing all over the World, in 2016, Morningstar has created a new tool to help investors determine whether the investments they own or want to invest-in reflect the ESG factors: the Morningstar Sustainability Rating.

It is an indicator which results from two steps: first, it is calculated the Portfolio Sustainability Score which measures the way the companies are managing the ESG related risks and opportunities. Then, a deduction correspondent to the Portfolio Controversy Score, a score which depends on the controversial incidents of a company, is applied (Morningstar, 2016).

All the data used by Morningstar are provided by Sustainalytics, a company which plays an important role in analysing firms across the spectrum of ESG issues.

### Portfolio sustainability score

Sustainalytics tracks and categorizes the ESG related performance and assess them in a 0-100 scale. The Morningstar Portfolio ESG Score shows how well a company is addressing ESG issues. It is an asset weighted average of the normalized ESG scores from Sustainalytics.

$$Portfolio\ ESG\ Score = \sum_{i=1}^{n} w_i ESP$$

Where:

- ESP = the ESG score of the company

- n = number of securities in the portfolio

- $W_i$ = normalized asset weight on security

A portfolio, to receive a portfolio ESG score, has to be composed by at least the 50% of companies which have a company ESG score.

### Portfolio controversy score

Sustainalytics tracks and categorizes all the ESG related incidents and assesses them in a 0-100 scale in terms of its level of impact on the environment and society as well its related risk to the company itself. The portfolio controversy score is an asset weighted average of the normalized controversy scores from Sustainalytics.

$$Portfolio\ Controversy\ score = \sum_{i=1}^{n} w_i Scont_i$$

Where:

- $Scont_i$ = Sustainalytics controversy score of company i

- n = number of securities in the portfolio

- $W_i$ = normalized asset weight on security i

To receive a portfolio controversy score at least the 50% of the companies in the portfolio must have a company controversy score.

*Table 7. Controversy score and correspondent deduction values*

|  | **Score** | **Deduction** |
|---|---|---|
| Best | 0 | 0 |
|  | 1 | 0.2 |
|  | 20 | 4 |
|  | 50 | 10 |
|  | 80 | 16 |
| Worst | 100 | 20 |

### Portfolio sustainability rating

The portfolio sustainability rating measures the way in which a company is managing its ESG risks and opportunities, giving to investors the possibility to evaluate investments on a sustainability basis, at portfolio level.

*Portfolio Sustainability Score = Portfolio ESG Score – Portfolio Controversy Deduction*

## 4.2 Morningstar Low Carbon Designation

In order to help investors to take into consideration the climate specific risk and so to compare and to select the investment funds according to their expose to risks deriving by polluting emissions, Morningstar created the Low Carbon Designation (Morningstar, 2018): an indicator based on the Morningstar Portfolio Carbon Risk Score and the Morningstar Portfolio Fossil Fuel Involvement. The Low Carbon Designation is assigned to the portfolios that have both a low Carbon-Risk score and a low level of Fossil Fuel exposure: the former assesses the risk that companies in a fund face from the transition to a low-carbon economy, while the latter assesses the degree to which a portfolio is exposed to coal extraction and power generation, oil and gas products and services and oil and gas production and power generation.

### *Portfolio Carbon Risk Score*

The Morningstar Portfolio Carbon Risk Score moves beyond carbon foot printing to provide a direct assessment of the carbon risk embedded in a portfolio. It is an averaged over 12 months, asset-weighted carbon-risk score of the instruments holding in a portfolio:

$$Morningstar\ Portfolio\ Carbon\ Risk\ Score = \sum_{i=1}^{n} w_i \cdot CCRR$$

Where:

- n = number of securities in the portfolio

- $w_i$ = asset weight of security i

- CCRR = Sustainalytics Company Carbon Risk Rating

To compute the Score, Morningstar uses Sustainalytics' CCRR, which is based on the degree of exposure to which carbon risks are material across the firm's value chain, its operations, its products and services, and on the ability of the firm to manage the reduction of the emissions and of the related carbon risks. The carbon-risk rating represents the unmanaged carbon risk, after considering the efforts spent by the management activities.

The Morningstar Portfolio Carbon Risk Score is assigned to the portfolios which have at least the 67% of assets covered by the carbon-risk rating from Sustainalytics. The rating attributed by Sustainalytics depends on:

- The firm's exposure to carbon related risks along the value chain;

- Sustainalytics' view on the alignment between the company's activities and a low-carbon economy;

- The quality of the firm's management approach to reduce carbon risks.

Scores should be interpreted as shown in Table 8.

*Table 8. How to interpret the results of the Carbon Risk Score*

| Score | Carbon-Risk level |
|---|---|
| 0 | Negligible |
| >0-9.99 | Low |
| 10-25.99 | Medium |
| 30-49.99 | High |
| 50+ | Severe |

Generally, portfolios with over-weightings to the energy, utilities, materials, and industrials sectors have higher levels of carbon risk while portfolios with over-weightings to the technology and healthcare sectors have lower levels of carbon risk.

## *Portfolio Fossil Fuel Involvement*

The Morningstar Portfolio Fossil Fuel Involvement represents the averaged portfolio's percentage exposure to fossil fuel, in a 12-month base. A company is defined as fossil-fuel involved if at least the 5% of its revenues are deriving from thermal coal extraction, thermal coal power generation, oil and gas production or oil and gas power generation. Furthermore, companies of which revenues are deriving for at least the 50% form oil and gas products & service are included.

## *Low Carbon Designation*

The Low Carbon Designation is assigned to the portfolios that have both a low Carbon-Risk score and a low level of Fossil Fuel exposure. The aim of the designation is to help investors to assess the investment funds according to their expose to risks deriving by polluting emissions. If a fund is characterized by the Low Carbon Designation, it means it is aligned with the transition to a low-carbon economy.

The designation is assigned by looking to two criteria:

- A 12-month average Morningstar Portfolio Carbon Risk Score < 10;

- A 12-month average exposure to fossil fuels less than 7% of assets.

# 5. PURPOSE OF THE STUDY

The aim of this study is to check the existence of a possible correlation between good carbon performances of mutual funds and their returns and to check if the knowledge of the market about the good carbon performances of funds influence their returns.

So far, several studies have focused their attention on the correlation between sustainability and good funds' performances. As shown in paragraph 3 – *Performances of Sustainable Investing*, there is not a unique result that comes out from the studies. The results that have been found do not go in the same direction and, in several cases, they are conflicting. The number of existing studies on the correlation ESG-CFP exceeds 2000 (Friede, Busch, & Bassen, 2015). Thus, in this field, there is no room for researches that can provide interesting and brand-new results.

On the other hand, none of the analysed studies considers the only carbon performances of the mutual funds. As explained in paragraph 1 – *Climate Change*, the topic of carbon emissions is one of the most recurrent in everyday life. Humanity has to face severe challenges to solve this problem, and the world of mutual funds is getting involved by this topic too. In fact, according to Morningstar, investors are increasingly recognizing the risks and opportunities posed by climate change. However, until the beginning of 2018, investors typically didn't know the extent to which a portfolio was exposed to carbon risk[12] (Koska, 2018).

For these reasons, this study wants to assess the unexplored field of the possible correlation between good carbon performances and better returns of funds. To do so, the new Morningstar Low Carbon Designation is considered.

In particular, the study does not only want to assess whether good carbon performances of a fund imply better returns. The objective is also to understand if the publication of the Low Carbon Designation helps increasing its returns. To assess these hypothesis, the analysis is divided in two

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[12] Carbon risk is about how well-positioned a company is to make a successful transition to a low-carbon economy.

main parts: first, the correlation between *(i) the Carbon Risk Score* and *(ii) the Fossil Fuel Involvement* (the components of the Low Carbon Designation) with the returns is analysed; second, the study focuses on the consequences of the Low Carbon Designation's publication.

The first part of the study (*model A* and *model B*) consists of a multiple linear regression in which the dependent variable (return of the funds) is related to different independent variables, and the evaluation and analysis of the results obtained.

A multiple linear regression is a predictive analysis that attempts to model the relationship between two or more explanatory variables (or *independent variables*) and a response variable (or *dependent variable*) by fitting a linear equation to observed data. Every value of the independent variable $x$ is associated with a value of the dependent variable $y$. The population regression line for $p$ explanatory variables $x_1, x_2, ..., x_p$ is defined to be $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p$. By giving the right inputs to a software (the inputs are the observed data), it is possible to find the $\beta_0, \beta_1, \beta_2, ..., \beta_p$ that describe how the response variable depends upon the explanatory variables. These coefficients are the result of the multiple linear regression and they are what have to be analysed.

The second part of the model (*model C, model D* and *model E*), on the other hand, is more similar to an event study. An event study is a statistical analysis method of the behaviour of a time series in the period around a certain event. The objective of an event study is to evaluate the impact of the event on the time series. Following this consideration, the objective of *model C, model D* and *model E* is to see if the returns of the analysed funds are different in two analysed periods: the quarter before the publication of the Morningstar Low Carbon Designation (January to March 2018) and the quarter after the publication of the designation (May to July 2018). In particular, the aim is to assess if there is any difference in the correlation factors between:

(i)      the January-March return and the Carbon Risk Score (*model C*) / Fossil Fuel Involvement (*model D*) / Low Carbon Designation (*model E*) (that will be called *CF1* – Correlation Factor 1 – for sake of simplicity)

(ii)      the May-July return and the Carbon Risk Score (*model C*) / Fossil Fuel Involvement (*model D*) / Low Carbon Designation (*model E*) (that will be called *CF2*).

The variables that can influence the difference between *CF1* and *CF2* are:

- The other independent variables considered;

- The funds' composition (since a different funds' composition changes the Carbon Risk Score and the Fossil Fuel Involvement of a fund);

- The knowledge of investors about the actual values of the Carbon Risk Score and Fossil Fuel Involvement.

Being the independent variables considered the same in the two phases of the analysis, they do not represent a differential factor in the model. Thus, they can be eliminated from the list of differential factors.

Moreover, as explained in paragraph 4.2 – *Morningstar Low Carbon Designation*, the Morningstar Carbon Risk Score refers to the last 12-months holdings of a fund. Therefore, the second variable (fund's composition) does not change in the considered periods (January-March 2018 and May-July 2018). In conclusion, the only factor that can influence the difference between the two correlation factors is the publication of the Low Carbon Designation.

# 6. THE MODEL

## 6.1 The dataset

The purpose of this research is to analyse the performances of a set of mutual funds collected from the Morningstar's database, in order to find if there are correlations between good performances and a low Carbon Risk Score (related to a low Morningstar Carbon Risk Score and Fossil Fuel Involvement).

The study has been carried out collecting a set of data of funds on [www.morningstar.com](http://www.morningstar.com). The analysis has been developed on a unique dataset of 133 active funds[13] from three different economies: Europe, Asia-Pacific and US. This has been made in order to have a broader view of the phenomenon and to highlight possible differences between the different geographical areas.

The fund selection has been performed thanks to the Morningstar Premium Fund Screener, a fund's screener that allows to select filters in order to see only the desired funds.

The first thing that has been done, was the definition of the three regions of the analysis. It has been decided to focus on Europe, US and Asia-Pacific since they represent the regions with the highest number of funds in the database. Once defined the three macro-regions, the funds for each of them had to be found. Only equity funds have been selected for the analysis. The following sub-paragraphs show how the funds have been selected and the filters applied in the research.

### *European funds*

For European funds, the category *Europe Stock* has been selected and only one retail class per fund has been chosen. The filters applied in the selection process were:

- "Fund category = *International Equity → Europe Stock*"

  **and** if available, A-class funds were chosen, otherwise another retail class was chosen

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[13] Active management refers to a portfolio management strategy where managers make specific investments with the aim of outperforming an investment benchmark index. On the contrary, passive management refers to a portfolio strategy that aims at replicating the performances of a benchmark index.

The result of this screening process gave as a result a set of 21 funds belonging to this first category.

## *Asia-Pacific funds*

Funds from the Asia-Pacific region have been selected combining four different Morningstar categories. The filters used have been:

- "Fund category = *International Equity → Asia-Pacific (ex Japan)*"

  **and** "Fund category = *International Equity → China*"

  **and** "Fund category = *International Equity → India*"

  **and** "Fund category = *International Equity → Japan*"

  **and** if available, A-class funds were chosen, otherwise another retail class was chosen

The result of this screening process highlighted 16 Chinese funds, 4 from India, 10 from Japan and 21 from the remaining countries of the Asia-Pacific area, resulting in 51 funds overall belonging to this second category.

## *US funds*

For US funds, a different screening process has been applied. Being morningstar.com a US rating agency, in its database there are more than 6,000 US funds. In order to have a set of funds comparable in number to the ones of the European and Asia-Pacific regions, a stricter screening process has been applied. In particular, the filters have been

- "Fund category = *US Equity*"

  **and "**Morningstar Analysis = *Available*"

  **and** "Fund Size (total assets in $MM) ≥ 5,000

  **and** if available, A-class funds were chosen, otherwise another retail class was chosen

  **and** only the biggest funds of the resulting 140 funds

It resulted in a list of 61 US funds belonging to this last category.

### *Data gathered for the analysis*

For each fund, the data that have been gathered from <u>www.morningstar.com</u> are the following:

- *Fund name;*

- *Ticker:* A symbol that represents a fund's stock on an exchange. It can be the most dependable way to identify a security, because it is less likely to change than a security name;

- *Fund category:* the Morningstar category is assigned to the funds on the base of the underlying securities contained in each portfolio. It helps the investors to compare the different funds, making easier to build a well-diversified portfolio and access performance;

- *Fund region*: Europe, Asia-Pacific or US*;*

- *Net Asset Value:* it is a simple calculation that consist in the ratio between the current market value of all the fund's net assets and the total number of outstanding shares. It is useful for tracing share price movements;

- *Fund Size (total assets);*

- *Expense Ratio:* it represents the annual fee that a fund charges to its shareholders. It is expressed as a percentage and includes management fees, administrative fees, operating costs and all the other asset -costs incurred by the fund during the year. Generally, the expense ratio is inversely proportional to the fund size;

- *3-months return;*

- *Return of the 1st quarter of 2018 (source: NASDAQ);*

- *YTD return;*

- *1-year return;*

- According to definition that morningstar.com gives, *Alpha* represents the measure of the difference between a fund's actual returns and its expected performance given its level of risk as measured by beta. A positive alpha indicates that the fund has performed better than its beta would predict. On the other hand, a negative alpha indicates that the fund has

underperformed the expectations established by its beta. All MPT statistics (including alpha) are based on a least-squares regression of the fund's return over Treasury bills and the excess returns of the fund's benchmark index;

- *Beta* represents a fund's sensitivity to market movements. Morningstar calculates beta by comparing a fund's excess return over Treasury bills to the market's excess return over Treasury bills;

- *Sharpe Ratio* is calculated by Morningstar using standard deviation and excess return to determine reward per unit of risk. It is calculated for the past 36-month period by dividing a fund's excess returns by the standard deviation of a fund's excess returns;

- *Portfolio ESG:* it is an asset-weighted average of normalized company-level ESG scores from Sustainalytics. The company-level ESG scores reflect how well a firm is addressing the ESG issues based on a series of indicators;

- *Controversy deduction*: it is a score assigned by Sustainalytics based on ESG-related incidents. Each incident is assessed in terms of its level of impact on the environment and society;

- *Sustainability score:* it is the difference between the Portfolio ESG and the Controversy deduction (see 3 – *Morningstar Sustainability Rating*);

- *Carbon Risk Score:* it is a 12-months average asset-weighted carbon-risk score of the securities holdings in a portfolio. To calculate the value Morningstar uses Sustainalytics ratings which indicate the risk that a company face from the transition to a low carbon economy;

- *Fossil Fuel Involvement:* it is the 12-months average portfolio's percentage exposure to fossil fuels. Companies are defined as fossil-fuel involved if at least the 5% of their revenues are deriving from: thermal coal extraction, thermal coal power generation, oil and gas production, and oil and gas power generation;

- *Low Carbon Designation:* it is a designation given to those portfolios with both a low Carbon Risk Score (<10) and a low level of exposure to fossil fuels (<7%).

The full data sample is shown in the Exhibit.

## 6.2 The software

As described, the analysis needs a software able to run a multiple linear regression model. The software that is used in this analysis is Minitab: it is a statistics package developed at the Pennsylvania State University in 1972. It is provided with all the necessary instruments to effectively analyse data, giving as an output complete results. The main features that Minitab offers are:

- *Smart Data Import*: it allows to easily import and edit data in the software;

- *Automatic Graph Updating*: graphs and control charts automatically update;

- *Seamless Data Manipulation*: columns can be format to instantly identify and subset the most frequent values, outliers, and more;

- *Effortless Presentations*: immediate export of graphs and tables in Microsoft Word or PowerPoint.

The main functions that have been used for the analysis are (i) the correlation matrix, that allows to identify the correlation among the independent variables in the model and (ii) the multiple linear regression function. Table 9 shows an example of the data that are shown by the software when running the multiple linear regression model.

*Table 9. Example of data given by Minitab*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $x_p$ | $\beta_p$ | | | | |

- *Term*: it is the independent variable ($x_p$) that is analysed in that row;

- *Coefficient*: it is the coefficient related to the independent variables ($\beta_p$);

- *SE Coef*: it is the Standard Error Coefficient. It measures how precisely the model estimates the coefficient's unknown value. *SE Coef* is always a positive number;

- *t-value*: it is the ration between the *Coefficient* and its standard error (*SE Coef*);

- *p-value*: it is also called calculated probability, and it is the probability of finding the observed results when the null hypothesis ($H_0$) of a study question is true. It highlights the probability of finding a result equal or "more extreme" of the observed one. A significant *p-value* is generally defined as lower than 0.05;

- *VIF*: it is the acronym for Variance Inflation Factor and it measures how much the variance of the estimated regression coefficients are inflated as compared to when the predictor variables are not linearly related. It is used to describe how much correlation between predictors exists in a regression analysis. In general, a value around 1 indicates no correlation, close to 5 indicates moderate correlation and from 5 to 10 indicates high correlation.

## 6.3 Methodology

As explained, the objective of the study is to analyse the performances of a set of mutual funds collected from the Morningstar's database, in order to find if there are any correlations between good performances and a low carbon performance (related to a low Morningstar Carbon Risk Score and Fossil Fuel Involvement).

In April 2018, Morningstar launched its Morningstar Low Carbon Designation: it is an analysis based on the past 12-months composition of the funds that aims at analysing the carbon performances of the funds, giving them a rating between 0 and 100 in two categories: Carbon Risk Score and Fossil Fuel Involvement (%). The lower the Carbon Risk Score and the lower the percentage of Fossil Fuel Involvement, the better the carbon performances of a fund.

The analysis is divided in two parts: in the first part, it is tested the correlation between returns and *Carbon Risk Score (model A) / Fossil Fuel Involvement (model B)*; in the second part, instead, the study analyses if there are differences in the correlation between *Carbon Risk Score (model C)* / Fossil

*Fuel Involvement (model D) / Low Carbon Designation (*model E*)* and the returns before and after the publication of the Low Carbon Designation (happened in April 2018). In other words, what has to be assessed is not only whether there is a positive correlation between good carbon performances and returns, but also if the publication of the Morningstar Low Carbon Designation helped improving the returns.

To perform the analysis, a multiple linear regression is used, to consider all the variables that could affect the performances of a fund. The first step for performing a multiple linear regression is to understand what are the independent variables that could affect the dependent variable. Obviously, the performances of a fund do not depend only upon one variable. They are the result of a complex combination among different factors which interact among them. According to the existing literature, there are several factors that historically have influenced mutual funds' performances. The most common factors that are cited in the literature are:

- **Volatility / Beta**: low volatility factors tend to provide higher returns relative to their standard deviations. They have asymmetric return profiles, producing profits most of the time. If the factors are managed well, they can provide a portfolio with considerable extra income (O'Connor, 2017) (Simmons, 2016);

- **Fund Size**: one of the main factors that seem to influence a fund's performances is fund size (Agnesens, 2013) (Simmons, 2016) (Fuerst & Matysiak, 2009);

- **Expense Ratio**: this factor historically influences the performances of mutual funds by impacting on the net returns of the investors (Agnesens, 2013) (Simmons, 2016);

- **Sustainability Score**: according to the existing literature, green funds tend to have slightly better performances than conventional funds (see paragraph 3 - *LITERATURE REVIEW – PERFORMANCES OF SUSTAINABLE INVESTING*);

- **Carbon Risk Score**: the factor that is tested in this study.

The resulting multiple regression model can be expressed by the following *multiple regression equation*:

$$y = \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + \beta_5 \times Carbon$$

To ease the understanding of the analysis, Table 10 sums up the terminology that will be used during the analysis.

*Table 10. Terminology adopted*

| Name | Terminology adopted |
|---|---|
| *Intercept* of the linear regression model | $\beta_0$ |
| Coefficient related to *Volatility* | $\beta_1$ |
| Coefficient related to *Fund Size* | $\beta_2$ |
| Coefficient related to *Expense Ratio* | $\beta_3$ |
| Coefficient related to *Sustainability Score* | $\beta_4$ |
| Coefficient related to *Carbon Risk Score* or to *Fossil Fuel Involvement* | $\beta_5$ |

The analysis is divided in 3 geographic areas: Europe, Asia-Pacific and US. Moreover, the global situation (called *World*) is analysed.

This procedure will help understanding both if the funds' performances are related to a good Carbon Risk Score (in *model A*) and to a low Fossil Fuel Involvement (*model B*), and if the publication of the Low Carbon Designation (*model C* and *model D*) influences funds' returns.

Table 11 sums up the 11 cases.

Table 11. Model A and Model B divided in the four geographic areas

| | Geographic areas | | | |
|---|---|---|---|---|
| | World | Europe | US | Asia-Pacific |
| *Model A* | *A.1* | *A.2* | *A.3* | *A.4* |
| *Model B* | *B.1* | *B.2* | *B.3* | *B.4* |
| *Model C* | *World* | | | |
| *Model D* | *World* | | | |
| *Model E* | *World* | | | |

## *Characteristics of Model A*

*Model A* consists is an analysis of the correlation between the returns and the Carbon Risk Score. The returns that are considered in this model are the 1-year returns of the 133 selected funds. This choice depends on the fact that the Carbon Risk Score that is given, depends on the holding of the funds in the last year. Considering the 1-year returns of the funds, the two periods can be compared, and the analysis does not have conflicts due to different periods considered. Therefore, the multiple linear regression equation is the following:

$$1 \, year \, returns = \ \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \ \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + \beta_5 \times CarbonRiskScore$$

## *Characteristics of Model B*

*Model B* is similar to *model A*. The only difference among the two, stands in the fact that the correlation between the Fossil Fuel Involvement and the 1-year returns is analysed, rather than the one with the Carbon Risk Score. Thus, the resulting multiple linear regression equation is:

$$1 \, year \, returns = \ \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \ \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + \beta_5 \times FuelInvolvement$$

## *Characteristics of Model C*

*Model C* aims assessing if the publication of the Low Carbon Designation has improved the correlation between the Carbon Risk Score and the fund's performances. To do so, two different

multiple linear regression models have been done: the first one, considering as the dependent variable the return before the publication of the Morningstar Low Carbon Designation (January-March 2018); the second one, considering as the dependent variable the return after the publication of the Morningstar Low Carbon Designation (May-July 2018). Then, the difference in the coefficient of the Carbon Risk Score ($\beta_5$) in the two situations is studied.

It results in two different multiple linear regression equations:

(1)    $y_1 = \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + + \beta_5 \times CarbonRiskScore$

(2)    $y_2 = \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + + \beta_5 \times CarbonRiskScore$

With:

- $y_1$: Return from January to March 2018;

- $y_2$: Return from May to July 2018.

## *Characteristics of Model D*

The difference between *model C* and *model D* is the same that it is possible to see among *model A* and *model B*: the Fossil Fuel Involvement is the fifth variable considered rather than the Carbon Risk Score. Therefore, *Model D* aims at assessing if the publication of the Low Carbon Designation has improved the correlation between the Fossil Fuel Involvement and the fund's performance.

The resulting multiple linear regression equations are:

(1)    $y_1 = \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + + \beta_5 \times FuelInvolvement$

(2)    $y_2 = \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + + \beta_5 \times FuelInvolvement$

With:

- $y_1$: Return from January to March 2018;

- $y_2$: Return from May to July 2018.

## *Characteristics of Model E*

*Model E* aims at assessing if the publication of the Low Carbon Designation fund influences its returns. To do so, two different multiple linear regression models have to be done: the first one, considering as the dependent variable the return before the publication of the Morningstar Low Carbon Designation (January-March 2018); the second one, considering as the dependent variable the return after the publication of the Morningstar Low Carbon Designation (May-July 2018). Then, the difference in the coefficient of the Low Carbon Designation ($β_5$) in the two situations is studied.

It results in two different multiple linear regression equations:

(1) $y_1 = β_0 + β_1 \times Volatility + β_2 \times FundSize + β_3 \times ExpenseRatio + β_4 \times SustainabilityScore + +β_5 \times LowCarbonDesignation$

(2) $y_2 = β_0 + β_1 \times Volatility + β_2 \times FundSize + β_3 \times ExpenseRatio + β_4 \times SustainabilityScore + +β_5 \times LowCarbonDesignation$

With:

- $y_1$: Return from January to March 2018;
- $y_2$: Return from May to July 2018.

## 6.4 Results

Before starting with the linear regression model, the correlation between each independent variable has to be tested in order to avoid multicollinearity[14]. To do so, a correlation matrix has to be done. It is a square matrix in which the element in the (i;j) position is the *Pearson correlation* between the i-th and the j-th elements of a vector. The Pearson correlation is an index that expresses a potential linear correlation among two variables. The correlation matrix simply crosses all the variables considered on the analysis and shows their Pearson correlation value with the related p-value that, as usual, highlights if the result is significant or not.

In this analysis, two variables will be considered correlated if they have a Pearson correlation value higher than 0.35 (in absolute value) with a related significant p-value (lower than 0.05).

### *Model A.1 World*

*Table 12. Correlation matrix – Model A.1*

| | | **Beta** | **FundSize** | **ExpenseRatio** | **SustainabilityScore** |
|---|---|---|---|---|---|
| **FundSize** | *Pearson correlation* | 0.093 | - | - | - |
| | *p-value* | *0.289* | - | - | - |
| **ExpenseRatio** | *Pearson correlation* | -0.120 | -0.433 | - | - |
| | *p-value* | *0.169* | *0.000* | - | - |
| **SustainabilityScore** | *Pearson correlation* | -0.399 | -0.102 | 0.143 | - |
| | *p-value* | *0.000* | *0.260* | *0.111* | - |
| **CarbonRiskScore** | *Pearson correlation* | -0.033 | -0.084 | 0.185 | -0.195 |
| | *p-value* | *0.745* | *0.401* | *0.062* | *0.049* |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation/>0.35) are highlighted.* | | | | | |

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[14] It is a state of very high inter-correlations or inter-associations among the independent variables. It is therefore a type of disturbance in the data, and if present in the data the statistical inferences made about the data may not be reliable (Statistics Solutions, n.d.)

From the correlation matrix, it emerges that the fund size of a mutual fund is negatively correlated with its expense ratio and that the beta and the Morningstar Sustainability Score are negatively correlated. Thus, to avoid multicollinearity only the expense ratio and the beta are considered.

Following these considerations, the new model will be:

$$1 - yr\ return = \ \beta_0 + \beta_1 \times Volatility + \beta_3 \times ExpenseRatio + \beta_5 \times CarbonRiskScore$$

Now that the final model has been defined, the analysis can be done. The results are shown in Table 13.

Table 13. Results Model A.1

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $\beta_0$ – constant | 8.73 | 4.32 | 2.02 | 0.046 | |
| $\beta_1$ – Beta | 18.18 | 3.87 | 4.70 | 0.000 | 1.01 |
| $\beta_3$ – ExpenseRatio | -5.10 | 1.01 | -5.04 | 0.000 | 1.04 |
| $\beta_5$ – CarbonRiskScore | -0.881 | 0.171 | -5.17 | 0.000 | 1.04 |

Table 14. Model A.1 summary

| R-sq | R-sq (adj) |
|------|-----------|
| 48.42% | 46.84% |

As it is possible to see, the coefficient $\beta_5$ (CarbonRiskScore) is negative and significant (p-value < 0.05). Its value is equal to -0.881, meaning that a decrease of 1% point in the Carbon Risk Score, leads (on average) to an increase of 0.881% in the annual return of a fund.

The conclusion that can be drawn from *model A.1* is that a good Carbon Risk Score positively impacts the returns if the overall sample is considered, highlighting a positive correlation between good carbon performances (resulting in a low Carbon Risk Score) and returns.

## Model A.2 Europe

*Table 15. Correlation matrix – Model A.2*

| | | **Beta** | **FundSize** | **ExpenseRatio** | **SustainabilityScore** |
|---|---|---|---|---|---|
| **FundSize** | *Pearson correlation* | 0.189 | - | - | - |
| | *p-value* | *0.412* | - | - | - |
| **ExpenseRatio** | *Pearson correlation* | -0.430 | -0.767 | - | - |
| | *p-value* | *0.051* | *0.000* | - | - |
| **SustainabilityScore** | *Pearson correlation* | 0.164 | -0.062 | -0.219 | - |
| | *p-value* | *0.489* | *0.796* | *0.354* | - |
| **CarbonRiskScore** | *Pearson correlation* | 0.118 | 0.141 | 0.039 | -0.335 |
| | *p-value* | *0.630* | *0.564* | *0.873* | *0.161* |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation/>0.35) are highlighted.* | | | | | |

The only correlation that emerges in European funds is the one among fund size and expense ratio.

Again, only the expense ratio is considered in the analysis.

According to the results of the correlation test, the new *multiple regression equation* will be:

$$1 - yr\ return = \ \beta_0 + \beta_1 \times Volatility + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore$$
$$+ \beta_5 \times CarbonRiskScore$$

By fitting the model considering Europe the results are the following.

*Table 16. Results Model A.2*

| **Term** | **Coefficient** | **SE Coef** | **T-Value** | **P-Value** | **VIF** |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 18.2 | 20.3 | 0.90 | 0.385 | |
| $\beta_1$ – Beta | 2.1 | 10.5 | 0.20 | 0.842 | 1.38 |
| $\beta_3$ – ExpenseRatio | 1.11 | 2.51 | 0.44 | 0.664 | 1.32 |
| $\beta_4$ – SustainabilityScore | -0.285 | 0.330 | -0.86 | 0.402 | 1.23 |
| $\beta_5$ – CarbonRiskScore | -0.173 | 0.243 | -0.71 | 0.488 | 1.18 |

*Table 17. Model A.2 summary*

| R-sq | R-sq (adj) |
|------|-----------|
| 8.22% | 0.00% |

The results show that, in Europe, no significant correlation exists between good carbon performances and returns. Even if $\beta_5$ is negative, its p-value is higher than 0.05 (0.488), meaning that it is not statistically significant.

## Model A.3 US

*Table 18. Correlation matrix – Model A.3*

| | | Beta | FundSize | ExpenseRatio | SustainabilityScore |
|---|---|------|----------|--------------|---------------------|
| **FundSize** | *Pearson correlation* | 0.010 | - | - | - |
| | *p-value* | *0.938* | - | - | - |
| **ExpenseRatio** | *Pearson correlation* | 0.019 | -0.341 | - | - |
| | *p-value* | *0.887* | *0.007* | - | - |
| **SustainabilityScore** | *Pearson correlation* | -0.338 | -0.036 | 0.260 | - |
| | *p-value* | *0.002* | *0.781* | *0.043* | - |
| **CarbonRiskScore** | *Pearson correlation* | -0.396 | 0.011 | -0.066 | -0.400 |
| | *p-value* | *0.003* | *0.937* | *0.636* | *0.003* |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation/>0.35) are highlighted.* | | | | | |

In the US funds, the Carbon Risk Score is correlated to beta and to the Sustainability Score. Since the analysis is aimed at testing if the Carbon Risk Score influences the performances, the independent variables that are not considered in this analysis are beta and the Sustainability Score.

According to the results of this analysis, the new *multiple regression equation* will be:

$$1 - yr\ return = \ \beta_0 + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_5 \times CarbonRiskScore$$

*Table 19. Results Model A.3*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $\beta_0$ – constant | 30.84 | 1.84 | 16.72 | 0.000 | |
| $\beta_2$ – FundSize | 0.000001 | 0.000004 | 0.16 | 0.874 | 1.18 |
| $\beta_3$ – ExpenseRatio | 0.12 | 1.35 | 0.09 | 0.929 | 1.18 |
| $\beta_5$ – CarbonRiskScore | -1.446 | 0.143 | -10.13 | 0.000 | 1.01 |

*Table 20. Model A.3 summary*

| R-sq | R-sq (adj) |
|------|-----------|
| 67.87% | 65.90% |

The correlation between returns and carbon performances are significant and strong in the US. On average, a reduction in Carbon Risk Score of 1-point leads to an increase in performances of 1.446 percent.

## Model A.4 Asia - Pacific

*Table 21. Correlation matrix – Model A.4*

| | | Beta | FundSize | ExpenseRatio | SustainabilityScore |
|---|---|------|----------|--------------|---------------------|
| **FundSize** | *Pearson correlation* | -0.110 | - | - | - |
| | *p-value* | 0.444 | - | - | - |
| **ExpenseRatio** | *Pearson correlation* | 0.208 | -0.481 | - | - |
| | *p-value* | 0.142 | 0.000 | - | - |
| **SustainabilityScore** | *Pearson correlation* | -0.482 | -0.025 | 0.008 | - |
| | *p-value* | 0.001 | 0.874 | 0.960 | - |
| **CarbonRiskScore** | *Pearson correlation* | -0.423 | -0.203 | 0.084 | -0.326 |
| | *p-value* | 0.020 | 0.282 | 0.660 | 0.078 |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation/>0.35) are highlighted.* | | | | | |

In this case, beta is correlated to both the Sustainability Score and the Carbon Risk Score. Thus, it is not considered in the analysis. Moreover, as it happened before, fund size and expense ratio are correlated. Again, the fund size will be not considered.

The resulting *multiple regression equation* is:

$$1 - yr\ return = \beta_0 + \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + \beta_5 \times CarbonRiskScore$$

*Table 22. Results Model A.4*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $\beta_0$ – constant | 74.3 | 17.4 | 4.28 | 0.000 | |
| $\beta_3$ – ExpenseRatio | 1.59 | 1.96 | 0.81 | 0.425 | 1.02 |
| $\beta_4$ – SustainabilityScore | -1.184 | 0.342 | -3.46 | 0.002 | 1.14 |
| $\beta_5$ – CarbonRiskScore | -1.248 | 0.400 | -3.12 | 0.004 | 1.14 |

*Table 23. Model A.4 summary*

| R-sq | R-sq (adj) |
|------|------------|
| 38.57% | 31.48% |

It is shown that, similarly to the US, also in Asia-Pacific the returns of the funds are positively related to their good carbon performances. In particular, in this case, the 1-point decrease in Carbon Risk Score leads to an increase of 1.248% in performances.

## Model A – results

The goal of *model A* is to understand if there is a correlation between the performance of a fund and the related Carbon Risk Score. Particularly, what it is expected to find is an inverse proportionality between the variables, meaning that a reduction/increase of the Carbon Risk Score has, consequently, an increase/reduction of the fund's performance.

Finding this correlation, it would be possible to conclude that environmental issues need to be considered by the fund's management on the investment process, since they affect the fund's performance.

The results obtained in Table 13 and Table 14, related to the whole sample of funds - World, show a quite relevant correlation between the funds' performance and the Carbon Risk Score. Specifically, it is highlighted an inverse proportionality between the variables with a coefficient $\beta_5$ equal -0.881,

meaning that a 1-point reduction of the Carbon Risk Score leads to an increase of the performance of +0.881%. This result confirms the expectations: environmental issues matter, the fund's management need to consider theme in the investment process since they affect the performance.

In order to validate the model, a deeper analysis has been performed, considering the specific geographical areas to which founds belong: Europe (*model A.2*), US (*model A.3*) and Asia-Pacific (*model A.4*).

Looking at the results obtained, there are encouraging data that confirm what has been obtained for the whole sample of funds.

Starting from US, that represents the majority of the sample (almost 50%), the results obtained are significant (p-value < 0.05) and confirm what has been obtained from the whole sample of funds. There is an inverse proportionality between the Carbon Risk Score and the performance, characterized by a coefficient $\beta_6$ equal to -1.446 meaning that a 1-point reduction of the Carbon Risk Score leads to an increase of +1.446% of the performance.

In Europe, the correlation between performance and Carbon Risk Score seems good, confirming the inverse proportionality between these variables. Unfortunately, this result cannot be considered since the p-value is higher than 0.05 and so, the results are not significant. This result could be due to the poor presence of funds investing in Europe within the sample, which make it difficult to come with relevant conclusion.

Concerning the Asia-Pacific region, the correlation between performance and Carbon Risk Score is relevant and confirm what has been obtained from the whole sample of funds. There is an inverse proportionality between the Carbon Risk Score and the performance, characterized by a coefficient $\beta_5$ equal to -1.248 meaning that a 1-point reduction of the Carbon Risk Score leads to an increase of +1.248% of the performance.

Given all the results, it is possible to conclude that the funds' returns are definitively affected by the Carbon Risk Score and, so, the fund's management must take into account environmental issues and the relative policies during the investment process.

## *Model B.1 World*

*Table 24. Correlation matrix - Model B.1*

| | | Beta | FundSize | ExpenseRatio | SustainabilityScore |
|---|---|---|---|---|---|
| **FundSize** | *Pearson correlation* | 0.093 | | | |
| | *p-value* | *0.289* | | | |
| **ExpenseRatio** | *Pearson correlation* | -0.120 | -0.433 | | |
| | *p-value* | *0.169* | *0.000* | | |
| **SustainabilityScore** | *Pearson correlation* | -0.399 | -0.102 | 0.143 | |
| | *p-value* | *0.000* | *0.260* | *0.111* | |
| **Fuel Involvement** | *Pearson correlation* | -0.089 | 0.125 | -0.279 | 0.151 |
| | *p-value* | *0.373* | *0.209* | *0.005* | *0.130* |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation/>0.35) are highlighted.* | | | | | |

According to Table 24, fund size and sustainability score are not considered in the analysis. The resulting multiple regression equation is:

$$1 - yr\ return = \ \beta_0 + \beta_1 \times Volatility + \beta_3 \times ExpenseRatio + \beta_5 \times FuelInvolvement$$

*Table 25. Results Model B.1*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 5.96 | 4.39 | 1.36 | 0.178 | |
| $\beta_1$ – Beta | 16.59 | 4.06 | 4.09 | 0.000 | 1.02 |
| $\beta_3$ – ExpenseRatio | -7.34 | 1.08 | -6.78 | 0.000 | 1.10 |
| $\beta_5$ – FuelInvolvement | -0.4095 | 0.0997 | -4.11 | 0.000 | 1.10 |

*Table 26. Model B.1 summary*

| R-sq | R-sq (adj) |
|---|---|
| 44.01% | 42.30% |

The result of *model B.1* shows that a low Fossil Fuel Involvement positively impacts the returns if the overall sample is considered, highlighting a positive correlation between good carbon performances (resulting in a low Fossil Fuel Involvement) and returns.

## Model B.2 Europe

*Table 27. Correlation matrix - Model B.2*

| | | Beta | FundSize | ExpenseRatio | SustainabilityScore |
|---|---|---|---|---|---|
| **FundSize** | *Pearson correlation* | 0.189 | | | |
| | *p-value* | *0.412* | | | |
| **ExpenseRatio** | *Pearson correlation* | -0.430 | -0.767 | | |
| | *p-value* | *0.05* | *0.000* | | |
| **SustainabilityScore** | *Pearson correlation* | 0.164 | -0.062 | -0.219 | |
| | *p-value* | *0.489* | *0.796* | *0.354* | |
| **Fuel Involvement** | *Pearson correlation* | 0.152 | 0.125 | 0.016 | 0.069 |
| | *p-value* | *0.534* | *0.609* | *0.947* | *0.779* |
| *The values with a significant p-value and a significant correlation (/|PearsonCorrelation|>0.35) are highlighted.* | | | | | |

Being the expense ratio related both to the volatility and to the sustainability score, it is not considered in the analysis. The resulting equation is:

$1\ year\ returns = \ \beta_0 + \beta_1 \times Volatility + \beta_2 \times FundSize + \ \beta_4 \times SustainabilityScore + \beta_5 \times FuelInvolvement$

*Table 28. Results Model B.2*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 16.9 | 17.0 | 0.99 | 0.338 | |
| $\beta_1$ – Beta | -1.50 | 9.48 | -0.16 | 0.876 | 1.11 |
| $\beta_2$ – FundSize | 0.000056 | 0.000143 | 0.39 | 0.702 | 1.06 |
| $\beta_4$ – SustainabilityScore | -0.199 | 0.310 | -0.64 | 0.532 | 1.06 |
| $\beta_5$ – FuelInvolvement | -0.052 | 0.125 | -0.42 | 0.680 | 1.04 |

*Table 29. Model B.2 summary*

| R-sq | R-sq (adj) |
|---|---|
| 5.88% | 0.00% |

The results show that, in Europe, no significant correlation exists between low Fossil Fuel Involvement and returns. Even if $\beta_5$ is negative, its p-value is higher than 0.05, meaning that a statistically significant correlation does not exist.

### Model B.3 US

*Table 30. Correlation matrix – Model B.3*

| | | Beta | FundSize | ExpenseRatio | SustainabilityScore |
|---|---|---|---|---|---|
| **FundSize** | Pearson correlation | 0.010 | | | |
| | p-value | 0.938 | | | |
| **ExpenseRatio** | Pearson correlation | 0.019 | -0.341 | | |
| | p-value | 0.887 | 0.007 | | |
| **SustainabilityScore** | Pearson correlation | -0.388 | -0.036 | 0.260 | |
| | p-value | 0.002 | 0.781 | 0.043 | |
| **Fuel Involvement** | Pearson correlation | -0.459 | 0.028 | -0.141 | 0.435 |
| | p-value | 0.001 | 0.843 | 0.315 | 0.001 |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation|>0.35) are highlighted.* | | | | | |

Due to the results of the matrix, the volatility and the sustainability score are not considered in the analysis; the consequent multiple linear regression equation is:

$$1\ year\ returns = \beta_0 + \beta_2 \times FundSize + \beta_3 \times ExpenseRatio + \beta_5 \times FuelInvolvement$$

*Table 31. Results model B.3*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 23.18 | 1.36 | 17.08 | 0.000 | |
| $\beta_2$ – FundSize | 0.000001 | 0.000004 | 0.27 | 0.792 | 1.18 |
| $\beta_3$ – ExpenseRatio | -0.74 | 1.40 | -0.53 | 0.599 | 1.20 |
| $\beta_5$ – FuelInvolvement | -0.7440 | 0.0769 | -9.68 | 0.000 | 1.02 |

*Table 32. Model B.3 summary*

| R-sq | R-sq (adj) |
|---|---|
| 65.84% | 63.75% |

In the US, the results show that a low Fossil Fuel Involvement positively impacts the returns in the sample considered. It means that a lower Fossil Fuel Involvement (e.g. of 1%) leads to higher returns (of 0.744%).

## Model B.4 Asia - Pacific

*Table 33. Correlation matrix – Model B.4*

| | | Beta | FundSize | ExpenseRatio | SustainabilityScore |
|---|---|---|---|---|---|
| **FundSize** | *Pearson correlation* | -0.110 | | | |
| | *p-value* | *0.444* | | | |
| **ExpenseRatio** | *Pearson correlation* | 0.208 | -0.481 | | |
| | *p-value* | *0.142* | *0.000* | | |
| **SustainabilityScore** | *Pearson correlation* | -0.482 | -0.025 | 0.008 | |
| | *p-value* | *0.001* | *0.874* | *0.960* | |
| **Fuel Involvement** | *Pearson correlation* | 0.355 | 0.026 | 0.083 | -0.314 |
| | *p-value* | *0.054* | *0.890* | *0.663* | *0.091* |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation/>0.35) are highlighted.* | | | | | |

Due to their correlation with the sustainability score and the expense ratio respectively, the volatility and the fund size are not considered in the analysis:

$$1\ year\ returns = \ \beta_0 + \ \beta_3 \times ExpenseRatio + \beta_4 \times SustainabilityScore + \beta_5 \times FuelInvolvement$$

*Table 34. Results Model B.4*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 58.9 | 16.1 | 3.66 | 0.001 | |
| $\beta_3$ – ExpenseRatio | 1.47 | 2.05 | 0.72 | 0.478 | 1.02 |
| $\beta_4$ – SustainabilityScore | -1.123 | 0.356 | -3.15 | 0.004 | 1.13 |
| $\beta_5$ – FuelInvolvement | -0.681 | 0.263 | -2.59 | 0.016 | 1.13 |

| R-sq | R-sq (adj) |
|------|-----------|
| 32.80% | 25.05% |

The results show that, similarly to the US, also in Asia-Pacific the returns of the funds are positively related to their low Fossil Fuel Involvement. In particular, in this case, a 1% decrease in Fossil Fuel Involvement leads to an increase of 0.681% in performances.

## Model B – results

The goal of *model B* is to understand if there is a correlation between the performance of a fund and the related Fossil Fuel Involvement. Particularly, what it is expected to find is an inverse proportionality between the variables, meaning that a reduction/increase of the Fossil Fuel Involvement leads to an increase/reduction of the fund's performance.

Finding this correlation, it would be possible to conclude that environmental issues need to be taken into account by the fund's management on the investment process, since they affect the fund's performance.

The results obtained related to the whole sample of funds - World, show a quite relevant correlation between the funds' performance and the Fossil Fuel Involvement. Specifically, it is highlighted an inverse proportionality between the variables with a coefficient $\beta_5$ equal -0.4095, meaning that a 1-point reduction of the Carbon Risk Score leads to an increase of the performance of +0.4095%. This result confirms the expectations: environmental issues matter, the fund's management need to consider theme in the investment process since they affect the performance.

In order to validate the model, a deeper analysis has been performed, considering the specific geographical areas to which founds belong: Europe (*model B.2*), US (*model B.3*) and Asia-Pacific (*model B.4*).

Looking at the results obtained, there are encouraging data that confirm what has been obtained for the whole sample of funds.

Starting from US, that represents the majority of the sample (almost 50%), the results obtained are significant (p-value < 0.05) and confirm what has been obtained from the whole sample of funds. There is an inverse proportionality between the Fossil Fuel Involvement and the performance, characterized by a coefficient $\beta_5$ equal to -0.7440 meaning that a 1-point reduction of the Carbon Risk Score leads to an increase of +0.7440% of the performance.

In Europe, the correlation between performance and Fossil Fuel Involvement seems good, confirming the inverse proportionality between these variables. Unfortunately, this result cannot be considered since the p-value is higher than 0.05 and so, the results are not significant. This result could be due to the poor presence of funds investing in Europe within the sample, which make it difficult to come with relevant conclusion.

Concerning the Asia-Pacific region, the correlation between performance and Fossil Fuel Involvement is relevant and confirm what has been obtained from the whole sample of funds. There is an inverse proportionality between the Fossil Fuel Involvement and the performance, characterized by a coefficient $\beta_5$ equal to -0.681 meaning that a 1-point reduction of the Carbon Risk Score leads to an increase of +0.681% of the performance.

Given all the results, it is possible to conclude that the funds' returns are definitively affected by the Fossil Fuel Involvement and, so, the fund's management must take into account environmental issues and the relative policies during the investment process.

### *Model C and Model D – reflections*

The variables considered in Model C and D are the same of Model A and Model B. The only difference, is that in model C and D two different periods are considered in order to assess the impact of the Low Carbon Designation's publication (before and after). It follows that the correlation

matrixes of *model C* and *model D* are exactly the same of *model A* and *model B*, since the independent

variables do not change. Table 36 summarizes the independent variables that are considered in *model*

*C* and *model D*.

*Table 36. Independent variables considered in Model C and Model D*

| MODEL | SIMILAR TO | INDEPENDENT VARIABLES | | | |
|---|---|---|---|---|---|
| **Model C.1** | *Model A.1* | $\beta_1$ | $\beta_3$ | $\beta_5$ | |
| **Model C.2** | *Model A.2* | $\beta_1$ | $\beta_3$ | $\beta_4$ | $\beta_5$ |
| **Model C.3** | *Model A.3* | $\beta_2$ | $\beta_3$ | $\beta_5$ | |
| **Model C.4** | *Model A.4* | $\beta_3$ | $\beta_4$ | $\beta_5$ | |
| **Model D.1** | *Model B.1* | $\beta_1$ | $\beta_3$ | $\beta_5$ | |
| **Model D.2** | *Model B.2* | $\beta_1$ | $\beta_2$ | $\beta_4$ | $\beta_5$ |
| **Model D.3** | *Model B.3* | $\beta_2$ | $\beta_3$ | $\beta_5$ | |
| **Model D.4** | *Model B.4* | $\beta_3$ | $\beta_4$ | $\beta_5$ | |

## Model C

Multiple linear regression equation:

$$y_{1,2} = \beta_0 + \beta_1 \times Volatility + \beta_3 \times ExpenseRatio + \beta_5 \times CarbonRiskScore$$

With:

- $y_1$: Return from January to March 2018;

- $y_2$: Return from May to July 2018.

*Table 37. Results Model C.1 – y1*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | -4.53 | 2.05 | -2.21 | 0-029 | |
| $\beta_1$ – Beta | 7.43 | 1.83 | 4.05 | 0.000 | 1.01 |
| $\beta_3$ – ExpenseRatio | 0.833 | 0.479 | 1.74 | 0.085 | 1.04 |
| $\beta_5$ – CarbonRiskScore | -0.3033 | 0.0809 | -3.75 | 0.000 | 1.04 |

| R-sq | R-sq (adj) |
|------|------------|
| 24.38% | 22.06% |

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $\beta_0$ – constant | 11.98 | 2.47 | 4.85 | 0.000 | |
| $\beta_1$ – Beta | 1.31 | 2.21 | 0.59 | 0.554 | 1.01 |
| $\beta_3$ – ExpenseRatio | -5.238 | 0.577 | -9.07 | 0.000 | 1.04 |
| $\beta_5$ – CarbonRiskScore | -0.5388 | 0.0975 | -5.53 | 0.000 | 1.04 |

| R-sq | R-sq (adj) |
|------|------------|
| 58.50% | 57.23% |

Looking at Table 37 and Table 39, it is possible to see that the coefficient $\beta_5$, related to the Carbon Risk Score, increased (in absolute value) after the publication of the Low Carbon Designation, meaning that it had a positive impact.

## Model D

Multiple linear regression equation:

$$y_{1,2} = \beta_0 + \beta_1 \times Volatility + \beta_3 \times ExpenseRatio + \beta_5 \times FuelInvolvement$$

With:

- $y_1$: Return from January to March 2018;

- $y_2$: Return from May to July 2018.

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $\beta_0$ – constant | -3.67 | 1.78 | -2.06 | 0.042 | |
| $\beta_1$ – Beta | 6.29 | 1.64 | 3.83 | 0.000 | 1.02 |
| $\beta_3$ – ExpenseRatio | -0.328 | 0.438 | -0.75 | 0.456 | 1.10 |
| $\beta_5$ – FuelInvolvement | -0.2660 | 0.0404 | -6.59 | 0.000 | 1.10 |

*Table 42. Model D.1/y1 summary*

| R-sq | R-sq (adj) |
|---|---|
| 40.07% | 38.24% |

*Table 43. Results Model D.1 – y2*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 7.46 | 2.75 | 2.72 | 0.008 | |
| $\beta_1$ – Beta | 1.27 | 2.54 | 0.50 | 0.618 | 1.02 |
| $\beta_3$ – ExpenseRatio | -5.995 | 0.676 | -8.86 | 0.000 | 1.10 |
| $\beta_5$ – FuelInvolvement | -0.0548 | 0.0624 | -0.88 | 0.382 | 1.10 |

*Table 44. Model D.1/y2 summary*

| R-sq | R-sq (adj) |
|---|---|
| 45.99% | 44.34% |

The results found for the whole sample, considering the correlation of the returns with the Fossil Fuel Involvement, show a contradictory result: it seems that the publication of the score has negatively affected the funds with low Fossil Fuel Involvement, since the correlation that was existing before the publication has vanished after the publication.

### Model E World

*Table 45. Correlation matrix – Model E.1*

| | | **Beta** | **FundSize** | **ExpenseRatio** | **SustainabilityScore** |
|---|---|---|---|---|---|
| **FundSize** | *Pearson correlation* | 0.093 | - | - | - |
| | *p-value* | *0.289* | - | - | - |
| **ExpenseRatio** | *Pearson correlation* | -0.120 | -0.433 | - | - |
| | *p-value* | *0.169* | *0.000* | - | - |
| **SustainabilityScore** | *Pearson correlation* | -0.399 | -0.102 | 0.143 | - |
| | *p-value* | *0.000* | *0.260* | *0.111* | - |
| **Low Carbon Designation** | *Pearson correlation* | 0.061 | -0.060 | -0.029 | 0.087 |
| | *p-value* | *0.540* | *0.549* | *0.769* | *0.383* |
| *The values with a significant p-value and a significant correlation (/PearsonCorrelation|>0.35) are highlighted.* | | | | | |

From the correlation matrix, what emerges is that the fund size of a mutual fund is negatively correlated with its expense ratio. It means that it can be safely said that the higher the size of a mutual fund, the lower its expense ratio while, on the other hand, the lower the size, the higher the expense ratio. Due to this fact, to avoid multicollinearity, it is better not to consider both the independent variables in the model, but to consider just one of them. For this reason, the fund size is not going to be included in the analysis.

Another factor that emerges from the matrix is that also the beta and the Morningstar Sustainability Score are negatively correlated. The less volatile a fund is (lower beta), the higher the Sustainability Score is. Thus, once more, to avoid multicollinearity only one of the two has to be considered. Since this analysis is not focused on the analysis of the correlation between the Sustainability Score and the performances and since the Sustainability Score is not available for all the sample of funds, this independent variable is excluded from the analysis, and the only variable considered is beta.

Following these considerations, the new model will be:

$$y_{1,2} = \beta_0 + \beta_1 \times Volatility + \beta_3 \times ExpenseRatio + \beta_5 \times Carbon$$

Now that the final model has been defined, the analysis can be done.

By fitting the model considering as $x_5$ the Low Carbon Designation (1 if the Low Carbon Designation stamp is given to the fund, 0 otherwise), what is found is shown in Table 46 and Table 48.

*Table 46. Results Model E.1 – y1*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | -7.74 | 1.84 | -4.20 | 0.000 | |
| $\beta_1$ – Beta | 7.09 | 1.79 | 3.96 | 0.000 | 1.01 |
| $\beta_3$ – ExpenseRatio | 0.554 | 0.459 | 1.21 | 0.231 | 1.01 |
| $\beta_5$ – LowCarbonDesignation (1 = YES; 0 = NO) | 2.285 | 0.513 | 4.46 | 0.000 | 1.00 |

*Table 47. Model E.1/y1 summary*

| R-sq | R-sq (adj) |
|---|---|
| 28.09% | 25.89% |

*Table 48. Results Model E.1 – y2*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| $\beta_0$ – constant | 6.34 | 2.3 | 2.76 | 0.007 | |
| $\beta_1$ – Beta | 0.83 | 2.24 | 0.37 | 0.710 | 1.01 |
| $\beta_3$ – ExpenseRatio | -5.749 | 0.574 | -10.01 | 0.000 | 1.01 |
| $\beta_5$ – LowCarbonDesignation (1 = YES; 0 = NO) | 3.373 | 0.641 | 5.26 | 0.000 | 1.00 |

*Table 49. Model E.1/y2 summary*

| R-sq | R-sq (adj) |
|---|---|
| 57.55% | 56.25% |

The results found show that the publication of the Morningstar Low Carbon Designation has positively affected the returns of the funds with the "certification". Before the publication, a fund that was eligible for having the Low Carbon Designation had returns 2.285% higher than the ones of funds

that were not eligible for having it. After the publication, the results were significant again (p-value = 0.000), and the returns of the funds with the "certification" were 3.373% higher. Therefore, the publication of the Low Carbon Designation seems to have positively influenced fund's performances with the "certification".

## Model E – aggregated period

With the objective of validating the results obtained in *model E,* the outcomes of the aggregate period (January to July 2018) are shown.

This analysis studies the correlation between the Low Carbon Designation and the return from January to July 2018, and it is considered as an aggregated of the two cases shown.

Table 50 shows the results in the World (133 funds – whole sample).

*Table 50. Model E – Aggregate result – World*

| Term | Coefficient | SE Coef | T-Value | P-Value | VIF |
|------|-------------|---------|---------|---------|-----|
| $\beta_0$ – constant | -0.15 | 2.90 | -0.05 | 0.959 | |
| $\beta_1$ – Beta | 7.33 | 2.82 | 2.60 | 0.011 | 1.01 |
| $\beta_3$ – ExpenseRatio | -5.835 | 0.724 | -8.06 | 0.000 | 1.01 |
| $\beta_5$ – LowCarbonDesignation (1 = YES; 0 = NO) | 6.063 | 0.808 | 7.50 | 0.000 | 1.00 |

As expected, the results show that, if the whole period is considered ($y$ = YTD return at the end of July), the Low Carbon Designation and the return of the funds are correlated.

# 7.CONCLUSIONS

Climate change is one of the main problems that is affecting our planet nowadays. According to the scientists, there is a probability higher than 95% that it is the result of the so-called *greenhouse effect* due to human activities in the past 50 years, like massive burning of fossil fuels and, generally, all the industrial human activities, which have increased the concentration of greenhouse gases, changing the atmosphere natural composition (Earth Science Communications Team, 2018).

The effects of the Global climate change on the environment are already well observable: from the temperatures that are rising over the years, to the growing frequency of the extinctions of animals and trees, to the accelerating sea level rise. Several studies (e.g. World Economic Forum, 2018) show that our planet is going to the brink and we should, as citizen and as investors, try to change this road.

In this harsh situation, the world of investments is changing to respond to the new challenges. The so-called *sustainable investments* have born in recent years. They can be defined as a long-term investment approach, which integrates ESG factors in the research, analysis and selection process of securities within an investment portfolio. Their growth in the last decade has been huge: from 1995 to 2014, the global market of responsible investments has increased of 929% with a CAGR of 13.1% (PNC, 2015).

Together with the growth of sustainable investments, also the number of studies that analyses their performances have grown: more than 2000 studies have focused their attention on the correlation between sustainability and good funds' performances. The results that have been found do not go in the same direction, but most of the studies highlights a non-negative ESG-CFP correlation.

Moreover, a gap has been identified in the current literature: none of the existing studies solely compares the returns of funds with their carbon performances. In an economy as the one described above, companies have to face the global warming problem and thus, also mutual funds are involved in this topic. In order to help investors to take into consideration the climate specific risk and so to

compare and to select the investment funds according to their expose to risks deriving by polluting emissions, Morningstar created the Low Carbon Designation (Morningstar, 2018): an indicator based on the Morningstar Portfolio Carbon Risk Score and the Morningstar Portfolio Fossil Fuel Involvement. The Low Carbon Designation is assigned to the portfolios that have both a low Carbon-Risk score (<10) and a low level of Fossil Fuel exposure (<7%): the former assesses the risk that companies in a fund face from the transition to a low-carbon economy, while the latter assesses the degree to which a portfolio is exposed to coal extraction and power generation, oil and gas products and services and oil and gas production and power generation.

To evaluate the possible correlation between carbon performances and returns, this study considers a sample of 133 equity funds investing in three different regions (Europe, US, Asia-Pacific) and, thanks to a multiple linear regression model, analyses the correlation factors related to the Morningstar Low Carbon Designation and the Morningstar Carbon Risk Score with the returns of the funds.

More in particular, the purpose of the study is (i) to assess whether good carbon performances of a fund imply better returns (*model* A) and (ii) to understand if the publication of the score has influenced the fund's performance (*model* B).

As explained in paragraph 1 – *CLIMATE CHANGE*, we are pushing the World to a tipping point. Europe has the objective, by 2030, to meet its action plan called 40-27-27, which consists in:

- A 40% cut in greenhouse gas emissions compared to 1990 levels;
- At least 27% share of renewable energy consumption;
- At least 27% energy savings compared with the business-as-usual scenario.

Moreover, according to several studies, the transition to a low carbon economy will have consequences for all the firms. Those who will not change, will face very high risks.

Some countries have already started introducing plans that go in the direction of a green economy. France, one of the most active countries, with the 2016 approval of the *French energy transition law*,

has introduced disclosure requirements for the portfolio managers related to the climate risk management and, more in general, related to the introduction of social and environmental factors in the investment policies. The European Commission has made request to adopt a shared taxonomy for the sustainable finance, together with standards for the "*green tools*". For financial operators, thus, it is always more important to evaluate, manage and reduce the exposure to pollutant emissions. As a consequence of this fact, the number of *products* available on the market has grown: in the last two years, more than 70 new green mutual funds / ETFs have been launched. Thus, there are more solutions available on the market. However, the "sustainable funds" are still relatively in low number if looking at SMEs: looking at the whole number of mutual funds present in Europe, only 7% of them are classified by Morningstar as *sustainable*. SMEs are nowadays always more affected by ESG criteria, which are becoming success factors for them. Big companies ask always more to the SMEs to review their processes and products in a "green perspective", putting more pressure on this topic.

The oil and gas will be negatively affected by the transition to a low carbon economy in the short term. According to the analysts of Sustainalytics, the companies belonging to this industry will suffer a profit reduction and an increase of the cost of capital. Generally, the firms that are facing the highest risk are those with the highest average production costs or involved in project regarding fossil fuels, as well as all the industries that are not diversifying on renewable energy sources.

Considering the change of the environment and the growing pressure coming from new policies and regulations related to the transition to a low carbon economy, it is expected to find a positive correlation between returns and a sustainable transition.

Moreover, since the analysis is based on a dataset coming from the Morningstar's database and related to the publication of the Low Carbon Designation, it is going to be assessed if the publication affects the performances of funds.

The results obtained show a quite relevant correlation between the funds' performance and the Carbon Risk Score considering the whole dataset. Specifically, it is highlighted an inverse proportionality between the two variables: a reduction of the Carbon Risk Score leads to an increase of the performances.

In order to validate the model, a deeper analysis has been performed, considering the specific geographical areas to which founds belong: Europe, US, and Asia-Pacific.

Looking at the results obtained, there are encouraging data that confirm what has been obtained from the whole sample of funds.

In the US and Asia-Pacific regions, the results confirm what found for the whole sample, while in Europe, even if the results obtained are the same, they are not statistically significant. This result could be due to the poor presence of funds investing in Europe within the sample, which make it difficult to come with relevant conclusion.

A second analysis has been performed looking at the Fossil Fuel Involvement, which is the second variable, together with the Carbon Risk Score, which composes the Low Carbon Designation. The results obtained show the same trend found with the Carbon Risk Score. It is highlighted an inverse proportionality between the two variables: a reduction of the Fossil Fuel Involvement leads to an increase of the performances.

Given all the results, it is possible to conclude that the expectations are met and so the funds' returns are definitively affected by both the Carbon Risk Score and the Fossil Fuel Involvement: environmental issues matter, the fund's management must take them into account and the relative policies during the investment process in order to obtain higher returns.

The second part of the analysis is related to the impact of the Low Carbon Designation's publication. In order to perform this type of analysis, three models have been considered.

First, it has been assessed the correlation between the Carbon Risk Score and the returns before and after the publication: as expected, the correlation factor has increased after the publication, making stronger the impact of the Carbon Risk Score on the returns.

Second, the same analysis has been performed for the Fossil Fuel Involvement. In this case, it is not possible to make conclusions since, after the publication, the correlation factor between Fossil Fuel Involvement and returns is not statistically significant.

Finally, due to the contradictory results found, it has been assessed the impact of the Low Carbon Designation as a whole. In order to do that, the funds that were eligible for having the Low Carbon Designation "certification" and the same funds after the effective publication have been considered. The results obtained show that returns have improved significantly as a consequence of the publication.

In the end, it is possible to conclude that the publication of the Low Carbon Designation has positively affected the returns of the related funds, consolidating the supported thesis, according to which "environmental issues matter" and they have to be taken into account by the financial industry.

In the next future, it is expected that firms will face always stricter and more pressing regulations that will inevitably have an impact on their business. In fact, they will need to dedicate a significant part of their revenues in sustainable investments that will negatively affect their balance sheets in the short term.

Despite that, sustainable investments have not to be seen just as an expense to lead social and environmental changes, but also as profit generators. In fact, thanks to the new technologies, in addition to reducing the emission level and the use of fossil fuels, it is possible to obtain huge increases of the internal processes efficiency, and so, to increase profit margins.

Furthermore, it is necessary to consider the increasing interest towards sustainable investments by young people, Millennials and women that consider the environmental impact as more important of the profit in the investment choices.

For these reasons, firms that will not follow the transition to a low carbon economy, will suffer a reduction of the appeal, and so, they will have serious problems in capital raising, compromising their growth.

The most important role in this transition is and will be played by managers, who have to drive the companies towards sustainable business strategies increasing investments on green technologies, industrial processes efficiency and social services.

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# 9. EXHIBIT

| # | Ticker | Name | Stock Industry/ Fund Category | Region | $ NAV | $mil Fund Size | % Expense Ratio | % 3-months return | % YTD return | % 12-months return |
|---|--------|------|-------------------------------|--------|-------|----------------|-----------------|-------------------|--------------|--------------------|
| 1 | APJAX | Aberdeen Asia Pac ex-Japan Eq A | Pacific/Asia ex-Japan Stk | Asia | 13,46 | 9,24 | 1,55 | -3,58 | -1,32 | 6,26 |
| 2 | GOPAX | Aberdeen China Opportunities A | China Region | Asia | 23,28 | 12,82 | 1,97 | -2,43 | 0,13 | 10,19 |
| 3 | SAESX | AIG Japan A | Japan Stock | Asia | 7,99 | 25,93 | 1,9 | -4,65 | -7,09 | 1,25 |
| 4 | MDPCX | BlackRock Asian Dragon Investor A | Pacific/Asia ex-Japan Stk | Asia | 15,69 | 181,07 | 1,32 | -6,57 | -6,73 | 0,96 |
| 5 | BIANX | Brown Advisory - Macq Asia New Stars Inv | Pacific/Asia ex-Japan Stk | Asia | 9,94 | 2,32 | 1,7 | -7,17 | -7,26 | 0,34 |
| 6 | BIAJX | Brown Advisory WMC JPN Alpha Opps Inv | Japan Stock | Asia | 10,76 | 745,28 | 1,3 | -4,69 | -5,61 | 5,64 |
| 7 | CAJAX | Columbia Contrarian Asia Pacific A | Pacific/Asia ex-Japan Stk | Asia | 13,38 | 21,85 | 1,56 | -6,82 | -5,64 | 4,96 |
| 8 | NGCAX | Columbia Greater China A | China Region | Asia | 49,91 | 137,4 | 1,55 | -2,88 | -2,37 | 15,89 |
| 9 | CNJFX | Commonwealth Japan | Japan Stock | Asia | 3,94 | 5,92 | 1,75 | -2,72 | -1,01 | 7,95 |
| 10 | EVCGX | Eaton Vance Greater China Growth A | China Region | Asia | 25,3 | 102,16 | 1,91 | -0,63 | -0,2 | 14,39 |
| 11 | ETGIX | Eaton Vance Greater India A | India Equity | Asia | 35,55 | 240,85 | 1,68 | 0,62 | -3,48 | 4,11 |
| 12 | FHKAX | Fidelity Advisor® China Region A | China Region | Asia | 34,51 | 1.415,53 | 1,3 | -3,09 | -3,03 | 9,59 |
| 13 | FEAAX | Fidelity Advisor® Emerging Asia A | Pacific/Asia ex-Japan Stk | Asia | 39,48 | 310,02 | 1,36 | -1,18 | -3,92 | 7,61 |
| 14 | FPJAX | Fidelity Advisor® Japan A | Japan Stock | Asia | 15,5 | 400,51 | 1,11 | -1,15 | 0,45 | 10,97 |
| 15 | FHKCX | Fidelity® China Region | China Region | Asia | 34,95 | 1.415,53 | 1 | -3,02 | -2,86 | 9,94 |
| 16 | FSEAX | Fidelity® Emerging Asia | Pacific/Asia ex-Japan Stk | Asia | 43,27 | 1.288,44 | 1,08 | -1,14 | -3,93 | 7,53 |
| 17 | FJSCX | Fidelity® Japan Smaller Companies | Japan Stock | Asia | 18,24 | 831,59 | 0,94 | -4,7 | -3,8 | 9,29 |
| 18 | FINGX | Franklin India Growth A | India Equity | Asia | 14,73 | 142,82 | 1,65 | -3,03 | -7,76 | -2,26 |
| 19 | GSAGX | Goldman Sachs Asia Equity A | Pacific/Asia ex-Japan Stk | Asia | 27,21 | 86,23 | 1,55 | -3,92 | -6,49 | 8,9 |
| 20 | IASMX | Guinness Atkinson Asia Focus | Pacific/Asia ex-Japan Stk | Asia | 21,81 | 19,3 | 1,98 | -1,09 | -3,45 | 11,97 |
| 21 | ICHKX | Guinness Atkinson China & Hong Kong | China Region | Asia | 25,25 | 71,59 | 1,64 | -5 | -4,9 | 9,5 |
| 22 | HJPNX | Hennessy Japan Investor | Japan Stock | Asia | 35,16 | 474,87 | 1,46 | -0,26 | 0,92 | 15,07 |
| 23 | HJPSX | Hennessy Japan Small Cap Investor | Japan Stock | Asia | 16,16 | 228,18 | 1,6 | -1,4 | 1,64 | 19,12 |

| # | Ticker | % 2018 Q1 (Jan-Mar) | Alpha 3 year | Beta 3 year | Sharpe Ratio | Std Dev 3 year | Portfolio ESG | Controversy Deduction | Sustainaiblity Score | Carbon Risk | Fuel Involvement |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APJAX | 1,91 | 1,95 | 1,11 | 0,55 | 15,14 | 51,78 | 5,41 | 46,37 | 14,15 | 2,79 |
| 2 | GOPAX | 3,78 | 1,27 | 0,93 | 0,49 | 13,69 | 47,46 | 3,65 | 43,81 | | |
| 3 | SAESX | -2,91 | -0,43 | 0,93 | 0,35 | 14,02 | 51,78 | 3,28 | 48,5 | 12,26 | 3,13 |
| 4 | MDPCX | 0,65 | -1,23 | 0,98 | 0,33 | 13,52 | 48,78 | 4,77 | 44,01 | 16,41 | 9,66 |
| 5 | BIANX | | -6,96 | 0,87 | -0,14 | 13,59 | 45,22 | 2,33 | 42,89 | | |
| 6 | BIAJX | -0,96 | -4,44 | 0,85 | 0,03 | 15,91 | 48,71 | 2,9 | 45,81 | | |
| 7 | CAJAX | 1,41 | 2,6 | 1,01 | 0,59 | 14,43 | 49,42 | 4,28 | 45,04 | 12,54 | 5,33 |
| 8 | NGCAX | 3,23 | 4,74 | 1,21 | 0,63 | 18,74 | 43,66 | 3,63 | 40,03 | 10,22 | 3,29 |
| 9 | CNJFX | 2,26 | 1,55 | 0,62 | 0,51 | 10,07 | 45,33 | 1,56 | 43,77 | 10,48 | 2,79 |
| 10 | EVCGX | 2,21 | 5,69 | 1,01 | 0,75 | 15,36 | 48,02 | 2,76 | 45,26 | 11,51 | 0,87 |
| 11 | ETGIX | -6,38 | 3,47 | 0,97 | 0,53 | 17,03 | 51,35 | 5,21 | 46,14 | | |
| 12 | FHKAX | 2,89 | 2,3 | 1,25 | 0,5 | 19,05 | 45,53 | 3,19 | 42,34 | | |
| 13 | FEAAX | 0,17 | 4,68 | 1,04 | 0,71 | 15,06 | 47,38 | 3,16 | 44,22 | 13,18 | 5,37 |
| 14 | FPJAX | 2,59 | 3,48 | 0,8 | 0,69 | 11,71 | 49,92 | 3,33 | 46,59 | 10,75 | 0,45 |
| 15 | FHKCX | 2,97 | 2,61 | 1,25 | 0,52 | 19,04 | 45,53 | 3,19 | 42,34 | | |
| 16 | FSEAX | 0,13 | 4,85 | 1,03 | 0,72 | 14,86 | 47,64 | 3,21 | 44,43 | 13,16 | 5,32 |
| 17 | FJSCX | 2 | 7,71 | 0,59 | 1,1 | 10,04 | 46,73 | 1,28 | 45,45 | | |
| 18 | FINGX | -7,45 | -0,05 | 0,97 | 0,34 | 16,38 | | | | | |
| 19 | GSAGX | -0,24 | 4,01 | 0,94 | 0,67 | 14,04 | 47,62 | 3,69 | 43,93 | 11,14 | 1,67 |
| 20 | IASMX | 0,71 | 6,29 | 0,99 | 0,79 | 15,26 | 47,68 | 2,91 | 44,77 | 14,1 | 9,75 |
| 21 | ICHKX | 1,21 | 4,44 | 1,14 | 0,61 | 17,93 | 44,48 | 3,15 | 41,33 | 15,52 | 3,27 |
| 22 | HJPNX | 1,38 | 7,56 | 0,73 | 0,95 | 12,38 | 51,03 | 3,49 | 47,54 | 8,15 | 0 |
| 23 | HJPSX | 3,02 | 12,51 | 0,61 | 1,53 | 10,49 | | | | | |

| # | Ticker | Name | Stock Industry/ Fund Category | Region | $ NAV | $mil Fund Size | % Expense Ratio | % 3-months return | % YTD return | % 12- months return |
|---|--------|------|-------------------------------|--------|-------|----------------|-----------------|-------------------|--------------|---------------------|
| 24 | HAJAX | HSBC Asia ex-Japan Smaller Coms Eq A | Pacific/Asia ex-Japan Stk | Asia | 11,5 | 107,21 | 1,75 | -7,11 | -6,12 | 1,3 |
| 25 | ASIAX | Invesco Asia Pacific Growth A | Pacific/Asia ex-Japan Stk | Asia | 33,29 | 846,54 | 1,45 | -3,11 | -5,93 | 1,67 |
| 26 | AACFX | Invesco Greater China A | China Region | Asia | 29,8 | 95,5 | 1,93 | 1,85 | 0,54 | 10,21 |
| 27 | JAQAX | Janus Henderson Asia Equity A | Pacific/Asia ex-Japan Stk | Asia | 11,77 | 33,93 | 1,63 | -1,01 | -1,42 | 5,62 |
| 28 | JCOAX | JHancock Greater China Opportunities A | China Region | Asia | 25,1 | 58,82 | 1,63 | -2,45 | -1,91 | 13,63 |
| 29 | MASGX | Matthews Asia ESG Investor | Pacific/Asia ex-Japan Stk | Asia | 11,28 | 21,63 | 1,5 | -2,67 | -2,42 | 6,94 |
| 30 | MAFSX | Matthews Asia Focus Investor | Pacific/Asia ex-Japan Stk | Asia | 11,44 | 8,21 | 1,5 | -2,22 | -6,08 | 3,16 |
| 31 | MATFX | Matthews Asia Innovators Investor | Pacific/Asia ex-Japan Stk | Asia | 13,94 | 284,66 | 1,24 | -2,11 | -1,76 | 9,68 |
| 32 | MSMLX | Matthews Asia Small Companies Inv | Pacific/Asia ex-Japan Stk | Asia | 21,95 | 390,71 | 1,46 | -3,98 | -4,11 | 6,17 |
| 33 | MACSX | Matthews Asian Growth & Inc Investor | Pacific/Asia ex-Japan Stk | Asia | 16,36 | 2.132,01 | 1,07 | -2,53 | -5,05 | -1,25 |
| 34 | MCDFX | Matthews China Dividend Investor | China Region | Asia | 17,75 | 347,83 | 1,19 | 0,3 | 2,69 | 18,41 |
| 35 | MCHFX | Matthews China Investor | China Region | Asia | 21,69 | 942,14 | 1,09 | -6,1 | -2,3 | 11,83 |
| 36 | MCSMX | Matthews China Small Companies | China Region | Asia | 12,8 | 72,98 | 1,5 | 2,48 | 7,65 | 30,9 |
| 37 | MEASX | Matthews Emerging Asia Investor | Pacific/Asia ex-Japan Stk | Asia | 13,62 | 479 | 1,48 | -9,62 | -12,19 | -6,44 |
| 38 | MINDX | Matthews India Investor | India Equity | Asia | 33,61 | 2.123,64 | 1,09 | -3 | -2,04 | 5,4 |
| 39 | MJFOX | Matthews Japan Investor | Japan Stock | Asia | 24,19 | 4.607,68 | 0,94 | -0,86 | 0,29 | 13,82 |
| 40 | MAPTX | Matthews Pacific Tiger Investor | Pacific/Asia ex-Japan Stk | Asia | 29,99 | 9.134,20 | 1,06 | -3,07 | -5,27 | 7,6 |
| 41 | MALAX | Mirae Asset Asia A | Pacific/Asia ex-Japan Stk | Asia | 12,9 | 58,54 | 1,5 | -5,77 | -6,45 | 5,13 |
| 42 | NCEAX | Neuberger Berman Greater China Eq A | China Region | Asia | 15,44 | 100,53 | 1,86 | -6,59 | -3,38 | 11,62 |
| 43 | OBCHX | Oberweis China Opportunities | China Region | Asia | 15,51 | 104,06 | 1,91 | -2,27 | -2,76 | 12,05 |
| 44 | SGCFX | Shelton Greater China | China Region | Asia | 8,66 | 8,25 | 1,98 | -5,32 | -3,63 | 4,33 |
| 45 | TRAOX | T. Rowe Price Asia Opportunities | Pacific/Asia ex-Japan Stk | Asia | 14,41 | 116,02 | 1,16 | -3,16 | -3,09 | 7,35 |

| # | Ticker | % 2018 Q1 (Jan-Mar) | Alpha 3 year | Beta 3 year | Sharpe Ratio | Std Dev 3 year | Portfolio ESG | Controversy Deduction | Sustainaiblity Score | Carbon Risk | Fuel Involvement |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 24 | HAJAX | 2,37 | 3,55 | 1,03 | 0,64 | 14,81 | | | | | |
| 25 | ASIAX | -1,44 | 1,38 | 0,87 | 0,53 | 11,97 | 48,4 | 2,71 | 45,69 | | |
| 26 | AACFX | 2,23 | 6,3 | 0,99 | 0,82 | 14,63 | 46,94 | 2,61 | 44,33 | 11,36 | 1,72 |
| 27 | JAQAX | 0,59 | 3,96 | 1,09 | 0,68 | 15,01 | 52,6 | 3,94 | 48,66 | 9,64 | 0 |
| 28 | JCOAX | 4,42 | 5,05 | 1,08 | 0,67 | 16,93 | 47,58 | 2,92 | 44,66 | 12,17 | 3,93 |
| 29 | MASGX | | 2,41 | 0,81 | 0,62 | 11,44 | 48,39 | 2,42 | 45,97 | | |
| 30 | MAFSX | -2,71 | 1,55 | 0,93 | 0,53 | 13,13 | 50,57 | 4,43 | 46,14 | 12,05 | 0 |
| 31 | MATFX | 4,16 | 5,37 | 1,06 | 0,7 | 16,45 | 47,24 | 3,04 | 44,2 | | |
| 32 | MSMLX | 1,92 | -0,31 | 0,73 | 0,32 | 12,27 | | | | | |
| 33 | MACSX | -1,83 | -1,53 | 0,72 | 0,25 | 10,38 | 50,41 | 3,54 | 46,87 | 11,4 | 5,05 |
| 34 | MCDFX | 1,93 | 7,3 | 0,97 | 0,86 | 14,93 | 42,42 | 3,79 | 38,63 | | |
| 35 | MCHFX | 6,17 | 5,57 | 1,3 | 0,63 | 20,83 | 43,98 | 4,38 | 39,6 | 12,34 | 5,15 |
| 36 | MCSMX | 6,48 | 10,28 | 0,95 | 0,92 | 17,24 | | | | | |
| 37 | MEASX | -0,06 | 2,29 | 0,57 | 0,53 | 10,54 | | | | | |
| 38 | MINDX | -2,62 | 2,77 | 0,78 | 0,52 | 13,82 | 46,05 | 3,39 | 42,66 | | |
| 39 | MJFOX | 5,22 | 5,43 | 0,69 | 0,75 | 12,6 | 46,11 | 2,21 | 43,9 | 10,67 | 2,09 |
| 40 | MAPTX | -0,82 | 2,74 | 0,95 | 0,6 | 13,67 | 47,45 | 3,61 | 43,84 | 11,53 | 5,83 |
| 41 | MALAX | 0,65 | 1,39 | 1,02 | 0,49 | 14,75 | 47,63 | 4,9 | 42,73 | 13,89 | 5,03 |
| 42 | NCEAX | 5,26 | 6,58 | 1,39 | 0,69 | 20,99 | 42,36 | 3,67 | 38,69 | | |
| 43 | OBCHX | 3,26 | 3,75 | 1,04 | 0,52 | 18,59 | 42,53 | 1,85 | 40,68 | | |
| 44 | SGCFX | 0,46 | 0,11 | 1,1 | 0,41 | 15,89 | 48,84 | 3,61 | 45,23 | 13,9 | 6,81 |
| 45 | TRAOX | 0,94 | 5,57 | 0,96 | 0,78 | 14,23 | 48,05 | 3,92 | 44,13 | 11,88 | 1,43 |

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| # | Ticker | Name | Stock Industry/ Fund Category | Region | $ NAV | $mil Fund Size | % Expense Ratio | % 3-months return | % YTD return | % 12-months return |
|---|--------|------|-------------------------------|--------|-------|----------------|-----------------|-------------------|--------------|--------------------|
| 46 | PRJPX | T. Rowe Price Japan | Japan Stock | Asia | 15,71 | 884,7 | 0,97 | 0,9 | 3,97 | 15,66 |
| 47 | PRASX | T. Rowe Price New Asia | Pacific/Asia ex-Japan Stk | Asia | 18,8 | 2.961,88 | 0,93 | -2,94 | -3,89 | 5,62 |
| 48 | TCWAX | Templeton China World A | China Region | Asia | 22,5 | 308,2 | 1,94 | -1,14 | 3,97 | 11,64 |
| 49 | IHSPX | Voya Hang Seng Index Port A | China Region | Asia | 14,43 | 49,5 | 1,02 | -4,7 | -2,74 | 7,26 |
| 50 | IJIAX | Voya Japan TOPIX Index® Port A | Japan Stock | Asia | 11,22 | 259,56 | 0,93 | -2,93 | -1,69 | 8,4 |
| 51 | WAINX | Wasatch Emerging India Investor | India Equity | Asia | 4,48 | 260,67 | 1,73 | 2,28 | 0,22 | 10,08 |
| 52 | EEDFX | AllianzGI Europe Equity Dividend A | Europe Stock | Europe | 16,04 | 7,48 | 1,21 | -1,9 | -0,4 | 3,65 |
| 53 | MDEFX | BlackRock EuroFund Inv A | Europe Stock | Europe | 15,06 | 204,03 | 1,32 | -1,5 | -1,12 | 1,75 |
| 54 | BIAHX | Brown Advisory WMC Strat Eurp Eq Inv | Europe Stock | Europe | 12,66 | 926,15 | 1,24 | 0,32 | -1,78 | 3,79 |
| 55 | CAEAX | Columbia Acorn European A | Europe Stock | Europe | 19,71 | 113,77 | 1,58 | 1,36 | 2,89 | 11,23 |
| 56 | AXEAX | Columbia Contrarian Europe A | Europe Stock | Europe | 7,35 | 392,07 | 1,38 | 0,41 | 0,41 | 5,32 |
| 57 | DURAX | DWS European Equity A | Europe Stock | Europe | 12,39 | 59,77 | 1,48 | 0 | 0 | 5 |
| 58 | FHJUX | Fidelity Advisor® Europe A | Europe Stock | Europe | 42 | 1.129,51 | 1,32 | 1,35 | -0,78 | 6,12 |
| 59 | TEMIX | Franklin Mutual European A | Europe Stock | Europe | 20,92 | 2.331,15 | 1,29 | -0,19 | 2,9 | 4,23 |
| 60 | AEDAX | Invesco European Growth A | Europe Stock | Europe | 39,77 | 1.700,48 | 1,38 | 0 | -3,61 | 4,04 |
| 61 | ESMAX | Invesco European Small Company A | Europe Stock | Europe | 16,15 | 831,74 | 1,4 | -2,24 | -2,59 | 0,56 |
| 62 | IEOAX | Ivy European Opportunities A | Europe Stock | Europe | 33,23 | 221,54 | 1,64 | -0,63 | 1,75 | 7,08 |
| 63 | HFEAX | Janus Henderson European Focus A | Europe Stock | Europe | 33,06 | 1.201,12 | 1,35 | -3,16 | -4,7 | -1,73 |
| 64 | VEUAX | JPMorgan Europe Dynamic A | Europe Stock | Europe | 26,38 | 894,73 | 1,36 | -0,08 | -0,79 | 2,56 |
| 65 | EUGAX | Morgan Stanley European Equity A | Europe Stock | Europe | 19,5 | 116,78 | 1,4 | 5,18 | 3,56 | 8,1 |
| 66 | UEPIX | ProFunds Europe 30 Inv | Europe Stock | Europe | 14,58 | 3,43 | 1,78 | -0,41 | 1,96 | 5,3 |
| 67 | PEUGX | Putnam Europe Equity A | Europe Stock | Europe | 27,61 | 199,14 | 1,29 | 0,91 | 0,62 | 3,33 |
| 68 | EUGIX | Shelton European Growth & Income Direct | Europe Stock | Europe | 9,24 | 9,76 | 1 | -0,97 | -0,99 | 1,86 |
| 69 | PRESX | T. Rowe Price European Stock | Europe Stock | Europe | 20,98 | 1.159,16 | 0,96 | -0,71 | 1,35 | 5,77 |

| # | Ticker | % 2018 Q1 (Jan-Mar) | Alpha 3 year | Beta 3 year | Sharpe Ratio | Std Dev 3 year | Portfolio ESG | Controversy Deduction | Sustainaiblity Score | Carbon Risk | Fuel Involvement |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | PRJPX | 4,57 | 9,9 | 0,64 | 1,33 | 10,25 | 45,52 | 2,17 | 43,35 | 12,5 | 0 |
| 47 | PRASX | 0,97 | 3,4 | 1,01 | 0,64 | 14,51 | 49,69 | 4,45 | 45,24 | 11,42 | 0,63 |
| 48 | TCWAX | 3,65 | 3,05 | 1,13 | 0,6 | 15,9 | 46,99 | 4,06 | 42,93 | 14,46 | 7,04 |
| 49 | IHSPX | 1,48 | 1,04 | 1,14 | 0,47 | 16,15 | 48,9 | 6,26 | 42,64 | 15,53 | 9,36 |
| 50 | IJIAX | 1,35 | 1,81 | 0,76 | 0,58 | 10,78 | 50,35 | 3,23 | 47,12 | 12,48 | 4,38 |
| 51 | WAINX | -4,7 | 9,35 | 0,77 | 0,81 | 17,02 | | | | | |
| 52 | EEDFX | -3,06 | 1,39 | 0,81 | 0,51 | 11,91 | 64,23 | 7,95 | 56,28 | | |
| 53 | MDEFX | -0,26 | -5,06 | 0,92 | 0,02 | 12,3 | 60,75 | 6,08 | 54,67 | 8,44 | 4,82 |
| 54 | BIAHX | -1,24 | 1,76 | 0,87 | 0,57 | 11,97 | 60,04 | 3,59 | 56,45 | 7,1 | 0 |
| 55 | CAEAX | 0,05 | 4,64 | 0,87 | 0,75 | 12,91 | 50,54 | 0,78 | 49,76 | 8,35 | 0 |
| 56 | AXEAX | -0,27 | -2,49 | 0,9 | 0,22 | 12,48 | 60,28 | 5,1 | 55,18 | 7,62 | 1,91 |
| 57 | DURAX | -2,34 | -0,95 | 0,83 | 0,31 | 12,49 | 62,09 | 4,41 | 57,68 | 9,25 | 8,2 |
| 58 | FHJUX | -2,34 | -1,39 | 0,98 | 9,32 | 13,5 | 53,37 | 3,97 | 49,4 | 10,06 | 2,73 |
| 59 | TEMIX | -1,87 | -2,45 | 0,77 | 0,17 | 11,65 | 61,06 | 9,01 | 52,05 | 14,81 | 12,55 |
| 60 | AEDAX | -2,5 | -0,52 | 0,79 | 0,37 | 10,9 | 56,81 | 3,88 | 52,93 | 9,32 | 6,47 |
| 61 | ESMAX | -0,36 | 5,5 | 0,67 | 0,94 | 9,91 | | | | | |
| 62 | IEOAX | 0 | -0,71 | 0,85 | 0,35 | 11,82 | 60,6 | 6,8 | 53,8 | 13,93 | 14,95 |
| 63 | HFEAX | -4,55 | -7,26 | 0,92 | -0,16 | 12,87 | 58,84 | 5,53 | 53,31 | 11,49 | 6,67 |
| 64 | VEUAX | -1,84 | -2,55 | 0,87 | 0,21 | 11,7 | 59,69 | 6,14 | 53,55 | 9,87 | 7,61 |
| 65 | EUGAX | -1,65 | -2,53 | 0,87 | 0,21 | 12,15 | 63,46 | 5,38 | 58,08 | 2,05 | 0 |
| 66 | UEPIX | -0,63 | -0,18 | 0,9 | 0,41 | 12,13 | 62,6 | 8,71 | 53,89 | 13,9 | 22,56 |
| 67 | PEUGX | -1,24 | -3,38 | 0,88 | 0,14 | 12,03 | 59,03 | 5,98 | 53,05 | 11,24 | 7,8 |
| 68 | EUGIX | -3,62 | -2,51 | 0,96 | 0,24 | 12,86 | 66,3 | 9,48 | 56,82 | 8,61 | 11,23 |
| 69 | PRESX | -0,48 | -3,31 | 0,91 | 0,15 | 12,75 | 60,75 | 6,04 | 54,71 | 8,42 | 7,6 |

| # | Ticker | Name | Stock Industry/ Fund Category | Region | $ NAV | $mil Fund Size | % Expense Ratio | % 3-months return | % YTD return | % 12-months return |
|---|--------|------|-------------------------------|--------|-------|----------------|-----------------|-------------------|--------------|---------------------|
| 70 | VEURX | Vanguard European Stock Index Investor | Europe Stock | Europe | 31,16 | 23.044,94 | 0,26 | -0,49 | 0,4 | 5,78 |
| 71 | VGEAX | Virtus Vontobel Greater Eurp Opps A | Europe Stock | Europe | 15,91 | 8,58 | 1,44 | 1,6 | -1,97 | 2,11 |
| 72 | IDJAX | Voya Euro STOXX 50® Index Port A | Europe Stock | Europe | 10,96 | 412,73 | 0,94 | -1,94 | 0,21 | 3,2 |
| 73 | FDSAX | AIG Focused Dividend Strategy A | Large Value | US | 18,24 | 13.520,02 | 1,04 | 5,22 | -1,44 | 9,99 |
| 74 | AMCPX | American Funds AMCAP A | Large Growth | US | 33,86 | 66.496,52 | 0,67 | 5,66 | 10,23 | 20,26 |
| 75 | AMRMX | American Funds American Mutual A | Large Value | US | 42,01 | 51.163,16 | 0,58 | 5,55 | 3,94 | 12,56 |
| 76 | AGTHX | American Funds Growth Fund of Amer A | Large Growth | US | 55,03 | 194.015,64 | 0,64 | 6,36 | 11,08 | 20,71 |
| 77 | AIVSX | American Funds Invmt Co of Amer A | Large Blend | US | 41,49 | 94.476,45 | 0,57 | 5,31 | 4,9 | 14,11 |
| 78 | ANEFX | American Funds New Economy A | Large Growth | US | 48,64 | 21.274,26 | 0,78 | 3,14 | 8,98 | 20,95 |
| 79 | AWSHX | American Funds Washington Mutual A | Large Value | US | 45,89 | 107.303,83 | 0,57 | 5,13 | 4,71 | 14,93 |
| 80 | MDDVX | BlackRock Equity Dividend Inv A | Large Value | US | 23,46 | 21.387,49 | 0,96 | 4,95 | 4,05 | 12,18 |
| 81 | FNIAX | Fidelity Advisor® New Insights A | Large Growth | US | 33,73 | 28.482,18 | 0,93 | 5,87 | 9,87 | 19,79 |
| 82 | FUSEX | Fidelity® 500 Index Investor | Large Blend | US | 98,48 | 152.098,30 | 0,09 | 6,86 | 6,41 | 16,14 |
| 83 | FBGRX | Fidelity® Blue Chip Growth | Large Growth | US | 99,75 | 25.994,72 | 0,7 | 8,73 | 13,66 | 25,21 |
| 84 | FCNTX | Fidelity® Contrafund® | Large Growth | US | 134,63 | 128.961,26 | 0,74 | 7,05 | 11,65 | 22,07 |
| 85 | FSEMX | Fidelity® Extended Market Index Investor | Mid-Cap Blend | US | 66,85 | 22.712,18 | 0,1 | 7,41 | 7,83 | 17,38 |
| 86 | FDGRX | Fidelity® Growth Company | Large Growth | US | 201,7 | 44.863,31 | 0,85 | 7,24 | 12,9 | 24,77 |
| 87 | FLPSX | Fidelity® Low-Priced Stock | Mid-Cap Value | US | 55,65 | 36.281,52 | 0,67 | 1,05 | 2,07 | 18 |
| 88 | FMAGX | Fidelity® Magellan® | Large Growth | US | 108,77 | 17.503,22 | 0,69 | 6,59 | 9,02 | 20,74 |
| 89 | FOCPX | Fidelity® OTC | Large Growth | US | 12,5 | 20.220,75 | 0,81 | 9,51 | 13,79 | 24,34 |
| 90 | FFSMX | Fidelity® Total Market Index F | Large Blend | US | 81,2 | 53.445,40 | 0,02 | 6,97 | 6,71 | 16,44 |
| 91 | FKGRX | Franklin Growth A | Large Growth | US | 102,5 | 15.239,60 | 0,87 | 6,54 | 8,45 | 18,67 |
| 92 | FRDPX | Franklin Rising Dividends A | Large Blend | US | 63,94 | 18.885,44 | 0,91 | 7,32 | 5,09 | 15,91 |
| 93 | HCAIX | Harbor Capital Appreciation Inv | Large Growth | US | 74,97 | 31.464,98 | 1,02 | 6,04 | 11,91 | 23,6 |

| # | Ticker | % 2018 Q1 (Jan-Mar) | Alpha 3 year | Beta 3 year | Sharpe Ratio | Std Dev 3 year | Portfolio ESG | Controversy Deduction | Sustainaiblity Score | Carbon Risk | Fuel Involvement |
|---|--------|---------------------|--------------|-------------|--------------|----------------|---------------|-----------------------|----------------------|-------------|------------------|
| 70 | VEURX | -1,3 | -0,89 | 0,96 | 0,37 | 12,46 | 61,05 | 6,89 | 54,16 | 10,7 | 10,16 |
| 71 | VGEAX | -3,94 | -0,6 | 0,75 | 0,34 | 11,01 | 58,63 | 5,73 | 52,9 | 3,47 | 0 |
| 72 | IDJAX | -1,05 | -2,51 | 1,1 | 0,26 | 15,03 | 65,39 | 8,18 | 57,21 | 10,36 | 10,51 |
| 73 | FDSAX | -5,58 | -1,51 | 0,9 | 0,81 | 11,08 | 57,1 | 7,66 | 49,44 | 9,95 | 11,55 |
| 74 | AMCPX | 3,3 | 0,04 | 0,95 | 1,08 | 10,28 | 50,15 | 6,09 | 44,06 | 9,95 | 7,7 |
| 75 | AMRMX | -2,15 | -0,24 | 0,86 | 1,07 | 9,13 | 55,95 | 8,5 | 47,45 | 12,14 | 15,5 |
| 76 | AGTHX | 2,95 | 1,43 | 1,02 | 1,18 | 11,24 | 51,03 | 7,18 | 43,85 | 8,92 | 8,47 |
| 77 | AIVSX | -1,3 | -0,69 | 0,97 | 1,03 | 10,26 | 54,97 | 8,98 | 45,99 | 10,42 | 12,16 |
| 78 | ANEFX | 5,29 | -0,58 | 1,03 | 0,93 | 12,27 | 49,13 | 5,83 | 43,3 | 7,38 | 1,71 |
| 79 | AWSHX | -1,39 | 0,44 | 0,94 | 1,15 | 9,81 | 55,78 | 8,89 | 46,89 | 11,13 | 13,01 |
| 80 | MDDVX | -2,69 | -0,28 | 0,95 | 1,03 | 10,45 | 57,24 | 8,96 | 48,28 | 12,46 | 15,79 |
| 81 | FNIAX | 2,25 | 0,7 | 0,97 | 1,12 | 10,71 | 51,03 | 6,94 | 44,09 | 9,91 | 6,7 |
| 82 | FUSEX | -0,78 | -0,09 | 1 | 1,12 | 10,27 | 54,17 | 8,22 | 45,95 | 9,9 | 9,71 |
| 83 | FBGRX | 3,02 | 1,72 | 1,06 | 1,1 | 12,7 | 51,59 | 7,83 | 43,76 | 6,21 | 2,66 |
| 84 | FCNTX | 3,06 | 2,07 | 0,97 | 1,19 | 11,14 | 52,42 | 8,15 | 44,27 | 7,33 | 2,2 |
| 85 | FSEMX | 0,15 | -1,58 | 1,03 | 0,85 | 12,25 | 42,67 | 1,65 | 41,02 | | |
| 86 | FDGRX | 5,23 | 1,91 | 1,22 | 1,14 | 14,02 | 51,22 | 6,5 | 44,72 | 5,46 | 1,39 |
| 87 | FLPSX | -1,06 | 0,57 | 0,77 | 0,98 | 9,6 | 49,76 | 4,21 | 45,55 | | |
| 88 | FMAGX | 1,08 | -1,14 | 1,09 | 1 | 11,53 | 52,96 | 7,81 | 45,15 | 10,13 | 6,94 |
| 89 | FOCPX | 3,03 | 2,7 | 1,25 | 1,11 | 15,43 | 51 | 7,37 | 43,63 | 5,15 | 1,5 |
| 90 | FFSMX | -0,6 | -0,35 | 1,01 | 1,09 | 10,4 | 52,14 | 7,05 | 45,09 | 10,34 | 8,64 |
| 91 | FKGRX | 1,88 | 0,84 | 0,96 | 1,17 | 10,21 | 52,21 | 6,42 | 45,79 | 9,3 | 3,78 |
| 92 | FRDPX | -2,63 | -0,15 | 0,95 | 1,07 | 10,2 | 55,12 | 6,48 | 48,64 | 12,97 | 6,52 |
| 93 | HCAIX | 4,24 | -0,01 | 1,12 | 0,97 | 13,42 | 53,05 | 8,03 | 45,02 | 5,08 | 1,22 |

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| # | Ticker | Name | Stock Industry/ Fund Category | Region | $ NAV | $mil Fund Size | % Expense Ratio | % 3-months return | % YTD return | % 12- months return |
|---|---|---|---|---|---|---|---|---|---|---|
| 94 | ACSTX | Invesco Comstock A | Large Value | US | 27,8 | 12.997,23 | 0,81 | 4,56 | 4,15 | 16,44 |
| 95 | LCEAX | Invesco Diversified Dividend A | Large Value | US | 20,35 | 22.173,82 | 0,8 | 3,7 | 0,93 | 4,69 |
| 96 | BSPAX | iShares S&P 500 Index Investor A | Large Blend | US | 335,33 | 15.706,68 | 0,36 | 6,77 | 6,25 | 15,84 |
| 97 | JDMAX | Janus Henderson Enterprise A | Mid-Cap Growth | US | 127,04 | 17.920,46 | 1,13 | 7,78 | 10,39 | 21,05 |
| 98 | JRAAX | Janus Henderson Research A | Large Growth | US | 50,31 | 13.722,54 | 0,92 | 8,38 | 9,11 | 18,26 |
| 99 | JVLAX | JHancock Disciplined Value A | Large Value | US | 23,03 | 15.853,84 | 1,05 | 3,51 | 2,22 | 12,74 |
| 100 | JVMAX | JHancock Disciplined Value Mid Cap A | Mid-Cap Blend | US | 22,88 | 14.979,66 | 1,1 | 2,6 | 1,92 | 9,32 |
| 101 | OIEIX | JPMorgan Equity Income A | Large Value | US | 17,58 | 18.099,17 | 1,04 | 5,99 | 3,42 | 13,98 |
| 102 | OLGAX | JPMorgan Large Cap Growth A | Large Growth | US | 42,94 | 14.487,57 | 1,05 | 7,46 | 14,17 | 26,39 |
| 103 | JAMCX | JPMorgan Mid Cap Value A | Mid-Cap Blend | US | 40,31 | 18.592,30 | 1,23 | 4,03 | 2,28 | 7,23 |
| 104 | JUEAX | JPMorgan US Equity A | Large Blend | US | 17,2 | 15.561,14 | 0,94 | 7,07 | 6,19 | 15,73 |
| 105 | MFEGX | MFS® Growth A | Large Growth | US | 102,19 | 19.159,09 | 0,93 | 7,76 | 13,97 | 23,39 |
| 106 | MEIAX | MFS® Value A | Large Value | US | 40,69 | 48.590,71 | 0,84 | 5,27 | 1,11 | 8,38 |
| 107 | OAKMX | Oakmark Investor | Large Blend | US | 87,67 | 21.092,64 | 0,86 | 4,89 | 3,96 | 13,48 |
| 108 | PRBLX | Parnassus Core Equity Investor | Large Blend | US | 45,61 | 16.200,70 | 0,87 | 6,71 | 7,5 | 15,57 |
| 109 | POGRX | PRIMECAP Odyssey Growth | Large Growth | US | 41,36 | 13.545,96 | 0,66 | 6,32 | 11,03 | 27,56 |
| 110 | PEMGX | Principal MidCap A | Mid-Cap Growth | US | 28,23 | 16.164,37 | 1 | 7,34 | 5,61 | 13,73 |
| 111 | SWPPX | Schwab® S&P 500 Index | Large Blend | US | 43,84 | 33.947,96 | 0,05 | 6,85 | 6,43 | 16,19 |
| 112 | TRBCX | T. Rowe Price Blue Chip Growth | Large Growth | US | 109,92 | 55.509,07 | 0,7 | 6,11 | 14,13 | 24,98 |
| 113 | PRFDX | T. Rowe Price Equity Income | Large Value | US | 34,04 | 21.805,79 | 0,65 | 4,64 | 3,08 | 11,51 |
| 114 | PRGFX | T. Rowe Price Growth Stock | Large Growth | US | 69,97 | 54.681,41 | 0,67 | 6,21 | 11,68 | 20,73 |
| 115 | PRNHX | T. Rowe Price New Horizons | Small Growth | US | 61,3 | 25.164,44 | 0,78 | 10,45 | 16,61 | 27,71 |
| 116 | TRVLX | T. Rowe Price Value | Large Value | US | 37,57 | 25.636,56 | 0,8 | 2,85 | 0,67 | 8,63 |
| 117 | VFINX | Vanguard 500 Index Investor | Large Blend | US | 260,3 | 417.743,09 | 0,14 | 6,84 | 6,38 | 16,09 |

| # | Ticker | % 2018 Q1 (Jan-Mar) | Alpha 3 year | Beta 3 year | Sharpe Ratio | Std Dev 3 year | Portfolio ESG | Controversy Deduction | Sustainaiblity Score | Carbon Risk | Fuel Involvement |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 94 | ACSTX | -2,52 | -3,43 | 1,16 | 0,75 | 13,23 | 56,19 | 9,21 | 46,98 | 15,48 | 16,08 |
| 95 | LCEAX | -3,71 | -1,56 | 0,64 | 0,77 | 7,51 | 54,88 | 6,76 | 48,12 | 13,84 | 20,94 |
| 96 | BSPAX | -0,83 | -0,37 | 1 | 1,09 | 10,27 | 54,16 | 8,22 | 45,94 | 9,9 | 9,63 |
| 97 | JDMAX | 4,84 | 2,96 | 0,9 | 1,28 | 10,48 | 46,91 | 1,33 | 45,58 | 6,52 | 0 |
| 98 | JRAAX | 1,3 | -1,51 | 1,01 | 0,92 | 11,06 | 52,1 | 6,51 | 45,59 | 6,18 | 2,12 |
| 99 | JVLAX | -1,86 | -3,53 | 1,05 | 0,74 | 11,63 | 54,83 | 8,44 | 46,39 | 12,68 | 10,52 |
| 100 | JVMAX | -0,45 | -2,57 | 1,01 | 0,79 | 11,55 | 48,09 | 3,41 | 44,68 | 15,81 | 15,62 |
| 101 | OIEIX | -2,25 | -0,78 | 0,91 | 1 | 9,8 | 54,96 | 7,01 | 47,95 | 13,54 | 15,1 |
| 102 | OLGAX | 5,11 | 0,93 | 1,07 | 1,02 | 13,11 | 51,48 | 7,15 | 44,33 | 5,81 | 1,66 |
| 103 | JAMCX | -1,85 | -2,79 | 0,86 | 0,73 | 9,72 | 48,54 | 3,19 | 45,35 | 15,02 | 15,81 |
| 104 | JUEAX | -1,13 | -1,88 | 1,08 | 0,94 | 11,27 | 54,37 | 7,83 | 46,54 | 11,09 | 11,16 |
| 105 | MFEGX | 5,13 | 2,4 | 0,96 | 1,2 | 11,24 | 52,75 | 6,83 | 45,92 | 4,75 | 0,6 |
| 106 | MEIAX | -3,06 | -2,8 | 0,98 | 0,81 | 10,56 | 55,61 | 8,19 | 47,42 | 10,13 | 8,31 |
| 107 | OAKMX | -0,88 | -1,35 | 1,13 | 0,95 | 12,33 | 55,32 | 8,29 | 47,03 | 10,11 | 4,76 |
| 108 | PRBLX | -0,26 | 0,15 | 0,84 | 1,08 | 9,12 | 54,79 | 6,93 | 47,86 | 7,7 | 5,11 |
| 109 | POGRX | 8,05 | 2,13 | 1,16 | 1,1 | 14,15 | 51,94 | 4,74 | 47,2 | 7,01 | 1,18 |
| 110 | PEMGX | -0,64 | -1,23 | 1 | 0,93 | 11,11 | 45,8 | 2,67 | 43,13 | 10,03 | 2 |
| 111 | SWPPX | -0,78 | -0,04 | 1 | 1,12 | 10,24 | 54,15 | 8,22 | 45,93 | 9,9 | 9,64 |
| 112 | TRBCX | 5,7 | 2,04 | 1,13 | 1,14 | 13,2 | 50,83 | 7,93 | 42,9 | 5,38 | 0,81 |
| 113 | PRFDX | -2,25 | -1,6 | 1,01 | 0,92 | 10,98 | 54,08 | 8,56 | 45,52 | 14,36 | 17,39 |
| 114 | PRGFX | 3,83 | 1 | 1,07 | 1,06 | 12,67 | 50,86 | 8,15 | 42,71 | 6,23 | 0,97 |
| 115 | PRNHX | 6,24 | 3,35 | 1,02 | 1,22 | 12,37 | 42,89 | 1,12 | 41,77 | | |
| 116 | TRVLX | -2,12 | -3,29 | 0,99 | 0,78 | 10,45 | 52,36 | 7,96 | 44,4 | 12,93 | 17,06 |
| 117 | VFINX | -0,79 | -0,14 | 1 | 1,12 | 10,26 | 54,16 | 8,22 | 45,94 | 9,9 | 9,73 |

| # | Ticker | Name | Stock Industry/ Fund Category | Region | $ NAV | $mil Fund Size | % Expense Ratio | % 3-months return | % YTD return | % 12-months return |
|---|--------|------|------------------------------|--------|-------|----------------|-----------------|-------------------|--------------|---------------------|
| 118 | VDAIX | Vanguard Dividend Appreciation Index Inv | Large Blend | US | 42,56 | 34.571,65 | 0,15 | 6,84 | 5,33 | 16,11 |
| 119 | VDIGX | Vanguard Dividend Growth Inv | Large Blend | US | 27,65 | 32.465,25 | 0,26 | 5,87 | 6,12 | 13,71 |
| 120 | VEIPX | Vanguard Equity-Income Inv | Large Value | US | 37,9 | 31.459,81 | 0,26 | 5,82 | 3,12 | 12,8 |
| 121 | VEXPX | Vanguard Explorer Inv | Small Growth | US | 108,26 | 15.075,74 | 0,43 | 9,11 | 13,95 | 24,84 |
| 122 | VEXMX | Vanguard Extended Market Index Investor | Mid-Cap Blend | US | 90,92 | 66.807,65 | 0,21 | 7,42 | 7,8 | 17,24 |
| 123 | VIGRX | Vanguard Growth Index Investor | Large Growth | US | 79,05 | 80.602,95 | 0,17 | 8,21 | 9,75 | 19,16 |
| 124 | VHDYX | Vanguard High Dividend Yield Index Inv | Large Value | US | 34,25 | 28.698,75 | 0,15 | 5,48 | 2,56 | 12,14 |
| 125 | VLACX | Vanguard Large Cap Index Investor | Large Blend | US | 52,22 | 20.093,86 | 0,17 | 6,78 | 6,39 | 16,11 |
| 126 | VIMSX | Vanguard Mid Cap Index Investor | Mid-Cap Blend | US | 44,13 | 97.856,81 | 0,17 | 5,33 | 5,14 | 12,89 |
| 127 | VMRGX | Vanguard Morgan™ Growth Inv | Large Growth | US | 32,47 | 15.149,09 | 0,38 | 7,16 | 10,97 | 21,09 |
| 128 | VISGX | Vanguard Small Cap Growth Index Inv | Small Growth | US | 49,93 | 23.513,44 | 0,19 | 8,12 | 10,6 | 20,94 |
| 129 | NAESX | Vanguard Small Cap Index Inv | Small Blend | US | 75,95 | 90.743,06 | 0,17 | 7,76 | 7,85 | 17,19 |
| 130 | VISVX | Vanguard Small Cap Value Index Inv | Small Value | US | 33,36 | 30.885,99 | 0,19 | 7,49 | 5,62 | 14,15 |
| 131 | VTSMX | Vanguard Total Stock Mkt Idx Inv | Large Blend | US | 70,6 | 701.184,13 | 0,14 | 6,94 | 6,67 | 16,36 |
| 132 | VIVAX | Vanguard Value Index Inv | Large Value | US | 42,39 | 67.248,79 | 0,17 | 5,5 | 3,48 | 13,47 |
| 133 | VWNDX | Vanguard Windsor™ Inv | Large Value | US | 23,94 | 19.619,47 | 0,31 | 3,11 | 3,02 | 10,87 |

| # | Ticker | % 2018 Q1 (Jan-Mar) | Alpha 3 year | Beta 3 year | Sharpe Ratio | Std Dev 3 year | Portfolio ESG | Controversy Deduction | Sustainaiblity Score | Carbon Risk | Fuel Involvement |
|-----|--------|------|------|------|------|-------|-------|------|-------|-------|-------|
| 118 | VDAIX | -0,48 | 1,24 | 0,85 | 1,2 | 9,25 | 54,2 | 7,16 | 47,04 | 10,78 | 3,36 |
| 119 | VDIGX | -1,06 | 0,01 | 0,85 | 1,07 | 9,24 | 54,78 | 7,62 | 47,16 | 9,24 | 6,96 |
| 120 | VEIPX | -2,56 | 0,56 | 0,89 | 1,15 | 9,44 | 55,66 | 9,05 | 46,61 | 12,46 | 17,3 |
| 121 | VEXPX | 4,14 | -0,34 | 1,05 | 0,93 | 12,76 | 42,44 | 1,2 | 41,24 | | |
| 122 | VEXMX | 0,12 | -1,68 | 1,04 | 0,84 | 12,28 | 42,76 | 1,65 | 41,11 | | |
| 123 | VIGRX | 1,14 | -0,2 | 1,06 | 1,06 | 11,37 | 52,15 | 7,18 | 44,97 | 6,73 | 3,69 |
| 124 | VHDYX | -2,86 | 0,38 | 0,89 | 1,12 | 9,58 | 54,51 | 8,62 | 45,89 | 12,68 | 16,7 |
| 125 | VLACX | -0,71 | -0,34 | 1 | 1,1 | 10,3 | 53,81 | 8,01 | 45,8 | 9,96 | 9,47 |
| 126 | VIMSX | -0,01 | -2,31 | 0,97 | 0,84 | 10,56 | 47,87 | 2,97 | 44,9 | 12,44 | 10,32 |
| 127 | VMRGX | 3,11 | 0,37 | 1,04 | 1,09 | 11,4 | 52,24 | 6,42 | 45,82 | 6,18 | 2,44 |
| 128 | VISGX | 2,06 | -1,87 | 1,04 | 0,81 | 12,54 | 41,61 | 0,97 | 40,64 | | |
| 129 | NAESX | -0,24 | -1,25 | 1,02 | 0,86 | 12,24 | 42,28 | 1,48 | 40,8 | | |
| 130 | VISVX | -2,1 | -0,67 | 1 | 0,87 | 12,48 | 42,84 | 1,9 | 40,94 | | |
| 131 | VTSMX | -0,63 | -0,44 | 1,01 | 1,08 | 10,38 | 52,11 | 7,04 | 45,07 | 10,37 | 8,64 |
| 132 | VIVAX | -2,35 | -0,38 | 0,96 | 1,04 | 10,24 | 55,34 | 8,78 | 46,56 | 12,8 | 14,57 |
| 133 | VWNDX | -0,51 | -3,87 | 1,08 | 0,72 | 11,93 | 51,53 | 6,43 | 45,1 | 14,07 | 12,04 |

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