



SCHOOL OF
ECONOMICS AND
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Climate innovations in the financial sector

The incorporation of climate-related risks into the financial analysis of
Swedish institutional investors and asset managers

by

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Abstract

A green transition requires to drive public and private capital towards investments in line with environmental norms. Scholars are constantly looking into the performances of sustainable finance and how to measure them. Yet, the perspective from financial firms on climate finance has hardly been studied. This research addresses this gap by offering a qualitative analysis of Swedish financial firms' incorporation of climate-related risks (CRR) into their financial analysis. The study consists of the interview of eight representatives of Swedish asset management firms and institutional investors. After describing how firms consider CRR, an analysis of the position of the firms in regards to the green transition is presented based on an adapted version of the three domains from Grubb, Hourcade, and Neuhoff (2014). Their framework is useful to understand decisions according to behavioral, neoclassical, and evolutionary theories. We found that the consideration for risks is shifting towards long-term perspectives with transition risks deemed more important than physical risks. The participants in our study showed signs of entering the transition, led by governmental investors and relying on international instruments to provide information and models. They mostly consider that CRR have not materialized yet and thus favor engagement strategies over divestments.

Keywords: Climate-related risks, Sweden, Financial risks, Financial innovation, Evolutionary theory

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1 Introduction

In November 2015, the world committed to the ambitious target of limiting global temperature well below 2 °C above pre-industrial levels, calling for a global and multi-sectorial mobilization of efforts toward one common goal (Paris Agreement, 2015). Forty years after the first alarms on the economic consequences of climate change (Nordhaus, 1977), in 2018, the Intergovernmental Panel on Climate Change (IPCC) warned the world against the high probability of global warming reaching a 1.5°C above pre-industrial age by 2052 and made tangible the negative consequences on Humanity (Masson-Delmotte, Zhai, Pörtner, Roberts, Skea, Shukla Pirani, Moufouma-Okia, Péan, Pidcock, Connors, Matthews, Chen, Zhou, Gomis, Lonnoy, Maycock, Tignor, Waterfield, 2018). This growing attention to climate change sheds light on the need for global action. One of the major concern is the capacity to create a “soft transition” with the support of new technologies (ESRB, 2016) and based on gradual shifts towards a low-carbon economy, which is a transition that maintains living standards and enable poverty reduction without losing time and irreversibly crossing boundaries. If the timing and solutions are still uncertain, all concur to the high cost of a green transition (Christophers, 2019; ESRB, 2016; Hall, Foxon & Bolton, 2017) and the incapacity for the production market to cover them without the active participation of the financial sector (Grubb, Hourcade & Neuhoff, 2014). For instance, the European Union estimates than an additional yearly investment of €175 to €290 billion is required to reach the target of the New Green Deal (European Commission, 2019a).

It is therefore a problem that is global in geography and actors, as the transition will not happen without the active participation of the population, the public sector, the businesses, and the investment community. With only 2% of the published work on climate change in 2015 within the field of economics and finance (McSweeney, 2015), there is a need to connect disciplines (Clapp, Alfsen, Torvanger, & Lund, 2015) and further analyze the position of the capital market in the transition. This research focuses on where the financial firms stand in the transition process. We especially look at Swedish institutional investors and asset managers. Since the country is a frontrunner in the transition, and investors have already shown concern for climate-related risks (CRR) for several years (Christophers, 2019) the case is particularly interesting.

Real concerns about the environmental outcome may be one of the drivers of green investment, however, most prominent investors are establishing investment strategies mostly based on traditional and rational indicators (Langlois & Lussier J. 2016). One topic that has drawn increasing interest from the financial sector is the CRR and their impact on financial performances. Climate-related risks are defined here as financial risks due to change in climate policies, poor anticipation of the transition to a low carbon economy, or physical destruction of assets (Task Force on Climate-related Financial Disclosures, 2020). Dietz, Bowen, Dixon, and Gradwell (2016, p.676) found that on a global scale and with no change in the proportions of emissions, *climate value at risk* is 1,8% which can be estimated to US\$2.5 trillion. Personalities of the economic world such as Mark Carney, governor of the Bank of England have publicly

warned about the high risks related to investments in fossil fuels (Carrington, 2019; Piketty & Jackson, 2015). Those comments are multiplying and followed by numerous multilevel initiatives to measure and mitigate them. The most important global action in regards to financial climate-related risks is the industry-led Task-force on Climate-related Financial Disclosures (TCFD) launched in December 2015, counting today over 1027 supporters accounting for more than \$12 trillion in market capitalization. TCFD encourages voluntary disclosure of climate-related risks. Even if non-binding, the tools provided by TCFD guide investors around unfamiliar non-financial risks and thus has the positive effect of increasing transparency of the capital market (Task Force on Climate-Related Financial Disclosures, 2019). The UN Principle on Responsible Investments (PRI) declared mandatory from 2020 for all their signatories to report according to the TCFD instrument (Principles for Responsible Investment, 2020)

Compared to the large initiatives that are the PRI and TCFD, the academic research on financial climate-related risks and the behavior of the investment community remains scarce (Diaz-Rainey, Robertson & Wilson, 2017). Climate-related risks are more often associated with sustainable finance than traditional investment strategies and thus much of the early research focuses on ethical or reputational concerns (Michelson, Wailes, Van Der Laan, & Frost, 2004). Nevertheless, the focus is shifting towards considering the financial impact on climate change, and this research is placed in this trend. We assume that there are benefits, beyond ethics and reputation for investors to incorporate climate finance. As represented in Figure 1, climate-related risks are a significant aspect of climate finance and do not only include ethical strategies (Hoggett & Nahan, 2002) such as Environmental, Social and Governmental (ESG) rating, Socially Responsible Investing (SRI), or Impact Investing.

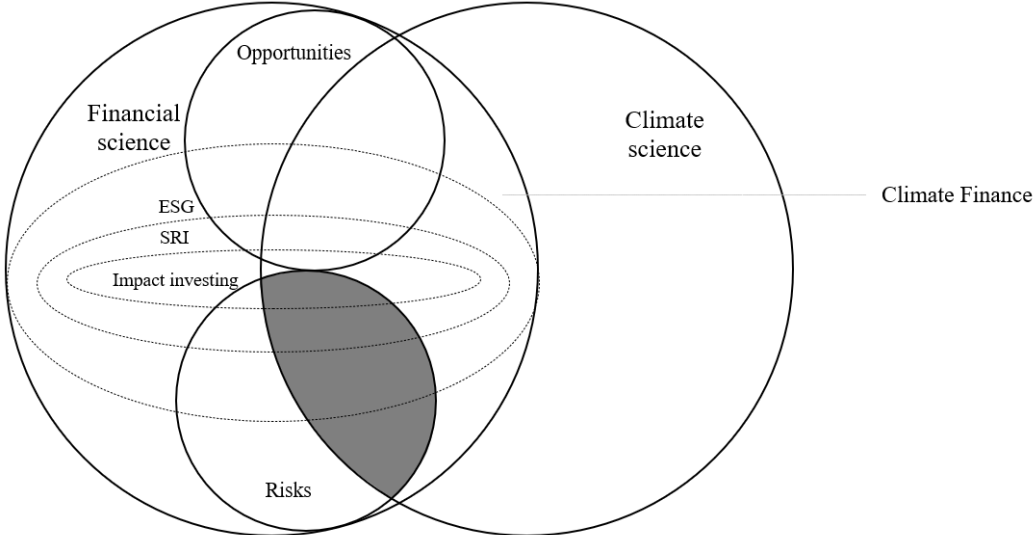


Figure 1: Visual representation of financial science and climate science.
 Source: Diagram constructed by the author, based on Caplan, Griswold and Jarvis (2013) and Michelson et al.(2004)

They can have consequences on financial performances. This point is developed throughout this paper. Ethical investment does not always correlate with low climate-related risks, because

ethics are much wider than environmental concerns and because ethical products are not constituted for risk-averse investors but for morally concerned investors.

An important part of the literature to date offers quantitative analysis on the relation between climate finance and performances. For instance, on whether sustainable investments offer better returns or have lower risks than traditional strategies (e.g. Caplan, Griswold & Jarvis, 2013; Dietz et al., 2016), on the carbon bubble (Ameli, Drummond, Bisaro, Grubb, & Chenet, 2019), on stranded assets (Caldecott, 2018; Thomä & Chenet, 2017) and on the incompatibility between short-term financial benefits and the long-term effects of climate risk which stems from classical schools to critical theories and the scientific community (e.g. Andersson, Bolton & Samama, 2016; Christophers, 2019; Clapp et al., 2015). Yet, many authors also highlight the lack of investors' and asset managers' perspectives in the academic literature. Davydov, Khrashchevskiy & Peltomäki (2019) observe that we have little information on how private investors pick the type of information to include in the analysis. Moreover, despite the multiplication of ratings, instruments, indices, and other innovations specific to climate-related risks, nobody really knows what investors think about these innovations (Christophers, 2019; Ilhan, Krueger, Sautner, & Starks, 2019). Besides that, there is little research that focuses on the risks on physical assets with all the attention turned to market risks. A few pieces of research on investor's perspective have been conducted on the broader topic of sustainable finance (Bergman, 2018; Nielsen, 2014) but, to our knowledge, there has been no qualitative research on climate-related risks and Swedish institutional investors and asset managers.

1.1 Aim and Purposes

In 2016, an estimated US\$23 trillion of assets were managed by professionals on a global scale. A 25% increase compared to the 2014 estimations (G20 Sustainable Finance Study Group, 2018). Further, Battiston, Mandel, Monasterolo, Schütze, and Visentin, G. (2017) indicate that in Europe, the percentage of high carbon exposure in regards to their total assets under management is of 1.3% for banks, 5% for pension funds and 4.4% for insurance. Hence, there is a need to investigate the role of asset managers and universal investors in regards to climate finance, a rather neglected area. So far, case studies on financial climate-related risks have a focus on the UK or the US (Christophers, 2019; Hall, Foxon & Bolton, 2017; Pfeifer & Sullivan, 2008). Yet, very few studies have explored the handling of climate-related risk elsewhere. With the current debates on the European Green Deal, it is essential to collect more data at a national level in the EU countries. With the hope to start filling these gaps, this thesis addresses the following questions:

RQ1: How do Swedish institutional investors and asset managers incorporate climate-related risks?

RQ2: Where does the financial sector stand in regards to innovation for climate finance?

RQ2a: What is holding back the integration of climate-related risks in their analysis?

RQ2b: What is motivating the integration of climate-related risks in their analysis?

To answer these questions, we gather qualitative data on Swedish institutional investors and asset managers through interviews and information retrieved from the firm's website and on the PRI website. We then analyze our data based on the three domains of economics by Grubb, Hourcade, and Neuhoff (2014). Their theory offers a framework to understand the different factors coming into the decision-making process and link the level of risk perception with the action. They set three categories distinguishing between short-term considerations with "satisficing" objectives, medium-term considerations with "optimizing" objectives and long-term considerations with "security" objectives (Grubb, Hourcade & Neuhoff, 2014, p.71)

The contribution of this research is twofold. First, we are providing information on central and influential actors of the financial sector by mapping the perception, behavior, decision factors, and preferences of institutional investors and asset managers. This research can serve as a preliminary investigation with a systematic approach, to make apparent motivations and issues that have been ignored so far. We provide a unique overall insight into the professionals' perspective on climate-related risks. Understanding the position of the professionals of the finance sector is useful to policy-makers, NGOs, multilevel initiatives, and all other actors working on setting environmental norms to better address the issues and guarantee the effective allocation of the capital.

Second, we have the epistemological ambition of bringing the disciplines together and offering a theoretical background to understand decision-making on financial climate-related risks. We are challenging and complementing the theories on financial innovation and offering an alternative analytical approach by connecting the economic literature on innovation and the traditional financial literature. We are questioning the neoclassical paradigm and looking at new theories and methods. In this context, it is not unusual to work with theoretical frameworks that go beyond the limit of one discipline (Buchanan & Bryman, 2007). These new methods are essential to stimulate innovation. For the sake of clarity, we place our research back into a model that includes different schools of thought. Based on this, we aim at presenting a broad map of the Swedish financial firm's decision-making on climate-related risks innovations.

1.2 Outline of the thesis

Chapter 2 of this research presents the scholar debates on financial climate-related risks starting with a search for historical examples and followed by a summary of the current institutional framework in Europe and Sweden. Then we present the CRR, the related financial innovations, and their adoption. In Chapter 3, we present our qualitative approach based on an adapted version from the three domains from Grubb, Hourcade, and Neuhoff (2014) and our interview-based case study. In Chapter 4, we present the statistical and descriptive results which allows us to provide an initial answer to our research questions 1. In Chapter 5, we analyze and discuss our results based on the three domains framework and show the importance of the evolutionary theory in the decision-making. Chapter 6 offers a brief conclusion with suggestions for policymakers and researchers.

2 Literature Review

2.1 Previous research

This section begins with a look into possible historical examples on similar questions. We then move to a short review of the present European and Swedish institutional finance landscape and policy development. Thirdly we define what are the financial climate-related risks and the debates around their existence and magnitude. Next, we present some financial innovations in CRR mitigation. Finally, we dive into the research on investors' perceptions and decision-making regarding CRR and innovations.

2.1.1 Examples from the past?

In investment strategies, policy-making, and sometimes in scholar analysis, climate finance is treated together with other ESG and innovation themes, from warfare stocks to tech markets (e.g. Hamilton & Eriksson, 2011; Michelson et al., 2004). Christophers (2019) argues that nothing comparable to climate-related risks has happened in the financial industry in terms of macroanalysis. Thomä and Chenet (2017) go further by asserting that the absence of historical data and examples raises uncertainty and prevents the financial sector to develop effective models. The debate over tobacco, often used as a comparison to climate finance, is indeed in many ways different from the current discussions on climate change, however, it is probably still the closest event that we have seen in the recent past over the institutional divestment movement and thus we deemed worth it to address it here.

In the 1920s, the Methodist Church already avoided certain stock, including tobacco for moral reasons (Nielsen, 2014). The debate grew louder in the 80' and 90' with the premises of the social responsibility movement and Medical Schools such as Harvard University moving away from the tobacco industry, their reputation turning their action an important statement (Wander & Malone, 2004). They have been followed a few years later by pension funds. Yet, by the turn of the century capital was returning to the industry (Fisher, 2000).

What is relevant to consider in this brief review of the tobacco capital market is when did the tobacco stock started to be viewed as not financially interesting. At what point did the costs or the risks took over the returns? Fisher (2000) presents the new US regulation of 1994 on tobacco and a series of lawsuits filed by 47 states against the tobacco industry as the main driver for divestment of pension funds. Kentucky was the only tobacco-producing state selling an important quantity of its tobacco stock (Fisher, 2000). Opposing Fisher's (2000) view on diminishing financial interest, Nathaniel Wander and Ruth Malone (2004), a renowned

researcher on tobacco and public health, argue that ethics is the main motivation for divestments, at least for medical schools.

However, they bring two other interesting findings to the debate. First, Philip Morris was not affected by the divestment from university because they found other investors. Second, that if the institution divests quietly, mostly to avoid breaking the academic-corporation partnership, they lose their leading role on ethics. Because of the first point, their impact on the tobacco industry is rather neglectable (Wander & Malone, 2004).

From this brief overview of tobacco stocks, we note that the leadership role of public institutions is not to be diminished. Furthermore, the tobacco industry has never been seen as a low return nor high-risk industry, the focus has been on ethical concerns rather than financial issues. In fact, some studies even found unexpected positive returns from the tobacco industry (Beneish, Jansen, Lewis, & Stuart, 2008). This is in line with the earlier argument that the capital market has not seen any similar situation in terms of risks (Christophers, 2019). Thirdly, that the tobacco industry recovered from the ethical debates and is still prospering decades later.

Counter-examples to the mediocre results of divestment from the tobacco industry can be found around international capital outflows from countries with institutionalized human rights violations. In 1985, in South Africa, amid the mobilizations calling for bottom-up reforms and a general instability, the risks of default and the political uncertainty drove foreign investment away (*Financial Times*, 29 August 1985, p. 2) with major consequences on the country's economy. In 2001, international investors left Myanmar under the impulsion of major European investors, followed by large companies (*Financial Times*, 3 Dec. 2001, p. 25). In both cases, the humanitarian effects of these divesting waves are debated (For South Africa: Hefti & Staehelin-Witt, 2011; For Myanmar: White, 2004), however, they show us, that ESG considerations are not so disconnected from performance and once again that leadership plays a role to create a major divesting movement.

2.1.2 The current Swedish context on financial climate-related risks

Christophers (2019) found differences in the sophistication of the CRR analysis between regions, some starting to look at the issue while others are developing their own models and scenarios. In the Americas, the financial CRR analysis is still at his infancy whereas in Europe, Asia, and Oceania they are more advanced.

International

In the last decade, the world has seen the proliferation of multilevel global and regional agreements on climate change. Following those new norms, many start-ups, NGO's or sectoral initiatives have been created on climate finance. For instance, to facilitate the implementation of the Paris agreement, the Paris Agreement Capital Transition Assessment (PACTA) tool was developed by an NGO to provide a software simplifying the integration of climate metrics into the financial analysis.

On December 11, 2020, the European Commission presented the European Green Deal, a milestone in climate politics with a detailed plan to make the European Union climate neutral

by 2050 (European Commission, 2020). At the core of the program is the role of financial resources to support all industries but there is a need for a massive mobilization of both public and private capital. Academic literature goes the same way by emphasizing the importance to have a smart and strategic combination of the public and private investors because neither could do it alone (Grubb, Hourcade & Neuhoff, 2014). In this prospect, the Commission adopted in March 2018 the Action Plan on Sustainable finance with three main objectives (European Commission, 2018, p.2):

- “reorient capital flows towards sustainable investment, in order to achieve sustainable and inclusive growth
- manage financial risks stemming from climate change, environmental degradation, and social issues
- foster transparency and long-termism in financial and economic activity”

Concretely, the EU developed two tools for investors. The first one is the Taxonomy, setting standards for sustainable activities. The details of the Taxonomy are still under discussion at the time of writing this research, however, it will provide norms on how a company is adapting their activities (Turnover) and how to proceed to an efficient screening (Capex and Opex). The second is the EU recommendations on Non-Financial Reporting Directive (NFRD) (European Commission, 2019b). In some European countries, especially the UK and France, the discussion on CRR has taken off and research at the national level can be found (Thomä & Chenet, 2017). In line with the NFRD, it is mandatory for investing firms in France to disclose non-financial information on their contribution to the climate goals and on transition risks since 2017 (Ministère de la Transition Écologique et Solidaire, 2019). Some pension funds in Europe already disclose their footprint, among which in Sweden the AP funds, KPA, and the Church of Sweden (Andersson, Bolton & Samama, 2016).

Sweden

Even if the EU Roadmap 2050 has not been accepted at the EU level, Sweden is among the countries that adopted it at a national level, committing to reach a neutral GHG emission level (Geden & Schenuit, 2019). Consequentially, we should expect changes in Sweden in the public and private sectors which makes it particularly interesting to study. The question of ESG investment is not new to the Swedish financial sector, with “engagement and voting” and “exclusion” strategies” being the favored ones. Yet, there is very little legal constraint on the Swedish industry which means that the transition will be driven by other mechanisms such as the leading role of certain funds (Eurosif, 2016). Möllersten and Källmark (2020) found that the most used reporting tools in the Nordics are the GRI, GHG Protocol, and the Carbon Disclosure Project (CDP).

The public Swedish pension fund systems, as it has been conceived after the last modification in 2001, is divided into six asset managers with different roles: Four buffer funds (AP1, AP2, AP3, AP4) with long-term returns and low risks mandates, a fifth buffer fund with a mandate oriented towards venture capital and unlisted companies (AP6) and a fund that serves as the default pension premium alternative (AP7). AP6 and AP7 are working under their own regulations. However, AP1 to AP4 are all operating under the AP Funds Act, but work independently from one another and with their own investment strategies (First Swedish National Pension Fund, 2020). All four are also guided by the ethical council which imposes to

take into account sustainable principles, although returns remain their main goal according to the AP Funds Act. 14% percent of the country’s pension assets are handled by AP 1 to AP4. According to Nielsen (2014), the objective behind having four different funds is to stimulate competition and obtain better returns. It also increases safety in investment thanks to the variety of investments strategy.

The Swedish pension funds have shown an early interest in the ESG standards since they are under a mandate to invest responsibly since 2001. Under this regime, pension funds are to include ESG indicators without sacrifice on the overall returns but no further explanation is given (Hamilton & Eriksson, 2011). According to Nielsen (2014), ethics, reputation, universal ownership, fiduciary duty, performance are motivating Swedish institutional investors to turn towards SRI. Hamilton and Eriksson (2011) find that AP1 to 4 favor engagement strategies compared to AP7 which favor an exclusion strategy.

2.1.3 Financial climate-related risks

If climate change and climate risks are intensively studied, there is still little consensus on the impact of CRR on the financial sector.

The TCFD (2020), an authority on financial CRR, divides them into:

- transition risks: policy and legal risks, technology changes, supply and demand changes and reputation risks
- physical risks: acute risks of material destruction and chronicle risks from changes in weather cycles

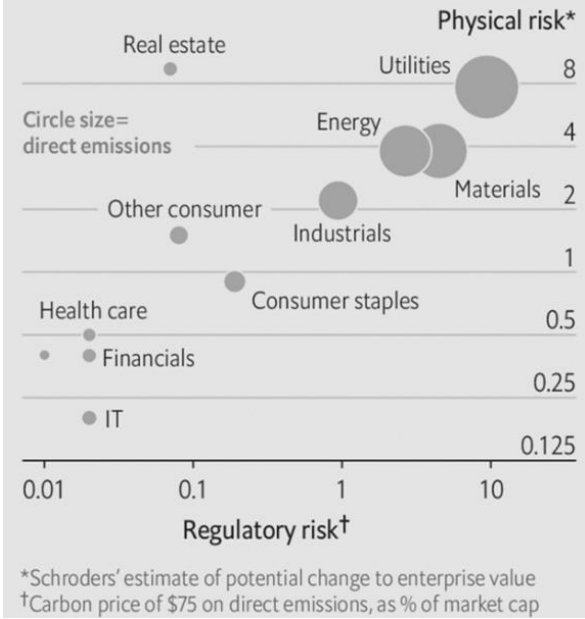


Figure 2: Regulatory and Physical risks
Note: Risks in percentages, from 2018, Log scale
Source: Adapted from Schroders, Bloomberg, The Economist

This denomination is used by professionals of the branch and appears more and more frequently in the literature. For instance, Dietz et al. (2016) write about destruction or depreciation of physical assets and the risks on the input/output ratio that diminishes returns. However, some authors use other frameworks or found other risks outside of the TCFD indications. It is for example quite frequent to see a third category with liability risks (e.g. The Economist, 2020) as in Figure 2.

Monnin (2018, p.11) offers a classification in three categories:

- *Direct risks* which disrupt the firm's operations (damages on assets or high emission cost, etc.)
- *Indirect risks* which disrupt the supply chain and input costs
- *Macroeconomic risks* which is a change in output market behavior

This framework reflects traditional theories. For instance, in the Arbitrage Pricing Theory, risk factors can be classified under either macro risks also called systemic risks or risk at the firm level where investors would expect risk premium for systemic risk and not for risks at the firm-level (Bodie, Kane & Marcus, 2014a).

One of the most discussed CRR is stranded assets (Bos & Gupta, 2019), which is the risk that some fossil fuel will not be used based on sustainable motivations (Andersson, Bolton & Samama, 2016). MacGlade and Ekins (2015) find that to reach the 2°C target, a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010 to 2050. They highlight the paradox with the state's strategies to completely exploit their local reserves and to carry out fossil fuel exploration. The uncertainty linked to the creation of new regulations increases risks as well (Andersson, Bolton & Samama, 2016). Another example of transition risks due to legal constraints is Volkswagen's manipulation of CO2 emissions (Langlois & Lussier J., 2016). All investors, regardless of their opinion on climate-change are thus encouraged to hedge against CRR to prevent policy or liability issues. Risks related to the fossil fuel industry and carbon emissions are very much discussed, although other sectors are at risk too. For instance, Hong, Li, and Xu, (2019) provide a detailed evaluation of the effect of drought on food production at a national level. This contribution offers an insight for investors on physical climate-related risks and once again highlights the poor market response to risks. Nevertheless, in Figure 2 the consumer staple shows relatively low physical and regulatory risks compared to other sectors.

In more general terms, Dietz et al. (2016) develop a method to quantify the climate Value at Risk (VaR) as the probability of loss on financial assets due to climate change. The VaR approach has become a widely used model with the Basel Committee on Banking, but relies on assumptions that are not empirically verified which has attracted many critics (Abad, Benito & López, 2014). VaR remains one of the best available methods. Dietz et al. (2016) model admits the absence of dividends in the short-run but assumes them on the long-run and take into account the increase in stock price. They also assume that the return of a diversified portfolio will reflect the economic growth and that debt and equity are perfect substitutes as stores of value, according to a neoclassical model of economic growth. Based on this assumption, Dietz et al. (2016) found that under a strategy of emission reduction to limit global warming to 2°C, the reduction in climate VaR is of 0.6 percentage point and even more pronounced at the tail

with 7.7 percentage points reduction at the 99th percentile. They, therefore, conclude on the effectiveness of reducing emissions to mitigate climate-related risks on the portfolio.

This summary and examples give a broad idea of the variety of potential CRR but also of their complexity. Even if recent literature is quite homogenous in recognizing CRR, empirically Christophers (2019) found that not all institutional investors he surveyed believed in the risks in the fossil fuel industries.

2.1.4 Climate finance innovation

We highlighted earlier the essential role of the financial sector to achieve a green transition. If all authors do not agree on the question of how to redirect the capital most efficiently and comprehensively, there is rather a consensus on the need for innovation in the financial sector. For instance, Hall, Foxon, and Bolton (2017) found that in the renewable energy sector in the UK, policymakers should not count on traditional finance instruments to automatically drive the transition to low-carbon because the capital might not suffice and this market is incompatible with the traditional balance sheet finance. They argue that the technology market is not guaranteed to show the returns of the traditional market and thus there should either be a turn towards unconventional investment and new institutions or research for new ways to attract the traditional investment community. The same reflections can be made about risks as we cannot expect the traditional tools to hedge against new risks as CRR. Furthermore, in a weak EMH, financial analysis uses predictions based on past behavior (Bodie, Kane & Marcus, 2014b) however this data does not give any indications in terms of climate-risks (Monnin, 2018) which are new and subject to growing regulation. In a semi-strong EMH, more information on the status quo is required which raises other issues on disclosures upon which we touch on section 2.1.5.

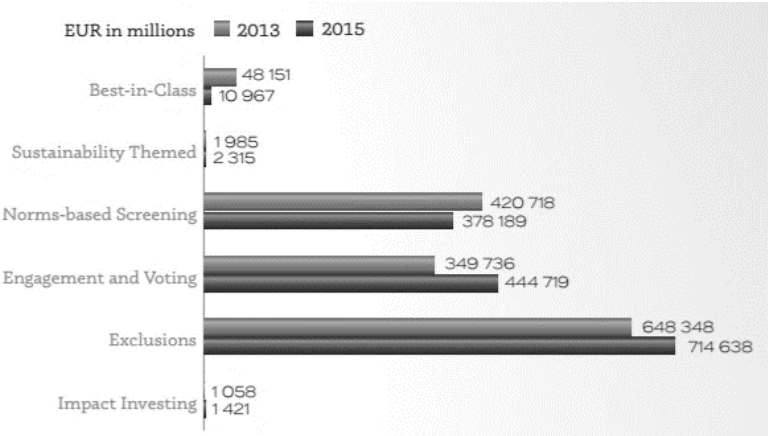


Figure 3: SRI strategies in Sweden

Source: Adapted from Eurosif (2016)

The solutions vary between the type and size of investors and whether they work on the active or passive market. Furthermore, the absence of standards for ESG strategies contributes to the chaotic amount of solutions labeled as green. As presented in Figure 3, in Sweden, Eurosif (2016) observed that between 2013 and 2015 shareholder engagement to push their holdings towards the sustainable transition and firms exclusions from their portfolios are the most used strategies and they suggested that engagement could even replace exclusion.

Exclusion

Exclusion strategies are widely discussed today and can take different forms. In passive investment, indices and benchmarks are often used. Andersson, Bolton, and Samama (2016) argue that the strategy to hedge CRR is not limited to exclusion but needs to be adjusted to address and even remove tracking error, making low carbon portfolio especially interesting. With active strategies, thematic portfolios, divestment, or complex valuation models (Möllersten & Källmark, 2020) are used. Similarly, the investors can promote green products per se or only hedge against CRR.

ESG notation is the most commonly used tool, yet it rarely provides a clear indication of the environmental performances and rather serves as an indicator of “best in class” (Möllersten & Källmark, 2020). Alternatively, it can serve as a minimum standard with systematic exclusion of anyone under the benchmark. Based on research showing that ESG screening does not alter performances and improves risk-adjusted returns, Verheyden, Eccles, and Feiner (2016) argue in favor of a systematic preliminary ESG screening regardless of the intention of the investor. ESG screening can also be used as a strategy to increase the performance according to the risks.

Shareholders engagement

One way of going around the fears of underperformance and higher risks due to negative screening is to encourage or even pressure firms in which investors are already investing to modify their behavior, whether it is by requiring more transparency or by forcing to enter the transition.

Investors' discussion with the firms in their portfolios can be classified into two categories: shareholders activism which covers traditional corporate behavior and shareholders engagement which refers to discussions to improve the ESG performances of the firm (Hamilton & Eriksson, 2011). Concretely, shareholders engagement can range from informal discussions to shaming and divestment (Hamilton & Eriksson, 2011). According to Hamilton and Eriksson's model, five factors are considered when it comes to choosing a strategy: Management's ESG experience and attitude, Interpretation of the directive, Dependencies (power and legitimacy), Reputation risk, Intended target audience. We notice that financial performance or risks are not included.

Michelson et al. (2004) claim that in most cases, activism is a behavior of institutional investors rather than individuals and it is argued that once they are big enough, ethical funds do have a say in a company's behavior. They find that this power might actually have a low environmental effect since financial firms still have short-term objectives to hold, for example, they might discourage R&D to reduce immediate costs. Overall, the research from a firm's perspective on the impact of shareholders engagement is still at its infancy.

In the same line as engagement, Nielsen (2014) mentions that institutional investors also might have the power to vote at a companies' annual general meetings with rather positive results on the private sector's involvement in corporate social responsibility. The limit is that this instrument can only be used with publicly listed stock.

2.1.5 Adoption of innovation

In the following section, we develop a debate around the various drawbacks of financial innovation on climate-related risks. Christophers (2019) highlights that most investors do not have extreme views on CRR. If they consider the risks as high, there might not divest but reduce their holdings to diminish the risks in the portfolio.

Costs and benefits

Arguments against sustainable finance are typically related to concerns on returns, opportunities, and risks (Andersson, Bolton & Samama, 2016) with investors fearing underperformance when shifting towards sustainable portfolios. According to Verheyden, Eccles, and Feiner (2016), a majority of studies show that there are positive correlations between ESG measures and the stock price performance as well as between ESG measures and operating performances. Furthermore, Andersson, Bolton, and Samama (2016) also reminded of the difference between looking for new sustainable industries and hedging climate-risks, the first strategy being likely to increase risks whereas the second one decreases them.

One argument against sustainable portfolios is the lower diversification leading to higher risks (Michelson et al., 2004) given that one of the most common strategies for ESG and responsible investing consists of excluding certain sectors or firms from the universe. Verheyden, Eccles, and Feiner (2016) find that in 75% of the observed cases, the returns from ESG screened portfolios justified the risks induced by the loss of diversification since ESG screening does not show significantly higher risks.

Other concerns are on the valuation of assets. Hoggett and Nahan (2002) argued that similar to the dotcom bubble in the US, the trend and high demand for sustainable products has created an "ethical bubble". This explains why we are currently seeing ethical portfolios outperforming but that on a longer-term the green bubble will explode.

It has also been argued that ethical funds are more expensive to manage because they are smaller and need information and expertise (Michelson et al., 2004). Ameli et al. (2019) have found that transaction costs and due diligence discourage low-carbon investments. Based on a model including abatement costs, Dietz et al. (2016) found that mitigation of climate-related risks under a 2°C scenario is more advantageous in terms of present market value and even more if the investor is risk-averse.

From data collection to financial analysis

One of the most discussed aspects of CRR among practitioners, policy-makers, or academics: the barriers around gathering data, comparing them, and transforming them into financial data. This area is prolific in innovations to create rankings and instruments, yet with little homogeneity.

First, it is loudly argued among the financial community that the major barriers to climate-related risk strategies are related to the lack of transparency and disclosures on operations from the firm's part. This assumption probably stems from the central position of the Efficient Market hypothesis (EMH) in neoclassical models and its increased efficiency correlated to the amount of accessible information (Fama, 1970). The issue of disclosure has been touched upon by the European Commission with the NFRD for disclosure from large firms (over 500 employees) (European Commission, 2019b). One of the most developed global tools in regards to climate-related risks is the Taskforce on Financial Disclosure (Task Force on Climate-Related Financial Disclosures, 2019). Another way to obtain information on a firm's climate behavior is to use data from third parties, such as ESG rating organizations (Möllersten & Källmark, 2020). From this disclosure efforts, rises the assumption that with a perfectly transparent reporting process, investors of all nature will account for the CRR in their analysis (Christophers, 2019) but the empirical results are still debated (Ameli et al., 2019). Andersson, Bolton, and Samama (2016) overlooking this, suggesting that all governments should be disclosing the carbon footprint of investments from their pension and insurance funds. They argue that, if risks are not mitigated then the population will eventually bear the costs through their pension and insurance, meaning that governments have to cover the costs of climate change. If governments compensate the losses from climate-related risks, then the burden is indeed on them, otherwise the population will bear the costs of climate change.

Then comes the issue of the use of this data. In an EMH, the price should reflect the available information (Verheyden, Eccles & Feiner, 2016). Traditionally, investors have relied on two sorts of information. Fundamental information includes a firm's financial statement and technical information that rely on the past performance of a company. More recently, a new set of information has come to complement the traditional analysis which is the ESG data (Verheyden, Eccles & Feiner, 2016). These new parameters are more often than not, labeled as "nonfinancial" performances which exclude them *de facto* from the traditional models. Thomä and Chenet (2017) reach a similar conclusion with a different methodology that might be deemed credible to some due to its proximity to traditional financial research: they suggest that climate-related risks models do not follow a normal distribution because of skewness and fat tails symptoms. According to Christophers (2019, p.769), this incompatibility of climate data and financial analysis reflects the impossibility of "external factor" to be included in the "internal" value analysis of the company. This leads him to find two majors limits to integrating climate information in the financial analysis: the traditions of using certain models and the generalized usage of such models because of the attraction towards conformity. Opposing this view, Thomä, Murray, Jerosch-Herold, and Magdanz (2019) argue that the improvements in information management allow to handle nonfinancial information. For example, several tools have been developed for this purpose, the most widely spread is probably the EU Taxonomy that serves as a sustainable rating tool (Möllersten & Källmark, 2020). However, many initiatives such as the EU taxonomy focus on transparency regarding the carbon emissions although carbon footprint is only a poor reflection of the financial climate-related risks and can hardly be operationalized by institutional investors who would need indications on the intentions to reduce emissions (Monnin, 2018).

Third, is the selection of the information to take into account, since the high number of financial and non-financial indicators available can become overwhelming (Thomä, Murray, Jerosch-Herold, and Magdanz, 2019), which is contrasting with the call for more disclosure discussed

previously. The discussion on which systemic factors to include when conducting a sound financial analysis has been at the center of traditional financial discussions for long (Chen, Roll & Ross, 1986). A lot of the attention has been turned towards the carbon footprint on financial climate-related risks measurement. Christophers (2019), finds that in many cases the chosen strategy to reduce carbon is not “scientific” but the right balance between showing good efforts towards green strategy and the capacity to put them into places. Consequently, there is no precise factor that has been selected.

Lastly, a barrier soon appears which is the rating of sustainable behavior due to the absence of common definitions and standards in labeling products as “green” (Möllersten & Källmark, 2020). We mentioned earlier products like green bonds or thematic portfolios, however, the absence of standardization also attains the credibility of ethical investment (Michelson et al., 2004). Any investor can declare any product sustainable and thus names are rather worthless. The absence of norms and standardization regarding “green” objects leads to an infinite number of products, ranking, and labels adding to the lack of real meaning to green investment (Ilhan et al., 2019).

Time horizon incompatibility

The questions of short-term and long-term risks have been substantially discussed in traditional and evolutionary literature and at first sight, the incompatibility with climate-risks seem to be quite straight forward; Investors take decisions on short-term perspectives counted in months, and climate change has long-term effects with risks that are to be considered over years or decades (Clapp et al., 2015; Möllersten & Källmark, 2020)

However, the reality is not so simple. Firstly, in the rational literature, recommendations on long-term risks can be found. For instance, Langlois and Lussier (2016), remind asset managers of the importance of the long-term perspective since short-term returns might only be due to “noises” and become invisible with on a longer time lap.

Secondly, Keynes (The theory of employment, Interest and Money (1936), cited by Christophers (2019, p.765)) points out the gap between the long assets’ life and the shorter timeframe for risk analysis. In other words, it is not only about short-term perspectives. It crystalized during Christophers’ (2019) interviews that when investors are planning to keep the company in their portfolio for about five years or more, then investors consider longer time horizons and start spontaneously weighing climate-related risks. This issue also materializes with bonds that are to mature for more than two years, Christophers (2019) found that the risks analysis changes in term of CRR. On the other hand, in the short-term, the cost of physical and transition risks can be externalized, hence asset managers do not need to bare them and choose to ignore CRR even if aware of them (Thomä & Chenet, 2017).

Another issue is the human preference bias for present gain over future gain (Hangartner in Wendt, 2018). This assumption has very strong implications because even if the financial innovations described above could be operational, there would still be a preference of the investor to ignore them and favor the short-term perspective (Thomä & Chenet, 2017).

In their research, Hall, Foxon, and Bolton (2017) found that the illiquidity and the long-term prospect of assets in renewable energy were indeed a barrier for insurance fund investors and

private fund managers, yet pension funds found themselves in a different situation since they have long-term mandates. In that case, the long-term character of these assets was considered a structural problem in the “investment chain” on the amortization period or the liquidity.

Cognitive bias

Another challenge to traditional risk assessment is the observation that investors are still human and therefore they cannot be a hundred percent rational (Langlois & Lussier J., 2016). Christophers (2019) finds that even if they are considered to be rational by all other stakeholders, investors themselves admit that they make subjective decisions. Different parameters such as emotion, motivation, external influence will interfere with the pure rational decision-making. Moreover, individuals can only focus on a finite number of parameters when making a choice, hence they are meant to pick which are the "right information" to include to improve performances (Davydov, Khrashchevskyi & Peltomäki, 2019, p.3). We argue that this behavior can be transposed to firms as they also have a defined number of employee and time restrictions. These biases can lead investors to neglect factors such as climate-related risks for various reasons listed below.

Langlois and Lussier, building on Keynes' contribution to rationality, mention for example that humans usually consider that an event is more likely to happen if they can clearly understand it or recall it (Langlois & Lussier J., 2016). Risks associated with climate change are often complex and come together with other ESG risks, adding parameters to the equation. According to Andersson, Bolton, and Samama (2016), there was little knowledge from investors on the GHG emissions of a portfolio. In summary, we could suppose that, because investors are still unfamiliar with CRR and rarely directly exposed, the cognitive bias drive them to underestimate the risks or the proportion of the consequences. Going in the same direction, Andersson, Bolton, and Samama (2016) defend that one of the positive outcomes of their decarbonized index is to increase investor's familiarity and sensibility to climate-related risks. Christophers (2019) argues that, in a firm, what matters is how the ultimate decision-maker such as the asset manager or the chief of risk think about climate-change.

Christophers (2019) finds a cleavage between a few investors who consider that divesting has an impact on firm behavior, in his case fossil fuel producers, and the investors who argue that they do not have any impact because if they divest other investors will be replacing them. Furthermore, he shows that some investors believe that remaining invested but calling on the firm to take environmental action has more impact. On a critical note, we consider that it might also be a convenient argument for investors to justify their investment.

Fiduciary duty

Opponents to the divestment movement often use the argument of fiduciary duty, arguing that including ESG aspects would mislead their analysis. Several investors perceive their duty as limited to performance and thus it would be irrelevant to consider sustainable questions if they do not impact the financial returns. (Bergman, 2018; Christophers, 2019). Surprisingly, Christophers (2019) finds that the definition of fiduciary duty is evolving and some respondents to his interviews started including nonfinancial responsibilities in the scope of fiduciary duty. They, therefore, include sustainable indicators when they consider it has an impact on financial performances or when it has been dictated by law, for example in the case of public pension funds (Nielsen, 2014).

2.2 Conceptual debates

In the previous section, a pattern appeared between approaches that attempted to integrate climate-related risks into the neoclassical models, and school of thoughts that rejected the traditional approaches as a whole. In climate finance, some resort to deontological arguments arguing towards a more ethical society (Wendt, 2018), others to consequentialist perspectives challenging the EMH by pointing out market failures and the financial consequences (Thomä & Chenet, 2017). We do not take a position on the ethical incentives or performances since it is not the point of this study but we assume that there are moral and financial incentives to climate finance, embodied for instance by climate-related risks. While the academic debate is quickly growing, the research on the opinion and decision-making of the central actors on the question -financial firms, has been seldom investigated.

The boundaries of social science theories are blurry (Buchanan & Bryman, 2007) and a reflection of our socio-economical context (Grubb, Hourcade & Neuhoff, 2013); the twenty-first century has seen a growing interest for the pressing issue of environmental protection which are marginalized in traditional approaches. This creates a paradoxical situation where many sectors and policy-makers keep on working with neoclassical instruments but to solve issues such as social and environmental questions that are different from the one in the era when the instruments were created (Hall, Foxon & Bolton, 2017). Most authors we have reviewed do not position themselves clearly in a School of Thought and rather draw from various perspectives (Christophers, 2019; Ilhan et al., 2019; Pfeifer & Sullivan, 2008).

Grubb, Hourcade and Neuhoff (2013) structure economic research into three pillars of economic corresponding to three levels of actions, which have the ambition to be comprehensive but not mutually exclusive. The first pillar labeled as behavioral and organizational, corresponds to the individual or organizational decision-making and challenges the assumption of the rational *homo economicus*. Second, the Neoclassical and Welfare economics pillar is the major framework for economic analysis under the neoclassical hypothesis. This pillar stems from the dominant Efficient Market Hypothesis (EMH). Third, the Evolutionary and Institutional economics pillar takes a long-term approach and looks at developments as embedded in systems. They define that in the third domain the need for security is more important. They map three pillars that can be used as a general framework for in economics but they always draw the analogy with the environmental challenges and in particular with the energy transition and encourage its usage on different research. We argue that it is compatible with the research on climate-related risks.

In their seminal work, Grubb, Hourcade and Neuhoff (2013) highlight that now a day, policies on prices, expectation, and investment are mostly created in light of the neoclassical and welfare economics as it encompasses the mainstream economic theories. Yet, they claim that some major achievements of the last decades tend to the third pillar, with the most prominent perhaps being the European integration. They further assert that the choice of the domain is not just ideological and that in reality, it is virtually impossible to remain exclusively in one domain. They find that with the prevalence of the Sustainable Development Goals, the global economic strategy, and long-term prospects all three domains are equally important and used. However,

their analysis shows that the first and third pillars have a more prevalent adaptation capacity, even if path dependency remains valid. To summarize, we could say that the first and second domain are useful to understand the current situation, while the first and third domains can offer new solutions.

3 Methodology

Our research question could be qualified as multidisciplinary in the sense that by observing the behavior of actors in the financial sector, we find ourselves at the intersection of social science and financial science. Both subjects will give us insights to understand the incentives shaping the decision-making process of our observed population. As a reminder, our research question was looking into the perception and position of investors and asset managers regarding the climate-related risks. Due to the scarce literature looking at financial firms as an actor of sustainable development there is no well-established theoretical framework. We, therefore, proceed to create the most efficient one by combining existing studies. Our data is obtained during interviews with professionals representing a financial firm.

3.1 Research Approach

The aim of this analysis is to give a structure to our subject of study while tending towards a comprehensive mapping. To do so, we combine three authors. First, Grubb, Hourcade and Neuhoff (2014) offer a well-constructed framework to understand decision-making and influences in regards to sustainable development based on three domains: Behavioral, Neoclassic, and Evolutionary economics. They argue that the three domains are comprehensive but not mutually exclusive. They created and applied this tool to the scope of energy transition and focus on industrial actors, customers, and policy-makers within the energy industry but encouraged to use it across other sectors. We apply it to the financial industry. However, this framework needs to be slightly readjusted to our needs and operationalized to be used for analysis (Van Campenhoudt, Quivy & Marquet, 2011). For this, we use two other pieces of research: *Environmental Beta or How Institutional Investors Think about Climate Change and Fossil Fuel Risk* from Christophers (2019) and *Investing in low-carbon transitions: energy finance as an adaptive market* from Hall, Foxon and Bolton (2017) who serve to apply the three domains framework to the financial industry. Both papers are qualitative analysis on the view of financial firms over the energy and fossil fuel industries. The final framework that we use is presented in Table 1.

Table 1: Conceptual framework

The three domains of climate finance

	Domain 1	Domain 2	Domain 3	
Grubb, Hourcade and Neuhoff (2013)	<i>Behavioral and Organizational</i>	<i>Neoclassical and Welfare</i>	<i>Evolutionary and institutional</i>	
	Time Scale:	Short-term	Long-term	
	Society Scale:	Individual	Meso	Systemic
	Decision framework:	Indifferent	Rational	Transformational
	Risk Conception:	Ignore/Satisficing	Compensate/Optimize	Secure/Transform
	Realm of opportunity:	“Smarter choice”	Substitute cleaner products	Innovation and infrastructure
Christophers (2019)	<u>Subjectivity</u>			
	Thinking about Risk Imperfectly and Individually			
	<u>Convention</u>			
	Thinking about climate risks as calculable risk			
Hall, Foxon and Bolton (2017)	<u>Economist</u>			
	Thinking about climate-related risks as financial risks			
	<u>Temporality</u>			
Thinking about risk in time				
			<u>AMH</u>	
			Strategic investment	
			Evolutionary, systemic change	
			External (structural) change has an impact	
			Routines and uncertainty	

Source: Adapted from Grubb, Hourcade and Neuhoff (2013), Christophers (2019), Hall, Foxon and Bolton (2017)

In his research on how investors “think” (p.754) about climate-related risks, Christophers (2019) puts his finding into four “tropes” (p.756): : subjectivity, economist (behavioral and rational thinking), temporality, and convention (habits), which already offers many insight on how investors integrate CRR. However, he only offers a static picture of the decision-making and barely touches upon structural changes or policy constraints, which would correspond to the third pillar. He merely focuses on the bias and behavioral patterns in decision-making and

on the usefulness and incompatibility of a neoclassical framework on climate-related risks but overlooks the structural changes in different industries and on policy level, many factors who play a changing role on the perception of risks. We argue that this significant omission prevents from understanding the position of the financial sector in regards to CRR and we proceed to complement it with the research from Hall, Foxon and Bolton (2017)

While, Hall, Foxon and Bolton (2017) barely consider the First and Second domains, they substantially contribute to the Third Domain. Hall, Foxon and Bolton (2017) take further the three domains framework from Grubb, Hourcade and Neuhoff to align it with the renewable energy financial market in the UK. They argue that there is a theoretical void in the Third domain when it comes to the analysis of the financial sector and fill it with it the Adaptive Market Hypothesis (AMH) (Lo, 2012). They also argue that the Evolutionary theory from Grubb, Hourcade and Neuhoff (2014) was still tied to the EMH since the diffusion of policies relied on their efficiency with the market and thus not acknowledging the role of structural change. In consequence, they suggest using the AMH model that considers intuitional and structural constrain as well as changes over time. Their research offers consistent results aligned with the financial sector and we thus use their contribution when conducting the analysis within the Third Pillar. This theory can be applied under the four following conditions: (1) Investors are rational to a certain extent, (2) operate under constant structural changes due to regulations and/or technological progress, (3) that the capital market affects the real economy, (4) and the actors of the climate finance market are evolving. The Swedish financial market fulfills those four requirements since (1) the first domain shows that even if they measure risks and opportunities, subjectivity also plays a role, (2) the period is marked by new climate policies on every level and intense research for green technologies, (3) major actors of the Swedish economy recognize the strong link between the financial market and the economy as shown by Thomas Franzén (2016), (4) it is more difficult to fulfill as there a not many new Swedish firms specialized in climate finance, rather well-establish firms that turn to this new market.

To summarize, Grubb, Hourcade and Neuhoff (2014) presents their three domains framework as a tool to understand the decision-making in regards to sustainability in any sector. They provide keys to understand risk perception, scale of analysis, timeframe, etc. which is valuable for creating a questionnair and interpreting the answers. However, this theoretical framework needs adaptation in order to be applied to the financial sector. We therefore invoke two other papers in order to operationalize the framework. The first one, from Christophers (2019), does not consider structural change in depth, and the second one, from Hall, Foxon, and Bolton (2017) suggests to use AMH to understand evolutionary behavior. Using those three studies as combined in Table 1 allows to structure our analysis and conceptualizes the research into observable categories. It also places the different observations back into theoretical knowledge. Moreover, it offers a new theoretical framework that is especially useful to understand institutional investors and asset managers behavior toward CRR and broader environmental issues.

Our research design has the advantage of offering an overall view of the situation. Rather than detailing one aspect, we aim at mapping all the different factors that can come into play when it comes to climate finance decision-making. We are hoping to bring the research a step closer to a comprehensive mapping.

3.2 Research Design

We are conducting a multiple case study on Swedish institutional investors and asset managers. To perform this analysis, we carry out eight semi-structured interviews, anonymize the answers and analyze them according to a qualitative design. This method is frequently used in social science but less common in economic science (Lenger, 2019). It has the advantages of enabling good complementarity between the existing theory and the new data (Schmidt, 2016) and is appropriate because of the exploratory nature of our research (Creswell, 2014); we are placing the case of Swedish investors within the three domains framework but by doing this we also aim to provide new observations and analysis on a topic that has been scarcely touched upon by the academic literature.

Case studies have the advantage of taking into account the context of the participant. Decision-making strongly reflects the social reality of the subject (Lenger, 2019), thus, the qualitative methods are particularly appropriate since we are trying to understand the *social world* according to its actors. (Bell, E., Bryman, A., Harley, 2018). This feature allows us to place a behavior back into a domain and explain the source of it. In this research, firms are treated as organizations with objectives that attempt to make rational decisions but are indeed influence by their context. In fact, organizations and individuals often have similar behavioral patterns and interests (Grubb, Hourcade & Neuhoff, 2014) since ultimately strategies are defined by individuals. Conducting interviews with a member of the firm is a way to understand the firm's strategy and decision-making process. Moreover, using anonymous interviews offers unique data that goes beyond the company's official publications.

Qualitative research also presents the opportunity to observe all the aspects of a situation and thus one particular quality of a sample must be its *contrastability*. (Lenger, 2019, p.949). For this reason, it is important to cover a variety of participants in our sample regardless of the quantitative representativity of the whole Swedish investment ecosystem. Larger firms have different roles and strategies than those operating on a smaller scale, however, in the mapping of behavior, all investors are equally important to observe as they might adopt different strategies. Our final sample is composed of eight recognized firms on the Swedish market but of different natures, sizes, mandates, and specialization as presented in Table 2. Our research aims at mapping the views of financial firms on climate-related risks, hence we looked for the widest possible set of firms to interview. The Swedish firms we are observing invest nationally and internationally.

Table 2: Participants in the case study

Details on the eight interviews

Date of interview	Name of firm	Asset under management in 2019 (Billion SEK)	Number of employees	Interviewee in the ESG department	Interviewee in the risk department
April 2020	Asset Manager 1	<100	< 100	X	
April 2020	Asset Manager 2	<100	< 100	X	
May 2020	Asset Manager 3	<100	< 100		X
May 2020	Public Pension fund 1	100 < 600	< 100	X	X
May 2020	Public Pension fund 2	100 < 600	-	X	X
May 2020	Public Pension fund 3	100 < 600	-	X	
April 2020	Pension and Insurance firm 1	> 600	> 100	X	
June 2020	Pension and Insurance firm 2	> 600	> 100		X

Note: X indicate that the interviewee is working in the indicated department. X in both columns indicates that the person interviewed worked at both departments or coordinates them.

We classify the participants in three categories and particularly focused on having representatives in each category. The number of representatives does not mirror the size of each category.

- Asset manager (AM): Asset management firms
- Public Pension Fund (PPF): Swedish pension funds (Allmänna Pensionfonderna or AP-Funds)
- Pension and Insurance Firm (PI): firms offering occupational pension and insurance services

One essential characteristic of the participants is the attention, even if very limited, to climate-related risks. Firms with no interest in CRR will not be able to discuss the drivers nor limits they have encountered. We only contacted investors who are supporters of TCFD to target firms that are already involved with CRR. Our sample selection was strongly influenced by the

investor's availability and desire to answer. Fifteen financial firms have been contacted by email or phone call and the eight who accepted to participate constitutes our sample.

Once the data collection is done, we proceed to the analysis of the data to find patterns of behavior and use it to reinforce the existing research or complement the theory with new findings. Qualitative research typically involves interpretation of the results by the researcher (Creswell, 2014) who is by definition, part of a system and thus not neutral, however, our analysis is driven by the three domains framework to ensure transparency.

3.3 Data Collection Method

Collecting data through interviews is a marginalized method in economics as it has most often been deemed as a less trustworthy approach. Yet, some subareas of studies such as developmental economics, institutional economics, or environmental economics have accepted qualitative research to a higher degree (Hall, Foxon & Bolton, 2017; Lenger, 2019). The choice of conducting interviews to collect qualitative data is embedded in a growing epistemological debate on the role of qualitative analysis in the field of economics. Organizational research is not limited to the traditional quantitative and inductive methods but has grown to include a variety of theories and paradigms including critical, constructivist, feminist or postmodern perspectives to name only a few (Buchanan & Bryman, 2007). From these new approaches, naturally rise new data collection and analysis methods. In itself, semi-structured interviews are not innovative, however, they have been very rarely used as a method to approach the financial sector.

Our research is framed in a very recent field of research which prevented us from using a database and lead us toward the collection of primary data. We believe that interviews are the most efficient method for our design. Interviews based on explorative survey are the most appropriate to have comprehensive data including new, unknown parameters. We set up online meetings with professionals of eight companies. Interviews were conducted in English via online calls with a camera. All our interviews were recorded for practical purposes to facilitate the analysis and to enable direct quotes, but the participants were guaranteed anonymity.

The interviews were structured by a questionnaire consisting of open and multiple choices questions that we had developed based on the theory applied the climate-related risks described above and inspired from previous case studies conducted in Sweden, in the UK and Switzerland (Christophers, 2019; Hall, Foxon & Bolton, 2017; Ilhan et al., 2019; Nielsen, 2014).

Even if our initial set of 45 questions was standardized for all interviews, we decided to keep a semi-structured format to offer the possibility for the interviewer to ask questions that are specific to the nature of the participant. This flexible procedure also allowed to dive into unexpected information provided by the participant (Schmidt, 2016) which is the strength and main advantage of qualitative as a research method. (Lenger, 2019).

3.4 Data Analysis

We followed the guidelines from Schmidt (2016) to perform our analysis. She recommends to create categories and code the collected data into those categories, to then proceed to systematic analysis.

We code our data into three categories mirroring the literature review:

- Description of the current situation
- Considerations on financial climate-related risks
- Considerations on climate finance innovations

We present our results according to these categories. They offer the necessary insights to answer our first research question:

RQ1: How do Swedish institutional investors and asset managers incorporate climate-related risks?

The first question rather requests a descriptive answer. We are also interested to understand how and why CRR are incorporated in the financial analysis. This analysis corresponds to our second research question and sub-questions:

RQ2: Where does the financial sector stand in regards to innovation for climate finance?

RQ2a: What is holding back the integration of climate-related risks in their analysis?

RQ2b: What is motivating the integration of climate-related risks in their analysis?

To conduct a systematic analysis and to compare our results to a sound theoretical basis, we use the three domains framework presented above and divide our analysis into the five mentioned categories: Subjectivity, Convention, Economics, temporality, AMH

3.5 Validity and Reliability

One of the major criticisms toward qualitative research is the reduced credibility. Patton (1999, p.1190) gives three methods to tackle this issue: rigor in the data gathering and analysis methods, credibility of the researcher, and the conviction of using the right method with qualitative analysis.

3.5.1 Rigor in the data gathering and analysis

Creating a survey that can be understood and answered by all participants according to their knowledge is a condition for a reliable data collection (Fowler, 2004). During the interviews,

the conversation was fluid and the participants were able to answer quite spontaneously. We believe that they answered to the best of their knowledge, some of them even provide further information by email after the interviews. However, online conversations are less spontaneous than in-person meetings, and technical inconveniences sometimes interrupted the flow. The participants might also have omitted what they would consider details for the sake of simplicity. Furthermore, based on the answers that have been collected, we realized a posteriori that some questions were not precise enough to be able to quantitatively compare the data of all participants on every question which is probably the weakest point of our data collection. However, we gathered a large amount of reliable data to conduct a sound qualitative analysis, draw patterns, and gain valuable insights.

The data collection method is based on interviews meaning that our sample is partly determined by the willingness of professionals to participate. Likely, we only received an answer from investors who are to some extent, proud of their accomplishments within the sustainability norms. This bias could affect the representativity of our sample. One way to prevent it has been to guarantee anonymity, since participants need not to show good behavior in regards to sustainability. When we contacted the participants, we made it clear from the beginning that their name not going to be cited. Guaranteeing anonymity to reduce reputation concerns. At the beginning of their interview, they were reminded that the answers are anonymous. Based on the received answers, we believe that the non-participation of contacted firms was due to time constraints rather than reputation issues, and thus participants reflect the behaviors of the population. Anonymity also encouraged participants to give more honest answers (Thomä et al., 2019). Interviewees have informed us that anonymity facilitates the participation and enable them to disclose more information. Yet, we expect participants to exaggerate the actions undertaken by their firm toward sustainability. The multiple-choice questionnaire encouraged participants to address all aspects of an answer without omissions, for example by ranking the risks. On the downside, some information might be less accurate due to anonymity as they feel less accountable. Overall, we consider that anonymity enhances the reliability of our data.

We submitted the request for an interview together with the questionnaire for the participants to know beforehand what kind of questions they would be asked. Most of the participants had already reflected on the questions ahead of the interview. Giving the questionnaire ahead of the interview can also introduce a bias as the answers might be less spontaneous. Yet, since we are not collecting data on the individual but on the firm they are representing, previous research and reflection is most probably useful for the accuracy of the answer.

Sometimes, our participants went astray from pCRR to cover ESG analysis in general, probably because it is a most common approach and their perspective does not always distinguish. Although during the interview we repeated that we are talking precisely about CRR, some answers might not be fully accurate.

To conduct a rigorous and structured analysis we use an adaptation of the three domains framework from Grubb, Hourcade, and Neuhoff (2014) which offers a clear theoretical basis. Our interviews have brought us a considerable amount of data, not all of them are directly relevant to our research and thus some questions are ignored in the final analysis although they could serve for other purposes or further analysis.

In the context of semi-structured interviews, Schmidt (2016) warns against the risk of missing out some information provided by the participant because the researcher focuses too much on the expected answers. As we used a multiple-choice questionnaire, the expected answers are the possible answers. More often than not, the participants completed the possible answers with extra information or disagreed with the proposed answers. Even if the existing answers might create a bias, using such a methodology facilitates the distinctions between the theory and new inputs.

3.5.2 Credibility of the researcher

This research is written in the context of research on sustainable development. Hence there is an obvious and accepted bias towards tackling climate change, however, the author gives high attention in placing this research in a consequentialist framework (as opposed to deontology) that excludes normative judgment. The sustainable context serves to highlight the importance of looking at climate change questions rather than to downgrade any sort of behavior.

3.5.3 Right method

The qualitative nature of the research and the semi-structured interviews are seen as the only possible approach due to the state of the art in sustainable finance. We collected the data for the purpose of the study which enhances the validity of this data.

At the beginning of this research, we found ourselves looking at a situation that has been seldom investigated and thus many possible ways to look at it. We chose the broader one to identify the trend, and paved the way to understand the financial sector's perspective on climate-related risks. This required to explore many possibilities and the most adequate way to proceed is with qualitative methods.

3.6 Limitations

It is worth mentioning that this study took place during the first outbreak of Covid-19, a period of high uncertainty and major global questioning. This situation prevented intended in-person interviews and certainly influenced the answers of our participants who, often spontaneously, admitted that the pandemic has and will have an influence on their behavior and the financial performances, as it can already be seen in the oil industry.

One aspect of research is its generalization potential (Creswell, 2014). Even if our analysis offers good insights into our sample, we do not consider that our data has a high generalization potential. The global pandemic not only attained the quality of the data collection but also has an impact on systemic and environmental risk perception. These special conditions also pose a limit to the replication of the study since this level of global uncertainty is seldom observed. Furthermore, the Swedish context and regulations are unique. Finally, the anonymous quality

of our interviews prevents the disclosure of detailed characteristics of our subjects which could have allow us to draw parallels with other subjects of similar characteristics. We can therefore not affirm that our sample is representative of the whole market.

To summarize, we acknowledge that interviews as a method for data collections come with some limits in terms of representativity and generalizability in geography. Nevertheless, we argue that it is a very useful method to explore new behaviors such as the rising interest for climate change in the economic world and that the method can be applied beyond climate-related risks.

4 Results

In this section, we look at how Swedish institutional investors and asset managers integrate CRR. In Appendix A, displays the standardized questionnaire. Appendix B shows the three additional questions addressed to PPF only. In this section, we present the answers obtained during the interview, and when relevant for the analysis we show the descriptive statistics in Appendix C.

4.1 Incorporation

All our participants presented some interests in climate-related risks since we have selected them based on their participation in TCFD. In Q9, all participants indicated that they integrate climate-risk scenarios in their analysis although mostly on a general level, and not necessarily on every operation. Table 3, shows which strategies are considered.

Table 3: Answers to Q21

	Negative screening: Reducing portfolio exposure to carbon-intensive investment?	Positive screening: Promoting climate-friendly investment	Advocate for the adoption of a climate friendly strategies by the portfolio companies	Community involvement: involving low-income communities by investment or donations	Divestment from sectors with high transition risks	Divestment from high physical risks sectors	Thematic portfolios	Prices according to risks	Other
Q21. Which action(s) would your firm consider to carry out in order to reduce climate-related risks?	7	5	8	1	4	2	2	1	1

Note: This table indicates how many times each category has been selected. All eight participants answered this question.

We can divide our sample into three groups according to the moment firms started considering CRR.

First, Asset Manager 1 focused on active and long-term strategies, have not known any special change in their approach to CRR for two decades. Based on their strategy, not created for sustainability purposes specifically, they present low or no investment in sectors that are deemed as very high risks. Hence, they consider that they are already oriented towards low climate-risks portfolios, and even if CRR is included in the ESG analysis, its only one aspect of many sustainable issues because it counts as an ethical question rather than a risk issue. They explained that every investment is systematically reviewed by the sustainability team, and every year they are to update the assessment to observe the change. In Q39, a participant explained that they started to look more into sustainability in general “when companies started to change. Due to regulations, requests of their clients, or change in demand”. We, therefore, understand that, in this case, the risks are entirely integrated with other traditional financial risks.

The second group includes two participants, PPF3 and PI2. They are earlier observers of CRR, with discussions and exclusion strategies starting around 2010. Those two firms are currently actively looking to deepen their analysis of CRR. PPF3 indicated that the discussion was sparked by a Conference of the Parties of the UNFCCC and international debates on stranded assets. According to Q38, actions followed in the next five years. The exclusion strategies have now become business-as-usual. PI2 indicated that their strategy was influenced by the consequences of climate hazards and losses, actions from the leader in the market, and the newly available tools.

In the third group are the firms that have been turning their attention to the CRR in the last two to four years. Those five firms are all at different stages of adopting strategies to integrate CRR into their activity, ranging from formalizing the analysis on financial climate-related risks to having taken divestment measures. These investors mostly mention their fiduciary duty as their main motivation for incorporating CRR in their analysis. Risk started to materialize in the form of shadows of regulations and long-term responsibilities for pension and insurance firms. Client requests -and in fact institutional clients, was only mentioned by one AM.

The three Pension Funds signaled their independence in strategic decisions. The choice of including CRR and divesting is taken regardless of the other PPF’s strategy. On the contrary, they rather work together given that they are all governed by the same law and ethical committee. The latter sets the minimum standards and AP funds are free to adopt their own strategy accordingly.

Our participants were largely reliant on internationally developed instruments. Q42 showed that the IPCC Report is the most widely used instrument to understand what are the CRR. Consequently, the 2°C scenario is the most frequently considered one, as expressed in Q43. However, 5 out of 8 participants also indicated that they run a 1,5°C scenario analysis and PPF3 mentioned they benchmarked against the latter. Scenarios beyond the 2°C were tested by 3 participants and 6 participants indicated that they use external data providers. All of them use externally developed models such as the PACTA Tool. The largest institutional investors that

we interviewed used both external tools and internally developed methods and one asset manager indicated that they have their own ESG rating scale. TCFD is deemed to offer a useful methodology for reporting on CRR. Except for new adopters, all other participants did not consider TCFD as a tool to increase their knowledge on CRR.

Most of the participants declared that they are not yet knowledgeable enough on the climate-related risks which contrasts with the average of 7.21 that we have found at Q11, with only one participant indicating a score under 5. This difference could be due to the desire to shine, but as explained in the methodology, we do not think our data suffers from this bias. We rather interpret these high scores as the gap between the high awareness of the existence of CRR giving a feeling of good knowledge, and the actual expertise.

Among the 8 participants in our research, only 1 indicated having experts on climate issues working with the strategy team, all other respondents have adopted a strategy of educating their entire staff. The aim is rather to have the whole analyst team well-educated in terms of CRR rather than designating a specialist team. Only one AP fund told us that they have large differences in expertise between its collaborators.

This strategy of global knowledge rather than department expertise is in line with the answer to Q29 which shows that none except for one firm, has a dedicated person to climate-risks. One asset manager explained that the size of the team did not allow for dedicating a person to the sole analysis of CRR. Their model was to have the two members of the ESG team working on CRR analysis because they have more time to allocate to this issue and then collaborating with the asset managers for a strategy. In most of the interviewed firms, the role of the ESG team is to treat the non-financial data, search or develop models and measurement tools, and remain informed on the fast changes on the subject.

4.2 Financial climate-related risks and performances after mitigation

We have seen in the literature that scholars disagree on the questions of risk measurement and mitigation strategies. However, when it comes to the incorporation of risks in the financial analysis, what matters most is the way investors themselves perceive and understand those risks, even if does not correspond to reality. This perception is observed below.

4.2.1 Risk perception

In Q1, many investors encountered difficulties to rank the risks by importance, mainly because they all argued that climate-risks are linked to other factors coming into considerations. The only pattern was that ‘Operational risks: Internal risks’ meaning the governance risks, the risks were systematically rated as more important than ‘Operational risks: External risks’ which are the market risks. Figure 4 offers indications on which risks are perceived as greater by financial firms. Transition risks are considered higher than physical risks, and within transition risks,

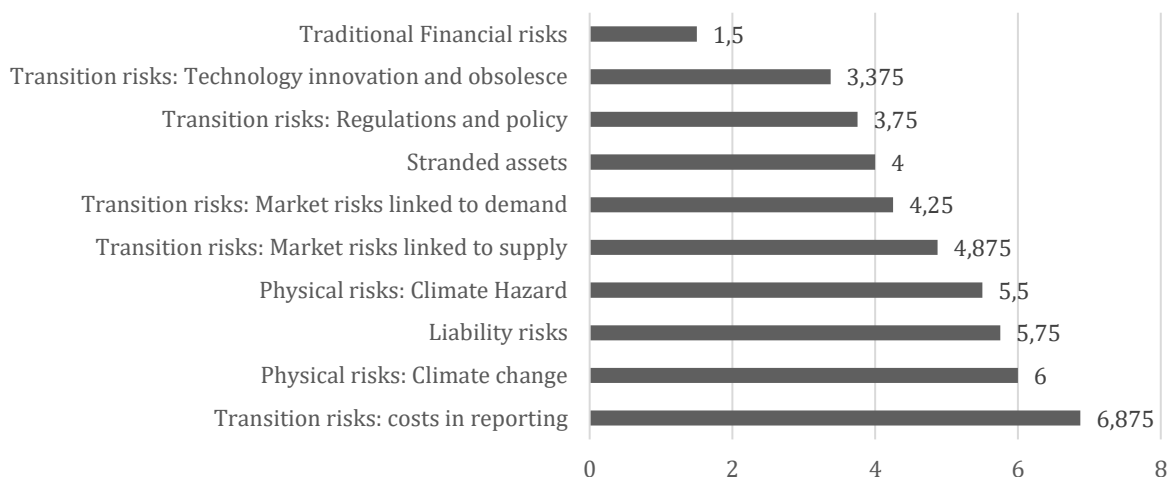


Figure 4: Results of Q12

Note: Participants were asked to rank the risks from most to less important to them. Each category shows the average of all the answers. 1 show that the risks are regarded as highly important, 10 as least relevant.

changes in technology and regulation regarded as more important than the supply and demand risks. One asset manager indicated that they focus on transition risks and neglect physical risks, following the recommendations from TCFD. Finally, the costs in reporting are ranked last even if the reporting itself can generate a lot of doubts and is at the source of initiatives like TCFD. Furthermore, in Q34, 7 out of 8 participants indicate having observed changes in the real economy due to climate change, mostly on physical risks and in some sectors only.

Table 4: Answers to Q15, Q16 and Q17

	Yes/No/Both	Average (min/max)	Number of respondents
Q15. How does your firm rank the probability for climate-related risks to have an impact on asset valuation?		8,25 (7/10)	4
Q16. Does your firm think that climate-related risks are reflected in the price of the market?	2/5/1		8
Q17. How would your firm rate the impact of climate-related risks on the volatility of assets?		6,4 (5/8)	5

Note: Q15: 1 indicates a low probability, 10 indicates a high probability. Q17: 1 indicates a low impact, 10 indicates a high impact.

Regarding the financial impact perception presented in Table 4, on the one hand, in Q15, participants rated the climate-related risks on asset valuation to 8.25/10 on average and the impact of CRR on volatility to 6,4/10. On the other hand, 5 out of 8 participants do not think that climate-related risks are reflected in the prices of the market. The explanation relies on the timeframe. According to our participants, not all sectors already feel the pressure of climate change and regulation change. For the latter, the risks are larger in Sweden and Europe than in developing markets.

Overall, they consider that the risks are existing but have not materialized today. This is also visible in Q36 where half of the participants estimated that in ten/twenty years their portfolio will be different due to climate-risks.

Across interviews, one theme was constant which is the awareness that we are at the dawn of a transition. The international framework targets a net 0 emission by 2050, in which investors are well aware and build strategy according to this timeframe. The following quote from one participant is very representative of this thinking “we are invested in energy companies but we are not invested in all of them. We are invested in the companies that we think will be part of the solution to become climate neutral”. It means that looking straight at whether asset managers and institutional investors have divested from certain sectors is not representative of the current reflection on climate-related risks.

4.2.2 Performance

Q27 and Q28 on the performance of low climate-related risks portfolios were very difficult to answer for all our participants. We did not get clear yes or no answers, and thus cannot present statistics, but we can summarize as follows. None of the participants had an external assessment of low climate-risks products but some used scenario analysis as a way to compare the performances. Others indicated that they have not conducted such a comparison at all. Asset Manager 1 indicated that, in normal times, low CRR holdings are performing equally, however, their performance has been increasing in the last two or three months. Similarly, one pension and insurance firm considered that it was too soon to accurately estimate the performances. An interviewee at one PPF estimated that low CRR portfolio performed “worse in the short term but in the long term it’s going to be better of course. That has to do with stranded assets that are overvalued on the long term”. Overall, our participants were *expecting* good performances but have not observed it yet on their own investments. If such observation has been made, it has only been recent and punctual.

4.3 Considerations on climate finance innovations

We have seen above that financial firms based their analysis on internationally developed instruments. However, this aspect does not solve all barriers for incorporation. In Q23, all but one participant indicated that the lack of information coming from firms is the major barrier. Most of them further explained that it is not only the lack of disclosure but the difficulties to

translate the information into financial data and to compare firms. The absence of knowledge on climate change and the consequences of exposure was also indicated as an important barrier. They ranked the lack of interest of clients as last, meaning that the demand for climate-risks mitigation is real. We now take the observations a step further to considerations on legal and normative diffusion.

Regulation on disclosure

None of our participants opposed the idea of increasing regulations on disclosure, however many were quite critical on how to regulate. The challenge is to offer information that is relevant for both climate change reduction and financial climate risk analysis.

As shown in Table 5, 6 out of 8 participants rejected the idea of regulating the disclosure of either the carbon footprint or the green and brown technology of their portfolio, arguing that disclosing this information is not a useful financial climate-related risk indicator. The reason is that this data would give information on the current situation and not the potential for improvement. If a firm is on the right path and is building the change, their risks are lowering with time. On the other hand, the carbon footprint is a straightforward standard framework.

Regardless of the opinion of each firm, all of them were well aware of the EU taxonomy and the fast changes in the domain of climate reporting. From one institutional investor’s perspective “standardized reporting for fair comparison is necessary, as well as clear criteria for supervision and follow up. [...] Of course, having a high carbon footprint does not show the potential for transition. it is a quite unsatisfactory indicator but it is easier to compare. We can only benefit from a standardized measure.”

Table 5: Answers to Q24

	Yes- the climate-related risks of the portfolio	Yes- the carbon footprint of the portfolio	Yes- green and brown technology ration	No, why not?
Q24. Would your firm be in favor of regulating on the disclosure of the following information (disclose form investors)?	8	6	4	0

Note: This table indicates how many times each category have been selected. All eight participants answered this question.

Another AP fund also highlighted the downside of regulations because it is simply a “box-ticking” without inducing profound changes. The same person also considered that AP funds are not necessarily constraint by reputation but rather follow global flows. According to the interviewee, this can be explained by the fact that sometimes regulations only come after the action, for example disclosing carbon footprint becomes more systematic although the regulation is not here yet.

Engagement and exclusion

Our observations confirm the trend observed between 2013 and 2015 by Eurosif (2016) regarding SRI strategies presented in the literature review. Among the two most used SRI innovations, exclusion, and stakeholder's engagement, they estimated that the latter will become the most used. Indeed, we did not observe many extra steps towards more exclusions but all our participants used engagement strategies. Among the 8 participants, only one had taken measures to divest from fossil fuels over the last 12 months. Some had adopted earlier on an exclusion strategy on sand coal or fossil fuels and did not intend to expand this strategy to other high CRR sectors. Others were still at a reflective phase but did not give any hint for prompt divestments. They rather favored active management and discussions with their holdings. They might also voice opinions in and out of general assemblies. One firm indicated that exclusion was only used in last resort if the companies in which they were invested in were not working towards CRR reduction.

Participants believed in their limited impact on companies, impact that increases if investors cooperate. All firms estimated that institutional investors can have a stronger influence on a firm's behavior. Participants also indicated that they have a much stronger influence in their Swedish holdings than on international holdings. Alternatively, one asset manager with mostly national holdings explained that "some clients require to know the carbon footprint of a portfolio. You need to have a broader portfolio to offer a green portfolio. But on the Swedish stock market, there are not enough possibilities to have a green portfolio".

5 Analysis and Discussion

In chapter 4, we exposed how investors incorporate CRR in their analysis, according to their interests and based on international tools. We now dive into the motivation, subjective or rationale, and understand the barriers and incentives according to our research questions 2a and 2b. We proceed through this analysis based on the three domains of Grubb, Hourcade, and Neuhoff (2014) and use the analysis of Christophers (2019) and Hall, Foxon, and Bolton (2017) as the conceptualization of decision-making.

The subjectivity aspect of the first domains probably the most difficult to observe according to our methodology. As a reminder, the first domain looks at the behavioral aspects on the micro-level: the individual or the firm's level. We observed that all employees in our interviewed firms had financial backgrounds making them very reliant on external knowledge regarding climate questions, which might contribute to the "herd mentality" described by Christophers (2019). Indeed, across our participants, there is a relative homogeneity in the innovations in regards to climate-risks.

Some of our participants indicated that they simply make the data available to the asset managers who are educated on the CRR. The choice of which information is precisely a critical aspect of the decision-making and the level of business acquaintance with CRR can play a decisive role (Andersson, Bolton & Samama, 2016), thus the absence of experts can be deemed as a representation of low interest in climate finance. However, Christophers (2019) highlights the low influence and thus figurative role of ESG teams who are disconnected from the investment decision. Yet, in our sample, the effort on educating all employees counters this issue. Scholars have also argue that internal knowledge is a key to low-carbon investments (Ameli et al., 2019).

This leads us to the second aspect of the first domain; convention or the tendency to think of climate-risks as calculable risks (Christophers 2019). If verified, this aspect is a limit to the incorporation of CRR. The ESG teams have essentially two roles. Either they work on developing and gathering non-financial information and facilitating their use by the portfolio managers, which involves making the risks calculable. Or they serve as advisors, especially because of their knowledge on the growing regulations, and frequently participate in decisive meetings. Both roles show that there is indeed a will to put climate-related risks into quantitative data. This verifies Christophers's (2019) observations on the tendency to simplify the CRR to make them calculable and thus leaves little space for innovative practices. On the other hand, making the data available for all employees contributes to closing the gap between sustainability questions and financial analysis in Swedish firms.

We move on to the second domain since the need to make all risk calculable is associated with the Effective Market Hypothesis in which financial firms want to operate, if the subjective aspects mentioned above are ignored (Grubb, Hourcade & Neuhoff, 2014).

Our results have shown that investors and asset managers are not convinced that risks are currently high nor that low CRR portfolios have better risks to return ratio. The performance is thus not the number one argument to switch to low climate-related risks. On the other hand, the performance does not seem to be the main barrier either since only one participant estimated that low CRR portfolios can perform worse. Adding non-financial information increases the work and the costs (Michelson et al., 2004) which we also observe with participants indicated that they do not have enough workforce for internal analysis. This factor adds a barrier to the incorporation of CRR innovations according to the EMH, since information availability and processing are key.

Another aspect of the economist thinking is the role of fiduciary duty. All our participants indicated that climate-related risks fall into their fiduciary duty to the extent that they are risks and not ethical choices. This answer clashed with the observation made above that performances are not the number one driver for the incorporation of climate-related risks and incarnates a major barrier to considering climate-related risks. However, the fiduciary duty is a direct reflection of the mandate of the firm (Bergman, 2018). Investors seeking long-term returns are expected to be particularly interested in CRR, which brings us to the temporality question.

The timeframe within which the climate-related risk materialize is a barrier to the inclusion of CRR according to the economist trope. Asset manager 1 indicated that the firm existed for several decades and have established long-term relationships with companies in which they are invested. In that sense they have a long-term perspective, however, they look at how risks materialize on a timeframe from 2 to 5 years. Other professionals from the financial sector are looking at longer timeframes, especially pension funds.

Investors are quite divided on the question of whether they could use the same portfolio in 10 or 20 years, but the underlying matter is similar: whether or not the holdings will be able to make the transition. Among the four participants who answered yes, one believed that their portfolios are already not exposed to high CRR due to their overall strategy, the three others indicated they were “hopeful” that the companies in which they are invested, will be capable of moving towards renewable systems. Talking about companies in their active portfolios, one asset manager also explained that “if we believe that they are not in a position to do it [the transition], we try to influence them.” This observation also explains why investors’ engagement is a preferred strategy than divestment. One AP fund explained that they know how different will be their portfolio in twenty years and they are working on updating the portfolio. To summarize, we can say that we are observing asset managers and institutional investors in the beginning or the middle of their construction work towards the transition.

This behavior towards the transition shows that part of the decision-making of investors have moved from the still Effective Market Hypothesis to an Adaptative Market Hypothesis. The timeframe is expanding, and future structural changes are considered. However, Hall, Foxon, and Bolton (2017) show that the adaptative market still has underpriced CRR which is also what is perceived by investors of our sample. In the two first domains, we looked into factors at the firm or the market level. Here, we move to the structural level and external influence coming from the system. The theories applied to the third domain are oriented towards change

and transformation and thus give us keys on how our Swedish firms lead the innovation or are constrained by the structural changes.

In the historical review, one salient aspect of the divestment movement was the leadership role of institutions, whether they were the churches and university in the case of the tobacco industry in the US, international retail firms regarding South Africa, or institutional investors with Myanmar. The same pattern can be observed in our case: one PPF pointed out that firms often consider governmental investors as an indicator of the good behavior. If the behavior is accepted by an AP fund, then it would be accepted by private asset managers. Institutional investors with governmental mandates become norm setters according to New Institutional Economics as they define the “rules of the game” Grubb, Hourcade and Neuhoff (2014, p.58). On the other hand, it has been observed that if institution have a positive behavior “quietly” the impact is lowered (Wander & Malone, 2004), thus pension funds who have divested from several years and do not communicate about it might minimized their leadership role.

Nielsen’s (2014) assertion that the Swedish pension fund system promotes the competition between the four AP funds has revealed to be wrong and we could not observe any market dynamism between the funds that would influence the considerations on climate-risks. This driver should thus be excluded. The growing importance of pension funds makes them particularly apt to influence firms and Swedish pension funds are deemed influent investors of the firms' activities (Hamilton & Eriksson, 2011). Asset managers indicated that demands for low CRR portfolios come from institutional investors and AP funds are aware of their normative role. Through this analysis, we can see that the systemic change and adaptation dynamics discussed by Grubb, Hourcade, and Neuhoff (2014) are starting to be observed in the Swedish financial sector.

6 Conclusion

The present study aimed to observe and analyze the current decision-making of eight Swedish asset managers and institutional investors in regards to climate-related risks. The analysis was conducted based on the three domains framework from Grubb, Hourcade, and Neuhoff (2014) to be as comprehensive as possible in identifying the motivations of our eight firms. The fast-changing area of climate finance remains largely unobserved, especially in regards to the behavior of its main actors. This research contributes to lift the veil on this aspect of financial business. Our first question led us to dive into the firms' strategies. We observed that they aim at educating the whole firm on climate-change rather than dedicating a special team to that purpose. We also note that transition risks are thoroughly considered although not yet observed on prices and performances. This perception of current low risks leads them to favor the engagement strategy over the exclusion strategy in prevision of a transition undertaken directly by their holdings. This provides an explanation for Hamilton and Eriksson's (2011) observation on the preference of AP1 to AP4 for engagement over exclusion strategies.

This observation is linked to the second question of our research on how institutional investors and asset managers consider innovations for climate finance. Christophers (2019) argues that the belief that we are still living in the same old world is an investor's cognitive bias standing as a barrier against financial innovation. Even if the goal is to quantify the risks and include them in the financial analysis as any other risk, we did not observe this bias as strong and unanimous as him. Our results were rather similar to the one from Hall, Foxon, and Bolton (2017) because we found that the Swedish firms are turning towards an evolutionary framework and consider systemic changes in their analysis. We have shown that the limits rise from the incompatibilities between CRR and EMH such as the scarcity of information, the difficulties to create metrics, and the related costs. We have also shown that the drivers are to be found in an AMH perspective, such as the rise of regulations and the leadership roles of institutional investors.

With these findings, we achieved our first objective to map the asset managers and institutional investor's decision framework. We also consider that we contributed to create a new framework to understand the choices of the financial sectors in regards to sustainable finance, based on traditional consideration and on structural changes, which constituted our second objective. By looking at climate-related risks, we aimed at providing insights on one topic -climate finance, that could be seen from different perspectives, from ethical to reputational as well as financial. Our analysis helps to define which decisions are made according to each of those aspects. Understanding the motivations behind a behavior is essential to create relevant and efficient policies or measurement tools. Our research is above all addressed to all norm-creators such as policymakers and public or private initiatives that contribute to improving transparency, quantification, discussion, or action with financial innovation. Our participants were quite homogenous in their answers and thus we consider that our results can be representative of the

Swedish market, however, they are not fully generalizable internationally given that the regulations, especially on pension systems are different.

A major debate around the behavior of firms on sustainable issues is the *greenwashing* phenomenon. We have highlighted that financial firms are aware of the changes and the rising number of regulations. They are not necessarily opposed to them as long as they can stand ready and that the regulations can serve them in grasping CRR better. What our analysis has shown us that the financial system can adapt and we have seen that the current uncertainty creates a vacuum calling for clear guidelines as firms are keen to be guided towards better mitigation of climate-related risks. Probably the most influential initiatives in regards to climate risks and finance are the IPCC report and the TCFD. The first one gathers scientists and policymakers, the second professionals of the capital market exclusively. We suggest to stimulate multilevel collaboration between the public sector and the capital market to reach the most effective structural changes. The many aspects mentioned by this research can give first information on where to find common ground between financial firms and other actors of society.

We have shown a broad picture of CRR perception. In the future, the three domains framework adapted to the financial sector can be used to understand the decision-making in regards to a specific sector or region. The present research also opens many doors for further investigation and quantitative analysis of financial climate-related risks, especially in high-risk sectors other than fossil fuels. Moreover, it is essential to understand the role of institutional investors in norm-setting, but additional research is also needed on the effectiveness of shareholders engagement on climate issues compared to divestment strategies or other innovations, both in terms of financial risks mitigation and in climate change reduction.

References

- Abad, P., Benito, S. & López, C. (2014). A Comprehensive Review of Value at Risk Methodologies, *The Spanish Review of Financial Economics*, [e-journal] vol. 12, no. 1, pp.15–32, Available Online: <https://linkinghub.elsevier.com/retrieve/pii/S217312681300017X> [Accessed 26 June 2020].
- Ameli, N., Drummond, P., Bisaro, A., Grubb, M. & Chenet, H. (2019). Climate Finance and Disclosure for Institutional Investors: Why Transparency Is Not Enough, *Climatic Change*, [e-journal] no. Special Issue, pp.1–25, Available Online: <http://link.springer.com/10.1007/s10584-019-02542-2> [Accessed 12 April 2020].
- Andersson, M., Bolton, P. & Samama, F. (2016). Hedging Climate Risk, *Financial Analysts Journal*, [e-journal] vol. 72, no. 3, pp.13–32, Available Online: <https://www.tandfonline.com/doi/abs/10.2469/faj.v72.n3.4> [Accessed 24 December 2019].
- Battiston, S., Mandel, A., Monasterolo, I., Schütze, F. & Visentin, G. (2017). A Climate Stress-Test of the Financial System, *Nature Climate Change*, vol. 7, no. 4, pp.283–288.
- Bell, E., Bryman, A., Harley, B. (2018). Qualitative Research, in *Business Research Methods*, 5th edn., Oxford University Press.
- Beneish, M., Jansen, I., Lewis, M. & Stuart, N. (2008). Diversification to Mitigate Expropriation in the Tobacco Industry, *Journal of Financial Economics*, [e-journal] vol. 89, no. 1, pp.136–157, Available Online: <https://linkinghub.elsevier.com/retrieve/pii/S0304405X08000469> [Accessed 7 June 2020].
- Bergman, N. (2018). Impacts of the Fossil Fuel Divestment Movement: Effects on Finance, Policy and Public Discourse, *Sustainability*, [e-journal] vol. 10, no. 7, p.2529, Available Online: <http://www.mdpi.com/2071-1050/10/7/2529> [Accessed 2 June 2020].
- Bodie, Z., Kane, A. & Marcus, A. J. (2014a). Chapter 9-10, in *Investment Global Edition*, McGraw-Hil.
- Bodie, Z., Kane, A. & Marcus, A. J. (2014b). Chapter 11, in *Investments Global Edition*, McGraw-Hil.
- Buchanan, D. A. & Bryman, A. (2007). Contextualizing Methods Choice in Organizational Research, *Organizational Research Methods*, vol. 10, no. 3, pp.483–501.
- Caldecott, B. (2018). Stranded Assets and the Environment, *Stranded Assets and the Environment*, Routledge.
- Caplan, L., Griswold, J. S. & Jarvis, W. F. (2013). From SRI to ESG: The Changing World of Responsible Investing, Wilton, Available Online: <https://docplayer.net/11738814-From-sri-to-esg-the-changing-world-of-responsible-investing-september-2013.html> [Accessed 7 January 2020].
- Carrington, D. (2019). Firms Ignoring Climate Crisis Will Go Bankrupt, Says Mark Carney, *The Guardian*, 13 October, Available Online: <https://www.theguardian.com/environment/2019/oct/13/firms-ignoring-climate-crisis-bankrupt-mark-carney-bank-england-governor> [Accessed 17 April 2020].

- Chen, N., Roll, R. & Ross, S. A. (1986). Economic Forces and Stock Market, *The Journal of Business*, vol. 59, no. 3, pp.383–403.
- Christophers, B. (2019). Environmental Beta or How Institutional Investors Think about Climate Change and Fossil Fuel Risk, *Annals of the American Association of Geographers*, [e-journal] vol. 109, no. 3, pp.754–774, Available Online: <https://www.tandfonline.com/action/journalInformation?journalCode=raag21> [Accessed 5 January 2020].
- Clapp, C. S., Alfsen, K. H., Torvanger, A. & Lund, H. F. (2015). Influence of Climate Science on Financial Decisions, *Nature Climate Change*, [e-journal] vol. 5, no. 2, pp.84–85, Available Online: <http://www.nature.com/articles/nclimate2495> [Accessed 24 December 2019].
- Creswell, J. W. (2014). *Research Design Qualitative, Quantitative and Mixed Methods Approaches*, Fourth., SAGE Publications Inc.
- Davydov, D., Khrashchevskiy, I. & Peltomäki, J. (2019). Investor Attention Allocation and Portfolio Performance: What Information Does It Pay to Pay Attention To?, *SSRN Electronic Journal*, [e-journal], Available Online: <https://www.ssrn.com/abstract=3436074> [Accessed 20 May 2020].
- Diaz-Rainey, I., Robertson, B. & Wilson, C. (2017). Stranded Research? Leading Finance Journals Are Silent on Climate Change, *Climatic Change*, [e-journal] vol. 143, no. 1–2, pp.243–260, Available Online: <http://link.springer.com/10.1007/s10584-017-1985-1> [Accessed 11 April 2020].
- Dietz, S., Bowen, A., Dixon, C. & Gradwell, P. (2016). ‘Climate Value at Risk’ of Global Financial Assets, *Nature Climate Change*, [e-journal] vol. 6, no. 7, pp.676–679, Available Online: <http://www.nature.com/articles/nclimate2972> [Accessed 24 December 2019].
- ESRB. (2016). Too Late, Too Sudden: Transition to a Low-Carbon Economy and Systemic Risk, Available Online: https://www.esrb.europa.eu/pub/pdf/asc/Reports_ASC_6_1602.pdf [Accessed 26 May 2020].
- European Commission. (2018). Commission Action Plan on Financing Sustainable Growth, Available Online: https://ec.europa.eu/info/publications/180308-action-plan-sustainable-growth_en [Accessed 24 May 2020].
- European Commission. (2019a). Financing Sustainable Growth, Available Online: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200108-financing-sustainable-growth-factsheet_en.pdf [Accessed 17 May 2020].
- European Commission. (2019b). Non-Financial Reporting, Available Online: https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/non-financial-reporting_en [Accessed 14 June 2020].
- European Commission. (2020). A European Green Deal, Available Online: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en [Accessed 17 May 2020].
- Eurosif. (2016). Sweden -Financial Industry Overview, *Eurosif*, Available Online: <http://www.eurosif.org/sri-study-2016/sweden/> [Accessed 7 January 2020].

- Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work, *The Journal of Finance*, vol. 25, no. 2, pp.383–417.
- Fisher, L. (2000). Divestment in the Tobacco Industry, *Cancer Causes and Control*, [e-journal] vol. 11, pp.381–382, Available Online: <http://resolver.ebscohost.com/openurl?sid=ProQ%3A&fmt=journal&genre=article&issn=09575243&volume=11&issue=4&date=2000-04-01&spage=381&title=Cancer+Causes+%26+Control&atitle=Divestment+in+the+tobacco+industry&au=Fisher%2C+Laurie&isbn=&jtitle=Cancer+Causes+> [Accessed 7 June 2020].
- Fowler, F. J. (2004). Structured Interview, in M. S. Lewis-Beck, A. Bryman, & T. Futing Liao (eds), *The SAGE Encyclopedia of Social Science Research Methods*, [e-book] Company: Sage Publications, Inc., pp.1095–1096, Available Online: <https://dx.doi.org/10.4135/9781412950589> [Accessed 7 May 2020].
- G20 Sustainable Finance Study Group. (2018). Sustainable Finance Synthesis Report, Available Online: http://unepinquiry.org/wp-content/uploads/2018/11/G20_Sustainable_Finance_Synthesis_Report_2018.pdf [Accessed 25 May 2020].
- Geden, O. & Schenuit, F. (2019). Climate Neutrality as Long-Term Strategy: The EU’s Net Zero Target and Its Consequences for Member States, Berlin, Available Online: <https://doi.org/10.18449/2019C33> [Accessed 14 June 2020].
- Grubb, M., Hourcade, J.-C. & Neuhoff, K. (2014). Planetary Economics Energy, Climate Change and the Three Domains of Sustainable Development, Earthscan., Routledge.
- Hall, S., Foxon, T. J. & Bolton, R. (2017). Investing in Low-Carbon Transitions: Energy Finance as an Adaptive Market, *Climate Policy*, [e-journal] vol. 17, no. 3, pp.280–298, Available Online: <https://www.tandfonline.com/doi/full/10.1080/14693062.2015.1094731> [Accessed 31 May 2020].
- Hamilton, I. & Eriksson, J. (2011). Influence Strategies in Shareholder Engagement: A Case Study of All Swedish National Pension Funds, *Journal of Sustainable Finance & Investment*, [e-journal] vol. 1, no. 1, pp.44–61, Available Online: <http://www.tandfonline.com/doi/abs/10.3763/jsfi.2010.0006> [Accessed 6 June 2020].
- Hefti, C. & Staehelin-Witt, E. (2011). Economic Sanctions against South Africa and the Importance of Switzerland, *Nationale Forschungsprogramme*, Available Online: www.snf.ch [Accessed 26 June 2020].
- Hoggett, J. & Nahan, M. (2002). Ethical Investment- Deconstructing the Myth, *IPA Review*, [e-journal] vol. 54, no. 3, Available Online: www.vicfund.com [Accessed 5 June 2020].
- Ilhan, E., Krueger, P., Sautner, Z. & Starks, L. T. (2019). Institutional Investors’ Views and Preferences on Climate Risk Disclosure, Research Paper No. 19-66, *SSRN Electronic Journal*, [e-journal], Available Online: <https://www.ssrn.com/abstract=3437178> [Accessed 5 January 2020].
- Langlois, H. & Lussier J. (2016). Rational Investing: The Subtleties of Asset Management, edited by C. U. Press, New York.
- Lenger, A. (2019). The Rejection of Qualitative Research Methods in Economics, *Journal of Economic Issues*, [e-journal] vol. 53, no. 4, pp.946–965, Available Online: <https://www.tandfonline.com/doi/full/10.1080/00213624.2019.1657748> [Accessed 7 May 2020].

- Lo, A. W. (2012). Adaptive Markets and the New World Order, *Financial Analysts Journal*, Available Online: <https://dspace.mit.edu/handle/1721.1/75362> [Accessed 30 June 2020].
- Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., J. Skea, P. R. S., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J. B. R., Chen, Y., Zhou, X., Gomis, M. I., Lonnoy, E., Maycock, T., Tignor, M. & Waterfield, T. (2018). IPCC, 2018: Summary for Policymakers, *Aromar Revi*, Available Online: <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/> [Accessed 8 April 2020].
- Mcglade, C. & Ekins, P. (2015). The Geographical Distribution of Fossil Fuels Unused When Limiting Global Warming to 2 6C, *Nature*, vol. 517, pp.187–190.
- McSweeney, R. (2015). The Most ‘cited’ Climate Change Papers, *Carbon Brief*, Available Online: <https://www.carbonbrief.org/analysis-the-most-cited-climate-change-papers> [Accessed 24 April 2020].
- Michelson, G., Wailes, N., Van Der Laan, S. & Frost, G. (2004). Ethical Investment Processes and Outcomes, *Journal of Business Ethics*, [e-journal] vol. 52, no. 1, pp.1–10, Available Online: <http://link.springer.com/10.1023/B:BUSI.0000033103.12560.be> [Accessed 4 June 2020].
- Ministère de la Transition Écologique et Solidaire. (2019). Le Reporting Extra-Financier Des Entreprises, Available Online: <https://www.ecologique-solidaire.gouv.fr/reporting-extra-financier-des-entreprises> [Accessed 24 April 2020].
- Möllersten, K. & Källmark, L. (2020). Assessment and Reporting of Environment and Climate-Related Risks and Impacts on Financial Markets, [e-book] Brussels: Nordic Council of Ministers, Available Online: <https://pub.norden.org/temanord2020-510> [Accessed 22 May 2020].
- Monnin, P. (2018). Integrating Climate Risks into Credit Risk Assessment Current Methodologies and the Case of Central Banks Corporate Bond Purchases, Available Online: https://www.researchgate.net/publication/331167173_Integrating_Climate_Risks_into_Credit_Risk_Assessment_Current_Methodologies_and_the_Case_of_Central_Banks_Corporate_Bond_Purchases [Accessed 24 March 2020].
- Nielsen, O. (2014). Responsible Investments in the Swedish Pension Fund System A Case Study of Institutional Investors, Available Online: <https://www.diva-portal.org/smash/get/diva2:756700/FULLTEXT01.pdf> [Accessed 5 January 2020].
- Nordhaus, W. D. (1977). American Economic Association Economic Growth and Climate: The Carbon Dioxide Problem, *Source: The American Economic Review*, Vol. 67.
- Paris Agreement. (2015). , Available Online: https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en#4 [Accessed 7 May 2020].
- Patton, M. Q. (1999). Enhancing the Quality and Credibility of Qualitative Analysis., *Health services research*, [e-journal] vol. 34, no. 5 Pt 2, pp.1189–208, Available Online: <http://www.ncbi.nlm.nih.gov/pubmed/10591279%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC1089059> [Accessed 6 June 2020].
- Pfeifer, S. & Sullivan, R. (2008). Public Policy, Institutional Investors and Climate Change: A UK Case-Study, *Climatic Change*, [e-journal] vol. 89, no. 3–4, pp.245–262, Available Online: <http://link.springer.com/10.1007/s10584-007-9380-y> [Accessed 4 June 2020].

- Piketty, T. & Jackson, T. (2015). Thomas Piketty et Tim Jackson : « Cessons d’investir Dans Les Énergies Fossiles ! », *Le Monde*, Available Online: https://www.lemonde.fr/idees/article/2015/11/13/thomas-piketty-et-tim-jackson-cessons-d-investir-dans-les-energies-fossiles_4809304_3232.html [Accessed 17 April 2020].
- Principles for Responsible Investment. (2020). FAQ on Mandatory Climate Reporting for PRI Signatories, Available Online: <https://www.unpri.org/reporting-for-signatories/faq-on-mandatory-climate-reporting-for-pri-signatories/5356.article> [Accessed 8 January 2020].
- Schmidt, C. (2016). The Analysis of Semi-Structured Interviews, in U. Flick, E. Von Kardorff, & I. Steinke (eds), *A Companion to Qualitative Research*, SAGE Publications Ltd, pp.253–259.
- Task Force on Climate-related Financial Disclosures. (2020). Booklet Task Force on Climate-Related Financial Disclosures, Available Online: <https://www.unepfi.org/climate-change/tcfd/> [Accessed 10 April 2020].
- Task Force on Climate-Related Financial Disclosures. (2019). , Available Online: <https://www.fsb-tcfd.org/> [Accessed 5 January 2020].
- The Economist. (2020). How Much Can Financiers Do about Climate Change?, Available Online: <https://www.economist.com/briefing/2020/06/20/how-much-can-financiers-do-about-climate-change> [Accessed 21 June 2020].
- Thomä, J. & Chenet, H. (2017). Transition Risks and Market Failure: A Theoretical Discourse on Why Financial Models and Economic Agents May Misprice Risk Related to the Transition to a Low-Carbon Economy, *Journal of Sustainable Finance and Investment*, vol. 7, no. 1, pp.82–98.
- Thomä, J., Murray, C., Jerosch-Herold, V. & Magdanz, J. (2019). Do You Manage What You Measure? Investor Views on the Question of Climate Actions with Empirical Results from the Swiss Pension Fund and Insurance Sector, *Journal of Sustainable Finance & Investment*, [e-journal] pp.1–15, Available Online: <https://www.tandfonline.com/doi/full/10.1080/20430795.2019.1673142> [Accessed 30 March 2020].
- Thomas Franzén. (2016). Does the Capital Market Create Problems for the Economy?, Available Online: http://archive.riksbank.se/Documents/Rapporter/POV/2016/2016_1/rap_pov_artikel_4_160317_eng.pdf [Accessed 17 June 2020].
- Van Campenhoudt, L., Quivy, R. & Marquet, J. (2011). Manuel de Recherche En Sciences Sociales, [e-book] Paris: Dunod, Available Online: <https://www.worldcat.org/title/manuel-de-recherche-en-sciences-sociales/oclc/800907155> [Accessed 3 June 2020].
- Verheyden, T., Eccles, R. G. & Feiner, A. (2016). ESG for All? The Impact of ESG Screening on Return, Risk, and Diversification, *Journal of Applied Corporate Finance*, vol. 28, no. 2, pp.47–55.
- Wander, N. & Malone, R. (2004). Selling Off or Selling Out? Medical Schools and Ethical Lead in Tobacco Stock Divestment, *Academic Medicine*, [e-journal] vol. 79, no. 11, pp.1017–1026, Available Online: https://journals.lww.com/academicmedicine/Fulltext/2004/11000/Selling_Off_or_Selling_Out__Medical_Schools_and.2.aspx [Accessed 7 June 2020].
- Wendt, K. (2018). Sustainable Financial Innovations, *Sustainable Financial Innovations*, CRC Press.

White, J. A. (2004). Globalisation, Divestment and Human Rights in Burma, *The Journal of Corporate Citizenship*, [e-journal] no. 14, pp.47–65, Available Online: <https://www.jstor.org/stable/jcorpciti.14.47?seq=1> [Accessed 26 June 2020].

Appendix A: Questionnaire for all participants

Financial analysis methods: General Questions

1. Rank the following risks from most to less important
 - a. Operational risks: Internal risks
 - b. Operational risks: External risks
 - c. Financial risks
 - d. Liability risks
 - e. Other risks (ex: Climate risks, social risks, etc.)

2. Which methods does your firm prefer for risk analysis?
 - a. Value at risks (VaR)
 - b. Expected short fall models
 - c. Stress testing (scenario analysis)
 - d. Other

3. Does your firm consider stress testing as a necessary part of the risk analysis?
 - a. Yes
 - b. No

4. When considering risks, which time frame does your firm consider?
 - a. short term (< 1 year)
 - b. middle term (1 to 3 year)
 - c. long-term (3 to 6 years)
 - d. very long term (> 6 years)

5. Does your firm use active or passive asset management approach?
 - a. Active
 - b. Passive
 - c. Both

6. Does your firm integrate climate-related risks mitigation in both active and passive asset management?
 - a. Yes
 - b. No

7. Does your firm consider mitigating against climate-related risks as part of its fiduciary duty?
 - a. Yes
 - b. No

8. Does your firm consider that institutional investors can have an impact on the companies' behavior (not only on ESG issues)?
 - a. Yes, individual firms can influence companies from their portfolios
 - b. Yes, investors can influence the market if they are collaborating
 - c. No

Climate-related risks assessment

9. Has your firm ever integrated climate-related risks scenarios in your risk assessment?
 - a. Yes
 - b. Considering it
 - c. No

10. How is climate-related risks currently integrated into to investment process in your firm?

11. How would you rate the degree of information of your firm on climate-related risks?
1(uninformed)-10(expert)

12. Can you rank the following risks from most to less important in your analysis?
 - a. Traditional Financial risks
 - b. Physical risks: Climate Hazard (destruction of assets, etc.)
 - c. Physical risks: Climate change (change of weather conditions, pollution, etc.)
 - d. Transition risks: Technology innovation and obsolesce
 - e. Transition risks: Market risks linked to supply
 - f. Transition risks: Market risks linked to demand
 - g. Transition risks: costs in reporting
 - h. Transition risks: Regulations and policy
 - i. Stranded assets
 - j. Liability risks

13. Does your firm prefer using fundamental or quantitative analysis?
 - a. Fundamental
 - b. Quantitative

14. Does your firm consider that this method is compatible with climate-related risk analysis?
 - a. Yes
 - b. No

15. How does your firm rank the probability for climate-related risks to have an impact on asset valuation?
1 (very low probability) - 10 (very high probability)

16. Does your firm think that climate-related risks are reflected in the price of the market?
 - a. Yes
 - b. No

17. How would your firm rate the impact of climate-related risks on the volatility of assets?
1 (no impact) - 10 (high impact)

Climate-related risks mitigation

18. Does your firm consider that the equity valuation of companies in which your firm invest reflects the risks and opportunities of climate-related risks?

19. Which sector does your firm consider as most exposed to climate-related risks?
20. Taking about asset valuation, does your firm consider that some sectors already reflect the climate-related risks more than others?
- Yes, which one?
 - No
21. Which action(s) would your firm consider to carry out in order to reduce climate-related risks?
- Negative screening: Reducing portfolio exposure to carbon-intensive investment?
 - Positive screening: Promoting climate-friendly investment
 - Advocate for the adoption of a climate friendly strategies by the portfolio companies
 - Community involvement: involving low-income communities by investment or donations
 - Divestment from sectors with high TRANSITION risks
 - Divestment from high PHYSICAL risks sectors
 - Thematic portfolios
 - Prices according to risks
 - Other
22. Which type of financial product would your firm use to mitigate climate-related risks?
23. Rank the barriers to include climate-related risks from the biggest to the smallest?
- Disclosure issues: no proper information from the firm side
 - Lack of tools to capture consequences of exposure
 - Lack of tools to create climate scenarios
 - Lack of knowledge on climate change
 - Metrics to translate into financial risks are unavailable
 - No interest from clients
 - It is not the type of product you which to offer
 - Lack of studies on the effect on returns
 - Does not offer any advantages compared to your competitors
24. Would your firm be in favor of regulating on the disclosure of the following information (disclosure form investors)?
- Yes- the climate-related risks of the portfolio
 - Yes - the carbon footprint of the portfolio
 - Yes - green and brown technology ratio
 - No, why not?
25. Did your firm consider using low climate-related risks as a new sort of product?
- No
 - Yes
26. Does your firm ever receive requests for low climate-related risks portfolio?
- Yes, what kind of client?

- b. No
27. Did your firm conduct (or use) any analysis assessing the performance of a low climate-related risks portfolio to see if it performs better/equally/worse than any other portfolio?
- a. Yes
 - b. No
28. From your firm's point of view, how do low climate-related risks portfolio behave compared to a regular portfolio?
- a. Better
 - b. Equally
 - c. Worse
29. Does your firm have a team / a person that is dedicated to climate-related risks?
- a. Yes, what is their background?
 - b. No
30. How does your firm keep their analysts educated/updated about climate-related risks?
31. Has your firm been exposed / educated to climate-related risks in any other context?
- a. Yes
 - b. No
32. In your firm, are climate-related risk assessed by analyst working on risks assessment or by ESG analysts?
- a. Analysts working on risks assessment
 - b. ESG analysts
33. Does participating in TCFD increase your firm's knowledge of climate-related risks and on tools to mitigate them?
- 1 (did not increase knowledge) - 10 (strongly increase knowledge)
34. Has your firm observed the effect of climate change on the real economy?
- a. Yes
 - b. No
35. If you have never/not yet included climate-related risks in your analysis, rank the reason for not doing so
- a. It is not relevant for your investment processes
 - b. Climate-related risks are long-term risk and that does not apply to our analysis
 - c. We do not see any benefits in including climate-related risks
 - d. You need more in-depth analysis before we can take further measures
 - e. We do not have the necessary information to conduct a correct risk analysis (disclosure issue)
 - f. We do not trust the disclosed information (asymmetry of information, lemons)

- g. We already performed well on climate compatibility test although we do not climate-related risks into account
 - h. Other
36. Does your firm think you could use the same portfolio that you have today in 10/20 years?
- a. Yes, Why?
 - b. No, Why not?
37. When did your firm start discussing / considering to integrate climate-related risks in your analysis?
38. When did your firm start integrating climate-related risks in your analysis?
39. What was the trigger for your firm's interest in climate-related risks?
- a. Climate Hazards (ex: fire in Australia)
 - b. Action from leaders in the market (ex: Blackrock)
 - c. Losses due to Climate changes
 - d. Clients requests
 - e. New tools that facilitate the inclusion of climate-related risks
 - f. Other
40. Which tool does your firm use to assess climate-related risks?
- a. Scenario analysis
 - b. Stress test / stress model
 - c. GHG emissions
 - d. Other
41. Does your firm use any external instrument and data for the Climate-related risk assessment?
- a. Yes, which ones?
 - b. No
42. If your firm does a scenario analysis, do they use any publicly available climate-related scenarios
- a. Intergovernmental Panel on Climate Change (IPCC)
 - b. International Energy Agency (IEA)
 - c. Other
43. If your firm does a scenario analysis, which objective do they use?
- a. +1.5 degrees
 - b. +2 degrees
 - c. +3 degrees
 - d. +4 degrees
 - e. Other
44. Which type of climate-related risks information does your firm use in your risk analysis?
- a. Quantitative data only

- b. Both quantitative and qualitative
- c. Qualitative data

Appendix B: Additional questions for AP funds

45. Does the Committee on Ethics advise your firm on climate-related risks?
 - a. Yes
 - b. They do if we request it
 - c. No
46. To what extent does the competition with the other AP fund plays a role in your decision making on climate-related risks?
 - a. 1(none) - 10 (Very strong influence)
47. Does the fact that AP1 divested from fossil fuel makes any difference in your approach to climate-related risks?
 - a. Yes
 - b. No

Appendix C: Descriptive statistics

	+1,5°C	+2°C	+3°C	+4°C	other	N/A
Q43. If your firm does a scenario analysis, which objective do they use?	5	7	3	2	0	0

	Yes/No/Both	Total Average (min/max)	Total Number of respondents	AP funds Yes/No/Both	AP funds Average (min/max)	AP funds Number of respondents
Q11. How would you rate the degree of information of your firm on climate-related risks?		7,21 (4/10)	7		6 (4/8)	2
Q29. Does your firm have a team / a person that is dedicated to climate-related risks?	1/7/0		8	1/2/0		3

	All Yes	All No	All N/A
Q34. Has your firm observed the effect of climate change on the real economy?	7	1	0

	Yes, Why?	No, why not?	N/A
Q36. Does your firm think you could use the same portfolio that you have today in 10/20 years?	4	4	0

	Short term (< 1 year)	Middle term (1 to 3 year)	Long-term (3 to 6 years)	Very long term (> 6 years)	Number of Respondent
Q4. When considering risks, which time frame does your firm consider?	4	6	6	5	7