

European Master in Law and Economics

Empirical Application of the Paris Agreement Capital Transition Assessment Theory: a Bottom Up Approach and Experiment.

by

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Abstract

The aim of this paper is twofold: calculate the level of sustainability of an investment fund and explore how different subjects perceive such sustainable funds. To achieve the former, I make use of the Paris Agreement Capital transition Assessment (PACTA) to determine how aligned certain sustainable investment funds are with the warming goals set out in the Paris Agreement. Of the three funds analysed, none is perfectly aligned with the two-degree warming scenario. These results could be biased or incomplete as the calculation method suffered from a lack of data. Next, a random control trial concluded that subjects who were shown a paragraph from the Paris Agreement perceived sustainable investment funds 6.8 % less green compared to subjects in the control group. This finding is significant and robust. It is of high relevance to the newly adopted European Sustainable Finance Disclosure and a normative regulatory design is brought forward. The transmission channels that lead subjects to perceive funds as less green remain unclear and therefore are paths of future research.

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Author declaration

I, Andreas Karel Frederique Heirbrant, hereby declare that the thesis is entirely the result of my own work, is not used as part of any other examination and has not yet been published.

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1. Introduction

Green investing has become much more common place in the last decades. The European investment bank transformed itself into the climate bank, pledging to invest a trillion euros in green projects [Bertrand, 2020]. While it historically holds that most green investments have been of public nature there is an emergence of private and retail investors looking for green shares and funds [Evraud et al., 2011]. Given that investment funds are complex financial instruments (making use of derivatives) it is not straight forward to determine their collective financed emissions. Moreover, there lies a problem of information asymmetry between the retail investor and the fund managers. The aim of this paper is twofold, first to determine the actual "greenness" of different investment portfolios and secondly to examine how subjects perceive the sustainability aspects of these funds. To attain the former I will discuss the Paris Agreement Capital Transition Assessment (PACTA) tool, a prominent tool to evaluate the "greenness" of an investment portfolio and its alignment with the Paris Agreement. The ambition of this paper is not to give an exhaustive overview of green investment neither is it to school the reader on the full application of the PACTA tool. It provides a first insight into the PACTA methodology and explores how the stated greenness of multiple funds correlate to the one calculated by the PACTA tool. Following, a random control trial experiment is conducted to investigate the characteristics of the perceived greenness when subjects are either treated with an extract from the Paris Agreement or from a report by the Two Degree Initiatives, the authors of the PACTA tool. The core research question posed is: "does environmental information disclosure make subjects more critical of advertised green financial products". The results are clear. Subjects treated with information from the Paris Agreement rate green funds 6.8 % lower on sustainability than subjects who did not receive information treatment, in other words, they perceive sustainable funds as less sustainable. This finding is robust for the inclusion of controls and another specification. Chapter 2 lays out the definition of green investment and discusses some stylized facts and developments. Chapter 3 goes further and investigates the emergence of retail investment in green investment and introduces the concept of green washing. Chapter 4 provides an overview of the Paris Agreement Capital Transition Assessment, its founding organization two degree initiative and earlier findings by the think tank. In chapter 5 multiple green funds are analysed and a short overview of the results and pitfalls is provided. The main pitfall is the lack of standardized data which makes attaining a full picture somewhat tedious. Chapter 6 then uses these same funds in a random control trial where we test the hypothesis that more informed subjects are more environmentally aware. Chapter 7 explores some of the descriptive statistics of the surveyed data, the results and limitations of this experiment are also discussed. The last chapter, chapter 8, provides the reader with an overview of financial regulations in place in the UK, EU and The United States of America. Following, some of the most ambitious and innovative sustainable financial regulation is discussed, most notably the French Article 173 of its energy transition law and the European sustainable finance disclosure regulation. The chapter concludes with normative regulations aspects based on the findings of the random control trial. Finally, Chapter 9 concludes this paper.

2. Developments of green investing

This chapter will briefly touch upon the most recent developments of green investing and lay out some stylized facts. Green investing can be regarded as a subclass of socially responsible investments (SRI). SRI adds ethical and social concerns to the conventional concerns of investment practices such as risk and return on capital [Sparkes, 2008]. This school of thought (i.e SRI), in some form, goes at least a century back. It was only in the 1990s that environmentally conscious investments started to gain ground [Richardson, 2008]. The chapter concludes with a short overview of the emission targets set by different governments.

2.1 Definition of green investment

There is no single definition of green investment, every definition makes some kind of value judgement about the "greenness" and/or "investing" aspect. One intuitive example is the construction of a nuclear power plant. Some might not classify this as a green investment given nuclear power plants produce radioactive waste and therefore cannot possibly be considered green. On the other hand, nuclear power plants produce little to no carbon dioxide emissions; based on this definition it could be classified as green. One more example is that of hydrogen driven vehicles, hydrogen in and of itself does not emit carbon dioxide emissions, however, the production process of hydrogen does. The paper by Inderst provides an excellent overview of the different definitions used in the literature [Inderst *et al.*, 2012]. I define green investment as "the investment necessary to reduce greenhouse gas and air pollutant emissions, without significantly reducing the production and consumption of non-energy goods" and by doing so follow [Eyraud *et al.*, 2011].

2.2 Stylized facts

According to the latest report by Bloomberg New Energy [Ajadi *et al.*, 2020] the rise in public investment in green energy has somewhat stagnated after a surge in the 2010s. The stagnation in the year 2020 is most likely induced by the COVID-19 pandemic as it made deal-making more cumbersome. Despite the COVID situation, a trend can still be detected. The total investment in 2019, amounting to 282.2 billion dollars, was only 1 per cent up from 2018. Figure 2.1 illustrates these developments. Crucial here to note is that the cost per megawatt has sharply decreased both for wind and solar power. The stagnating monetary values in investment over the last few years do not necessarily imply a plateau for energy generated by renewable energy sources as a record number of green gigawatts have been produced. This latest report goes on to conclude that we are at a tipping point in our efforts to de-carbonize our energy supply.

The spatial distribution of these green energy investments varies significantly. Figure 2.2 shows the disparity between developed countries¹, emerging economies and India and China. Despite the observed decline in growth for India and China, of whom the latter has been the front runner in green investment (excluding hydro-power) since overtaking the U.S in 2012, China remains the dominant power when it comes to green investment. The more recent sluggish trend in Chinese green energy investment is due to its phasing out of (mostly solar) subsidies.

When considering the sector dimension of the green investments it becomes apparent that wind and solar dominate the other sectors, with marine and tidal waves energy generation being almost obsolete. The further rise in wind energy can be attributed to the development of wind farms of the coast of mainland China and Europe. The small shrinkage in solar energy is mainly caused by the diminishing cost per megawatt produced per photovoltaics, in economic terms, an efficiency increase. Biomass makes up a solid and stable part of the renewable energy sectors. Figure 2.3 illustrates this division by sector.

¹All OECD countries excluding Chile, Mexico and Turkey.



Figure 2.1: Global renewable energy investment capacity investment, 2004 to 2019, in billion dollar [Ajadi *et al.*, 2020]

Figure 2.2: Spatial distribution of green energy investment [Ajadi et al., 2020]



Figure 2.3: Division by sector [Ajadi *et al.*, 2020]



From these descriptive findings it is clear that investing in green energy has a prominent and growing role in the liability side of (central) banks balance sheets. It would nevertheless be too narrow of a perspective to only consider this strict type of green investing. Investing in green energy supply can be classified quite unambiguously² as green investing. A less conservative

²Expect for investment in nuclear energy perhaps.

perspective towards green investing does allow for the inclusion of investment in environmentally aware firms that are active outside the energy sector. One approximation of that environmental awareness of private companies is membership to the RE100 group. A global initiative bringing together the world's most influential businesses driving the transition to 100 per cent renewable electricity [Graichen *et al.*, 2016]. Some notable members are Apple, Facebook and Microsoft. I am aware of the shortcomings of this approximation to actual environmental commitment. Nevertheless, the uptake of the RE100 initiative has sharply risen and has now over 300 corporate members. One important caveat that I would like to flag is that the manufacturing sector is not participating in this initiative neither are small-medium enterprises (SMEs). This is not to say that there haven't been substantial efforts and progress in these sections of the supply chain governance. It already becomes apparent that there is a dichotomy between investment in green energy production and more conventional investment in a member of the RE100 group. The following chapters will explore this phenomenon further, more specifically Chapter 8 where we take a look at regulation that eases the classification effort and transparency of sustainable investing policies.

2.3 Governments 2030 targets

Environmental and emission reduction targets are numerous, almost all significant private and public players have made some pledge to reduce their impact on the environment. The most prominent of these agreements is the Paris Agreement. This section, however, will only focus on the targets that have been written into policy by governments around the world. One recent and heavyweight example of such a pledge is the European green deal, consisting of a set of new directives and amending old ones. Bloomberg NEF calculated that an additional 721 gigawatts of wind, solar, biomass and waste-to-energy, geothermal and marine power plants would need to be built over the coming decade to meet those targets [Ajadi et al., 2020]. The actual investment needed to achieve this goal is estimated to be between 900 billion dollars and 1.1 trillion dollars. The actual number depends on the mix of renewable energy used and the rate of innovation in the renewable energy sector. One thing worth noting is that these written-into-law pledges fall short of the goals set out in the Paris Agreement. This 1 trillion (give or take) dollars investment in renewable energy would not suffice to limit the global warming to two degrees. To achieve the 2 degree Celsius goal, an additional 2,836 gigawatts would be required, costing an estimated 3.1 trillion dollars over the coming decade. From this numerical example it becomes clear that the policy defined targets are not aligned with the Paris Agreement. Chapter 5 lays out the Paris Agreements Capital Transmission tool, a tool aimed to verify just that.

3. Emergence of retail investing and green funds

After determining what a retail investor encompasses this chapter focus on the development of green consumerism. A brief, non-exhaustive overview of the literature on green consumerism is given in the second section. The last section deals with the emergence of sustainable investing market towards retail investors.

3.1 Retail investors

A retail investor is an umbrella term and differs from institutional investors in the sense that they are individuals who purchase securities for their personal accounts on a non-professional basis. Traditionally they tend to have less influence given their small purchasing power, although this is changing [Clayton, 2018]. Retail investors are more numerous and the market is better developed in the United States compared to Europe and frankly the rest of the world. Even within Europe there are large differences in the shareholder structure [Wins & Zwergel, 2016]. It is outside the scope of this paper to extensively describe the developments of retail investors. The main takeaway is that investments have become more accessible, even for middle-income individuals [Konana & Balasubramanian, 2005]. With rapid technological innovation and the emergence of broker applications, there are fewer barriers and more product choices.

3.2 Environmentally aware consumers

Green behaviour can be defined as behaviour that minimises harm to the environment as much as possible, or even benefits it [Steg & Vlek, 2009]. It is clear that this definition leaves many transmission channels for green behaviour to have an impact on the environment. The one I will focus on in this paragraph is green purchase behaviour or also known as green consumerism. Green purchase behaviour is buying environmentally friendly products which are usually recycled and bring benefits to the environment [Mostafa, 2007]. Efforts to identify green consumerism can be traced back as far as the early 1970s [Anderson & Cunningham, 1972]. Green purchase behaviour has known a sharp rise from the fringe to mainstream popularity, albeit mostly in developed countries. There is little evidence for an overall increase of green consumerism in the global market as developing countries are in a catch-up phase [Joshi & Rahman, 2015]. Green purchasing behaviour can be regarded as the demand side of the market, environmentally aware consumers demanding more sustainable products. Firms react to this trend by making their supply chain more green can be seen as the supply side of the equilibrium. Moreover, firms themselves can set sustainability goals even in the absence of changing demand [Hamner, 2006]. It becomes clear that it is extremely hard to distinguish the genuine efforts of firms to go green regardless of the demand structure from the superficial marketing perspective. The latter is known as "green-washing", misleading consumers about their environmental performance or the environmental benefits of a product or service. A rising incidence of green-washing can have profound negative effects on consumer confidence in green products[Delmas & Burbano, 2011].

3.3 Green funds

The reasoning set out in the previous paragraph can be extended to include green investing. In that regard, green investing can be seen as a subclass of green consumption behaviour. While this is common practice there are some issues with this classification as also mentioned by different scholars [Getzner & Grabner-Kräuter, 2004]. I will briefly mention them. The investment decisions individuals or households make take place in a private sphere. This contrasts with the consumption choices a household takes. Think of the fair-trade coffee that sits on the

kitchen counter compared to the private equity fund one can invest in. The general point is that behaviour might be a biased proxy for attitude, as behaviour can be heavily influenced by social norms [Lampe & Gazda, 1995]. One might even argue that a green investment is an ethical investment which is significantly different from an economical investment. Recognizing this distension pushes the boundaries of neoclassical economic theory. Some scholars introduce the concept of warm glow in order to try to reconcile classical economic theory and this seemingly not value-maximizing behaviour [Andreoni, 1990]. Be that as it may, I will continue with the first classification as it is of high practical relevance and different authors have found statistically robust relations between green consumerism and green investment behaviour [Getzner & Grabner-Kräuter, 2004]. In this light, banks offering green funds are no different from firms offering greener products. The same crucial question arises again, how green are the funds they are offering, or does green washing play a role? Chapter 5 will try to address this exact question. For now we consider some of the characteristics of green funds.

3.3.1 Characteristics of green funds

An investment fund is a vehicle to investing by which capital is pooled from different investors and invested over a multitude of different assets [Morley, 2013]. In oversimplified terms, it is a basket consisting of different shares that one can buy into. Originally, green funds would rely on negative screening, not including the worst polluters in the fund. More recently it has shifted towards positive screening, searching and including ambitious green firms in the fund. The vast majority of research concerning green mutual funds deals with the question of whether green funds perform as well as conventional funds. Formulated in economic terms: whether investors pay a premium for green funds. Some scholars find that this premium does exist and that it exhibits itself as a lower return or higher volatility [Reboredo et al., 2017], while others find no evidence of such premium or at least nuance previous findings [Climent & Soriano, 2011]. The second largest distinguishable part of the literature deals with the determinants of green funds. What are the drivers behind green investment? Education, income level, environmental awareness and expected profit seem to be the main determinants of private green investing [Getzner & Grabner-Kräuter, 2004]. Some scholars find that these determinants are somewhat correlated with the determinants of green purchase behaviour. On a macro-economic level, green investing is driven by economic growth, a sound financial system that is conducive to low interest rates and high fuel prices [Eyraud et al., 2013]. One key question that remains unanswered in the literature is how "green" different sustainable funds are. This paper aims to fill that gap in the literature by providing a first insight into such a comparative study. Most investment banks nowadays offer at least one fund that they claim is sustainable. The term sustainability is very broad and could encompass both a fund holding solely renewable energy projects and a fund holding "environmentally aware companies". It becomes illustrative that the latter can be regarded less green. The Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) has set out standardized rules to communicate the investment policy of a fund. This is done via the Key Investor Information Disclosure (KIID), an example of such disclosure can be found in Appendix A.4, chapter 8 elaborates further on this legislation. The following chapter explores the Paris Agreement Capital Transmission tool which allows us to compare different investment portfolios and their alignment to the Paris agreement.

4. Paris Agreement and the alignment of green funds

The first part of this chapter will shed light on the basic principles of the Paris Agreement. As such, I will discuss the legal nature of this agreement given it is classified as soft law, the theoretical foundations of linking green funds to their emissions and eventually their collective emissions. It is by no means my ambition to school the reader on the technical or legal details of the Paris Agreement, this chapter can be regarded as a first intuitive encounter with the legal framework and calculation methods of the PACTA.

4.1 Paris Agreement

The Paris Agreement is an agreement within the framework of the United Nations Framework Convention on Climate Change. It was drafted by more than 196 parties on the 15th of December in Le Bourget, a municipality close to Paris 1 . The overwhelming majority of the countries came together and established a common ambition to limit global warming. More specifically, according to article 2 (a), "Holding the increase in the global average temperature to well below $2^{\circ}C$ above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above preindustrial levels, recognizing that this would significantly reduce the risks and impacts of climate change" [par, n.d.]. This 1.5 degree Celsius threshold is defined by the IPCC [P.R. Shukla, 2019]. Letting global warming rise beyond this point will most certainly permanently and irreversibly damage our ecosystems. The other articles of the agreement elaborate more on the equity aspects and recognising, affirming and acknowledging the presence of climate change and the eminent danger that it poses to the core of our being. One specific article that is of great relevance to my work is Article 2 (c): "Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. ". This article defines a duty to manage capital in such a way that it is aligned with the 1.5 degree warming goal. It is not so obvious as to how this should be attained or assessed.

4.2 Soft law aspect to the agreement

The web page of the Paris Agreement clearly states: "it is a legally binding agreement". There is however a consensus among legal scholars that this agreement can be regarded as soft law [Lawrence & Wong, 2017]. What exactly is meant by soft or hard law is not that clear, there is an ongoing legal debate concerning this topic. Some scholars argue that the spectrum does not range from softest to hardest but that it is multidimensional²[Abbott & Snidal, 2000]. I will not provide an exhaustive synthesis of the debate surrounding soft law, only touch upon a few key points. First off, reputational loss plays a significant role in the implicit enforcement of the Paris Agreement. This effect is amplified by a biennial reporting system as set out in article 13.4 of the agreement, as an international expert review can announce which countries fall short of the goals set out. Secondly, the Paris Agreement can nudge national parliaments into ratifying ambitious climate legislation. Lastly, it is important to note that climate change, in essence, is a common good problem, in this light it can be understood that the Paris Agreement is a signal of reciprocal cooperation. Hence, when the United States pulled out of the Paris Agreement under the Trump administration, other nations were very quick to restate their devotion to the agreement in fear that the cooperation would unravel through backwards iteration, something we typically see in public good games [Fellner & Lünser, 2014].

¹after all, Le Bourget agreement would not have sounded that prestigious.

²Abbot Sindal argue that obligation, precision, delegation are the three dimensions of international treaties.

4.3 2DII and the Paris Agreement Capital Transmission Assessment

4.3.1 Two Degree Investing Initiative

The two degree investing initiative (2DII) is an independent, non-profit think tank founded in 2012 with funding from the European Commission, Swiss and German government. Its headquarters are in Paris but there are also offices located in London, Brussels, New York and Berlin. 2DII is the leading global expert on research concerning the alignment of financial instruments with the goals in the Paris Agreement. Being an independent, interest neutral think tank the 2DII has developed instruments both for governments and banks. Their latest commitment is towards emerging economies as these countries are more often than not the more vulnerable to climate change. 2DII assisted the French government in drafting the first climate-related financial regulation in Europe, under this (now famous) article 173 of the energy transition law it is established that financial institutions have to report on both the climate change related fiscal and transaction risk of their financial instruments [Evain et al., 2018]. On top of that, the 2DII introduced climate scenario analysis and stress-testing into regulatory practices, through high level collaborations with governments and supervisors including the UK, Japan, Switzerland, the Netherlands, etc [2DI, n.d.]. One could argue that the PACTA instrument is their most relevant and most adopted publication. This tool, as before mentioned, estimates the environmental impact of investment portfolios. The last section of this chapter will elaborate more on the calculation methods used in the estimate. The following subsection will lay out the theoretical foundations for this alignment.

4.3.2 Paris Agreement Capital Transmission Assessment

Banks have relatively little direct emissions, they might consume a small but substantial amount of energy used to heat or light their office buildings. Another way they directly consume energy is by powering their servers on which most (if not all)³ in-house banking services are stored [Ryszawska & Zabawa, 2018]. When solely equipped with this narrow perspective one could reason that banks are quite climate neutral, especially if they would happen to have their power generated by a renewable energy source, solar panels for example. The overwhelming majority of the emissions by banks are known as financed emissions. The emissions emitted by entities, mostly firms, incorporated in the financial products held, bought and sold by banks. This reasoning assumes that financial institutions are responsible for the emissions of entities they hold. An analogy can help clarify this concept. Carbon emissions of airports are significant, after all, it is a large complex institution. Many airports around the world have started investing in infrastructure in order to reduce their carbon footprint and eventually reach carbon neutrality[Baxter, 2021]. These efforts are often communicated to travellers and stake holders while other more indirect impacts (airplanes taking off and landing) are left out[Boussauw & Vanoutrive, 2019]. It is in no case my intention to belittle or neglect the efforts most airports have made toward climate neutrality, I aim to illustrate the crucial difference between direct and indirect emissions.

4.4 Model for financed emissions

The total amount of emissions of a financial institution is the sum of the operational emissions and the financed ones. Equation 4.1 illustrates this relationship.

$$TOTe = OPe(m^2, \rho, \lambda, ..) + FINe$$

$$\tag{4.1}$$

The operational emissions of a financial institution (OPe) are a function of a multitude of variables relating to their daily operations: the surface of their operational infrastructure (offices, safes,..), insulation and the energy efficiency coefficient of that infrastructure. Equation 4.2 lays out the basic mechanics behind the estimation of the financed emissions.

$$FINe = \sum_{i=1}^{k} \alpha_i * EM(firm_i)$$
(4.2)

³other, more secondary IT tasks are mostly outsourced by banks.

The total of financed emissions is the weighted sum of the emissions emitted by the k number of firms held by the bank, the weights (α_i) are the relative holding positions by the bank. A portfolio comprising of a relatively higher stake in a polluting firm will have higher financed emissions given the weight attached to that firm is expressing exactly that relative stake. The most crucial element in the sum is the EM function, for our purpose, it is regarded as a black-box that calculates the emissions of a specific firm.

4.4.1 Technical details of the PACTA software

The PACTA software is open source, everyone can use it and contribute to it. As of present, it can tap into a broad climate-related financial database that covers more than 30,000 securities, 40,000 companies, and 230,000 energy-related physical assets from 9 climate related sectors which together make up 75 per cent of the global emissions⁴. Imperative to notice is that this database consists of forward looking data, such as future development plans of a firm. This allows the PACTA software to estimate future climate related scenarios. The core climate analysis of the PACTA tool provides answers to multiple questions. It addresses the transition risk of certain portfolios, exposes the sectorial distribution of assets compared to a benchmark model and elaborates on which companies are driving the results. All of this lies outside the scope of this paper. Most relevant for this study is that the analysis provides a clear answer to the following question: how aligned are the investment and production plans of companies in the portfolio with different climate scenarios and the Paris Agreement? One caveat of the software is that it does not calculate a single warming metric. This would be impossible with the state of the data as it is. Moreover, the calculation of such a metric would rely on even more assumptions making the final result unreliable. Figure 4.1 illustrates how such an alignment estimation looks like.



Figure 4.1: Production trajectory of oil compared to Ishares Core SP 500

The solid line indicates the development of the production in the selected sector within the portfolio for the next 5 years. The coloured areas indicate the required chance of production according to different climate scenarios in such that it would be in line with the Paris Agreement 1.5 degree warming goal. The software enables the researcher to compare it with different warming scenarios as well, such as the 2 degree warming scenario. The dashed line represents the chosen benchmark scaled to the starting point of the portfolio (in this case the Ishares Core SP 500). It is clear that neither the oil sector holdings in this portfolio nor benchmark is aligned with the goals set out in the Paris Agreement. The proportion of oil held in the portfolio would have to decline more significant to be aligned with a 1.5 degree Celsius warming scenario.

⁴power, oil gas, coal mining, automotive, shipping, aviation, cement, steel, and heavy-duty vehicles.

PACTA analysis of investment funds 5.

The first part of this chapter explores the application of the PACTA tool on three real-world investment funds. While dissecting each fund comments are provided on the inner workings of the PACTA tool. The last part of the chapter deals with the pitfalls of the methodology and future developments of the tool.

5.1Analysis of three investment funds

I handpicked three of the most prominent and popular sustainable investment funds. I will not discuss these funds nor investment banks by name, instead, I will refer to them as Fund 1, 2 and 3. Table 5.1 shows the key figures of these three funds.

Table 5.1: Overview funds						
	Market capitalization	Currency	growth 5 year time	main asset class		
Fund 1	5,384,665,314 \$	USD	22.48%	Equity		
Fund 2	671,340,000 £	Gbp	12.24 %	Equity		
Fund 3	6,405,500,000 \$	USD	8.96 %	Equity		

All three funds are actively managed and are allowed to make use of financial derivatives to hedge their risk. Their market returns variate significantly with fund 1 outperforming the two other funds on a 5-year time horizon. Interesting to note is that the third fund has a minimum entry-level capital of 5000 \$. These three funds all have large holdings in climate relevant sectors, which is to be expected given they are sustainable funds. The large exposure to these sectors makes them most fit to be analyzed by the PACTA open software. The following section will discuss the process and results of such an analysis.

5.2The results

As stated before, the PACTA software is regarded as a black box. It is user friendly and the researcher does not need to have any knowledge of data science. It is a free online tool. All one has to do is register on the Two degrees initiative site and upload a portfolio, in the form of a csv file, which you wish to analyse. After that, it is as easy as clicking on the button "analyse". The calculation itself can take up to 30 minutes, depending on how large and/or diverse the fund is. Following the completion of the calculation the researcher is provided with the output: an audit file and the PACTA-report. The audit file is a list of all the assets held by the fund and their key characteristics. This file does not have a high interpretation value, as it is just an excel sheet with raw data. It could however be used for further more specified analysis, this lays outside the scope of this paper. Finally, we arrive at the PACTA report, the backbone of the software.

5.2.1Fund number one

Let us consider the report of the first fund. Following the introduction and general information section, we are presented with the asset classes within this fund. Not surprisingly 89% consist of equity, the other 11% is excluded from the analysis. To date the PACTA software only applies to listed equity, this limits the scope of the analysis. Succeeding, we are presented with the sector coverage. The tool only covers sectors which are relevant from a climate perspective (1) , have scenario benchmarks available for each sector (2) and have sufficient data and business intelligence (3). These are three significant conditional assumptions and limit the scope of the

analysis even further. Only the power sector which accounts for 35% of the listed equity is covered by the analysis. This part elucidates 26 % of emissions emitted by all the equity held in this fund. The third section of the report lays out the exposure level of the portfolio to climaterelevant sector. This, however, provides a biased outlook for two reasons: the tool is usually used to analyse a portfolio¹, moreover, the analysis is only applied to 35% of the listed equity in this fund. I will neglect this section of the report, for the following two funds the same reasoning does apply and this section will again be neglected. Let us now consult the climate alignment part of the report. As stated earlier the tool makes use of forward-looking data with a time horizon of 5 years. It calculates whether the current and future production plans of a subsection of a specific sector is in line with the 2 degree warming goal as set out in the Paris Agreement. The first fund does not hold and does not plan on holding any coal, this ensures that it is aligned with the 2°C Scenario (2DS). The same goes for gas power, where only a minimal amount of gas energy is held in the fund. The energy production stemming from hydro-power attains 620 Megawatt, this exceeds the 570 Megawatt needed to stay on the 2DS. The fund holds 6.7 Megawatt in energy generated by oil, this exceeds the desired amount of energy produced by oil to stay below the 2DS. And lastly, while it is set to amp up its renewable energy production capacity it does still fall short of the 420 Megawatt needed in the year 2025. I will neglect the last two sections of the PACTA report as they are of little relevance to this paper. Table 5.2 provides a summary of some of the key results.

scope of analysis	Fund 1	Fund 2	Fund 3
listed equity	89%	99%	29%
equity covered	35%	6%	100%
emissions covered	26%	35%	100%
alignment?	Fund 1	Fund 2	Fund 3
coal power	yes	yes	yes
gas power	yes	yes	no
hydro power	yes	yes	yes
nuclear power	n/a	n/a	n/a
oil	no	no	no
renewables	no	no	yes

Table 5.2: Results of PACTA report (source: 2DII)

5.2.2 Fund two and three

The second fund consists almost solely out of equity however only 6 % is covered by the database, one could regard this as a serious impediment to the analysis. However, this covered equity accounts for 35~% of the total emissions held in the fund. Three of the four sectors are aligned with the 2° Celsius scenario. The third fund only consists of 29% listed equity, this is not to say that the other 71% is not equity, it might not be listed or just not recognized by the software. Fortunately for the sake of the analysis, 100% of the listed equity is covered by the tool, implying that also the full amount of emissions (of that 29% of the fund) is accounted for. Again, three out of four sectors are aligned with the 2° Celsius scenario. It has to be said that this fund is the only one that has aligned energy production levels in the renewable energy sector. This could be the successful outcome of positive screening. Lastly, there is one caveat that I would like to flag. In the climate scenario analysis of all three funds, the nuclear sector was not aligned with the goals of the Paris Agreement. All three funds exclude any nuclear energy, however, to reach the 2° Celsius goal it is assumed that the production of nuclear energy has to be increased. This somewhat controversial conclusion is reached by applying a definition of "greenness" that solely relies on carbon dioxide emissions [Fellner & Lünser, 2014] [Blowers, 2011], it links back to the reasoning set out in chapter 2.

5.3 Conclusion

The PACTA software is a promising and innovative tool, it makes use of state of the art methods and has helped policymakers and researchers worldwide to better understand the relationship between financial assets and the environment. On the other hand has this analysis highlighted

¹A bundle of funds, implying it is even more diversified.

how complex and tedious it is to estimate the environmental impact of investment funds. The main issue seems to be the lack of (forward looking) data but also the numerous assumptions one has to make. There is still a long way to go for the PACTA tool. Arriving at a single uni-variate outcome for the environmental impact of an investment fund is not attainable. This makes it hard to compare different funds. One thing the tool is fit for is analysing in which different sectors improvements have to be made. It surely aids investment bankers to obtain a better picture of the sectorial impacts of their financial products. The PACTA tool could also further climate ambition in the financial sector, in that regard can be regarded as a success.

6. Experimental design to determine perceived greenness

The first part of this section develops the theoretical motivations for determining the discrepancy in perceived greenness within retail investors informed to a different level. Following, An experimental design is set out to answer the research question: "does environmental information disclosure make subjects more critical of sustainable financial products". The expected hypotheses are discussed in the last part of this chapter.

6.1 Theoretical motivations

The above section sought to determine a measure for the actual greenness of an investment fund. This is of crucial importance as one can imagine that there exists some information asymmetry between the investment bankers and retail investors. The banker is on average more financially literate when it comes to these complex financial instruments. It is to say that she/he might have a better understanding of the fundamentals of the investment fund. The retail investor does not. Equation 6.1 expresses the utility of the environmental aware retail investor.

$$U_i = (\pi - \epsilon, -FINe) \tag{6.1}$$

The utility the retail investor derives from a sustainable investment is a positive function of the return of the investment (π). I follow [Reboredo *et al.*, 2017] and include the premium investors pay for green investments (ϵ). It is still debated within the literature whether or not green funds under preform traditional funds [Ibikunle & Steffen, 2017], nevertheless, the premium is included in the equation, if it does not exist for a certain green fund it equals zero. Lastly, the utility is a negative function of the financed emissions as set out in equation 4.2. It is assumed that the lower the amount of emissions emitted by the fund the more utility the investor derives. This is assumption stretches the boundaries of the utility maximizing paradigm as in neoclassical economics solely monetary gain is considered. Some scholars point towards warm glow as a possible explanation, forgoing monetary gain for an altruistic purpose [Clark *et al.*, 2003]. When the investor purchases a fund with less than optimal financed emissions (in line with her/his preferences) this leads to a Pareto inefficient resource allocation [Brennan & Kraus, 1987]. Hence why it is important for the retail investor to have a profound understanding of the environmental impacts of the investment fund.

6.2 Methodology of the random control trial

In order to establish an estimate for the difference in perceived greenness of an investment fund by subjects who are differently informed a random control trial was conducted. 310 participants were questioned, the survey ran over a period of 7 days. The sample population was at random divided into a control group and two different treatment groups. The control group was asked to rate the greenness of the three different funds analysed in the first section of this chapter and one more non climate-related fund. They had to base their estimate on the fact sheets which contain overviews of the investment policies of the different funds. These were censored for any references towards the investment fund or investment bank. The exact question posed was: "How "Green" or "Environmentally aligned" do you think this fund is? (0 = not at all green, 10 = greenest)". Moreover, the subjects had to rate the trustworthiness and greenness of an investment bank based on their web page. A full overview of the survey conducted can be found in the Appendix A.1. The first treatment group was (before starting the survey) presented with some abstracts from the Paris agreement and the 2018 report from the IPCC, most relevant: "The parties to this agreement recognize, note, acknowledge, that it is pressing to make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." The second treatment group was presented with an abstract from the executive summary of a study claiming that "In spite of increased deployment of new "green" technologies, the retirement of high-carbon technologies like coal power capacity is still far too slow to achieve the 1.5° or even $2^{\circ}C$ goal. Some firms held in the analyzed portfolios even planned further expansion of coal mining and oil production. In terms of climate actions, portfolio analysis of financial institutions with coal exclusion policies showed that more than 50% of their listed equity and more than 70% of their corporate bond portfolios still contained coal assets." [Initiative & Partner, 2020]. This statement offers the subjects a piece of information on which they could build their own benchmark. Notice how it is not to general ¹ and still quite technical. To conclude the subjects are polled on their age and education level. Given the large amount of subjects and the random distribution over the three different groups, there is no real need to control for these characteristics. Nevertheless it would be of value to see how they correlated with perceived greenness. The full survey can be found in Appendix A.1.

6.3 Anticipated results

It is unlikely that we will perceive a significantly different result within the groups for the three sustainable funds. Their fact sheets all have similar aesthetics and their investment policies can be regarded as parallel. There is however a difference to be expected between the sustainable funds and the traditional investment fund on the one hand and the more graphical investment bank web page. In all likelihood, the traditional fund will be rated less green than the other funds. It is harder to make an inference on the perceived greenness of the website. It either is perceived as more green given the more elaborate explanation of the investment policy and climate-related issues or less green due to it more abstract nature. Between the groups, there are differences expected. The second treatment group that receives the information on dis-alignment of sustainable portfolios could rate the entities less green overall. It is hard to inference on the effect of the first treatment (the abstract of the Paris agreement), all it does is give the subjects a clearer definition of "greenness". None of the fact sheets mention anything about degrees warming making it difficult to anticipate how perceived greenness might change.

¹it is for the Swiss market.

7. Results of the random control trial

This chapter discusses the main findings of the experiment. The first section deals exclusively with the descriptive statistics while the second one tests the research question: do more informed subjects perceive sustainable financial products as less green? The third section addresses some robustness concerns. Finally, this chapter concludes with the limitations of the experiments and perspectives that could be further explored.

7.1 Descriptive statistics

In this section, the descriptive statistics of the data obtained through the survey are examined. Besides visual inspection, some interesting dynamics of the data are tested. The survey was active for 7 days and was distributed exclusively through online media, mostly email. I obtained 344 recorded responses, but more than 30 of those were incomplete and eventually removed from the data frame. The distribution of these 310 responses over the different groups is illustrated in table 7.1. The treatment group "Paris" received an abstract of the Paris Agreement and the IPCC report, while the treatment group "2DII" received an abstract from a study by the 2 degree investment initiative stating that 70 per cent of Swiss green funds are still not aligned with the Paris Agreement. The distribution is not perfectly equal, with the 2DII treatment group encompassing less of the total observations than the other groups.

Table 7.1: Distribution over the groupsN totaln 2DIIn Parisn control31083112115

There is a very straightforward explanation for this phenomenon of unequal distributions over the groups. To obtain true randomisation, respondents were selected into different groups based on the initial of their first names. This individualistic level of randomization is among the best practices, especially in smaller random control trials [Houle, 2015]. Individuals with the first initial: C, F, I, L, O, R, U or X were assigned to the 2DII group. First names starting with these letters happened to be less common than other first letters. A more significant asymmetry is found with regard to the age of the respondents. Image 7.1 shows the histogram of the age distribution.

While the distribution of age has a large variance, with the extreme values spanning from 18 to 65, it has a disproportionately large amount of 20-30 years old's. The survey was distributed among universities, mostly among university students. This explains the large presence of young adults in the respondents. The same reasoning extends to the distribution of education. Respondents were asked about their highest level of education: no high school degree (1), a high school degree (2), a Bachelors degree (3), a Masters degree (4) or a Phd (5). Image 7.2 shows their answers with regard to education level.

More than two-thirds of the total respondents indicated to have a high school degree or a bachelors degree. This is in large part driven by the fact that most of the respondents were university students and were still completing their Bachelors and/or Masters degrees. This is expected to have some effects on the results as the variable education is somewhat miss specified. The last section of this chapter will deal with this and potential other shortcomings. Each respondent was asked to rate the "greenness" of a financial product or bank on a scale of 1 to 10. This part in the survey was the same, regardless of what group you were assigned to. This allows us to compare the perceived greenness of the different financial products. Figure 7.3 shows the box-plot of each financial entity, with the perceived greenness on the y-axis. The centerline of each box-plot being the median (50th quantile).

Figure 7.1: Age distribution of the respondents



Figure 7.2: Education distribution of the respondents



The first, second and last box-plot present the perceived greenness of the sustainable funds analysed by the PACTA-tool in the previous chapter of this paper. Upon first inspection, there does not seem to be a significant difference. However, one has to bear in mind that the box-plot uses the median instead of the mean. Further inspection will be carried out in the next section of this chapter. The one stark deviating box-plot is that of the traditional fund. The respondents were shown the information sheet of this fund (which made no mention of sustainability or environmental ambitions). Unsurprisingly the respondents rated it less green compared to the sustainable funds, which did mention environmental ambitions. This is by all means informative to observe but it is not something out of the ordinary. In the next section we will investigate whether or not being treated with information changes the perceived greenness of these funds.

7.2 Hypothesis testing and regression results

In order to test our research question, we will have to compare the different levels of perceived greenness per group (control, Paris and 2DII). To attain a rough estimate of the perceived greenness per group, a new variable is calculated, namely the average greenness spanning over the 5 financial products. Figure 7.4 shows the box-plot of the average perceived level of greenness per group.

From this first visual inspection, we can see how the control group has the highest level of



average perceived greenness per financial entity

Figure 7.4: Average perceived greenness per group

sequences of the second second

average perceived greenness per group

average perceived greenness, individuals who did not get to see any disclaimer before the survey rated the financial products higher on greenness than the two other groups. We have to bear in mind that we are only observing the median, the mean will give us a more conclusive image of this phenomenon. The group that was treated with the 2DII abstract (i.e."70% of sustainable green funds do not align with the goals of the Paris Agreement") rated the greenness of the financial products the lowest. This is somewhat unsurprising, informing people about the state of alignment within the financial market will make them more aware of the gap that exists. The group that was treated with article 2(b) from the Paris Agreement and a quote from the IPCC 2018 report rated the financial products less green than the control group, but greener than the 2DII group. This is a first visual inspection, this on its own is not enough to say anything about our research question with any certitude. Let us consider the mean of average perceived greenness per group. Table 7.2 provides us with this information. The same pattern we observed in figure 7.4 is visible here, the control group rated the financial products more green than the Paris-group and this group in turn rated the products greener than the 2DII-group. To test for a statistically significant difference between those three different means I made use of an analysis of variance test (ANOVA). The results of this test are displayed in table 7.3, the high F value and

very small p-value allows us to reject the null-hypothesis at an 0,00001 level. At least one of the three means differs significantly from the other two. Note how the ANOVA test does not indicate which mean is differing from the others, or whether all three are differing from each other. To determine which group mean differs from which an ordinary linear regression is most fit. Table 7.4 shows the regression results of the baseline regression and a regression with controls.

Table 7.2: average perceived greenness per group

group	2DII	Paris	control
mean average perceived greenness	5.44	5.91	6.34

Table 7.3: Anova of average perceived greenness per group

	Df	Sum squared	Mean squared	F value	$\Pr(>F)$
Group	2	39.5	19.735	12.45	0.00000634
Residuals	307	486.7	1.586		

The first, very simple regression, makes it clear that all three group means differ highly significantly from each other. An individual in the 2DII-group has an expected average perceived greenness of 5.439. This is significantly lower than an individual in the Paris-group who has an average expected greenness of 0.469 higher (5.91 in total). Lastly, the control group has the highest expected perceived average greenness, 0.902 units higher than the 2DII-group (6.34 in total). All the coefficients are highly significant, as indicated by the stars adjacent to them. The second regression presented in the table is the baseline regression extended by two controls. Note how in a random control trial, including controls in the regressions is not as crucial as in other empirical work. If the randomisation is done in a correct manner most omitted variables are controlled for by default. Nevertheless, in this case, it is of relevance how perceived greenness relates to these control variables. The group-dummy variables remain significant in the regression with controls. The coefficient of age is positive and significant at the 0.05 level. For every year one gains in age the expected average perceived greenness rises by 0.022 units.

	Dependent	t variable:	
	averagegreen		
	(1)	(2)	
GroupControl	0.902***	0.854^{***}	
	(0.181)	(0.181)	
GroupParis	0.469**	0.419**	
	(0.182)	(0.182)	
age		0.022**	
-		(0.010)	
edu		0.015	
		(0.098)	
Constant	5.439***	4.866***	
	(0.138)	(0.315)	
Observations	310	310	
\mathbb{R}^2	0.075	0.093	
Adjusted \mathbb{R}^2	0.069	0.081	
Residual Std. Error	$1.259 \ (df = 307)$	$1.251 \ (df = 305)$	
F Statistic	12.447^{***} (df = 2; 307)	7.775^{***} (df = 4; 305)	
Note:	*p<(0.1; **p<0.05; ***p<0.01	

Table 7.4: Regressions with average greenness as dependent variable

This finding is in line with that of some other scholars in that young people tend to be more environmentally aware [Sachdeva *et al.*, 2015] and on average tend to be more critical of hyperbolic claims. [Autio & Heinonen, 2004]. However, there is no consensus in the literature about this phenomenon as other studies have found reverse effects, with older people being more environmentally aware [Aminrad *et al.*, 2011]. The coefficient for education is rather small and not significant at all. This is most likely due to the misspecification of the variable education, the survey was completed in large part by young university students who did not yet obtain their bachelors or masters degree. Most other studies polling for environmental awareness do find a positive relationship between environmental awareness and education level [Aminrad *et al.*, 2011].

Having established that the treatment group an individual was assigned to has an statistical significant influence on their expected average perceived greenness, it might be worthwhile to step back from this general viewpoint and take a more fine-grained look. Table 7.5 shows the same regression as regression 2 in table 7.4 with the slight difference that the dependent variable is the perceived greenness of a single financial product instead of the average perceived greenness. In all five regressions, we observe the same pattern as we did in table 7.2, albeit not statistically significant for all regressions. Note how the 'normal fund' got a very low perceived greenness compared to the others, this is completely in line with the expectations as it was the only fund that did not make a mention of environmental ambitions. The marketing web page of a sustainable investing bank was rated significantly higher (a higher constant) by the reference group (2DII) than the other financial entities. Also, the pattern observed in table 7.2 is less present in this regression, with the Paris-group not significantly differing from the 2DII-group. This result hints at a weakening of the information treatment effect by a more eve-catching and "flashy" design. In other words, it could very well be that informing individuals increases their awareness but this mechanism only holds for "dry" plain text environmental claims, including flashy images and appealing web-pages could lessen the effect.

			Dependent var	riable:	
	Fund1	Fund2	greenbank	'normal fund'	Fund3
	(1)	(2)	(3)	(4)	(5)
GroupControl	1.255^{***}	0.694^{***}	0.435^{*}	1.037***	0.849***
	(0.250)	(0.265)	(0.257)	(0.313)	(0.256)
GroupParis	0.833***	0.309	0.185	0.191	0.575**
	(0.252)	(0.267)	(0.258)	(0.315)	(0.258)
age	0.018	0.044***	0.004	0.028	0.019
0	(0.014)	(0.015)	(0.015)	(0.018)	(0.015)
edu	0.159	-0.116	0.092	-0.121	0.062
	(0.135)	(0.143)	(0.139)	(0.169)	(0.138)
Constant	4.730***	4.996^{***}	6.164^{***}	3.140^{***}	5.302***
	(0.435)	(0.461)	(0.446)	(0.545)	(0.445)
Observations	310	310	310	310	310
\mathbb{R}^2	0.097	0.053	0.013	0.053	0.048
Adjusted \mathbb{R}^2	0.085	0.041	-0.0001	0.040	0.035
Residual Std. Error $(df = 305)$	1.728	1.829	1.771	2.161	1.766
F Statistic (df = $4; 305$)	8.188***	4.299***	0.992	4.233***	3.820***

Table 7.5: regression per financial product

Note:

*p<0.1; **p<0.05; ***p<0.01

7.2.1 Robustness checks and limitations

Robustness checks

In the above section, we were able to reject the null hypothesis with a high level of statistical confidence, and so we can accept that the means per group differ from each other. However, this test was done through an analysis of variances which assumes homogeneity of variances over the groups. Just by inspecting figure 7.4 we might suspect heterogeneity of the variances per group (one box-plot is wider than the other). Table 7.6 lays out the results of the Levene's test for homogeneity of variance, which has the null hypothesis that all variances are equal[Glass, 1966]. The infinitesimal p-value allows us to reject that null hypothesis, this confirms the visual clues derived from figure 7.4. This same conclusion is confirmed by the Fligner test for homogeneity of variance, this test allows for deviations from the normality assumption [Eberhardt & Fligner, 1977]. The output of this test can be found in table 7.7. This test gives a similar result as the Levene's test.

	Df	F value	$\Pr(>F)$
Group	2	7.844	0.0004757
Residuals	307		

Table 7.6: Levene's test for homogeneity of variance

Table 7.7: Fligner test for homogeneity of variance

	Df	Chi-squared	$\Pr(>F)$
Fligner-Killeen	2	15.82	0.0003671

The fact that the variances are in all likelihood not homogeneous gives rise to a potential bias in the outcome of the analysis of variances. A more appropriate approach is the non-pragmatic Kruskal-Wallis rank sum test, this test is the equivalence of the one-way ANOVA test but relaxes some of its assumptions. The output of this test can be found in table 7.8, it is very similar to the ordinary analysis of variance [McKight & Najab, 2010]. These results are not that surprising, however, for the sake of completeness I believe it is essential to include them in this work.

Table 7.8: Kruskal-Wallis test for mean of average perceived greenness over groups

	Degrees of freedom	Chi-squared	$\Pr(>F)$
Kruskal-Wallis	2	17.711	0.0001426

Limitations of the approach

The main limitation of this experiment is the dichotomy between true environmental awareness and the score (0 to 10) indicated on the survey. Literature has shown that there are few ways to determine true environmental awareness [Rotaris et al., 2021], [Bockstael & McConnell, 2007]. Most studies make use of either revealed or stated preferences, the former being the method used in this work. This method is efficient in the sense that it provides fast results without significant resources, a revealed preference (if performed correctly) would deliver a better proxy for environmental awareness and behaviour. This however, lays outside the scope of this paper. A second limitation we can touch upon, besides the obviously skewed distribution when it comes to age, is the technical nature of the information. Some people, especially younger ones might not be that familiar with investment funds or their investment policy fact sheet. This could in part explain why all the regressions have such a low R squared. A final constraint on the interpretation of these results lays in the fact that the group that was shown the Paris Agreement abstract was also shown an abstract from the 2018 IPCC report. "If warming reaches 2 degrees.....resulting in increased coastal flooding, beach erosion, salinization......this point might trigger irreversible changes to our ecosystems", this could have emphasized the urgency of climate change and so it is not clear whether their lower perceived average greenness was induced by this sentence or the legal text of the Paris Agreement.

8. Regulation of investment funds

The first section of this chapter will discuss the regulation of investment funds in the western world. This is a vast amount of regulation, hence why I only focus on the information obligation of the investment bank or manager towards the (retail) investor. The regulatory framework within the European Union, the United States of America and the United Kingdom is discussed. In the second section of this chapter, a light is shed on some innovative financial information disclosure regulations in the environmental sphere that some countries, most notably France, have adopted. The last section considers normative implications of the research results this paper has brought forward on financial information obligation regulations.

8.1 Financial regulation and authorities

8.1.1 European Union

In 1985 the council of the European communities adopted the first regulation with the aim to harmonize open ended investment funds [the Council of the European Communities, 1985]. This legislation has since been amended many times, its latest version is the Directive 2009/65/ECof the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS), [the European Parliament, the European Council, 2009]. Each member state has its own financial authority which is responsible for the oversight of financial activity within the national state, for a full overview of Europe its financial regulatory ecosystem I recommend [Masciandaro, 2005]. The UCITS directive covers more than 75% of the investments made by small investors in Europe. The contents of the UCITS are numerous and I will solely focus on chapter IX of this directive: "Obligations concerning information to be provided to investors". There are three sections within this chapter of the directive, the first one titles: "publication of a prospectus and periodical reports" and entails the more technical side of the performance and risk measures of the financial product. The second and shortest section titles: "publication of other information", this section contains only two articles concerning marketing communication. The third and last section is titled the "Key investor information", this section specifies what elements have to be included in the key investor information sheet and how this sheet should or should not be presented to the (retail) investors. Note that this key investor information disclosure sheet is exactly what I used for one of the investment funds in the survey, you can find it in Appendix A.4. Article 78(3)b states "Key investor information shall provide information on the following essential elements in respect of the UCITS concerned: a short description of its investment objectives and investment policy". This is where the sustainable funds define their objectives and policy. Other, more traditional funds will indicate a different strategy.

8.1.2 United States of America

In the United States the federal investment law separates investment companies in three categories: mutual funds (open ended), close ended funds and UITs. Depending on the size and type of the investment company multiple regulators might have the competence of oversight. The U.S Securities and Exchange Commission (SEC) is the main regulator, other regulatory bodies in this field are the U.S. Commodity Futures Trading Commission (CFTC), the National Futures Association (NFA) and the Financial Industry Regulatory Authority (FINRA). Investment companies are mainly regulated under the Investment Company Act of 1940. Section 8(b)(1)of the act reads: "Every registered investment company shall file with the Commission, within such reasonable time after registration as the Commission shall fix by rules and regulations, an original and such copies of a registration statement, in such form and containing such of the following information and documents as the Commission shall by rules and regulations prescribe as necessary or appropriate in the public interest or for the protection of investors: a recital of all investment policies of the registrant, not enumerated in paragraph" [Jaretzki, 1941]. It has to be noted that the Securities and Exchange commission drafts new regulation based on this act, this makes sense: in a highly complex and evolving industry such as the financial one, regulation has to innovate.

8.1.3 United Kingdom

In the United Kingdom section 235 to 284 of the financial services and market act elaborates on the conditions of a collective investment scheme to be operational. This act, passed in 2000, encompasses a large number of topics related to corporate finance and financial markets [Parliament of the United Kingdom, 2000]. Moreover, it gave birth to the Financial Service Authority (FSA). The act has been significantly amended by the financial service act of 2012 [Parliament of the United Kingdom, 2012]. Notable is how Part 23 of the financial services and market act, titled: "Public Record, Disclosure of Information and Co-operation", contains a provision of information disclosure to the European Markets and Securities Authority (ESMA) under the UCITS directive.

8.2 Innovative financial environmental regulation

8.2.1 French energy transition law

As set out in the above section of this chapter, almost if not all financial regulation has no regard for environmental concerns. The main vehicle through which sustainable investment funds or banks have to communicate their environmental goals is through the investment policy part of the Key Investor Information Disclosure (KIID) sheet. This section in the chapter will go a bit deeper and explores some regulations that have been adopted by national states to encompass a more environmental dimension to investing funds. The main and most famous of these regulations is Frances article 173 of the law on energy transition and green growth [art, 2016]. After the 2015 Paris Agreement France passed Article 173 to put weight behind the freshly signed climate pledges of the Paris Agreement. This article has a direct effect on the asset management companies and institutional investors while lighter obligations are in place for funds with less than 500 million euros in holdings. The two main goals of the regulation are: raising the awareness of investors concerning their environmental impact generated by their investment and associated risks, firstly and ensuring transparency on climate action by investors, secondly [Evain et al., 2018]. One of the more innovative elements of the regulation is that it requires investment funds to disclose their ESG policies and at the same time disclose the calculated impact of the investment fund on the environment. The regulation works on a comply or explain basis, according to the French lawmakers, this is to allow full flexibility to the investment fund calculating the impacts based on the tools and data to their disposal. This is ought to allow for the emergence of best practices. The critics are numerous and claim that such a comply or explain basis is not binding enough. The French Ministry of Finance and the Ministry for the Ecological and Inclusive Transition performed an ex-post evaluation in 2018 (two years after the adoption of the new regulation). The findings are slightly positive but the aims of the regulation are still far from met. Let us start with the positives, a study by Novethic concludes: "the vast majority of the main French institutional investors have become aware of their role and responsibilities in taking into account climate risks and ESG dimensions in the management of financial assets", more than 86% of the asset managers reported some calculation of their carbon footprint [Nicolas & Julie, 2018]. A different study considers the adoption of Article 173 as a quasi-experiment within Europe, they find that investors subject to the new French requirements experienced significant disinvestment in fossil fuels compared to investment funds in the control group (not affected by article 173) [Mésonnier & Nguyen, 2020]. Not all reports shed such a positive light on the matter. A metastudy performed by the institute for climate economics is less optimistic. Besides a little group of dedicated investment managers, Article 173 has not yielded the desired changes in reporting. This is mainly due to the lack of standardisation and the nature of the comply or explain principle, the report goes on to claim that the regulation has shifted towards a compliance exercise rather than upholding the spirit of the law [Evain *et al.*, 2018]. It is clear that this highly ambitious article has somewhat underperformed, nevertheless, it opens the pathway for an international

climate analysis of investment funds.

8.2.2 European Sustainable Finance Disclosure Regulation

The European Commission launched its plan for financing green growth in 2018, the sustainable Finance disclosure regulation [The European Parliament, Council of the European Union, 2019] (SFDR) is a major pillar in this plan. Its aim is to harmonize and standardize the environmental practises and reporting of the European market for financial products and services. Article 6 titles :"Transparency of the integration of sustainability risks"; it lays out the pre-contractual environmental information obligations investment managers have most notably "(a) the manner in which sustainability risks are integrated into their investment decisions; and (b) the results of the assessment of the likely impacts of sustainability risks on the returns of the financial products they make available.". Parallel to the French article 173, article 6 of the SFDR works on a comply or explain basis as set out by the following abstract: Where financial market participants deem sustainability risks not to be relevant, the descriptions referred to in the first subparagraph shall include a clear and concise explanation of the reasons therefor. Moreover, following this directive, investment companies will have to consider and disclose potential adverse impacts (PAI) of their investment policy on the environment, human rights and anti-corruption measures. Even though these regulations are implemented on a comply or explain basis they do have real-world implications for investors. Due to amendments in the Markets in Financial Instruments Directive II [The European Parliament, Council of the European Union, 2014], funds that have not disclosed their environmental risks or PAI cannot be sold to clients that have indicated to take ESG policies at heart. This might give rise to distributional problems for funds that do not disclose any ESG policies and in turn incentivise them to do so. The SFDR has been in force since 10 march of 2021, it is too early to derive any conclusions on the effectiveness of this regulation. Article 19 of the regulation commits the European commission to an ex-post assessment obligation [The European Parliament, Council of the European Union, 2019]. By December 2022 the commission shall have evaluated the application of this obligation, it reads.

8.3 Normative sustainable financial regulation

As is made clear by the above paragraph, sustainable financial regulation has come a long way in the last century, especially in Europe. On the other hand, one could argue that it is still in its infancy, with the most ambitious regulation being merely a few months in place. This section explores some regulatory designs based on the findings in chapter 7 while taking into account behavioural biases. Ideally speaking we want the retail investor to be as informed as the investment banker selling the financial products, this is highly unlikely as financial products are inherently complex and technologically advanced. Hence, the aim of the regulator is to draft regulations that empowers the retail investor such that she/he is capable of making well founded decisions in alignment with her/his preferences. Moreover, in the realm of sustainable investing one would like to arm the retail investor against practices such as green washing as this implies a mismatch between the preferences of the environmentally aware investor and the actual greenness of the fund. How can these goals be achieved? The European sustainable financial disclosure regulation lays a very good foundation, many of the rules set out in this directive are innovative and have great potential. As mentioned before, an ex-post evaluation is needed to derive any conclusions on the effectiveness of these different rules but one potential pitfall they could suffer from is the information overload problem. This behavioural bias is inherent to human cognition and in simple terms boils down to the fact that once presented with too much information the individual will try to absorb it all but it will not increase the marginal benefit of the decision making and might even be detrimental to it [Bawden et al., 1999]. The most straightforward remedy of information overload is simplifying how the information is presented. most regulators have been taking this into consideration within the "better regulation" tools they have implemented [Wiener, 2006]. As found in chapter 7, paraphrasing a brief abstract from the Paris Agreement in combination with the IPCC report increases individuals environmental awareness towards green investing. The exact transmission mechanisms through which this happens remain unclear and could be subject to further research. The sustainable financial regulation I propose includes an information disclosure obligation of this exact abstract: "The Paris Agreement is an international treaty on climate change adopted by 196 parties, its goal is to limit global warming to well below 2. Moreover, it is believed that global warming beyond this point might trigger irreversible changes to our ecosystems (IPCC, 2018)". The way this information should be disclosed is on the key investor information sheet. On average this should make individuals perceive the funds as less green (in line with the results of this paper), while it is not 100% clear as to what this implies for their further conduct of behaviour one can expect that they become less susceptible to green washing and nudges them into a further pursuit of information on the fund. Again, further research is needed into this. The crucial element is that the additional information I propose to be disclosed is brief and standardized. This would be a valuable addition to the existing financial regulation.

9. Conclusion

The aim of this research was twofold: on the one hand, this paper sought to determine the actual greenness of sustainable investment funds by applying the PACTA tool. The theoretical foundations for this approach are based on the gap between operational emissions and financed emissions by banks. Later the software was applied to three real-life sustainable investment funds in an attempt to familiarise the reader with the application of the PACTA tool. This yielded some illustrative results, the majority of the sectors held in the funds were aligned with the 2 degrees warming path. The major pitfall was that the calculation method suffered significantly from a lack of comparable forward looking data, resulting in a less than optimal outcome for this part of the research. I am convinced that the PACTA tool can be of high relevance for the financial sector as it does allow for sectorial comparison. However, the absence of a single measure for expected warming stemming from the financed emissions complicates the interpretation of the report. The second pillar of this work is related to the perceived greenness of sustainable investment funds. The theoretical relevance of this part of the research is straightforward: we set out to lessen the existing information asymmetry between the retail investor and the investment banker. This information asymmetry can result in a mismatch between the preferences of the retail investor and the characteristics of the financial product. Through means of a survey, a random control trial was set up to test the hypothesis that better informed subjects would perceive sustainable investment funds as less green. The outcome is inline with the anticipated results, subjects treated with information disclosure from the Paris Agreement and the IPCC report rated the sustainable funds 6.8 % lower than subjects in the control group. Subjects treated with information on the state of environmental alignment in the financial sector (i.e 70% of funds are not yet aligned with the Paris Agreement) rated the funds the least green. These findings are robust to different specifications. What is not clear is what induced people to perceive these financial products as less sustainable. It might have been that the sentence from the IPCC report restated the urgency of climate change and that the commitment of the Paris Agreement gave it more legitimacy. Even then, why would this restated urgency and more legitimacy lead to lower compared to a higher level of perceived sustainability? All this can be explored in further research. The major short coming of this study is that it is not clear how the stated perceived greenness correlates to other actions the subject might take. This perceived greenness as defined on a scale from 0 to 10 does not indicate whether or not a subject would purchase such a fund, this is therefore an avenue for further research. Notwithstanding, the findings of this study are of high relevance for regulators. As proposed in the last chapter of this work, adding a standardized disclosure concerning the Paris Agreement¹ to the KIID under the UCITS directive can increase the environmental awareness of the retail investor. With the European Sustainable Finance Disclosure regulation up for review in two years, this increases its relevance. This study also opens up new avenues for future research, more specifically on the transmission channels of this alleged increased skepticism.

¹" The Paris Agreement is an international treaty on climate change adopted by 196 parties, its goal is to limit global warming to well below 2. Moreover, it is believed that global warming beyond this point might trigger irreversible changes to our ecosystems" (IPCC, 2018)

A. Appendix

A.1 Randomization before the survey

Subjects were asked to select the group where they could find the initial of their first name. ((A D G J M P S V Y) - (B E H K N Q T W Z) - (C F I L O R U X)). Depending on the group they were selected into the subjects received different information before starting the survey.

$(A D G J M P S V Y) \rightarrow$

The Paris Agreement is an international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

If warming reaches 2 degrees Celsius, more than 70 percent of Earth's coastlines will see sealevel rise greater than 0.66 feet (0.2 meters), resulting in increased coastal flooding, beach erosion, salinization of water supplies and other impacts on humans and ecological systems. Moreover, it is believed that global warming beyond this point might trigger irreversible changes to our ecosystems (IPCC, 2018)

Article 2 (b) of the Paris Agreement reads: The parties to this agreement recognize, note, acknowledge, that it is pressing to make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

$(C F I L O R U X) \rightarrow$

"..... But despite improvements from 2017, the 2020 assessment shows that overall, Swiss financial markets are still not aligned with the Paris Agreement goals:

In spite of increased deployment of new "green" technologies, the retirement of high-carbon technologies like coal power capacity is still far too slow to achieve the 1.5° or even 2°C goal. Some firms held in the analyzed portfolios even planned further expansion of coal mining and oil production.

In terms of climate actions, portfolio analysis of financial institutions with coal exclusion policies showed that more than 50% of their listed equity and more than 70% of their corporate bond portfolios still contained coal assets.

 $\begin{array}{c} (\mathrm{B} \ \mathrm{E} \ \mathrm{H} \ \mathrm{K} \ \mathrm{N} \ \mathrm{Q} \ \mathrm{T} \ \mathrm{W} \ \mathrm{Z}) \rightarrow \\ \mathrm{Control \ group} \end{array}$

	Question	Answer
	road the following fact sheet carefully and answer	How "Green" or "Environmentally aligned"
5	the questions below Figure A 1	do you think this fund is?
	the questions below Figure A.1	(0 = not at all green, 10 = greenest)
	read the following fact sheet carefully and answer	How "Green" or "Environmentally aligned"
6	the questions below	do you think this fund is?
	Figure A.2	(0 = not at all green, 10 = greenest)
		How "Green" or "Environmentally aligned"
	Read the information on the web page carefully	do you think this investment bank is?
	and answer the questions below	(0 = not at all green, 10 = greenest)
7	and answer the questions below	How trustworthy does this investment
	Figure A 2	bank seem to you ?
	Figure A.5	(0 = not trustworthy at all,
		10 = most trust worthy)
	Read the following factsheet carefully and answer	How "Green" or "Environmentally aligned"
8	the questions below	do you think this fund is?
Ŭ		(0 = not at all green 10 = greenest)
	Figure A.4	
	Read the following fact sheet carefully and answer	How "Green" or "Environmentally aligned"
9	the questions below	do you think this fund is?
Ŭ		(0 = not at all green, 10 = greenest)
	Figure A.5	
10	What is your age?	
		No high school -High school
11	What is your highest level of education obtained?	Bachelor -Master
		PhD
END	Thank you for participating in this survey	END

Table A.1: Survey conducted after subjects were sorted in groups

Figure A.1: Fund 1



Figure A.2: Fund 2



Figure A.3: Investment bank web-page





Figure A.4: Traditional fund

High Yield Fund (UK) (the "Fund")

Fixed Interest Investment Series (the "Company") are class (ISIN: GB0033) (the "Share Class") A fund of

Accumulation share class (ISIN: GB0033 Group.

Fund Managers Limited, part of the The Fund is managed by

Objectives and Investment Policy

- The objective of the Fund is to achieve income and capital growth over the medium to long term (3 to 5 years plus).
- The Fund invests at least 80% of its assets in corporate and government debt securities which are either non-investment grade or have no credit rating.
- The Fund may use derivatives (complex instruments) for investment purposes and to manage the Fund more efficiently, with the aim of reducing The Fund has an active investment approach based on fund manager judgement supported by macroeconomic and credit risk analysis with an
- emphasis on valuation, has a flexible approach with a preference for the high yield bond market and is not constrained by a benchmark. The reference to (UK) in the Fund's name only relates to the Fund's domicile and is unrelated to the Fund's objective and investment policy.
- You can buy, sell and switch shares in the Fund on any Dealing Day (as defined in the Prospectus).
- Any income from your investment will be reinvested. Recommendation: The Fund may not be appropriate if you plan to withdraw your money within 5 years.

Figure A.5: Fund 3

EQUITY

🔎 KIID/KID 🔎 Factsheet 🔎 Prospectus 🔚 Download

Sustainable Energy Fund

Class D2 (U.S. Dollar	~	
NAV as of 28-May-21	1 Day NAV Change as of 28-May-21	Morningst
52 WK: 11.38 - 19.72		

	Overview	Performance	Key Facts	Managers	Holdings	Pricing	Literature			
Investment Approach										
The Sustainable Energy Fund seeks to maximise total return. The Fund invests globally at least 70% of its total assets in the equity securities of										
	sustainable energy companies. Sustainable energy companies are those which are engaged in alternative energy and energy technologies									
	including: renewal	ble energy technology: ren	newable energy develo	opers: alternative fuels	s: energy efficiency: e	nabling energy ar	nd infrastructure.			

The Fund will not invest in companies that are classified in the following sectors (as defined by Global Industry Classification Standard): coal and consumables; oil and gas exploration and production; and integrated oil and gas.

Bibliography

- [2DI, n.d.] About us. https://2degrees-investing.org/about-us/. Accessed: 2021-05-20.
- [par, n.d.] Paris Agreement. UNTC XXVII 7.d.
- [art, 2016] 2016. Article 173-VI : extension du domaine de la lutte contre le changement climatique.
- [Abbott & Snidal, 2000] Abbott, Kenneth W, & Snidal, Duncan. 2000. Hard and soft law in international governance. *International organization*, 421–456.
- [Ajadi et al., 2020] Ajadi, Tayo, Cuming, Victoria, Boyle, Rohan, Strahan, David, Kimmel, Matthias, Logan, Michael, McCrone, Angus, et al. 2020. Global trends in renewable energy investment 2020.
- [Aminrad et al., 2011] Aminrad, Zarrintaj, Zakaria, SZBS, & Hadi, Abdul Samad. 2011. Influence of age and level of education on environmental awareness and attitude: case study on Iranian students in Malaysian Universities. The Social Sciences, 6(1), 15–19.
- [Anderson & Cunningham, 1972] Anderson, T. Jr, & Cunningham, W.H. 1972. The socially conscious consumer. Journal of Marketing, 36(7), 22–31.
- [Andreoni, 1990] Andreoni, James. 1990. Impure altruism and donations to public goods: A theory of warm-glow giving. The economic journal, 100(401), 464–477.
- [Autio & Heinonen, 2004] Autio, Minna, & Heinonen, Visa. 2004. To consume or not to consume? Young people's environmentalism in the affluent Finnish society. Young, 12(2), 137– 153.
- [Bawden et al., 1999] Bawden, David, Holtham, Clive, & Courtney, Nigel. 1999. Perspectives on information overload. In: Aslib proceedings. MCB UP Ltd.
- [Baxter, 2021] Baxter, Glenn. 2021. Achieving Carbon Neutral Airport Operations By 2025: The Case of Sydney Airport, Australia. *Transport and Telecommunication*, **22**(1), 1–14.
- [Bertrand, 2020] Bertrand, Matthieu. 2020. The Juncker Plan, when EU public banking enters politics. *The Juncker Commission: Politicizing EU Policies*, **79**, 71.
- [Blowers, 2011] Blowers, Andrew. 2011. Why Fukushima is a moral issue? The need for an ethic for the future in the debate about the future of nuclear energy.
- [Bockstael & McConnell, 2007] Bockstael, Nancy E, & McConnell, Kenneth E. 2007. Environmental and resource valuation with revealed preferences: a theoretical guide to empirical models. Vol. 7. Springer Science & Business Media.
- [Boussauw & Vanoutrive, 2019] Boussauw, Kobe, & Vanoutrive, Thomas. 2019. Flying green from a carbon neutral airport: the case of Brussels. *Sustainability*, **11**(7), 2102.
- [Brennan & Kraus, 1987] Brennan, Michael, & Kraus, Alan. 1987. Efficient financing under asymmetric information. The Journal of Finance, 42(5), 1225–1243.
- [Clark et al., 2003] Clark, Christopher F, Kotchen, Matthew J, & Moore, Michael R. 2003. Internal and external influences on pro-environmental behavior: Participation in a green electricity program. Journal of environmental psychology, 23(3), 237–246.
- [Clayton, 2018] Clayton, Jay. 2018 (5). The Evolving Market for Retail Investment Services and Forward-Looking Regulation — Adding Clarity and Investor Protection while Ensuring Access and Choice. accessed: 22 of April 2021.

- [Climent & Soriano, 2011] Climent, Francisco, & Soriano, Pilar. 2011. Green and good? The investment performance of US environmental mutual funds. *Journal of Business Ethics*, 103(2), 275–287.
- [Delmas & Burbano, 2011] Delmas, Magali A, & Burbano, Vanessa Cuerel. 2011. The drivers of greenwashing. *California management review*, 54(1), 64–87.
- [Eberhardt & Fligner, 1977] Eberhardt, Keith R, & Fligner, Michael A. 1977. A comparison of two tests for equality of two proportions. *The American Statistician*, 31(4), 151–155.
- [Evain *et al.*, 2018] Evain, Julie, Cardona, Michel, & Nicol, Morgane. 2018. Article 173: Overview of climate-related financial disclosure after two years of implementation. Climate Brief No. 59.
- [Eyraud et al., 2011] Eyraud, Luc, Wane, Abdoul Aziz, Zhang, Changchang, & Clements, Benedict. 2011. Who's going green and why? Trends and determinants of green investment.
- [Eyraud et al., 2013] Eyraud, Luc, Clements, Benedict, & Wane, Abdoul. 2013. Green investment: Trends and determinants. Energy Policy, 60, 852–865.
- [Fellner & Lünser, 2014] Fellner, Gerlinde, & Lünser, Gabriele K. 2014. Cooperation in local and global groups. Journal of Economic Behavior & Organization, 108, 364–373.
- [Getzner & Grabner-Kräuter, 2004] Getzner, Michael, & Grabner-Kräuter, Sonja. 2004. Consumer preferences and marketing strategies for "green shares": Specifics of the Austrian market. *International Journal of Bank Marketing*.
- [Glass, 1966] Glass, Gene V. 1966. Testing homogeneity of variances. American Educational Research Journal, 3(3), 187–190.
- [Graichen et al., 2016] Graichen, Jakob, Healy, Sean, Siemons, Anne, Höhne, Niklas, Kuramochi, Takeshi, Gonzales-Zuñiga, Sofia, & Wachsmuth, Jakob. 2016. Climate initiatives, National Contributions and the Paris agreement. *Berlin: Öko-Institute*.
- [Hamner, 2006] Hamner, Burton. 2006. Effects of green purchasing strategies on supplier behaviour. Pages 25–37 of: Greening the supply chain. Springer.
- [Houle, 2015] Houle, Sherilyn. 2015. An introduction to the fundamentals of randomized controlled trials in pharmacy research. *The Canadian journal of hospital pharmacy*, **68**(1), 28.
- [Ibikunle & Steffen, 2017] Ibikunle, Gbenga, & Steffen, Tom. 2017. European green mutual fund performance: A comparative analysis with their conventional and black peers. *Journal* of Business Ethics, 145(2), 337–355.
- [Inderst *et al.*, 2012] Inderst, Georg, Kaminker, Christopher, & Stewart, Fiona. 2012. Defining and measuring green investments: implications for institutional investors' asset allocations.
- [Initiative & Partner, 2020] Initiative, Investing, & Partner, Wüest. 2020. Bridging the Gap: Measuring progress on the climate goal alignment and climate actions of Swiss Financial Institutions. Im Auftrag des Bundesamtes für Umwelt. Bern.
- [Jaretzki, 1941] Jaretzki, Alfred. 1941. The Investment Company Act of 1940. Washington University Law Review, 26(3), 303–307.
- [Joshi & Rahman, 2015] Joshi, Yatish, & Rahman, Zillur. 2015. Factors affecting green purchase behaviour and future research directions. *International Strategic management review*, 3(1-2), 128–143.
- [Konana & Balasubramanian, 2005] Konana, Prabhudev, & Balasubramanian, Sridhar. 2005. The social–economic–psychological model of technology adoption and usage: an application to online investing. *Decision Support Systems*, **39**(3), 505–524.
- [Lampe & Gazda, 1995] Lampe, Marc, & Gazda, Gregory M. 1995. Green marketing in Europe and the United States: an evolving business and society interface. *International Business Review*, 4(3), 295–312.

- [Lawrence & Wong, 2017] Lawrence, Peter, & Wong, Daryl. 2017. Soft law in the Paris Climate Agreement: Strength or weakness? Review of European, Comparative & International Environmental Law, 26(3), 276–286.
- [Masciandaro, 2005] Masciandaro, Donato. 2005. Handbook of central banking and financial authorities in Europe: new architectures in the supervision of financial markets. Edward Elgar Publishing.
- [McKight & Najab, 2010] McKight, Patrick E, & Najab, Julius. 2010. Kruskal-wallis test. The corsini encyclopedia of psychology, 1–1.
- [Mésonnier & Nguyen, 2020] Mésonnier, Jean-Stéphane, & Nguyen, Benoit. 2020. Showing off cleaner hands: mandatory climate-related disclosure by financial institutions and the financing of fossil energy. Available at SSRN 3733781.
- [Morley, 2013] Morley, John. 2013. The separation of funds and managers: A theory of investment fund structure and regulation. Yale LJ, 123, 1228.
- [Mostafa, 2007] Mostafa, Mohamed M. 2007. Gender differences in Egyptian consumers' green purchase behaviour: the effects of environmental knowledge, concern and attitude. *Interna*tional Journal of Consumer Studies, **31**(3), 220–229.
- [Nicolas & Julie, 2018] Nicolas, Redon, & Julie, Nicolas. 2018. Nuance de reporting: Analyse du reporting climat et ESG des principaux investisseurs institutionnels français.
- [Parliament of the United Kingdom, 2000] Parliament of the United Kingdom. 2000. An Act to make provision about the regulation of financial services and markets; to provide for the transfer of certain statutory functions relating to building societies, friendly societies, industrial and provident societies and certain other mutual societies; and for connected purposes. (UK) 2000 c 8.

https://www.legislation.gov.uk/ukpga/2000/8/contents/enacted.

- [Parliament of the United Kingdom, 2012] Parliament of the United Kingdom. 2012. An Act to amend the Bank of England Act 1998, the Financial Services and Markets Act 2000 and the Banking Act 2009; to make other provision about financial services and markets; to make provision about the exercise of certain statutory functions relating to building societies, friendly societies and other mutual societies; to amend section 785 of the Companies Act 2006; to make provision enabling the Director of Savings to provide services to other public bodies; and for connected purposes. (UK) 2012 c 21. https://www.legislation.gov.uk/ukpga/2012/21/contents/enacted.
- [P.R. Shukla, 2019] P.R. Shukla, J. Skea, E. Calvo Buendia V. Masson-Delmotte H.-O. Pörtner D. C. Roberts P. Zhai R. Slade S. Connors R. van Diemen M. Ferrat E. Haughey S. Luz S. Neogi M. Pathak J. Petzold J. Portugal Pereira P. Vyas E. Huntley K. Kissick M. Belkacemi J. Malley (eds.). 2019. Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. *Inpress*.
- [Reboredo et al., 2017] Reboredo, Juan C, Quintela, Miguel, & Otero, Luis A. 2017. Do investors pay a premium for going green? Evidence from alternative energy mutual funds. *Renewable* and Sustainable Energy Reviews, 73, 512–520.
- [Richardson, 2008] Richardson, Benjamin J. 2008. Socially responsible investment law: Regulating the unseen polluters. Oxford University Press.
- [Rotaris *et al.*, 2021] Rotaris, Lucia, Giansoldati, Marco, & Scorrano, Mariangela. 2021. The slow uptake of electric cars in Italy and Slovenia. Evidence from a stated-preference survey and the role of knowledge and environmental awareness. *Transportation Research Part A: Policy and Practice*, **144**, 1–18.
- [Ryszawska & Zabawa, 2018] Ryszawska, Bożena, & Zabawa, Justyna. 2018. THE ENVIRON-MENTAL RESPONSIBILITY OF THE WORLD'S LARGEST BANKS. *Economics & Busi*ness, 32(1).
- [Sachdeva et al., 2015] Sachdeva, Sonya, Jordan, Jennifer, & Mazar, Nina. 2015. Green consumerism: moral motivations to a sustainable future. Current Opinion in Psychology, 6, 60–65.

[Sparkes, 2008] Sparkes, Russell. 2008. Socially responsible investment. Handbook of finance, 2.

- [Steg & Vlek, 2009] Steg, Linda, & Vlek, Charles. 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of environmental psychology*, 29(3), 309–317.
- [the Council of the European Communities, 1985] the Council of the European Communities. 1985. Council Directive 85/611/EEC of 20 December 1985 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) (EEC) no 85/611. http://data.europa.eu/eli/dir/1985/611/oj.
- [The European Parliament, Council of the European Union, 2014] The European Parliament, Council of the European Union. 2014. Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (EC) no 2014/65. http://data.europa.eu/eli/dir/2014/65/oj.
- [The European Parliament, Council of the European Union, 2019] The European Parliament, Council of the European Union. 2019. Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector (EC) no 2019/2088. http://data.europa.eu/eli/reg/2019/2088/oj.
- [the European Parliament, the European Council, 2009] the European Parliament, the European Council. 2009. Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) (EC) no 65/2009. http://data.europa.eu/eli/dir/2009/65/oj.
- [Wiener, 2006] Wiener, Jonathan B. 2006. Better regulation in Europe. *Current legal problems*, **59**(1), 447–518.
- [Wins & Zwergel, 2016] Wins, Anett, & Zwergel, Bernhard. 2016. Comparing those who do, might and will not invest in sustainable funds: A survey among German retail fund investors. Business Research, 9(1), 51–99.