Does disinvestment from fossil fuels reduce the financial performance of responsible Sovereign Wealth Funds?

Abstract

This paper examines the implications of negative screening on the financial performance of Sovereign Wealth Funds (SWF). The main responsible SWFs are requested to divest from fossil fuel firms by their government and citizens. Yet, such a strategy may reduce the financial performance of these funds. This study proposes to determine to what extent excluding fossil fuel firms from SWF portfolios in order to comply with their ethical standards reduces their financial performance. By the mean of asset pricing models, namely the capital asset pricing model (CAPM) and the Carhart four-factor model, we find that exclusions without considering fossil fuel firms do not harm the financial performance of SWFs. Besides, we document similar results regarding the performance of SWFs fossil fuel portfolios, suggesting that fossil fuel divestment will not impact SWFs performance. We also test for differences between fossil fuel firms by distinguishing two categories: "extraction and production" and "refiners and integrated firms" to account for the decision of some SWFs to divest from the first category only. Our findings indicate that "extraction and production" companies generate to some extent lower returns. This implies that the decision of some SWFs to divest only from "extraction and production" firms could be based on financial considerations, in addition to ethical considerations. We also observe that exclusion and fossil fuel portfolios have a higher risk level, implying SWFs could decrease their overall risk-exposure when divesting from these portfolios. We conclude that SRI, by the mean of negative screening, does not reduce SWF performance.

Keywords: Sovereign Wealth Funds, Negative Screening, Fossil Fuel Divestment.

JEL Classification: G11, G23, Q30

I. Introduction

On October 1st, 2019, the Norwegian Ministry of Finance announced that the Government Pension Fund Global of Norway (GPFG) – the country's sovereign wealth fund – will divest from companies whose main core business is dedicated to oil and gas exploration and production[1]. Similarly, other sovereign wealth funds (SWF) such as the New Zealand Superannuation Fund, expressed their objective to reduce their portfolio carbon emission to fight against climate change[2]. Nevertheless, it seems that this campaign concerns particularly firms operating in fossil fuel extraction and production while refining companies are not concerned by such divestments.

Negative screening, which consists of excluding firms from a portfolio due to social, environmental, or governance issues has been widely used by "responsible SWFs" over the last decade as a strategy to implement socially responsible investments (SRI). In fact, several SWFs, as the GPFG of Norway or the New Zealand Superannuation fund have used negative screening to exclude from their portfolios firms that did not comply with their ethical guidelines or SRI policies (Jensen and Seele, 2013). The main reasons that led to these exclusions could be classified into two categories: norm-based and sector-based exclusions (Hoepner and Schopohl, 2018). The first category concerns companies that were reported to violate specific social norms such as children labor and human rights, while the second category concerns firms which business is related to "sin stocks" such as alcohol, tobacco, gambling (Fabozzi et al., 2008), and others sectors that may cause damage to the environment such as coal extraction.

Because more and more investors are implementing a social and ethical strategy, sovereign wealth funds are particularly incented to adopt SRI. First, even though SWFs are created and owned by governments and therefore do not have explicit liabilities, these funds are indirectly owned by the general public since they serve the purpose of increasing wealth for future generations (Seele et al. , 2015). They should then act in the best interest of their beneficiaries, that is to maximize the financial performance of their portfolios without undue risk, but also to behave responsibly and ethically. In fact, as public institutional investors, SWFs

[1] "Norway sovereign wealth fund to divest oil explorers, keep refiners", by Terje Solsvik, 1 October 2019, Reuters (https://www.reuters.com/article/us-norway-swf-oil/norway-sovereign-wealth-fund-to-divest-oil-explorers-keep-refiners-idUSKBN1WG4R9)

[2] https://www.unpri.org/climate-change/low-carbon-investing-and-low-carbon-indices/3283.article

have the fiduciary duty to act in the best interest of their beneficiaries in the long term, which goes beyond economic and financial considerations (Karametaxas, 2017).

Second, the massive investments of SWFs have raised public and legal concerns during the last years. For instance, during the financial crisis of 2008, SWFs injected important amounts of liquidities into distressed institutions in Europe and the United States. Among these investments, we could cite a capital acquisition of 11.4 billion$ in UBS made by the Singapore Investment Corporation, or an acquisition in Citigroup made by the Abu Dhabi Investment Authority for an amount of 7.5 billion$[3]. However, SWFs investments raised concerns and worries in recipient countries due to the lack of transparency of some funds regarding their true motivations. This led to defensive actions by authorities to protect strategic sectors related to energy, technology, and finance. Moreover, concerns emerged in the home countries of several SWFs where the general public increasingly expressed its interest in a proper behavior since it became aware of the social and ethical footprints of institutional investors (Clark and Monk, 2010).

Following the various financial, economic, social, and environmental crises of the past few years, we are witnessing the strengthening of a collective consciousness concerning environmental, social, and governance issues. This is reflected by the fact that public opinion considers investors as responsible for the business behavior of the firms they invest in (Blanc and Cozic, 2012). This is the case for many SWFs (mainly in democratic countries) that have been criticized for their investments in controversial sectors such as nuclear and weapons industries, in addition to firms that violated human, child, and labor rights. In fact, since those public funds manage a considerable amount of state-owned assets on behalf of the "people" (who are the implicit owner of those assets), they are constantly under public scrutiny (Richardson, 2011).

To face the public pressure, some SWFs with the approval of regulatory authorities, took the initiative to shift toward a responsible investment strategy. In order to implement SRI and reassure the general public, several funds have adopted negative screening and decided to divest from controversial companies. Among these funds, we can mention the GPFG of Norway, the New Zealand Superannuation fund, the French Pension Reserve fund (FRR), the Ireland Strategic Investment Fund (ISIF), and the Future Fund of Australia. All those funds excluded from their portfolios companies within specific 'sin activities' (e.g. tobacco, gambling, nuclear and weapons

[3] See "UBS writes downs $10 billion, Singapore injects capital", 10 December 2007, Reuters (https://www.cnbc.com/id/22178101)

production), as well as companies that are responsible for environmental damage (e.g. the GPFG and the FRR excluded coal-based companies) and firms that violated human and labor rights. However, with increasing awareness of climate change, public opinion becomes skeptical about the oil and gas industry and its environmental impact, and fossil fuel divestment campaigns emerge to urge SWFs to sell their stakes in this sector. For instance, this is the case in Norway, New Zealand, or Alaska[4] where public and political pressures ask for the respective funds of these states to consider excluding firms related to oil and gas production and extraction.

The exclusionary strategy used by SWFs and other funds has raised concerns about its impact on the financial performance of investors who use it. Avoiding investments in some industries can indeed be expected to generate some financial cost due to a reduction in opportunities for portfolio diversification (Barnett and Salomon, 2006). An important stream of the literature analyzing the impact of exclusions on financial performance found that investors could suffer from an opportunity cost insofar as screened portfolios do not benefit from the superior profitability offered by "sin stocks" (Hong and Kacperczyk, 2009; Trinks and Scholtens, 2017). A dilemma might exist then between choosing financial performance and favoring ethical and responsible behavior since it seems that being responsible (through the use of negative screening) has a cost. SWFs that implemented or are considering implementing SRI are also concerned by this problem, especially since they are more sensitive to their beneficiaries' claims as public investors and may be urged to adopt SRI.

This study aims to examine the validity of this dilemma regarding the choice between financial performance and ethical requirements. We investigate the case of sovereign wealth funds that apply an exclusionary strategy and discuss whether excluding firms from their portfolios is at the expense of their financial returns. This issue has been tackled in previous research related to 'sin stocks' along with the implication of exclusions on sustainable indexes and SRI private funds (Endrikat, 2016). However, little is known about how negative screening may impact SWFs financial performance. To the best of our knowledge, one research focused on this issue by studying the case of the GPFG (Hoepner and Schopohl, 2018) and found that negative screening did not harm the fund performance, meaning that the Norwegian fund "*can meet the ethical objectives of their beneficiaries without compromising financial returns*".

[4] See "https://www.juneauempire.com/opinion/opinion-its-time-for-the-permanent-fund-to-divest-from-fossil-fuels/"

The first novelty in our study is that we propose to include other SWFs that use exclusion and examine if their financial performance is impacted. We propose to consider the New Zealand Fund and the Irish SWF in addition to the GPFG. These 3 SWFs have excluded firms that did not respect their ethical policies even though the criteria of exclusion may differ from one fund to another. The scope of industries concerned by exclusions, as well as the intensity of screening, depend on the funds and slightly diverge. For instance, the GPFG chooses to exclude from its investment portfolio companies involved in the production of coal, which is not the case for the other SWFs considered. This sheds light on examining whether the nature and intensity of screening by SWFs lead to different impacts on their financial performance.

The second novelty consists of considering fossil fuel as a new criterion for divestment. A review of the negative screening literature shows that several industries and activities are considered sinful in a recurring way. By contrast, the fossil fuel industry – more specifically, gas and oil firms – is rarely considered as a reason for divestment, despite the emergence of fossil fuel divestment campaigns in developed countries. To this date, no SWF has effectively divested from all fossil fuel firms. The main exception concerns the case of coal and coal-based firms, which have been partially excluded from the portfolio of several SWFs such as the GPFG of Norway or the Ireland Strategic Investment Fund. For instance, the GPFG excludes firms with at least 30 percent of the income derived from the production of thermal coal or coal-based power production[5].

Nevertheless, responsible SWFs expressed their will to divest from other fossil fuel firms related to oil and gas production, since the GPFG and the Ireland Strategic Investment Fund recently decided to divest from firms related to oil and gas even though the decision has not been executed yet, and other SWFs are seriously examining the issue. We propose then to expand the field of screens applied by some SWFs by adding the oil and gas sectors and analyze their impact on the financial performance of considered funds. In other words, we examine the outcome of the exclusionary strategy on SWFs in terms of financial performance by adding other SWFs and considering the case of fossil oil divestment.

One should note that SWFs willing to divest from the fossil fuel industry expressed their intention to keep stakes in refiners, downstream firms, and some integrated oil firms. One of the reasons given behind the distinction between “oil and gas extraction and production firms” and “refiners and integrated firms” is that the second category has the financial and

[5] According to their website: “https://www.nbim.no/en/the-fund/responsible-investment/divestments/”

technological capacities to shift toward renewable energy, and therefore has a lower environmental negative impact[6]. One could question this argument and discuss the real motives behind the decision to distinguish among firms related to the fossil fuel sector. This is why we propose to separate fossil fuel firms into two groups: "fossil fuel extraction and production" and "refiners and integrated firms", to perceive if there are any differences between the two groups in terms of financial returns which could explain the distinction made by SWFs.

Add to this, this study aims to enrich the negative screening literature, more precisely on oil and gas divestment, by the means of real-world based portfolio analyses. Whilst a large stream of the literature regarding exclusionary strategies uses hypothetical or 'fictive' portfolios to examine the financial impact of the exclusions, we consider SWFs real-world based portfolios. We can then examine the impact of negative screening on the financial performance of those funds, and therefore account for real-world investment restrictions (Adamsson and Hoepner, 2015).

This study proposes to combine several fields of literature, namely negative screening, oil divestments, and SWFs responsible investments. By focusing on the case of responsible SWFs, we analyze the impact of one of the main SRI strategies they implement (i.e. negative screening) on their financial performances. We extend the framework of 'sinful' issues generally considered in the negative screening literature by including the fossil fuel sector. Examining whether the SWFs exclusionary strategy may harm their financial returns is a challenging issue since these funds are public institutional investors with no explicit liabilities except for the citizen of their home countries. This means that SWFs are supposed to allocate their assets in a way it suits the best interest of the people in terms of financial performance, as well as in terms of social and environmental performance. Because public opinion nowadays seems in favor of fossil fuel divestment and a transition toward renewable energies, SWFs could play an important role to achieve these objectives. As state-owned companies, they may be used by authorities as a tool to reduce the social and environmental impact of their investments and encourage private stakeholders to follow them in the long term.

This paper is organized as follows. Section 2 provides an overview of the literature regarding responsible SWFs and negative screening while section 3 presents the hypotheses

[6] "Norway's $1tn wealth fund to divest from oil and gas exploration", by Rob Davies, 8 Mars 2019, The Guardian (https://www.theguardian.com/world/2019/mar/08/norways-1tn-wealth-fund-to-divest-from-oil-and-gas-exploration)

being tested in the paper. Section 4 introduces the data and methodology used in this paper. Section 5 presents the empirical results. Section 6 concludes.

II. Litterature background

1. SWFs and negative screening: toward fossil fuel divestment

Even though the first SWF was created more than six decades ago, the literature about these institutional investors is more recent since the term "sovereign wealth fund" was first mentioned by Rozanov (2005). A sovereign wealth fund can be defined as " *a special investment fund created by government to hold foreign assets for long-term purposes"*(International Monetary Fund, 2008). At the end of 2019, the SWF Institute counts 88 SWFs around the world managing more than $8 trillion of assets[7], which consist mainly of shares, but also bonds, private equity, and real estate. The bulk of SWF literature focuses on their investment strategies, and more specifically on the impact of their investments and divestments on the value of a targeted company. As large and activist investors with a long-term investment horizon, they tend to have a positive impact on the value of targeted firms (Bortolotti et al., 2009; Fernandes, 2009; Dewenter et al., 2010). However, such results vary according to the sample period studied, since short-term impacts on targeted firm values seem to be more pronounced than long-term impacts.

During the last decade, we have seen the emergence of a new trend within SWFs. In fact, some of them pay attention to extra financial considerations, by integrated ethical issues into their investment policies. A famous example is the case of the GPFG of Norway, that is the biggest SWF in terms of assets under management and considered as one of the most influential responsible SWF. This fund has completely integrated ethical and socially responsible values in its investment guidelines (Yin, 2017). Additional SWFs have followed the lead of the GPFG by implementing SRI in their core strategies, such as the FRR of France, the New Zealand Superannuation fund, the Ireland Strategic Investment Fund, or the Future Fund of Australia, while others are beginning to apply some aspects of SRI. A large part of the literature focusing on SWFs sustainability and their implication in SRI are either conceptual or

[7] See "Top 88 Largest Sovereign Wealth Fund Rankings by Total Assets", available on: https://www.swfinstitute.org/fund-rankings/sovereign-wealth-fund

descriptive and they focus mainly on governance and legal issues. For instance, Roose et al. (2012) propose a research agenda to facilitate SWFs to implement SRI, while Van der Zee (2012) emphasizes the role responsible SWFs play by influencing target firms' social and environmental behaviors.

However, we notice a clear lack of empirical studies about SRI implications on SWFs. Yet, interesting findings deserve to be mentioned on this topic. The first one concerns the activism of some responsible SWFs, that interfere in targeted firms in order to improve their corporate and governance practices (Dimson et al., 2015). A second study takes the case of the GPFG and provides evidence about its role as an intermediary signaler since the location of fund investments provides indications about target countries' institutional environment to market participants (Vasudeva et al., 2018). Finally, Hoepner and Schopohl (2018) show that negative screening does not reduce the financial performance of the GPFG of Norway and that the fund can meet its ethical commitment without reducing its return. Our study stands in the same stream. In fact, several SWFs have already applied the exclusionary strategy as a tool to respect their ESG commitments. They apply several screens related to sectors or business conducts they consider to be unethical, such as tobacco or nuclear weapons (details of SWFs screens are displayed in Table 1).

Table 1. Presentation of responsible SWFs and screens applied

Nevertheless, during the last decade, a rise of protests and an increase of oil and gas divestment campaigns surged in the home countries of several SWFs, urging investors and authorities to divest from fossil fuel firms. The rise of this movement has been driven by scientific community warnings and calls for a global action to prevent climate change (Gross, 2015) and the related social costs it causes (Bergh and Botzen, 2015). The first organizations calling for fossil fuel divestment were universities, foundations as well as municipal bodies (e.g. cities and counties). However, the growth of public opinion awareness began to put pressure on firms, institutional investors, and governments-owned companies to account for extra-financial issues, such as their ecological impacts (Ayling and Gunningham, 2017). SWFs in democratic countries were criticized due to their stakes in fossil fuel companies responsible for high levels of carbon emissions and climate change, which is in contradiction with one of the main aims of SWFs, which is to act in the best interest of their beneficiaries (Richardson,

2011). Even though those funds manage by themselves their assets allocation and investment, they remain state-owned entities financed mainly by public money. Therefore, they are under pressure of public opinion, and public authorities may interfere to negotiate divestment terms. Sometimes, as it was the case in Norway, the SWF board can take the initiative to call upon the Parliament to vote for an oil and gas divestment bill. Due to their institutional nature, the size of their assets, their diversified portfolios, and their long-term investment horizon, SWFs are more likely to support the possible costs related to a fossil fuel divestment. A commitment to fossil fuel divestment could encourage other governmental institutions and even private entities to follow their lead.

2. Negative screening and financial performance

SWFs that adopt SRI may implement several strategies such as shareholder activism, best-in-class strategy, or negative screening. The last strategy seems to encounter a large success within responsible SWFs since most of them use it. However, this phenomenon seems to be in contrast with the theoretical grounds on SRI since this literature considers that negative screening is an outdated method, and responsible investors should rather adopt more "modern" strategies such as commitment and positive screening (Kolstad, 2016; Sparkes and Cowton, 2004).

Negative screening is a strategy consisting of avoiding investing in or excluding companies that do not comply with predetermined environmental, social, and governance criteria (Renneboog et al., 2008). Even though the exclusionary strategy could impact the value and performance of concerned firms (Doh et al., 2010), we focus in this study on its impact on the financial performance of investors, and more specifically SWFs that use it. This stream of the literature is relatively mature, and several scholars already examined the financial performance of screened portfolios and compared them with portfolios composed of controversial sectors. Hong and Kacperczyk (2009) were pioneers in this field, where they analyzed American "sin stocks" from the tobacco, alcohol, or gambling sectors and they found that those stocks generated a positive abnormal return compared to their peers. Several studies found results similar to the ones of Hong and Kacperczyk (2009). For example, Durand et al. (2013) extended the field of screens by considering firms involved in nuclear and military businesses and found supporting evidence of outperformance of unscreened portfolios. In the same stream, Trinks and Scholtens (2015) considered a wider range of controversial issues and

included fourteen types of screens. They concluded that negative screening generates an opportunity cost since it reduces the size of the investment universe. Those results were confirmed on other stock markets by Salaber (2013) for Europe and Fabozzi et al. (2008) with a global study including 21 different markets.

On the other hand, many studies did not find significant evidence about the outperformance of controversial stocks. For example, Kempf and Osthoff (2007) documented insignificant results for controversial U.S. stocks compared to industry comparable stocks. Similar results on American companies were found by Adamsson and Hoepner (2015), as well as on European firms where Vide (2016) did not find evidence about a consistent outperformance or underperformance of sin stocks.

With respect to negative screening, it seems that the literature is inconclusive as well. The heterogeneity of the findings is probably due to differences in cultures, countries, investor behaviors, and methodological choices (Trinks and Scholtens, 2015). Add to this, all the studies mentioned above share the fact that all of them have constructed hypothetical or fictional portfolios of sin stocks. According to Hoepner and Zeume (2014) and Hoepner and Schopohl (2018), this assumption presents one main disadvantage: it does not consider real-world investment constraints. For instance, screenings may differ from one investor to another in terms of screening intensity, and some criteria related to stocks such as market capitalization and liquidity should be considered. Other studies managed to overcome this issue by focusing on "real-world" screened portfolios, mainly mutual funds that use the exclusionary strategy, by analyzing their performance.

A large part of this stream of the literature shows that SRI funds do not differ from conventional funds or benchmark indexes in terms of financial performance, implying that negative screening does not reduce SRI funds' performance (Capelle-Blancard and Monjon, 2014). This result should be interpreted with caution since several factors have not been accounted for. In fact, Barnett and Salomon (2006), Lee et al. (2010), and Capelle-Blancard and Monjon (2014) show that the intensity and the type of screenings applied by funds affect the impact of exclusions on financial performance. For instance, Lee et al. (2010) and Capelle-Blancard and Monjon (2014) documented a negative relation between the number of screens and performance, while Renneboog et al. (2008) found that social screens have a higher negative impact on the financial performance of funds than ethical or environmental screens.

3. Oil divestment and financial performance

As the literature on negative screening got developed, the number of screens considered by academics increased. Whereas Hong and Kacperczyk (2009) retained only three types of screens, namely tobacco, alcohol, and gambling, the studies that followed broadened this field by including new types of screening. For instance, added 11 new types to the screens proposed by Hong and Kacperczyk (2009). Also, we notice that it is often the same screens that are highlighted in the literature since many studies are based on screens classification by ESG raters. In the two studies mentioned above, the case of oil and gas was not included as a screen since it is not considered as a "sinful" or controversial activity.

An important issue arising from the call to fossil divestment is its effect on financial performance. More specifically, investors wonder whether excluding firms extracting and producing oil and gas may lead to a deterioration of their portfolios' financial performance, as a result of a decrease in diversification (Trinks et al., 2018). The literature addressing this impact is quite recent, contrary to other controversial issues since the fuel divestment started recently (Ayling and Gunningham, 2015). Even though modern portfolio theory (Markowitz, 1952) predicts a decrease in performance due to fuel divestment, a large stream of this emerging literature shows quite the opposite. For instance, Sireklove (2016) shows that divesting from the fossil fuel sector reduces the financial performance of screened portfolios in the short-term, but this effect tends to disappear in the long run, implying that short-term investors are more sensitive to this issue. Trinks et al. (2018) find similar results and provide evidence that fossil fuel company stocks do not outperform other stocks in the long term. Similar conclusions are documented by Yook and Hooke (2019). Moreover, Halcoussis and Lowenberg (2018) documented a slightly higher rate of return of fossil-free portfolios compared to the market index, suggesting the absence of an opportunity cost. Similar results were found by Henriques and Sadorsky (2018).

Despite the homogeneity of these results, they must be interpreted cautiously. Similarly to a non-negligible part of the negative screening literature, the studies mentioned above have constructed hypothetical fossil fuel portfolios that do not necessarily consider real-world investment constraints (Hoepner and Zeume, 2014). Add to this, they all considered the fossil fuel divestment case as being independent of the remaining of the negative screening literature in the sense that they did not account for other types of screens. In other words, they only excluded fossil fuel stocks from the investment universe without excluding other controversial

stocks. However, screening intensity has an impact on financial performance (Capelle-Blancard and Monjon, 2014) and therefore should be accountable since it could lead to different and more realistic results. SRI investors that already excluded "traditional" controversial firms are more likely to divest from the fossil fuel industry (Ritchie and Dowlatabadi, 2015).

A part of the literature overcomes the issue regarding the "fictive" aspect of fossil-free portfolios by examining the case of green mutual funds[8]. One of the first scholars to examine the performance of green funds was White (1995) who compared environmental funds with SRI and conventional funds. He found out that environmental funds exhibited lower risk-adjusted returns vis-à-vis the US market (S&P 500) for a period before 1995. However, the latest studies focusing on a more recent sample period and other market indexes found that green fund does not significantly underperform their conventional peers (Climent and Soriano, 2011). Similar results were found by Ibikunle and Steffen (2017) on European green mutual funds. They documented an improvement in the financial performance of these funds in a recent period. They indeed noticed in several cases that this improvement could be explained by an increase of investors' awareness of a decreased risk exposure of green funds compared to their peers and more specifically their black peers[9].

III. Hypotheses development

The review of the literature addressing the financial performance of negative screening revealed that there is not a strong consensus among scholars. Moreover, we also observed a lack of research on the financial impact of exclusionary strategies on public asset owners and on SWFs in particular. To the best of our knowledge, only one study has tackled this issue. Hoepner and Schopohl (2018) took the case of one specific SWF, the GPFG of Norway, and examined whether exclusions may deteriorate the financial performance of the fund. By conducting a time-series analysis, they found that negative screening does not harm the financial returns of the fund and that the type of screening seems to have a nonsignificant impact on the results. While fitting the same stream of the literature, our study proposes to extend the

[8] A green mutual fund is defined as a fund that undertakes investments with regards to environmental principles and engagements (see Ibikunle and Steffen, 2017)

[9] Black mutual funds are funds investing in carbon-intensive stocks of firms involved in the extraction and exploitation of natural resources (see Ibikunle and Steffen, 2017)

field of research by considering all SWFs that apply negative screening, which should increase the robustness of the results. We also have to take into consideration the oil and gas sector as a new category of screen, since SWFs are on the verge of divesting from fossil fuel firms.

1. Financial performance of exclusion portfolios

The first part of our research question is to examine the impact of negative screening on the financial performance of SWFs without considering fossil fuel divestment. Due to the divergence of results we observed in the literature, several outcomes to our first question could be expected.

Several studies focusing on the performance of "sin stocks" documented an outperformance of these controversial stocks in comparison with their conventional peers (Fabozzi et al., 2008; Hong and Kacperczyk, 2009). Two main theoretical explanations are put forward to justify this relation. First, some institutional and public investors that are constrained by social norms investors due to the continuous pressure of public and/or political scrutiny are prompted to divest from controversial firms. The price of these stocks will drop relative to their fundamental values due to reduced risk-sharing, thus generating a higher expected return for controversial stock compared to their peers (Merton, 1987). Second, because of reduced risk sharing, Merton demonstrated that the CAPM is no longer accurate, meaning that the idiosyncratic risk and not just the beta matter for pricing. As a result, the higher litigation risk related to the core-business of sin companies, which is increased by social norms, should raise the expected return of sin stocks. Another argument highlighted by scholars is that adopting social and other ethical norms can generate additional costs which may affect negatively a firm revenue (Fabozzi et al., 2008). According to these arguments, we formulate the following hypothesis:

H1a. Exclusion portfolios have higher expected returns than the market index

Another stream of this literature states that portfolios that include controversial stocks underperform the market. The main argument behind this underperformance is that controversial firms are overvalued because firms involved in unethical business practices are more likely to bear hidden risks. The market may then misprice the real risk of the firm. In fact, unethical behavior often leads to litigation risk, social protests, and even political actions.

Another explication proposed by Barnett and Salomon (2006) is that unethical behavior decreases the reputation of concerned firms and causes a decline in customers' loyalty and revenues, as well as the capacity of the firm to be attractive on the labor market. This ultimately leads to a deterioration in management competitiveness and effectiveness (Renneboog et al., 2008b). In this configuration, we formulate the following hypothesis:

H1b. Exclusion portfolios have lower expected returns than the market index

A third possible outcome is that controversial stocks document no difference in their performance with their conventional peers. In other words, negative screening does not reduce financial performance. This assumption relies on the market efficiency hypothesis (Fama, 1970), which states that stock prices entirely reflect available information to investors. Any anomaly in prices would be detected and immediately corrected by market participants, thus reflecting all "visible and hidden risk" related to any unethical behavior or "sinful" activity (Fama, 1998; Hoepner and Schopohl, 2018). Applying this theory to the case of SWFs, this would imply that fund exclusion should not exhibit abnormal returns in comparison with their peers, and therefore the financial performance of SWFs should not be affected. Therefore, we formulate the following hypothesis:

H1c. Exclusion portfolios have similar returns than the market index

The increasing number of screens may have an implication on the diversification level of SWFs. According to modern portfolio theory (Markowitz, 1952), the reduction of the investment universe due to social or ethical norms would leave some investors with a less efficient portfolio. Negative screening would cause inefficiency by increasing an idiosyncratic risk that is not entirely compensated by a rise in returns. This diversification cost is a function of the number of stocks in a portfolio and the correlation between the stock returns. Therefore, based on Markowitz's (1952) portfolio theory, we believe that divestment from a large set of stocks poorly correlated with other market assets causes higher diversification costs. Add to this, if fossil fuel stocks are to be considered as sin stocks, one may expect a decrease of risk-sharing among fossil fuel investors since the aggregate demand for those stocks decreases in favor of their conventional peers causing an underpricing of oil and gas shares (Heinkel et al., 2001; Merton, 1987). As a result, fossil fuel investors, witnessing the decrease of their portfolio diversification, would ask for higher compensation and higher required rate of return. Therefore, one could predict a negative linear relation between screening intensity and risk-

adjusted returns. Considering fossil fuel as a new screen from which SWFs divest should decrease performance. Hence, we formulate the following hypothesis:

H2a. Exclusion portfolios with fossil fuel screen outperform the market index

In contrast, other scholars claim that increased screening intensity does not necessarily impact negatively risk-adjusted returns. The proponents of this relationship (Barnett and Salomon, 2006; Renneboog et al., 2008b) believe that screening intensity and financial performance are related to the intensity itself, but also to the type and nature of screens. Moreover, even though diversification costs can emerge from screening, they could be compensated by the benefits of selecting firms with stronger corporate social performance. In fact, companies with robust CSR performance are believed to be better managed and therefore more profitable. This postulate is supported by the stakeholder theory (Wicks et al., 1999), suggesting that maximizing stakeholder benefits may result in greater company productivity and value. This implies that the demand for companies with good CSR performance would increase, leading to a rise in their stock price, while firms showing low CSR performance would experience a decrease in their demand, and therefore a decrease in their stock price. Therefore, we formulate the following hypothesis:

H2b. Exclusion portfolios with fossil fuel screen do not outperform the market

2. Fossil fuel firms: Exploration and production firms vs refiners and integrated firms

As mentioned previously, the fossil fuel divestment decisions made (or under study) by some SWFs do not concern the whole "oil and gas" industry. Exclusions concern mainly companies operating exclusively in fossil fuel exploration, drilling, and extraction. This process is referred to as the upstream phase of the life cycle of oil. On the other hand, refiners, integrated firms, and other "downstream" companies are not concerned with this decision. This choice could be driven by extra-financial concerns (environmental and social impacts), but also by economical and financial motivations. We examine the impact of distinguishing between these two categories of fossil fuel firms: do the two types of firms exhibit similar or different financial performance, and why? We believe that the answer to this question will shed the light on the true motivation behind SWFs decision to differentiate between fossil fuel firms. To the best of

our knowledge, this issue (the difference between the two categories in terms of financial performance) has not been raised yet in previous studies. Several outcomes could be expected.

First, the two categories exhibit differences in terms of environmental and social impacts. Even though they both have a negative effect, extraction and production activities tend to cause more severe environmental and social damages. For instance, they affect ecosystems through the pollution and contamination of land and water as well as the harm of animals and represent health and safety risks on oil industry workers and on local communities (O'Rourke and Connolly, 2003). In comparison, refiners and integrated firms exhibit lower environmental and social risks (Epstein and Selber, 2002). We could expect then than socially responsible investors will tend to refrain and abstain from investing in those firms, due to their environmental and social negative impacts. According to Hong and Kacperczyk (2009), such firms involved in "vice" activities that are contradictory to societal norms are exposed to funding restrictions, since norm-constrained investors and institutions avoid investing in such companies. This should result in the decrease of stock prices of "fossil fuel extraction and production" firms relative to their fundamental values due to reduced risk sharing (Merton, 1987) and therefore generate higher expected returns. Add to this, one should take into consideration litigation risks related to fossil fuel extraction and production companies (e.g. conflicts with local communities), as well as other risks such as terrorism targeting oil facilities. Due to the risky nature of the oil extraction business, investors would then require higher compensation. Therefore, we formulate the following hypothesis:

H3a. Exploration and extraction firms outperform refiners and integrated firms

In contrast, one could expect that fossil fuel extraction and production firms underperform refiners and integrated firms if we follow the same reasoning as for the hypothesis H1b. In fact, fossil fuel extraction and production firms are more likely to bear hidden risks. For instance, as mentioned previously, these firms could be affected by political risks, as well as environmental risks that are not always visible to the market. We can cite for example the risk of oil spills on onshore and offshore facilities[10], the risk of incidents that workers are exposed to, or even the risk related to fossil fuel exploration. For instance, during the phase of identification of potential oil reserves, important infrastructures are deployed, generally at expensive costs. However, there is no certainty of finding fossil fuel and the amounts invested

[10] The National Academy of Sciences estimated in 2002 that 38000 tons of petroleum hydrocarbons were spilled into oceans each year during the 1990s due to oil and gas extraction (Oil in the Sea III: Inputs, Fates, and Effects. National Research Council, 2003)

generate no revenue at this time. All these hidden risks may not be correctly incorporated by the market, causing an overvaluation of those firms that are more likely to generate lower financial performance (Hoepner and Schopohl, 2018). In comparison, refiners and integrated firms are less exposed to these hidden risks. Therefore, we formulate the following hypothesis:

H3b. Exploration and extraction firms underperform refiners and integrated firms

IV. Data and methodology

We investigate the performance impact of divestment on the profitability of SWFs that employ negative screening. The first source of data is the exclusion lists published by the following SWFs: the GPFG of Norway, the FRR of France, the New Zealand Superannuation Fund, and the Ireland Strategic Investment Fund. We will also consider the case of Alaska Permanent Fund, which has not implemented SRI nor negative screening, but due to public pressure is considering divesting from the fossil fuel sector. The second source of data consists of all reports and publications disclosed by the concerned SWFs. To do so, we searched for all the publications available on their website and extracted all the data related to their holdings as well as their exclusions. We managed to gather the history of their divestments, including the company names, the reason for exclusion, and when available, the exact date of exclusion for all concerned funds. When exact dates of exclusions were not available, we relied instead on the year when those divestments occurred. Then, for each fund, we grouped the exclusions according to the year in which they took place in order to construct annual lists of exclusions, starting from the most recent ones and reconstructing the annual lists back in time based on the funds' announcements of previous exclusions and re-inclusions if available. Based on these lists, we managed to construct portfolios of excluded firms at any point in time (annually). For each fund, we established several portfolios in order to test our hypotheses:

- Portfolio A containing all exclusions with the exception of fossil fuel divestments for each fund on an annual basis
- Portfolio B containing only fossil fuel divestments for each fund on an annual basis
- Portfolio C containing all exclusions for each fund on an annual basis
- Portfolio D containing only fossil fuel firms operating in extraction and production for each fund on an annual basis (GICS codes: 10101010; 10102020; 10102050)

– Portfolio E containing only fossil fuel firms considered as refiners and integrated firms for each fund on an annual basis (GICS codes: 10102010; 10102030; 10101020; 10102040)

We created these different portfolios in order to analyze and to compare changes in performance implied by exclusions, especially those related to fossil fuel divestment for each fund.

Only the Ireland Strategic Investment Fund and the GPFG of Norway have begun to partially exclude some fossil fuel firms, mainly related to the coal industry. The remaining fossil fuel companies have not been excluded yet effectively by the SWFs, even though the decision has been taken or is under serious consideration. Therefore, we decide to consider fossil fuel divestment as granted. In other words, we decide to consider all fossil fuel firms in which funds have shares as if they have already been excluded from SWFs portfolios. To do so, we extracted from SWFs annual holding lists all firms related to the fossil fuel industry based on the Global Industry Classification Standard codes (GICS)[11]. Then, in order to separate those firms regarding their activities (extraction and production versus refiners and integrated firms), we used the GICS sub-industry codes related to the energy equipment & services industry (code 101010) and oil, gas & consumable fuels (code 101020), as displayed in Figure 1. After identifying fossil fuel firms with respect to their sub-industry, we managed to construct for each fund two portfolios, the first one containing extraction and production firms, and the second one containing refiners and integrated firms, by following the same method mentioned previously[12].

[11] According to the GICS, fossil fuel firms are classed under the sector code 10.
[12] Please note that some firms (less than 10%) were removed from Portfolios D and E because we did not find their GICS sub-industry codes

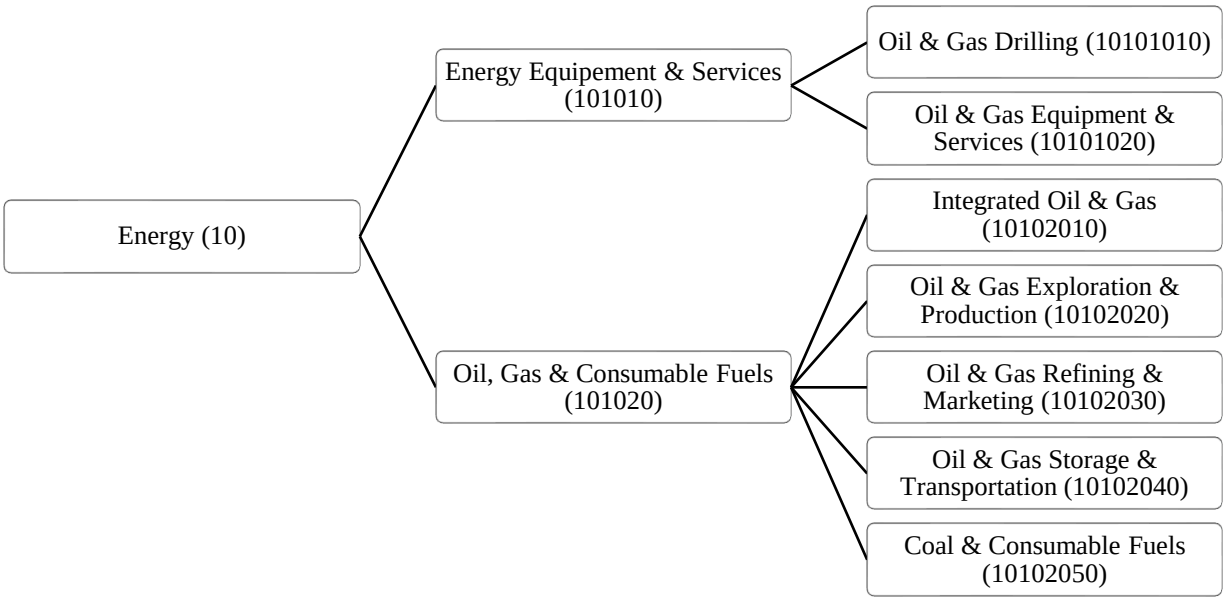

Figure 1: Fossil Fuel Firms Categorizations According to the GICS

Then, we match the portfolios we constructed with the stock price data of their relative stocks. Monthly stock prices for excluded companies and fossil fuel firms were extracted from Datastream© for the period 2005-2019.

For each of the portfolios, we constructed monthly continuously compounded returns for equal-weighted portfolios. Equal-weighted portfolios allocate equal weight to each company so that the return of the portfolio represents the simple average of the individual stock returns. The equal-weighted return is calculated as the natural logarithm of the average return of all companies excluded at the end of a particular month, which can be expressed in the following way:

$$r = \ln\left[\frac{1}{k}\sum_{i=1}^{k}\frac{P_{i,t}}{P_{i,t-1}}\right] \quad (1)$$

where r is the equal-weighted, continuously compounded portfolio return over month t, $P_{i,t}$ is the stock price of a company *i* at the end of month t, $P_{i,t-1}$ is that company's stock price at the end of the previous month *t-1*, and the total number of companies in the portfolio equals *k*.

Because this study performs real-world based portfolio analysis, we also computed value-weighted portfolio returns. Several arguments motivated our choices. Not only

computing value-weighted returns is in line with SRI literature (Adamsson & Hoepner, 2015; Hoepner & Schopohl, 2018; Trinks & Scholtens, 2015), it also accounts for SWFs characteristics. SWFs are passive investors, and their holding weights are similar to the market weights (Chambers et al., 2012). They also use value-weighted market indices as benchmarks (Hoepner & Schopohl, 2018). The main difference between the value-weighted return and the equal-weighted return calculation is that a firm return is weighted by the firm market capitalization at the end of the previous month:

$$r_t = ln\left[\sum_{i=1}^{k}\left(\frac{P_{i,t}}{P_{i,t-1}} \times \frac{MCap_{i,t-1}}{\sum_{i=1}^{k} MCap_{i,t-1}}\right)\right] \quad (2)$$

where r_t represents the value-weighted, continuously compounded portfolio return over month *t* and $MCap_{i,t-1}$ is the market capitalization of a company *i* at the end of month *t*-1.

In order to test the performance consequences of negative screening on SWFs' financial returns, we use two standard asset pricing models. First, we estimate a Capital Asset Pricing Model (CAPM) with the market risk premium corresponding to the excess return of the fund's performance benchmark. Second, we test the performance effects in the framework of a four-factor model, where we add size, value, and momentum factors to the market factor (Carhart, 1997). As all the SWFs considered in the analysis invest in a worldwide and very diversified portfolio, the market benchmark considered in the models needs to be a worldwide and diversified index. The MSCI All Country World index (here and after MSCI) meets these characteristics and subsequently it is commonly used in academic research (Trinks and Scholtens, 2015). The CAPM model can be expressed in the following way:

$$r_{p,t} - r_{f,t-1} = \alpha_p + \beta_p\left(r_{m,t} - r_{f,t-1}\right) + u_{p,t} \quad (3)$$

Where $r_{p,t}$ is the continuously compounded return on either the equal-weighted or value-weighted exclusion portfolio p over month t, $r_{f,t-1}$ is the continuously compounded 3-month U.S. Treasury bill rate at the end of month t-1 which serves as a proxy for the risk-free rate applicable for month t, $r_{m,t}$ is the continuously compounded return on the MSCI All Country World index which represents the market benchmark portfolio, α_p is Jensen's alpha measuring the abnormal return of portfolio p relative to the market, β_p is the market beta of portfolio p capturing the systematic risk exposure of the portfolio and $u_{p,t}$ is the independent disturbance term.

Following the existing literature (Hoepner and Schopohl, 2018; Trinks et al., 2018), we also applied the Carhart four-factor model, given as follows:

$$r_{i,t} - r_{f,t-1} = \alpha_i + \beta_i\left(r_{m,t} - r_{f,t-1}\right) + \gamma_i SMB_t + \delta_i HML_t + \varphi_i WML_t + u_{i,t} \qquad (4)$$

where SMB_t (small minus big) is the global size factor, HML_t (high minus low) is the global value factor, and the WML_t (winner minus loser) is the global momentum factor. The data corresponding to the three factors was extracted from the Kenneth French's online data library[13].

V. Results

1. Descriptive statistics

Table 2a presents summary statistics of the exclusion portfolios for each SWF. We notice that the ISIF (Ireland Strategic Investment Fund) excluded only 10 firms non-related to the fossil fuel sector, a number which is significantly lower than the ones displayed by GPFG (Government Pension Fund Global) and the NZSF (New Zealand Superannuation Fund). This is due to the fact that the ISIF applies just one screen –on cluster munitions– which is not related to fossil fuel. The APF (Alaska Permanent Fund) does not exhibit any exclusion in the portfolio since this fund does not use negative screening yet. The GPFG and the NZSF respectively excluded 147 and 131 firms from their investment universe. These numbers are higher since both SWFs apply more screens on tobacco, alcohol, nuclear and weapons production, and norm-based screens. We also notice that, with the exception of the ISIF, SWFs fossil fuel portfolios contain more "extraction and production" firms than "refiners and integrated firms".

Table 2a. Summary statistics of the exclusion portfolios for each SWF

[13] Available on their website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Table 2b provides descriptive statistics regarding the returns of the different portfolios for each fund and provides an initial insight into the performance implications of exclusions. Regarding portfolios (A), the average returns of exclusions by the GPFG and the ISIF are relatively low and positive, while the NZSF one exhibits a higher positive average return. On the other hand, with the exception of the ISIF, the SWFs fossil fuel portfolios (B) exhibit high average returns, thus providing initial evidence about the performance implications of fossil fuel divestment. This implies that divesting from fossil fuel may generate an opportunity cost for SWFs.

Table 2b. Descriptive statistics on portfolio returns for each SWF

2. Results from the main portfolios

In order to assess implications of the exclusions on the performance of SWFs, we first rely on the CAPM model which accounts for the systematic market risk of a portfolio, and on the four-factor model which allows measuring the risk-adjusted performance of the different portfolios we previously defined. We estimate these models for both equally-weighted and value-weighted portfolios. To capture any outperformance (underperformance) of the excluded firms, we analyze the Jensen alpha estimates obtained from the regressions. A positive (negative) and significative alpha estimate suggests that a portfolio outperforms (underperforms) compared to the market, meaning that exclusions generate opportunity costs (benefit the fund). Any insignificant performance implies that negative screening does not impact the returns of SWFs.

Table 3. Equally-weighted performance results of considered SWFs using the CAPM model

Table 4. Equally-weighted performance results of considered SWFs using the Carhart four-factor model

Table 3 shows the estimations based on the CAPM for equally-weighted portfolios. Regarding portfolio (A) composed of all exclusions non-related to fossil fuel sectors, we find that for all SWFs, the alphas are positive, and they are significant for all funds according to the CAPM model (at the 1% and 5% respectively). Significantly positive alphas suggest that both funds' exclusions outperform relative to the market. Thus, negative screening may reduce the financial performance of these SWFs, since the funds are excluding from their portfolio's firms displaying high abnormal returns compared to the market. In addition, our findings related to the ISIF exclusion portfolio are in line with Hoepner and Schopohl (2018) results about the performance of controversial weapons since this fund uses only this screen (controversial weapons). Overall, when using an equally-weighted portfolio, it seems that the exclusionary strategy reduces the financial performance of SWFs. However, in a concern of robustness, we also consider value-weighted portfolios in the computation of the CAPM regression. The results are displayed in Table 5. We obtain different results, since all alphas are non-significant, except for the NZSF which displays a positive Jensen alpha that is significant at the 10% level. This means that when using value-weighted portfolios, the exclusionary strategy has no significant impact on the financial performance of SWFs. The results obtained in this way differ from those obtained previously, and this difference is explained by the fact that we take into account the market capitalization of the existing companies in the different portfolios. We believe that value-weighted results are more robust and realistic since they consider SWFs' actual portfolios allocation. The loss of significance we observe is in line with several studies (Adamsson & Hoepner, 2015; Hoepner & Schopohl, 2018) that also found that value-weighted portfolios tend to narrow abnormal returns observed on equally-weighted portfolios.

Regarding the performance of SWFs fossil fuel portfolios, we find for equally-weighted portfolios that only the FRR and the ISIF fossil fuel portfolios significantly outperform the market at the 10% level. However, this outperformance narrows when using value-weighted portfolios, implying that SWFs should not be financially impacted by fossil fuel divestment, regardless of other exclusions, since fossil fuel divestments do not appear to reduce their financial performance. This is in line with Trinks et al. (2018) findings which indicate that fossil fuel company stocks do not outperform the market over the period 1927-2016. Our results are therefore in line with their findings, as well as those of Henriques and Sadorsky (2018). In addition, we notice for both equally-weighted and value-weighted portfolios, the market betas are positive and highly significant, and fossil-fuel portfolios have a higher beta compared to the

exclusion portfolios, implying that the former is more volatile than the latter, and therefore excluding fossil fuel firms could contribute to reduce the risk of SWFs.

Finally, regarding portfolios (C) composed by all exclusion including fossil fuel divestment, we find no evidence about the outperformance of exclusions including fossil fuel stocks since we do not document significant Jensen alphas, based on value-weighted portfolios. This means that adding the oil and gas sector as a new screen for exclusions will not significatively impact SWFs by decreasing their financial performance. Therefore, we can validate our hypothesis H2b.

Table 5. Value-weighted performance results of considered SWFs using the CAPM model

Table 6. Value-weighted performance results of considered SWFs using the Carhart four-factor model

We also conducted regressions on the same portfolios using the Carhart four-factor model which accounts for several global risk factors. The results are presented in Table 4. Overall, the outcomes validate our initial findings and the results are consistent with our previous findings. In fact, we find significant levels for Jensen alpha using equally-weighted portfolios, but we observe a loss of significance when using value-weighted portfolios. Besides, value-weighted fossil-fuel portfolios do not exhibit significant abnormal returns, which confirms our previous hypothesis H2b, and reinforce the idea that negative screening does not reduce SWFs financial performance. Regarding the coefficient estimates of the four-risk factors, it seems that the size of the estimates on the MSCI market returns is slightly impacted by the addition of the risk factors (SMB, HML, and WML). The estimates on the HML factor for portfolio (B) are intuitive. In fact, all funds display positive and significant coefficients, meaning that SWFs have significant exposure to fossil fuel value stocks. This is also due to the fact that most fossil-fuel firms are value firms rather than growth firms. Overall, we strengthen our results using the Carhart model.

Table 7. Performance results by type of fossil fuel firms

We analyzed for each fund the performance of their fossil fuel portfolios by separating "extraction and production firms" from "refiners and integrated firms". The motivation behind this categorization is to examine whether fossil fuel firms differ in terms of financial performance according to their sub-sectors. In addition, several SWFs (the GPFG for instance) focus their fossil fuel divestment on "extraction and production firms". Our analysis thus allows us to better capture possible differences between the two categories (Table 7). It seems that some disparities exist between the two categories. While "refiners and integrated" firms do not seem to perform differently from the market index, this is not the case for "extraction and production firms". In fact, the GPFG and the NZSF exhibit negative and significant alphas (at the 5% and1% levels respectively, meaning that both "extraction and production" portfolios underperform their peers. Excluding these firms should be beneficial for these funds since it would improve their performance. Two other funds also display negative but insignificant alphas for their "extraction and production" portfolio. It seems then that the decision to exclude only this latter could also have financial motivations, rather than just ethical considerations, especially for the GPFG and the NZSF since they both expressed their will to divest from "extraction and production" fossil firms only. Nevertheless, we cannot' generalize our conclusion because not all SWFs show similar results.

3. Robustness tests

3.1. Negative screening and risk implications

We also propose to examine whether negative screening influences SWFs risk features. As a matter of fact, incorporating socially responsible policies by the mean of negative screening serves for managing risk rather than for maximizing returns. Excluding unethical firms from the funds' portfolios contributes in reducing risks, since avoiding investing in these companies exempts investors to support costs related to the unethical component of total risk (Boutin-Dufresne & Savaria, 2004) such as reputational costs (Aramburu & Pescador, 2019; Axjonow et al., 2018), cost of capital (El Ghoul et al., 2018; El Ghoul et al., 2011) or litigation risks (Hong & Kacperczyk, 2009; Hong & Kostovetsky, 2012). This issue has been mentioned in the literature dealing with SRI, and more specifically with negative screening and its risk implications (Hoepner & Schopohl, 2018; Humphrey & Lee, 2011). We then propose an

analysis of the riskiness of the exclusion portfolios with and without fossil fuel exclusions and a comparison to the funds' benchmark index. We begin by analyzing the total risk of the different portfolios using the standard deviation of returns, as follows:

$$sd_p = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_{xp,t} - \bar{r}_{xp})^2} \quad (5)$$

Where sd_p is the standard deviation of monthly excess returns of a portfolio *p* over a year, $r_{xp,t}$ represents the monthly return in excess of the risk-free rate of portfolio *p* on month *t*, $\bar{r}_{xp}$ is the average monthly excess return of portfolio *p* over the respective year, and T represents the number of months of the recent year.

Other measures were proposed in the literature to consider the downside risk of portfolio returns. Since we are examining the performance of SWFs 'unethical portfolios' compared to a market index in order to identify any excess returns (either positive or negative), we should consider other downside risk measures, as proposed in the literature. Downside risk represents the probability of actual returns losses endured by an investor compared to its expectation (Trinks et al., 2018). Such measures are appropriated when examining screening impact on financial performance since most of the exclusions concern firms implied in unethical activities and business practices, which bear risks as well as volatile and negative shocks to returns, mainly due to costs related to legal actions and boycotts (Humphrey & Lee, 2011). Moreover, these measures reflect more investors' incentives toward risks as investors tend to fear losses but welcome larger than expected gains. We propose then a measure that takes into consideration this asymmetry, the semi-standard deviation, that focuses only on the negative deviations from expected returns, and is calculated as follows:

$$ssd_p = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T} max\left[\left(\bar{r}_{xp} - r_{xp,t}\right), 0\right]^2} \quad (6)$$

Where ssd_p represents the semi-standard deviation of daily excess returns of portfolio *p* over the recent month. The maximum function ensures that only returns below $\bar{r}_{xp}$ are taken into consideration.

Finally, we also consider the minimum abnormal return of a portfolio over the recent year. The incentive behind adding this indicator is to capture the largest potential loss a portfolio could experience over a particular period of time. Examining the minimum abnormal return of SWFs exclusion portfolios allows us to determine if excluding firms with low ESG standards

or operating in the oil business protect SWFs from large losses. The results of the risk measures are displayed in Table 8.

Table 8. Risk measures of SWFs portfolios

Panel A shows the means and standard deviation of the risk measures for SWFs exclusion and oil divestment portfolios and Panel B shows the differences of risk measures between SWFs portfolios and the MSCI index, computed by the mean of a paired *t*-test on the mean values. The latter allows comparing if the difference between the mean values of different samples is statistically significant. We notice in Panel A that the MSCI index exhibits the lowest standard deviation *vis-à-vis* SWFs portfolios, and overall the lowest risk measure (semi-standard deviation and minimum return), with the exception of the NZSF portfolio (A) both semi-standard deviation and minimum return. This result is expected since this index is more diversified than exclusion portfolios, and therefore is less exposed to unsystematic risk. Because we consider the MSCI index is representative of SWFs global portfolios in terms of holdings allocation and diversification, we can assume that SWFs global portfolios risk measures are similar to the one of the MSCI index. This implies that SWFs exclusion portfolios present a higher risk level than SWFs global portfolios, and consequently excluding these firms would decrease SWFs risk exposure. We also observe higher values for oil divestment portfolios risk measures in comparison with both the MSCI index and exclusion portfolios, implying that oil firms are riskier than other excluded and firms, and SWFs would decrease their risk exposure when excluding them.

Panel B displays the mean differences between the MSCI index and the SWFs exclusion and oil divestment portfolio risk measures. Regarding portfolios (A) featuring excluded firms, it seems that only the ISIF presents a higher standard deviation and semi-standard deviation compared to the MSCI index. Other SWFs exclusion portfolios do not result in significant risk implications for their overall portfolios. This is not the case for oil divestment portfolios, since all SWFs exhibits significantly higher standard deviation and semi-standard deviation than the MSCI index and implicitly from SWFs global portfolios at the 1% level. The GPFG is the only exception because the standard deviation of the oil divestment portfolio is significant at the 10% level. Moreover, both the GPFG and the APF display a higher and significant minimum return than the MSCI index, at the 1% and 5% level respectively. Based on these results, we

can deduce that oil firms tend to be riskier than their counterparts, and therefore SWFs risk exposure should decrease if they consider divesting from fossil fuel industries. This is all the more true as SWFs oil divestment portfolios do not generate positive abnormal returns, and therefore these firms might expose SWFs to a higher downside risk without offering any compensation in terms of returns. We believe then that SWFs have all interest in divesting from fossil fuel industries.

3.2. Crisis versus non-crisis period

The sample time horizon used in this study covers the period 2005-2020, which corresponds to the date when SWFs exercised their first exclusions till today. Although this time frame does not extend over a very long period of time, many events have affected the economic and financial sphere and impacted the global financial markets, such as the financial crisis in 2008 or the collapse of the oil price in 2014. These two events have had a significant impact on financial securities, such as the companies concerned by the SWFs exclusion portfolios and the oil divestment portfolios. We could then presume that our results are affected by these events. For robustness issues, we then decided to examine several sub-periods in order to distinguish between crisis and non-crisis periods.

Regarding excluded firms portfolios (Portfolio A), we divided the studied time frame with regard to the financial crisis of 2008 into three subperiods: from 2005 to mid-2008, which corresponds to a period of stock market growth before the 2008 crisis, from mid-2008 till 2012, which correspond to the subprime crisis and its repercussions, and finally from 2013 to 2019, a period when the market has returned to a normal trend. For the determination of the sub-periods, we used the price curve of the MSCI World index, as this corresponds best in terms of geographical allocation with the exclusion portfolios. We also examine the sub-periods performance of exclusions and fossil fuel firms portfolios (i.e. Portfolio C). The results are presented in Table 9.

Table 9. Crisis vs non-crisis performance of excluded firms portfolios

For the period preceding the financial crises, we notice that excluded firms portfolios (Portfolio A) do not underperform their peers, and we even observe a significant outperformance of the FRR and ISIF portfolios at the 10% and 5% levels respectively. Moreover, when examining the period following the subprimes crises, we observe that exclusion portfolios do not exhibit an underperformance, and the GPFG displays a positive Jensen alpha. It seems that overall, excluded firms' portfolios perform well during non-financial times. However, for the sub-period corresponding to the 2008 financial crisis, all SWFs exclusion portfolios exhibit negative Jensen alphas, and the GPFG and FRR exhibit significant negative alpha at the 5% level. This implies that excluded firms do not perform well during financial crises comparing to their peers. We also analyze SWFs portfolios that include both excluded firms and fossil fuel firms (Portfolio C) to better capture how both excluded and fossil fuel firms impact SWFs' performance during crisis and non-crisis times. We find that SWFs portfolios "C" do not under or overperform during financial crises. However, they tend to underperform prior to the financial crises of 2008 since the GPFG, the FRR and the NZSF exhibit significant negative returns but show no significant performance differences after the financial crises. The conclusion for the non-crisis period is not conclusive, while it seems that during financial turmoil times, SWFs tend to not be negatively impacted by both excluded and fossil fuel firms.

Table 10. Oil crisis vs non-oil crisis performance of fossil fuel firms portfolios

Since our firm's sample contains a significant number of fossil fuel firms, we believe it would be interesting to examine how these companies are influenced by crude oil prices. Besides, we analyze to which extent fossil fuel firms are affected by oil shocks, and intuitively if SWFs are exposed to these shocks. We first identified three subperiods correspondings to different oil price trends: from January 2005 to June 2008, where oil prices were in an ascending movement, from July 2008 to June 2014, which corresponds to a decrease in oil price, and finally from July 2014 to 2019, where we observe a more severe oil shock. The results are displayed in Table 10. For the first shock (2008 to 2014), only the NZSF fossil portfolio exhibits a significant negative coefficient, while other SWFs fossil fuel portfolios do not show significant performance disparities. Likewise, all SWFs fossil fuel portfolios do not exhibit returns differences with their conventional funds, implying that these fossil fuel portfolios do not harm SWFs performance in times of oil shocks. Nevertheless, during the period 2005-2008

where oil prices were increasing, we observe that all SWFs fossil fuel portfolios display negative Jensen alphas, which are significant for the GPFG, the FRR, and the NZSF. It seems then that there is an inverse relationship between crude oil prices and fossil fuel firms' stock movements. We conclude then that SWFs fossil fuel portfolios can reduce their global financial performance during non-oil shock periods.

VI. Conclusion

Negative screening represents an effective strategy to protect investors from investing in controversial firms that are associated with unethical activities. Among the investors who employ this strategy, responsible SWFs are important and visible stakeholders. However, these funds also need to meet their financial objectives. They face a dilemma when employing negative screening, since exclusions may reduce the financial returns of these funds. The objective of this study is to examine this issue, by taking the case of several SWFs which apply negative screening. Moreover, in addition to analyzing all exclusions that already occurred, we also consider the case of fossil fuel divestment since several SWFs expressed their intention to divest from oil and gas firms, and more specifically from firms related to fossil fuel "extraction and production" activities. We consider the case of the four SWFs that already use the exclusionary strategy, namely the GPFG (Norway), the NZSF (New Zealand), the FRR (France), and the ISIF (Ireland). We also take the case of the APF (Alaska), a SWF considering engaging in fossil-fuel divestments.

In order to test the implications of negative screening on SWFs financial returns, we use two standard asset pricing models: the CAPM and the four-factor model. Regarding exclusions non-related to the fossil-fuel sector, we find overall that SWFs financial performance is not reduced or increased overall. We also document that SWFs fossil fuel portfolios do not under or overperform their conventional peers, suggesting that excluding these firms do not harm the financial performance of SWFs. Even when we account for both existing exclusions and fossil fuel divestment combined, we found that SWFs would not be affected when divesting in terms of financial performance. This implies that responsible SWFs could meet their ethical standards without harming their financial performance.

In addition, we divide fossil fuel firms into two categories, namely "extraction and production" and "refiners and integrated firms" to capture possible disparities between the two.

The first category has slightly more significant results than the second one since both the GPFG of Norway and the NZSF of New Zealand "extraction and production" portfolios display an underperformance. This means that the SWFs motivation behind excluding only "extraction and production" firms could be, to a certain extent, driven by financial considerations, rather than just ethical issues. However, not enough evidence is found to support this statement, since not all SWFs show the same results. Moreover, one possible reason which could motivate the choice of some socially responsible SWFs to not exclude "refiners and integrated firms" is that these funds may consider that this category of firms can shift toward cleaner and renewable energies, which is not necessarily the case for "extraction and production" firms.

We also consider negative screening implications on SWFs' risk exposure. By the mean of several risk measures, we acknowledge that excluded firms and fossil fuel portfolios exhibit higher downside risk levels, which increases SWFs risk exposure. This involves that when excluding these firms, SWFs' global risk exposure should decrease. We also test for the financial crises and oil crises impact on our results.

Through this study, we managed to provide new insights about negative screening and its implications on SWFs performance. In fact, we relied on actual exclusions and real-world fossil fuel portfolios, thus giving our results a realistic aspect. SWFs considering engaging in fossil fuel divestment should be encouraged that this strategy will not reduce their financial performance in order to meet their ethical objectives. However, the relative share of "extraction and production firms" in the SWFs portfolios should not strongly impact their overall financial performance. This should also encourage other SWFs and institutional investors to consider fossil fuel divestment, and more generally the implementation of social and environmental values. Future studies should consider other SWFs committed toward ethical investments.

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Tables

Table 1. Presentation of responsible SWFs and screens applied

	GPFG	NZSF	ISIF	FFA	FRR
General information					
Name	Government Pension Fund Global	New Zealand Superannuation Fund	Ireland Strategic Investment Fund	Future Fund of Australia	Fonds de Réserve pour les Retraites
Country	Norway	New Zealand	Ireland	Australia	France
Assets under management	1,098,820,000,000	28,939,100,000	24,521,500,000	117,535,000,000	36,400,000,000
Date of creation	1990	2001	2001	2006	2001
SRI implementation					
Negative screening	Yes	Yes	Yes	Yes	Yes
Positive screening	Yes	Yes	-	Yes	Yes
Shareholder Activism	Yes	Yes	Yes	Yes	Yes
Screen(s) applied					
Tobacco	Excluded	Excluded	-	Excluded	Excluded
Alcohol	Excluded	-	-	-	-
Weapons production	Excluded	Excluded	Excluded	Excluded	Excluded
Nuclear	Excluded	Excluded	-	-	Excluded
Human rights issues	Excluded	-	-	-	-
Environmental damage	Excluded	-	-	-	-
Coal industry	Partially excluded	Under study	Excluded	Under study	Partially excluded
Oil and gas industry	Exclusion pending	Under study	Partially excluded	Under study	Under study

Key: This table describes the different types of screens (such as exclusion criteria) applied by the following sovereign wealth funds: The Government Pension Fund Global (GPFG) of Norway, the French Fonds de Réserve pour les Retraites (FRR), the New Zealand Superannuation Fund (NZSF), the Ireland Strategic Investment Fund (ISIF) and the Future Fund of Australia (FFA). Screens applied by a fund are noted as "Excluded", screens partially applied are noted as "Partially excluded", screens that are under consideration of application by a fund but have not been decided yet are noted as "Under study", screens that have been adopted by a fund but are not effective yet are noted by "Exclusion pending". This table was made using sources and information available on the funds' websites, as well as information extracted from news articles.

Table 2a. Summary statistics of the exclusion portfolios for each SWF

	Number of firms				
	Portfolio A	Portfolio B	Portfolio C	Portfolio D	Portfolio E
GPFG	147	424	571	219	168
FFR	58	108	166	63	45
NZSF	131	242	373	145	94
ISIF	10	109	119	48	61
APF	-	237	237	122	115

Key: This table provides summary statistics on the number of firms in each portfolio and for each fund. The acronyms GPFG, NZSF, ISIF, and APF respectively refer to Government Pension Fund Global of Norway, New Zealand Superannuation Fund, Ireland Strategic Investment Fund, and Alaska Permanent Fund. Portfolio A exhibits the number of firms excluded from a fund except for fossil fuel firms. Portfolio B exhibits fossil fuel firms for each fund. Portfolio C exhibits all exclusions for each fund, including fossil fuel firms. Portfolio D exhibits "extraction and production" firms for each fund. Portfolio E exhibits "refiners and integrated firms" for each fund.

Table 2b. Descriptive statistics on portfolio returns for each SWF

	GPFG	FFR	NZSF	ISIF	APF
Portfolio A returns					
Mean	0.006	0.005	0.077	0.009	-
Sd	0.039	0.035	0.036	0.052	-
Min	-0.167	-0.103	-0.063	-0.242	-
Max	0.130	0.128	0.175	0.182	-
Portfolio B returns					
Mean	0.071	0.047	0.041	0.005	0.045
Sd	0.235	0.198	0.254	0.063	0.257
Min	-0.337	-0.263	-0.289	-0.255	-0.315
Max	0.608	0.239	0.948	0.181	0.404
Portfolio C returns					
Mean	0.055	0.021	0.068	0.005	0.045
Sd	0.187	0.095	0.257	0.061	0.257
Min	-0.278	-0.211	-0.169	-0.254	-0.315
Max	0.767	0.207	0.501	0.171	0.404
Portfolio D returns					
Mean	0.084	0.062	0.052	0.004	0.055
Sd	0.224	0.213	0.209	0.081	0.322
Min	-0.334	-0.286	-0.359	-0.268	-0.329
Max	0.646	0.364	0.463	0.231	0.997
Portfolio E returns					
Mean	0.036	0.012	0.006	0.005	0.017
Sd	0.172	0.086	0.049	0.055	0.113
Min	-0.323	-0.114	-0.192	-0.246	-0.299
Max	0.335	0.168	0.154	0.159	0.827

Key: This table displays descriptive statistics for the equal-weighted returns of the portfolios of the GPFG, the NZSF, the ISIF, and the APF, namely the mean, standard deviation, minimum and maximum values.

Table 3. Equally-weighted performance results of considered SWFs using the CAPM model

	GPFG	FRR	NZSF	ISIF	APF
Portfolio A					
Alpha	0.0029* (1.97)	0.0060*** (3.64)	0.0667*** (4.00)	0.0067** (2.35)	-
Market	0.8151*** (24.38)	0.8720*** (23.31)	0.7982** (2.12)	0.9341*** (14.51)	-
Observations	180	180	180	180	-
R^2	0.7695	0.7533	0.0245	0.5418	-
Adjusted R^2	0.7682	0.7519	0.0191	0.5392	-
Portfolio B					
Alpha	0.0023 (0.74)	0.0039* (1.83)	0.0037 (1.25)	0.0046* (1.93)	0.0034 (1.23)
Market	1.2772*** (17.62)	0.9487*** (19.60)	1.0939*** (16.34)	0.9959*** (17.84)	1.1447*** (18.07)
Observations	180	180	180	180	180
R^2	0.6357	0.6834	0.6001	0.6412	0.6473
Adjusted R^2	0.6336	0.6816	0.5979	0.6392	0.6453
Portfolio C					
Alpha	0.0026 (0.97)	0.0048*** (2.94)	0.0309*** (3.15)	0.0047** (2.07)	0.0034 (1.23)
Market	1.1759*** (19.5)	0.9173*** (24.51)	1.0567*** (4.76)	0.9925*** (19.20)	1.1447*** (18.07)
Observations	180	180	180	180	180
R^2	0.6811	0.7715	0.1129	0.6744	0.6473
Adjusted R^2	0.6793	0.7702	0.1079	0.6726	0.6453

Key: This table displays the results of the performance analysis of the equally-weighted portfolios for each fund. Portfolio A exhibits the number of firms excluded from a fund except for fossil fuel firms. Portfolio B exhibits fossil fuel firms for each fund. Portfolio C exhibits all exclusions for each fund, fossil fuel firms included. Performance is measured according to the CAPM model. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10, 5, and 1% level, respectively.

Table 4. Equally-weighted performance results of considered SWFs using the Carhart four-factor model

	GPFG	FRR	NZSF	ISIF	APF
Portfolio A					
Alpha	0,0031** (2.11)	0.0062*** (3.75)	0,0657*** (3,89)	0,0074*** (2,63)	-
Market	0,8024*** (22,61)	0.8592*** (21.59)	0,8790** (2.19)	0,9001*** (13.39)	-
SMB	0,1913* (1,82)	0.1619 (1.38)	1.0794 (0,91)	0,4975** (2,50)	-
HML	-0,0053 (-0,06)	-0.0576 (-0.54)	-1.2364 (-1.16)	-0,2583 (-1.45)	-
WML	-0,0347 (-0,68)	-0.0493 (-0.86)	0,1532 (0,790)	-0,1484 (-1.54)	-
Observation	180	180	180	180	-
R^2	0,7743	0.7571	0,0409	0,5661	-
Adjusted R^2	0,7692	0.7515	0,0190	0,5562	-
Portfolio B					
Alpha	0,0032 (1.09)	0.0039* (1.85)	0.0045 (1.62)	0,0047** (2.03)	0,0041 (1.59)
Market	1,2187*** (17.25)	0.9432*** (18.84)	1,0407*** (15.70)	0.9847*** (17,16)	1.0980*** (17,63)
SMB	1.1270*** (5.39)	0.3625** (2.45)	0,9148*** (4.66)	0,5609*** (3,40)	0,9698*** (5.26)
HML	0,5556*** (2.96)	0.3715*** (2.79)	0,5237*** (2,97)	0,3042** (2.05)	0,4207** (2.54)
WML	-0,0079 (-0,08)	0.0938 (1.31)	-0,0136 (-0,14)	0,0639 (0,80)	-0,0049 (-0,06)
Observation	180	180	180	180	180
R^2	0,6989	0.7053	0,6587	0,6693	0,7034
Adjusted R^2	0,6920	0.6986	0,6509	0,6617	0,6966
Portfolio C					
Alpha	0,0033 (1.35)	0.0049*** (3.00)	0,0305*** (3,07)	0,0047** (2.13)	0,0041 (1.59)
Market	1,1271*** (19.06)	0.9087*** (23.23)	1.0888*** (4.62)	0.9838*** (18,45)	1.0980*** (17,63)
SMB	0,9205*** (5.26)	0.2849** (2.46)	1.0795 (1,55)	0,4925***(3.12)	0,9698*** (5.26)
HML	0,4293*** (2.73)	0.2013* (1.94)	-0.4368 (-0.70)	0,3233** (2.28)	0,4207** (2.54)
WML	-0,0162 (-0,19)	0.0362 (0.65)	0,1334 (0,40)	0,0822 (1.08)	-0,0049 (-0,06)
Observation	180	180	180	180	180
R^2	0.7334	0.7828	0,1312	0,6988	0,7034
Adjusted R^2	0.7273	0.7779	0,1113	0,6919	0,6966

Key: This table displays the results of the performance analysis of the equally-weighted portfolios for each fund. Portfolio A exhibits the number of firms excluded from a fund except for fossil fuel firms. Portfolio B exhibits fossil fuel firms for each fund. Portfolio C exhibits all exclusions for each fund, fossil fuel firms included. Performance is measured according to the Carhart four-factor model, where we include the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10%, 5% and 1% level, respectively.

Table 5. Value-weighted performance results of considered SWFs using the CAPM model

	GPFG	FRR	NZSF	ISIF	APF
Portfolio A					
Alpha	0.0003 (0.16)	-0.0006 (-0.24)	0.0041* (1.68)	0.0041 (1.41)	-
Market	0.9077*** (19.51)	0.8859*** (15.71)	0.7879*** (14.11)	0.9042*** (13.29)	-
Observations	180	180	180	180	-
R^2	0.6814	0.5809	0.5281	0.4980	-
Adjusted R^2	0.6796	0.5785	0.5254	0.4952	-
Portfolio B					
Alpha	0.0015 (0.25)	0.0015 (0.58)	-0.0032 (-1.32)	0.0011 (0.45)	0.0001 (0.04)
Market	1.0472*** (7.73)	0.7981*** (13.38)	0.9475***(17.07)	0.9517*** (17.28)	0.9987*** (17.76)
Observations	180	180	180	180	180
R^2	0.2511	0.5014	0.6207	0.6293	0.6392
Adjusted R^2	0.2469	0.4986	0.6185	0.6272	0.6371
Portfolio C					
Alpha	0.0008 (0.20)	0.0006 (0.30)	-0.0003 (-0.19)	0.0014 (0.61)	0.0001 (0.04)
Market	1.0052*** (9.75)	0.8196*** (17.04)	0.9186*** (19.25)	0.9493*** (17.96)	0.9987*** (17.76)
Observations	180	180	180	180	180
R^2	0.3483	0.6200	0.6754	0.6444	0.6392
Adjusted R^2	0.3447	0.6178	0.6736	0.6424	0.6371

Key: This table displays the results of the performance analysis of the value-weighted portfolios for each fund. Portfolio A exhibits the number of firms excluded from a fund except for fossil fuel firms. Portfolio B exhibits fossil fuel firms for each fund. Portfolio C exhibits all exclusions for each fund, fossil fuel firms included. Performance is measured according to the CAPM model. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10, 5, and 1% level, respectively.

Table 6. Value-weighted performance results of considered SWFs using the Carhart four-factor model

	GPFG	FRR	NZSF	ISIF	APF
Portfolio A					
Alpha	0,0001 (0.02)	-0.0079 (-0.32)	0,0006 (0.26)	0,0045 (1.54)	-
Market	0,9269*** (18.86)	0.8976*** (15.16)	0,8269*** (14.36)	0,8855*** (12.21)	-
SMB	-0,2249 (-1.55)	-0.0047*** (-2.74)	-0.0037** (-2.21)	-0.3251 (-1.57)	-
HML	-0,2119 (-1.62)	-0.0008 (-0.56)	-0.0043*** (-2.82)	0.0379 (0.20)	-
WML	0.0100(0.14)	-0.0001 (-0.20)	0,0002 (0,35)	-0,1043 (-1.04)	-
Observation	180	180	180	180	-
R^2	0,6907	0.5984	0,5628	0,5099	-
Adjusted R^2	0,6836	0.5892	0,5528	0,4987	-
Portfolio B					
Alpha	0,0012 (0.22)	0.0008 (0.33)	-0.0037 (-1.52)	0,0005 (0.23)	-0.0003 (-0.16)
Market	1,0453*** (7.30)	0.8283*** (13.19)	0.9683*** (16.55)	0.9735*** (16.95)	1.0170*** (17,38)
SMB	0.6410 (1.51)	-0.1728 (-0.93)	0,1085 (0.63)	0,1016 (0.60)	0,2741 (1.58)
HML	0,6918* (1.82)	0.3216* (1.93)	0,3189** (2,05)	0,3618** (2.37)	0,4106*** (2.64)
WML	0.2051 (1.00)	0.1646** (1.96)	0,0136** (1.96)	0,1777** (2.16)	0,1901** (2.27)
Observation	180	180	180	180	180
R^2	0,2735	0.5193	0,6336	0,6450	0,6605
Adjusted R^2	0,2569	0.5083	0,6252	0,6369	0,6528
Portfolio C					
Alpha	0,0006 (0.14)	0.0001 (0.04)	-0.0029 (-1.39)	0,0008 (0.38)	-0.0003 (-0.16)
Market	1,0112*** (9.24)	0.8465*** (16.72)	0.9460*** (18.69)	0.9714*** (17,49)	1.0170*** (17,38)
SMB	0,3893 (1.20)	-0.2556* (-1.71)	0.0016 (0.01)	0.0847 (0.52)	0,2741 (1.58)
HML	0,4168 (1.43)	0.1805 (1.34)	0.1449 (1.08)	0,3357** (2.27)	0,4106*** (2.64)
WML	0,1526 (0,97)	0.1245* (1.72)	0,1427** (1.97)	0,1714** (2.16)	0,1901** (2.27)
Observation	180	180	180	180	180
R^2	0.3613	0.6337	0.6827	0,6587	0,6605
Adjusted R^2	0.3467	0.6253	0,6754	0,6509	0,6528

Key: This table displays the results of the performance analysis of the value-weighted portfolios for each fund. Portfolio A exhibits the number of firms excluded from a fund except for fossil fuel firms. Portfolio B exhibits fossil fuel firms for each fund. Portfolio C exhibits all exclusions for each fund, fossil fuel firms included. Performance is measured according to the Carhart four-factor model, where we include the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10%, 5% and 1% level, respectively.

Table 7. Performance results by type of fossil fuel firms

	Portfolio D: Extraction and Production firms					
	Alpha	MSCI	SMB	HML	WML	R^2
GPFG	-0.0080** (-2.16)	1,2163*** (13.77)	0,6685** (2,56)	0,3580 (1,52)	0,0868 (0,69)	0,6236
FFR	0.0019 (0.51)	1.1899*** (13.05)	0.7376*** (2.73)	0.8981*** (3.71)	0.2372* (1.82)	0.5410
NZSF	-0.0188*** (-5.17)	1,2439*** (14,36)	0,3954 (1,54)	0,2248 (0.98)	0.1102 (0,89)	0,563
ISIF	-0.0031 (-0.84)	1,2671*** (14,97)	0,5215** (2.08)	0,2672 (1,19)	0,0671 (0,55)	0,5906
APF	-0.0029 (-0.83)	1,2334*** (14,80)	0,7896*** (3.20)	0,4535** (2.04)	0,1297 (1.09)	0,5932
	Portfolio E: Refiners and Integrated firms					
	Alpha	MSCI	SMB	HML	WML	R^2
GPFG	0.0005 (0.22)	0.9542*** (16.41)	0,1140 (0.66)	0.3827** (2.48)	0.1824** (2.19)	0,6225
FFR	-0.0012 (-0.48)	0.8480*** (13.39)	-0.1828 (-0.98)	0.6569*** (3.90)	0.3043*** (3.35)	0.5264
NZSF	0,0013 (0,56)	0,9055*** (15,35)	0,0203 (0.12)	0,3425** (2,18)	0,1787** (2.11)	0,587
ISIF	0,0009 (0,36)	0,9248*** (15,36)	0,0114 (0.06)	0,3823** (2.39)	0,2097 (2.43)	0,5864
APF	-0.0001 (-0.08)	0.9430*** (17,62)	0,1220 (0.77)	0,3940*** (2.77)	0,2097*** (2.74)	0,6539

Key: This table displays the results of the performance analysis of the portfolios for each fund. Portfolio D exhibits "extraction and production" firms for each fund. Portfolio E exhibits "refiners and integrated firms for each fund. Performance is measured according to the Carhart four-factor model, where we include the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10%, 5% and 1% level, respectively.

Table 8. Risk measures of SWFs portfolios.

	Panel A			Panel B		
	Standard deviation	Semi-standard deviation	Minimum return	Standard deviation	Semi-standard deviation	Minimum return
MSCI	0,0388 (0,0185)	0,0293 (0,0146)	-0,0744 (0,0515)	-	-	-
Portfolio A						
GPFG	0,0423 (0,0211)	0,0309 (0,0145)	-0,0814 (0,0457)	-0,0035 (-0,9991)	-0,0015 (-0,6968)	0,0069 (1,0463)
NZSF	0,0398 (0,0197)	0,0291 (0,0137)	-0,0706 (0,0482)	-0,0009 (-0,3160)	0,0001 (0,0774)	-0,0037 (-0,4693)
ISIF	0,0483 (0,0264)	0,0353 (0,0215)	-0,0834 (0,0763)	-0,0094*** (-2,7458)	-0,0061** (-2,2202)	0,0091 (0,7130)
FRR	0,0415 (0,0237)	0,0299 (0,0172)	-0,0772 (0,0622)	-0,0026 (-1,0302)	-0,0005 (-0,3393)	0,0028 (0,3387)
APF	-	-		-	-	-
Portfolio B						
GPFG	0,0713 (0,0617)	0,0440 (0,0154)	-0,0927 (0,0417)	-0,0324* (-1,8179)	-0,0146*** (-2,9033)	0,0183*** (2,8072)
NZSF	0,0513 (0,0151)	0,0373 (0,0110)	-0,0873 (0,0365)	-0,0124*** (-4,6305)	-0,0081*** (-3,4489)	0,0129 (1,6097)
ISIF	0,0509 (0,0152)	0,0368 (0,0112)	-0,0830 (0,0345)	-0,0121*** (-4,6615)	-0,0075*** (-3,3410)	0,0086 (1,1456)
FRR	0,0481 (0,0134)	0,0346 (0,0099)	-0,0902 (0,0372)	-0,0092*** (-3,8321)	-0,0053*** (-2,8429)	0,0158 (1,3040)
APF	0,0521 (0,0168)	0,0381 (0,0130)	-0,0870 (0,0437)	-0,0132***(-5,7606)	-0,0087*** (-4,7101)	0,0126** (2,0592)
Portfolio C						
GPFG	0,0615 (0,0448)	0,0388 (0,0127)	-0,0871 (0,0431)	-0,0226* (-1,7003)	-0,0095** (-2,4379)	0,0127** (2,0747)
NZSF	0,0468 (0,0157)	0,0341 (0,0111)	-0,0825 (0,0376)	-0,0079*** (-3,3053)	0,0048** (-2,3598)	0,0081 (1,1041)
ISIF	0,0501 (0,0156)	0,0362 (0,0115)	-0,0821 (0,0345)	-0,0112*** (-4,4257)	-0,0069*** (-3,1428)	0,0077 (1,0507)
FRR	0,0434 (0,0149)	0,0315 (0,0109)	-0,0849 (0,0421)	-0,0045** (-2,4555)	-0,0022 (-1,3672)	0,0105 (1,0128)
APF	0,0521 (0,0168)	0,0381 (0,0130)	-0,0870 (0,0437)	-0,0132***(-5,7606)	-0,0087*** (-4,7101)	0,0126** (2,0592)

Key: This table displays the results of the risk analysis of the portfolios for each fund. Panel A displays mean values and standard deviations of the monthly risk measures (standard deviation, semi-standard deviation, and minimum return) for the value-weighted exclusion portfolios of SWFs as well as the MSCI index. Panel B shows the mean differences in the monthly risk measures between the MSCI index and SWFs' exclusion portfolios. The number in brackets represents *t* values for a paired *t* test of the mean values of the MSCI index against SWFs' exclusion portfolios. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10%, 5% and 1% level, respectively.

Table 9. Crisis vs non-crisis performance of excluded firm portfolios

	GPFG		FRR		NZSF		ISIF		APF
	Portfolio A	Portfolio C	Portfolio A	Portfolio C	Portfolio A	Portfolio C	Portfolio A	Portfolio C	Portfolio C
2005-2007									
Alpha	-0,0019 (-0,34)	-0,0141** (-2,32)	0,0068* (1,70)	-0,0222*** (-2,81)	0,0060 (1,50)	-0,0126** (-2,11)	0,0092* (1,94)	-0,0047 (-0,74)	-0,0058 (-0,95)
Market	1,0263*** (4,68)	1,0726*** (4,50)	0,5684*** (3,60)	0,8750*** (2,83)	0,4479*** (2,82)	0,9835*** (4,19)	0,4471** (2,34)	1,1243*** (4,52)	1,0280*** (4,28)
SMB	-0,6135* (-1,87)	-0,3115 (-0,87)	-0,5613** (-2,37)	-0,4265 (-0,92)	-0,4766** (-2,01)	-0,4350 (-1,24)	-0,2297 (-0,83)	-0,3530 (-0,95)	-0,1209 (-0,34)
HML	-0,6316 (-1,52)	0,3056 (0,67)	-0,2459 (-0,82)	0,9444 (1,60)	-0,2942 (-0,97)	0,3215 (0,72)	0,0114 (0,03)	0,5227 (1,11)	1,1556** (2,53)
WML	0,8896*** (2,78)	1,3533*** (3,89)	0,5921*** (2,57)	0,7821* (1,73)	0,6129*** (2,65)	1,4537*** (4,25)	0,2385 (0,9)	1,4458*** (3,99)	1,3546*** (3,87)
R^2	0,6679	0,6899	0,5486	0,4179	0,4898	0,6868	0,2966	0,6911	0,6769
2008-2012									
Alpha	-0,0113** (-2,08)	-0,0056 (-1,24)	-0,0186** (-2,41)	0,0016 (0,34)	-0,0002 (-0,04)	-0,0041 (-0,92)	-0,0043 (-0,58)	0,0004 (0,10)	0,0025 (0,52)
Market	0,8921*** (10,05)	0,9835*** (13,36)	0,8189*** (6,51)	0,8481*** (11,08)	0,8215*** (7,48)	0,9259*** (12,62)	0,7869*** (6,13)	0,9546 (12,28)	1,0573*** (13,12)
SMB	-0,1838 (-0,54)	-0,1466 (-0,52)	-0,4510 (-0,93)	-0,4287 (-1,46)	-0,2013 (-0,48)	-0,3334 (-1,19)	-0,1642 (-0,35)	-0,3831 (-1,28)	-0,1533 (-0,50)
HML	-0,6117** (-2,01)	-0,5502** (-2,18)	-0,1650 (-0,38)	-0,2006 (-0,76)	-0,7903** (-2,10)	-0,5148** (-2,05)	0,5960 (1,41)	-0,4163 (-1,56)	-0,5515** (-2,00)
WML	-0,1946 (-1,56)	-0,0205 (-0,20)	-0,2473 (-1,40)	0,1063 (0,99)	-0,0839 (-0,54)	0,0320 (0,31)	-0,3444** (-2,00)	0,0484 (0,44)	0,1256 (1,11)
R^2	0,7344	0,8155	0,5556	0,7395	0,5756	0,7905	0,6137	0,7809	0,7987
2013-2019									
Alpha	0,0033* (1,72)	0,0060 (0,73)	0,0019 (0,98)	0,0034 (1,46)	-0,0038 (-1,31)	-0,0035 (-1,42)	0,0047 (1,28)	-0,0014 (-0,51)	-0,0040 (-1,31)
Market	0,7948*** (12,89)	1,0570 (4,03)	0,8616*** (13,34)	0,8923*** (11,74)	0,8823*** (9,42)	0,9158*** (11,32)	0,9400*** (8,03)	0,9260*** (10,28)	0,9702*** (9,81)
SMB	-0,3032** (-2,13)	0,7745 (1,28)	-0,4580*** (-3,07)	-0,2343 (-1,34)	-0,5932*** (-2,74)	0,0475 (0,25)	-0,3300 (-1,23)	0,1928 (0,93)	0,3099 (1,36)
HML	0,0377 (0,30)	1,0510** (1,97)	-0,1107 (-0,84)	0,3892** (2,52)	-0,2478 (-1,30)	0,3889** (2,37)	-0,1170 (-0,50)	0,5807*** (3,18)	0,6736*** (3,36)
WML	0,0494 (0,54)	0,2375 (0,61)	0,0821 (0,86)	0,1181 (1,05)	0,1615 (1,16)	0,0185 (0,15)	0,2844* (1,66)	0,0226 (0,17)	0,0033 (0,02)
R^2	0,6719	0,2039	0,6882	0,6297	0,5226	0,6263	0,431	0,5944	0,5828

Key: This table shows the results of the performance analysis of the value-weighted portfolios of Portfolio A and Portfolio C for each fund in both crisis and non-crisis periods. Portfolio A exhibits the number of firms excluded from a fund except for fossil fuel firms. Portfolio C exhibits all exclusions for each fund, fossil fuel firms included. Performance is measured according to the Carhart four-factor model, where we include the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10%, 5% and 1% level, respectively.

Table 10. Oil crisis vs non-oil crisis performance of fossil fuel firms' portfolios

	GPFG	FRR	NZSF	ISIF	APF
2005-2008					
Alpha	-0,0124** (-2,03)	-0,0188** (-2,04)	-0,0101* (-1,66)	-0,0007 (-0,14)	-0,0012 (-0,22)
Market	1,2906*** (8,49)	0,9440*** (4,12)	1,3283*** (8,74)	1,3706*** (9,49)	1,2172*** (8,75)
SMB	-0,2313 (-0,66)	-0,6323 (-1,20)	-0,3830 (-1,10)	-0,3396 (-1,02)	-0,2389 (-0,75)
HML	0,6263 (1,36)	0,6862 (0,99)	0,4761 (1,03)	0,5822 (1,33)	0,8775** (2,08)
WML	1,1069*** (4,42)	0,8555** (2,27)	1,0653*** (4,26)	0,9882 (4,16)	1,0888*** (4,75)
R^2	0,7202	0,3886	0,7227	0,7445	0,7309
2009-2013					
Alpha	-0,0055 (-1,59)	0,0008 (0,33)	-0,0070** (-2,05)	-0,0023 (-0,73)	-0,0018 (-0,57)
Market	0,9631*** (14,13)	0,8283*** (13,19)	0,8825*** (13,29)	0,8908*** (14,00)	0,9907*** (15,19)
SMB	-0,3179 (-1,26)	-0,0017 (-0,93)	-0,5140** (-2,08)	-0,4815** (-2,04)	-0,2598 (-1,07)
HML	-0,3315 (-1,51)	0,0032* (1,93)	-0,2673 (-1,25)	-0,2764 (-1,35)	-0,3914* (-1,86)
WML	-0,0983 (-1,05)	0,0017** (1,96)	-0,0913 (-1,00)	-0,0945 (-1,08)	-0,0493 (-0,55)
R^2	0,7763	0,5083	0,7553	0,7743	0,7944
2014-2019					
Alpha	0,0150 (0,97)	0,0046 (1,19)	-0,0007 (-0,21)	-0,0023 (-0,73)	-0,0035 (-0,90)
Market	1,4697*** (2,82)	0,9641*** (7,28)	1,0131*** (8,15)	0,8908*** (14,00)	1,0420*** (7,81)
SMB	1,7435 (1,50)	0,0866 (0,29)	0,4901* (1,77)	-0,4815** (-2,04)	0,5116* (1,72)
HML	2,3789** (2,22)	0,7629*** (2,80)	0,9119*** (3,56)	-0,2764 (-1,35)	0,9393*** (3,42)
WML	0,9926 (1,14)	0,2991 (1,35)	0,2524 (1,22)	-0,0945 (-1,08)	0,2269 (1,02)
R^2	0,1873	0,5184	0,5771	0,7743	0,5611

Key: This table shows the results of the performance analysis of the value-weighted portfolios of Portfolio B for each fund in both oil crisis and non-oil crisis periods. Portfolio B exhibits fossil fuel firms for each fund. Performance is measured according to the Carhart four-factor model, where we include the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, ** and *** represent significance level at the 10%, 5% and 1% level, respectively