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

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Abstract

This paper examines the effects of negative screening on the financial performance of sovereign wealth funds (SWFs)¹. The main responsible SWFs are requested to divest from fossil fuel firms by their respective governments and citizens. Yet, such a strategy may reduce the financial performance of these funds. This study proposes to determine the extent to which excluding fossil fuel firms from SWF portfolios in order to comply with ethical standards reduces their financial performance. By using asset pricing models, namely the capital asset pricing model and the Carhart four-factor model, we find that excluding fossil fuel firms does not harm the financial performance of SWFs. Besides, we document similar results regarding the performance of SWF fossil fuel portfolios, suggesting that fossil fuel divestment will not impact SWF performance. We conclude that socially responsible investment, by means of negative screening, does not reduce SWF performance.

Keywords: sovereign wealth funds, negative screening, fossil fuel divestment.

JEL Classification: G11, G23, Q30

¹ SWFs: sovereign wealth funds.

1. Introduction

On October 1st, 2019, the Norwegian Ministry of Finance announced that the Government Pension Fund Global (GPF) of Norway—the country’s sovereign wealth fund (SWF)—will divest from companies whose main core business is dedicated to oil and gas exploration and production². Similarly, other SWFs, such as the New Zealand Superannuation Fund (NZSF), announced their intention to reduce the carbon emissions of their portfolios to combat climate change³. However, it seems that this campaign concerns firms mostly operating in fossil fuel extraction and production while refining companies are not affected.

Negative screening, which excludes firms from portfolios due to social, environmental, or governance issues, has been widely used by responsible SWFs since 2010 as a strategy to implement socially responsible investment (SRI). In fact, several SWFs, like the GPF of Norway or the NZSF, 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 for these exclusions can be classified into two categories: norm-based and sector-based exclusions (Al Ayoubi and Enjolras, 2021). The first category concerned companies that were reported for violating specific social norms, such as child labor and human rights, while the second category concerned firms whose business is related to so-called “sin stocks,” such as alcohol, tobacco, gambling (Fabozzi et al., 2008), and other sectors such as coal extraction that may harm the environment. Because more and more investors are implementing a social and ethical strategy, SWFs are increasingly incentivized to adopt SRI.

² “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>)

³ <https://www.unpri.org/climate-change/low-carbon-investing-and-low-carbon-indices/3283.article>

First, although SWFs are created and owned by governments and therefore do not have explicit liabilities, such funds are nevertheless indirectly owned by the public since they serve the purpose of increasing wealth for future generations (Seele et al., 2015). Hence, institutional investors should not only act in the best interest of their beneficiaries—that is, to maximize the financial performance of their portfolios without undue risk—but also behave responsibly and ethically. In fact, as public institutional investors, SWFs have the fiduciary duty to act in the best interests of their beneficiaries in the long term, which goes beyond economic and financial considerations (Karametaxas, 2017).

Second, the sheer scale of SWF investments in recent years has raised public and legal concerns. For instance, during the financial crisis of 2008, SWFs injected significant liquidity into distressed institutions in Europe and the United States, including a capital investment in UBS Group AG of USD 11.4 billion by the Singapore Investment Corporation, or an investment in Citigroup of USD 7.5 billion by the Abu Dhabi Investment Authority⁴. The investment of such significant sums has raised concerns in recipient countries over the lack of transparency about the motivations behind such financing. Such concerns have led the relevant authorities to defend their actions to protect strategic sectors related to energy, technology, and finance. Moreover, the public in the home countries of several SWFs have expressed their desire for exemplary behavior in light of reported institutional investors' social and ethical footprint (Clark and Monk, 2010).

Following recent financial, economic, social, and environmental crises, we are witnessing the strengthening of a collective consciousness concerning environmental, social, and governance issues. This is reflected in the fact that public opinion considers investors responsible for the business behavior of the firms in which they invest (Hoepner and Schopohl,

⁴ See “UBS writes down \$10 billion, Singapore injects capital,” December 10, 2007, Reuters (<https://www.cnbc.com/id/22178101>).

2020, 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 the nuclear and weapons industries, in addition to firms that violated human, child, and labor rights. Since those public funds manage considerable state-owned assets on behalf of the people (the implicit owners of those assets), they are constantly under public scrutiny (Richardson, 2011).

In response to public pressure, some SWFs (with the approval of regulatory authorities) have shifted toward a more responsible investment strategy. In order to implement SRI and reassure the public, several funds—the GPF of Norway, the NZSF, the French Pension Reserve fund (FRR), the Ireland Strategic Investment Fund (ISIF), and the Future Fund of Australia (FFA)—have adopted negative screening and excluded from their portfolios companies that conducted the abovementioned sin activities, companies that damaged the environment (e.g., the GPF and the FRR excluded coal-based companies), and firms reported to have violated human and labor rights. Moreover, with increasing awareness of climate change, public opinion has become increasingly skeptical about the environmental impact of the oil and gas industry, and campaigns have emerged to encourage SWFs to sell their stakes in this sector. This is the case in Norway, New Zealand, and Alaska⁵ where public and political pressure is mounting for the respective funds of these states to exclude firms related to oil and gas production and extraction.

From the investors' point of view, there are concerns about the effect on financial performance of such exclusionary strategies. Withholding investment from some industries can be expected to have a financial cost due to the 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

⁵ See <https://www.juneauempire.com/opinion/opinion-its-time-for-the-permanent-fund-to-divest-from-fossil-fuels/>

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 then exist in choosing between financial performance or favoring ethical and responsible behavior since it seems that being responsible (by employing negative screening) comes with a cost. SWFs that implemented or are considering implementing SRI are also affected, 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 the apparent dilemma between financial performance and ethical requirements. We investigate the case of SWFs that apply an exclusionary strategy and discuss the effects on their financial returns of excluding firms from their portfolios. Although this issue has been addressed in previous research related to sin stocks and the effect of exclusions on sustainable indexes and SRI private funds (Endrikat, 2016), little is known about how negative screening may impact the financial performance of SWFs. To the best of our knowledge, one study examined the case of the GPFG as well as the Swedish AP-Funds (Hoepner and Schopohl, 2018) and found that negative screening did not harm fund performance, meaning that the Norwegian fund “can meet the ethical objectives of their beneficiaries without compromising financial returns.”

The first novelty in our study is that we include other SWFs with an exclusion strategy and examine if their financial performance is affected, namely the FRR, the NZSF, the Alaska Permanent Fund (APF), the ISIF, and the GPFG. These five SWFs have excluded firms that did not respect their ethical policies even though their proprietary criteria for exclusion may differ. The scope of excluded industries, as well as the intensity of screening, depends on the funds and so there is some divergence. For instance, the GPFG excludes from its investment portfolio companies involved in the production of coal, which is not the case for the other

SWFs considered. This paper examines whether the nature and intensity of screening by SWFs has affected their financial performance.

We distinguish between the so-called “common” exclusions and fossil fuel exclusions (as referred to in the literature). Common exclusions refer to businesses that are considered to be non-compliant with certain social standards, such as the production of conventional and nuclear weapons, the sale of alcohol and tobacco, use of child labor, etc. This type of exclusion dominates the literature on the relationship between negative screening and financial performance. Fossil fuel exclusions refer to companies operating in the fossil fuel sector. This type of exclusion has been largely ignored in the negative screening literature since the fossil fuel sector is not necessarily considered “sinful”⁶. However, this sector has a significant impact on the environment, which explains the recent wave of divestment from this sector. A review of the negative screening literature shows that several industries and activities are regularly considered sinful. By contrast, operating in the fossil fuel industry—more specifically, gas and oil firms—is rarely considered a reason for divestment, despite the emergence of divestment campaigns in developed countries. To date, no SWF has effectively divested from all fossil fuel firms; the main exception concerns coal and coal-based firms, which have been partially excluded from the portfolio of several SWFs such as the GPF of Norway or the ISIF. For instance, the GPF excludes firms that derive at least 30% of their income from the production of thermal coal or coal-based power production⁷. Nevertheless, responsible SWFs—including the GPF and the ISIF—have expressed their intention to divest from other fossil fuel firms related to oil and gas production, and other SWFs are seriously examining the issue. For instance, in 2018, the FRR affirmed its commitment to reduce its carbon emissions and invest more in a low-carbon economy by excluding

⁶ We are referring to the so-called sinful activities in the literature, i.e., activities that go against social mores, such as the sale of tobacco, gambling, adult entertainment, the sale of nuclear weapons, etc.

⁷ According to their website: <https://www.nbim.no/en/the-fund/responsible-investment/divestments/>

companies whose thermal coal mining activity or production of electricity, heat, or steam from coal exceeds 10% of their turnover⁸. Similarly, the NZSF aims to reduce by 80% its ownership of fossil fuel reserves by 2025⁹. Hence, we both 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.

The third novelty of this paper is to distinguish between extraction and production firms and refining and integrated firms. (It should be noted that SWFs willing to divest from the fossil fuel industry have expressed their intention to keep stakes in refining, downstream, and some integrated oil firms.) One of the reasons given for the distinction between “oil and gas extraction and production” and “refining and integrated” firms is that the second category has the financial and technological capacities to shift toward renewable energy, and therefore has a lower environmental negative impact¹⁰. One could question the real motives behind the distinction, but we distinguish between “fossil fuel extraction and production” and “refining and integrated” firms to identify any differences between the two groups in terms of financial returns which might explain the distinction made by SWFs.

Moreover, this study aims to enrich the negative screening literature, especially on oil and gas divestment, by means of real-world-based portfolio analyses. While much of the literature on exclusionary strategies uses hypothetical or “fictive” portfolios to examine the financial impact of the exclusions, we consider real-world-based SWF portfolios. This allows

⁸ According to their website: <https://www.fondsdereserve.fr/fr/investissement-socialement-responsable/>

⁹ “NZ super fund ramps up focus on climate impact investing”, by Richard Newell, 19 August 2021, Capital Monitor (<https://capitalmonitor.ai/institution/asset-owners/nz-super-fund-ramps-up-focus-on-climate-impact-investing/>)

¹⁰ “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>). See also <https://www.nzsuperfund.nz/how-we-invest/responsible-investment/engagement/climate-change-engagement/>

to 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 responsible SWF investments. By focusing on responsible SWFs, we analyze the impact of one of their main SRI strategies (i.e., negative screening) on financial performance. We refine the general framework of sinful issues considered in the negative screening literature by including the fossil fuel sector. Examining whether exclusionary strategies harm the financial returns of SWFs is challenging given that these funds are public institutional investors with no explicit liabilities. This means that SWFs are supposed to allocate their assets in the best interests of the people, not only in terms of financial performance but also in terms of social and environmental performance. Because contemporary public opinion seems to favor fossil fuel divestment and a transition toward renewable energies, SWFs could play an important role in achieving 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 suit in the long term.

This paper is organized as follows. An overview of the literature regarding responsible SWFs and negative screening is presented in the next section. Thereafter, Section 3 presents development of the hypotheses being tested in the paper. In Section 4, we present the data and methodology used in this paper. The empirical results are presented in Section 5, and we present our conclusions in Section 6.

2. Literature background

2.1 SWFs and negative screening: Toward fossil fuel divestment

Although the first SWF was created more than six decades ago, the literature on these institutional investors dates from when Rozanov (2005) first coined the term. An SWF 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 Sovereign Wealth Fund Institute counted 88 SWFs around the world managing more than USD 8 trillion in assets¹¹, 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 proactive 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.

Since 2010, we have seen the emergence of a new trend within SWFs, namely that they are starting to consider extra-financial aspects by integrating ethical issues into their investment policies. A good example is the case of the GPF of Norway, which is the biggest SWF in terms of assets under management and considered one of the most influential responsible SWFs: it has completely integrated ethical and socially responsible values into its investment guidelines (Yin, 2017). Other SWFs—such as the FRR, the NZSF, the ISIF, or the FFA—have followed GPF’s lead by implementing SRI in their core strategies, while others are beginning to apply some aspects of SRI. Much of the literature on SWF sustainability and its implications for SRI is either conceptual or descriptive and tends to focus on governance and legal issues. For instance, Roose et al. (2012) propose a research agenda to facilitate

¹¹ See “Top 88 Largest Sovereign Wealth Fund Rankings by Total Assets,” available at <https://www.swfinstitute.org/fund-rankings/sovereign-wealth-fund>

SWFs to implement SRI, while Van der Zee (2012) emphasizes the role responsible SWFs play in influencing target firms' social and environmental behaviors.

However, we notice a clear lack of empirical studies about SRI implications for SWFs, and we feel that the findings of some interesting studies deserve to be mentioned on this topic. The first concerns the activism of some responsible SWFs that interfere in targeted firms to improve their corporate and governance practices (Dimson et al., 2015). A second study examines the role of GPFG as an intermediary signaler to market participants insofar as countries that accept fund investments have an attractive institutional environment (Vasudeva et al., 2018). Finally, Hoepner and Schopohl (2018) show that the GPFG of Norway can meet its ethical commitments without reducing its returns. Our study stands in the same stream. In fact, several SWFs have already applied an exclusionary strategy as a tool to respect their environmental, social, and governance (ESG) commitments: they apply several screens related to sectors or business activities they consider to be unethical, such as tobacco or nuclear weapons (details of SWFs screens are displayed in Table 1).

Insert Table 1 about here
Responsible SWFs and screens applied

Nevertheless, since 2010, protests and oil and gas divestment campaigns have surged in the home countries of several SWFs, urging investors and authorities to divest from fossil fuel firms. This groundswell of opposition has been driven by scientific community warnings and calls for global action to prevent climate change (Gross, 2015) and its associated social costs (Bergh et al., 2015). The first organizations calling for fossil fuel divestment were universities, foundations, and municipal bodies (e.g., cities and counties). However, public opinion has subsequently started to put pressure on firms, institutional investors, and government-owned companies to account for extra-financial issues, such as their ecological

impacts (Ayling and Gunningham, 2015). SWFs in democratic countries have been criticized for their stakes in fossil fuel companies responsible for high levels of carbon emissions and climate change, which conflicts with a main aim of SWFs to act in the best interests of their beneficiaries (Richardson, 2011). Although SWFs manage themselves, their assets allocation, and investment, they are still state-owned entities financed mainly by public money. Therefore, they must heed public opinion, and public authorities may interfere to negotiate divestment terms. Sometimes, as was the case in Norway, the SWF board can call upon 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.

2.2 Negative screening and financial performance

SWFs that adopt SRI may implement several strategies such as shareholder activism, best-in-class strategy, or negative screening, which has had some success within socially responsible SWFs since most of them use it (Al Ayoubi & Enjolras, 2021). However, this seems to contrast with the theoretical grounds for SRI since the literature considers that negative screening is outdated, and responsible investors should rather adopt more “modern” strategies such as engagement and positive screening (Kolstad, 2016; Sparkes and Cowton, 2004).

Negative screening is a strategy of avoiding investing in or excluding companies that do not comply with predetermined ESG criteria (Renneboog et al., 2008a). Although an 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, more specifically SWFs, that use it. Several scholars have already examined the financial performance of screened portfolios, comparing them with portfolios comprising more

controversial sectors. Hong and Kacperczyk (2009) were pioneers in this field, analyzing American sin stocks in the tobacco, alcohol, or gambling sectors. They found that such stocks generated a positive abnormal return compared to their alternatives. Several studies found similar results, 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 (2017) considered a wider range of controversial issues and included 14 types of screens. The authors concluded that negative screening generates an opportunity cost since it reduces the size of the investment universe. Salaber (2013) confirmed those results in the European stock market, and Fabozzi et al. (2008) found much the same in a global study of 21 different markets.

However, many studies did not find significant evidence of the outperformance of controversial stocks. For example, Kempf and Osthoff (2007) documented insignificant results for controversial US stocks compared to comparable industry stocks, Adamsson and Hoepner (2015) produced similar results for American companies, and Vide (2016) did not find evidence of consistent outperformance or underperformance of sin stocks in European firms.

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, 2017). Add to this the fact that all the studies mentioned above have constructed hypothetical or fictional portfolios of sin stocks. According to Hoepner and Zeume (2014) and Hoepner and Schopohl (2018), this assumption has one main disadvantage: it does not consider real-world investment constraints. For instance, screenings may differ between investors in terms of intensity, and some criteria related to stocks—such as market capitalization and liquidity—should also be considered.

Some studies managed to overcome this issue by analyzing the performance of real-world screened portfolios (mainly mutual funds that use an exclusionary strategy).

A large part of this growing 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 fund performance (Humphrey & Tan, 2014; Humphrey & Lee, 2011). However, this relationship has been questioned by several studies which have shown that several factors have not been accounted for. For instance, 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 affects the impact of exclusions on financial performance. Lee et al. (2010) and Capelle-Blancard and Monjon (2014) documented a negative relationship between the number of screens and performance, while Renneboog et al. (2008b) found that social screens have a higher negative impact on the financial performance of funds than ethical or environmental screens.

2.3 Oil divestment and financial performance

As the literature on negative screening has developed, the number of screens considered by academics has increased. Whereas Hong and Kacperczyk (2009) retained only three types of screens, namely tobacco, alcohol, and gambling, the studies that followed broadened the field. For instance, Lee et al. (2010) added 11 new types to the screens proposed by Hong and Kacperczyk (2009). Also, we notice that often the same screens are highlighted in the literature since many studies are based on an ESG classification of screens. In the two studies mentioned above, “oil and gas” was not included as a screen since it is not considered a sinful or controversial activity.

An important issue arising from the call for fossil fuel divestment is its potential effect on financial performance. Investors wonder whether excluding firms that extract and produce

oil and gas will affect their portfolios' financial performance as a result of a decrease in diversification (Trinks et al., 2018). The literature addressing these potential impacts is relatively recent compared to other controversial issues (Ayling and Gunningham, 2015). Although modern portfolio theory (Markowitz, 1952) predicts a decrease in performance due to fuel divestment, some researchers in the emerging literature show 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 that this effect tends to disappear in the long term, 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. The studies mentioned above constructed hypothetical fossil fuel portfolios that do not necessarily reflect real-world investment constraints (Hoepner and Zeume, 2014). Add to this the fact that they all considered fossil fuel divestment as independent of other types of screens present in the negative screening literature. 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 should therefore be accounted for since it could lead to different, more realistic results. SRI investors that have 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 fictive aspect of fossil-free portfolios by examining the case of green mutual funds¹². 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 that environmental funds exhibited lower risk-adjusted returns *vis-à-vis* the US market (S&P 500) for a period before 1995. However, later studies focusing on a more recent sample period and other market indexes found that green funds do not significantly underperform their more conventional alternatives (Climent and Soriano, 2011). Ibikunle and Steffen (2017) found similar results in their study of European green mutual funds. The authors not only reported an improvement in the financial performance of these funds, but they also noticed in several cases that this improvement could be explained by an increase in investors' awareness and a decreased overall risk exposure of green funds compared to their alternatives and, more specifically, their brown alternatives¹³.

3. Hypotheses development

Our review of the literature addressing the financial performance of negative screening revealed that there is no strong consensus among scholars. Moreover, we noted a lack of research on the financial impact of exclusionary strategies on public asset owners in general 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 deteriorated 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 non-significant impact on the results. Our study proposes to extend the field of research by considering all SWFs that apply negative screening, which should increase the robustness of the results. We

¹² A green mutual fund is defined as a fund that undertakes investments with regards to environmental principles and engagements (see Ibikunle and Steffen, 2017).

¹³ Brown 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).

must also consider the oil and gas sector as a new category of screen since SWFs are on the verge of divesting from fossil fuel firms. Since the so-called traditional exclusions have already been partially addressed in the literature, we will focus more on the fossil fuel exclusions in the development of our hypotheses, knowing that the reasoning is valid for both types of exclusion.

SWFs represent a very interesting research framework because they differ from traditional investors by their very nature, that is, they are state-owned. Indeed, they may be subject to political interference, and thus may have strategic objectives, which is not the case for other institutional investors whose main objective is wealth maximization (Bahoo et al., 2020). Implementing an SRI policy may be one of these strategic objectives, and this may result in SWFs disengaging from the fossil fuel sector. As SWFs are state-owned, their investment strategies and decisions may implicitly reflect the will of their governments. A withdrawal from the fossil fuel sector could then be perceived by the various political and economic actors as a reflection of political will emanating from the governments owning these funds.

Another interesting aspect of the study on the exclusion of oil companies by SWFs is the fact that many of these funds are financed by fossil fuels, something that is true for several socially responsible SWFs. It is therefore interesting to see how these funds can reconcile their socially responsible policies—which aim to meet the expectations of their citizens as well as climate issues—with their financial objectives, particularly with regard to their fossil fuel revenues.

Due to the divergence of results we observed in the literature, several outcomes could be expected. Several studies focusing on the performance of sin stocks documented an outperformance of these controversial stocks in comparison with their more conventional

alternatives (Fabozzi et al., 2008; Hong and Kacperczyk, 2009). Two main theoretical explanations are proposed to justify this relationship. First, institutional and public investors are constrained by social norms due to the continuous pressure of public and/or political scrutiny and are therefore 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 stocks compared to the alternatives (Merton, 1987). Second, because of reduced risk-sharing, Merton demonstrated that the capital asset pricing model (CAPM) is no longer accurate, meaning that the idiosyncratic risk—and not just the beta—matters 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. Therefore, 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 alternatives, causing an underpricing of oil and gas shares (Heinkel et al., 2001; Merton, 1987).

The increasing number of screens may also affect 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 an increase in returns. This diversification cost is a function of the number of stocks in a portfolio and the correlation between the stock returns. This means that divesting from a large set of stocks poorly correlated with other market assets causes higher diversification costs. Therefore, one could predict a negative linear relationship between screening intensity and risk-adjusted returns. Considering fossil fuel as a new screen from which SWFs divest should decrease performance. According to these arguments, we formulate the following hypothesis:

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

Another stream of negative screening literature states that portfolios that include controversial stocks underperform the market. The main argument for this underperformance is that controversial firms are overvalued because firms involved in unethical business practices are more likely to bear hidden risks, in which case the market may then misprice the real risk of the firm. In fact, unethical behavior often leads to litigation risk, social protest, and even political action, as exemplified by fossil fuel firms that have been involved in environmental and natural disasters (Liang and Renneboog, 2017). Another explication proposed by Barnett and Salomon (2006) is that unethical behavior negatively affects the reputation of concerned firms, causing a decline in customers' loyalty and revenues, as well as the firm's attractiveness on the labor market. Due to rising CO₂ emissions and accelerating global warming, fossil fuel companies have seen their images tarnish rapidly in recent years, and have fallen prey to the emergence of public campaigns calling for divestment from fossil fuels. Ultimately, this could lead 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 demonstrate no difference in their performance compared to their conventional alternatives. 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 would imply that fund exclusion should not exhibit abnormal returns in comparison

with the alternatives, and therefore the financial performance of SWFs should not be affected by fossil fuel divestment. While one can expect a negative relationship between screening intensity and risk-adjusted returns according to Markowitz (1952) portfolio theory, some 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 not only to the intensity itself but also 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 corporate social responsibility (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 with poor CSR performance would experience a decrease in their demand, and therefore a decrease in their stock price. Therefore, we formulate the following hypothesis:

H1c. Exclusion portfolios have similar returns to the market index.

3.1 Fossil fuel firms: Exploration and production vs. refining and integrated

As mentioned, the fossil fuel divestment decisions made (or under consideration¹⁴) by some SWFs do not concern the whole oil and gas industry; exclusions mainly concern 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. “Downstream” companies—that is, refining, integrated, and others—are not affected by this decision. This choice could be driven by extra-financial concerns (environmental and social impacts) or by economic and financial

¹⁴ Screens that have not yet been decided on are labeled “Under study.”

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 answering this question will reveal 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 yet been raised in studies.

Several outcomes could be expected. First, the two categories exhibit differences in terms of environmental and social impacts. Although they both have a negative effect, extraction and production activities tend to cause more severe environmental and social damage. For instance, they affect ecosystems by polluting and contaminating land and water, by harming animals, and by representing health and safety risks for oil industry workers and local communities (O'Rourke and Connolly, 2003). In comparison, refining and integrated firms are associated with lower environmental and social risks (Epstein and Selber, 2002). We could expect then that socially responsible investors will refrain from investing in extraction and production firms because of their negative environmental and social impacts. According to Hong and Kacperczyk (2009), such firms involved in "vice" activities that contradict societal norms are exposed to funding restrictions since norm-constrained investors and institutions avoid investing in such companies. This should decrease the 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. In addition, one should consider litigation risks related to fossil fuel extraction and production companies (e.g., conflicts with local communities) as well as other risks, such as terrorists 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:

H2a. Exploration and extraction firms outperform refining and integrated firms.

In contrast, following the same reasoning as H1b, one would expect that fossil fuel extraction and production firms underperform refining and integrated firms. In fact, fossil fuel extraction and production firms are more likely to bear hidden risks. For instance, as mentioned, 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 facilities¹⁵, incidents to which workers are exposed, or even risks related to fossil fuel exploration when, for instance, important infrastructures are deployed (generally at great expense). However, there is no certainty of finding fossil fuels, and the amounts invested generate no revenue at this time. All these hidden risks may not be adequately absorbed by the market, causing an overvaluation of those firms that are more likely to generate lower financial performance (Hoepner and Schopohl, 2018). In comparison, refining and integrated firms are less exposed to these hidden risks. Therefore, we formulate the following hypothesis:

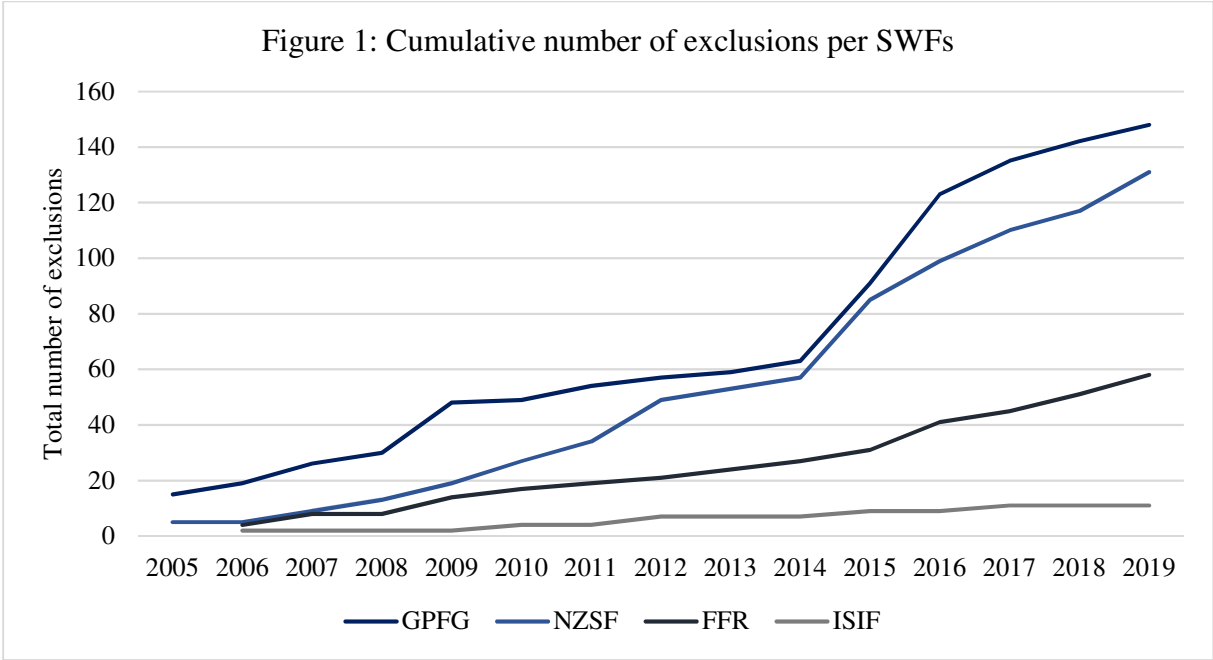
H2b. Exploration and extraction firms underperform refining and integrated firms.

4. Data and methodology

We investigate the performance impact of divestment on the profitability of SWFs that employed negative screening over the period 2005–2019. SWFs using an exclusionary strategy have adopted ethical guidelines to define the reasons behind their exclusions. For example, companies operating in sectors deemed to be unethical such as tobacco, alcohol, and conventional and nuclear weapons tend to be excluded from the portfolios of the funds we have studied. Similarly, companies involved in coal production may now be excluded and, more recently, fossil fuel companies are to be excluded. In addition to sector-based exclusions, a company may also be excluded for non-compliance with certain social and

¹⁵ The National Academy of Sciences estimated in 2002 that 38,000 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, available at <https://www.nap.edu/catalog/10388/oil-in-the-sea-iii-inputs-fates-and-effects>).

environmental norms. For example, a human rights violation—such as child labor or employee abuse—can result in a company being excluded. Similarly, a company that causes serious environmental damage may be excluded. Before excluding a company, a fund engages in dialogue with the company concerned to warn and inform it of its breaches. The company has the opportunity to explain the circumstances that have led to this situation and to change its conduct. If the company fails to respect the norm requirements, the fund will then consider the firm appropriate for exclusion (Etikkradet, 2019). SWF exclusion policies have gradually tightened over time as SWFs have progressively increased the number of screens they apply (Al Ayoubi & Enjolras, 2021), as displayed in Figure 1.



Our first source of data is the exclusion lists published by the following SWFs: the GPFNG of Norway, the FFR of France, the NZSF, and the ISIF. We also consider the APF, which has not implemented SRI or negative screening but, due to public pressure, is considering divesting from the fossil fuel sector¹⁶. These funds have been selected because they have implemented, or are in the process of implementing, classical exclusions and

¹⁶ See <https://www.peer.org/alaska-permanent-fund-weans-off-fossil-fuel-companies/>

divestment from fossil fuels. Our second source of data consists of all reports and publications disclosed by the concerned SWFs. SWFs usually communicate their decision to exclude a company from their portfolio through a press release published on their website. To identify all exclusions, we searched for all the publications and press releases available on the various websites and extracted all the data related to their holdings and 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. Only the GPFG discloses the exact date of exclusions for each firm, while the remaining SWFs disclose only the year of exclusion for each firm. Therefore, since not all exact dates of exclusions were 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 to construct annual lists of exclusions, starting from the most recent and reconstructing the annual lists back in time based on the funds' announcements of previous exclusions. Based on these lists, we managed to construct portfolios of excluded firms at any point in time (annually). All firms are included in the exclusion portfolios at the beginning of the year in which the exclusion was announced. We conceived several portfolios for each fund to test our hypotheses:

- Portfolio A contains all exclusions with the exception of fossil fuel divestments for each fund on an annual basis
- Portfolio B (Portfolio D+E) contains only fossil fuel divestments for each fund on an annual basis
- Portfolio C (Portfolio A+Portfolio B) contains all exclusions for each fund on an annual basis

- Portfolio D contains only extraction and production fossil fuel firms for each fund on an annual basis (Global Industry Classification Standard [GICS] codes: 10101010; 10102020; 10102050)
- Portfolio E contains only refining and integrated fossil fuel firms for each fund on an annual basis (GICS codes: 10102010; 10102030; 10101020; 10102040)

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

Only the ISIF, the FFR, and the GPF of Norway have begun to partially exclude some fossil fuel firms, mainly related to the coal industry. The remaining fossil fuel companies have not yet been excluded by the SWFs, even though an official decision has been taken or is under consideration. In such cases, we consider fossil fuel divestment as granted. In other words, we consider all fossil fuel firms in which funds have shares as if they have already been excluded from SWF portfolios. To do so, we extracted from SWF annual holding lists all firms related to the fossil fuel industry based on the GICS¹⁷. To construct fossil fuel exclusion portfolios, two strategies are possible: if an SWF publishes its holdings on an annual and regular basis, and if an SWF does not publish its holdings annually (in which case we only have the holdings for the most recent year, i.e., 2019).

In the first case, for each year and over the duration of our study period, we extracted the fossil fuel companies from the SWF holdings. When there was no exclusion date, we considered that fossil fuel holdings for a given year are excluded in the same year. We started from the most recent year (2019), and were able to reconstruct the fossil fuel exclusion portfolios back in time based on the fossil fuel holdings for each year. Three funds are concerned: the GPF, the FRR, and the NZSF. In the second case, since we only had data

¹⁷ According to the GICS, fossil fuel firms are classed under sector Code 10.

relating to the holdings of SWFs for the most recent year (2019), we constructed the fossil fuel exclusions portfolios for that year and assumed that it did not change over time. This means that the composition and the weighting (in terms of market capitalization) of the fossil fuel exclusion portfolios does not change for the entire sample period. Two funds are concerned: the ISIF and the APF. Then, to separate those firms into extraction and production or refining and integrated firms, we used the GICS sub-industry codes related to the energy equipment and services industry (Code 101010) and oil, gas, and consumable fuels (Code 101020), as displayed in Figure 2. After identifying fossil fuel firms by sub-industry, we followed the same method mentioned above to construct two portfolios for each fund: the first containing extraction and production firms, and the second containing refining and integrated firms¹⁸.

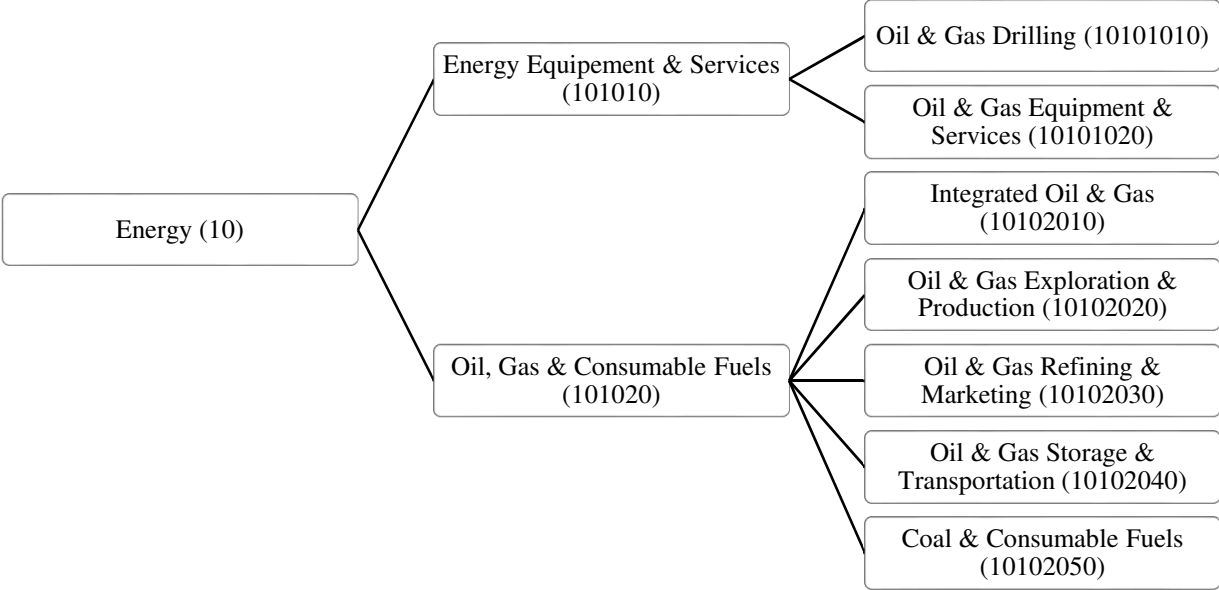


Figure 2: GICS categorization of fossil fuel firms

¹⁸ Please note that some firms (less than 10% of the sample) were removed from portfolios D and E because we did not find their GICS sub-industry codes.

Then, we matched 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 and for each fund, 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 is k .

Because this study analyzes real-world-based portfolios, we also computed value-weighted portfolio returns. Several arguments motivated our choices. Computing value-weighted returns is not only in line with SRI literature (Adamsson & Hoepner, 2015; Hoepner & Schopohl, 2018; Trinks & Scholtens, 2017), but it also accounts for SWF characteristics. SWFs are passive investors, and their holding weights are similar to the market weights (Chambers et al., 2012). SWFs 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's return is weighted by the firm's 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 $t-1$.

We use two standard asset pricing models to test the effects of negative screening on the financial performance of SWFs. First, we estimate a 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 diversified portfolio, the market benchmark considered in the models also needs to be a worldwide and diversified index. The MSCI All Country World Index (hereafter MSCI) meets these requirements, and it is commonly used in academic research (Trinks and Scholtens, 2017). The CAPM model can be expressed in the following way:

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

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 three-month US 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, 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:

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

where SMB_t (small minus big) is the global size factor, HML_t (high minus low) is the global value factor, and WML_t (winner minus loser) is the global momentum factor. The data corresponding to the three factors was extracted from Kenneth French's online data library¹⁹.

5. Results and discussion

5.1 Descriptive statistics

Table 2a presents the number of stocks in the exclusion portfolios for each SWF. We notice that the ISIF excluded only 10 firms unrelated to the fossil fuel sector, far fewer than the number of exclusions in the GPFG and NZSF portfolios. This is because the ISIF applies just one screen—cluster munitions—which is not related to fossil fuels. The APF has no exclusions in its portfolio since it has yet to employ negative screening. The GPFG and the NZSF excluded 147 and 131 firms respectively from their investment universe. These numbers are higher since both SWFs apply more screens (tobacco, alcohol, and nuclear and weapons production) and norm-based screens. We also notice that, with the exception of the ISIF, SWF fossil fuel portfolios contain more extraction and production firms than refining and integrated firms.

Insert Table 2a about here

Number of stocks in the exclusion portfolios for each SWF

Table 2b provides descriptive statistics regarding the equally weighted returns of the different portfolios for each fund and gives an initial insight into the performance implications of exclusions. Regarding Portfolio A, the average returns of exclusions by the GPFG, the FFR, and the ISIF are relatively low and positive, while the NZSF exhibits a higher positive average return. For Portfolio B returns, with the exception of the ISIF, the fossil fuel portfolios exhibit high average returns, providing initial evidence about the performance

¹⁹ Available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

implications of fossil fuel divestment. This implies that divesting from fossil fuels may generate an opportunity cost for SWFs.

Insert Table 2b about here

Descriptive statistics on exclusion portfolio returns for each SWF, 2005–2019

5.2 Results from the main portfolios

To assess the effects 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 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 Jensen’s alpha estimates obtained from the regressions. A positive (negative) and significant 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.

Insert Table 3 about here

Equally weighted performance results of SWFs using the CAPM model

Insert Table 4 about here

Equally weighted performance results of SWFs using the Carhart four-factor model

Table 3 shows the estimations based on the CAPM for equally weighted portfolios. Regarding Portfolio A, comprising all exclusions unrelated to fossil fuel sectors, we find that

the alphas are positive for all SWFs, and they are significant for all funds according to the CAPM model (at the 1% and 5% levels respectively). Significantly positive alphas suggest that the 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 portfolios firms displaying high abnormal returns compared to the market. Besides, our findings related to the ISIF exclusion portfolio are in line with Hoepner and Schopohl (2018) results on the performance of controversial weapons since this fund (ISIF) 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, to ensure 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's 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 portfolio 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 SWF fossil fuel portfolios (Portfolio B), we find for equally weighted portfolios that only the FRR and the ISIF fossil fuel portfolios significantly outperform the market at the 10% level (see Table 3). 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.'s (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). Also, we notice for both equally weighted and value-weighted portfolios that 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. Therefore, excluding fossil fuel firms could contribute to increased risks for SWFs.

Finally, regarding Portfolio C, comprising all exclusions including fossil fuel divestment, we find no evidence about the outperformance of exclusions including fossil fuel stocks since we do not document significant Jensen's alphas, based on value-weighted portfolios. This means that, according to our results, adding the oil and gas sector as a new screen for exclusions should not significantly decrease the financial performance of SWFs.

Insert Table 5 about here

Value-weighted performance results of SWFs using the CAPM model

Insert Table 6 about here

Value-weighted performance results of 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 and Table 6. Overall, the outcomes validate our initial findings and the results are consistent with

our previous findings. In fact, we find significant levels for Jensen's 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 H1c and reinforces the idea that negative screening does not reduce the financial performance of SWFs. Regarding the coefficient estimates of the four-risk factors, it seems that the size of the estimates of 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. All funds display positive and significant coefficients, meaning not only that SWFs have significant exposure to fossil fuel value stocks, but also that most fossil fuel firms are value firms rather than growth firms. Overall, we strengthen our results using the Carhart model.

For our return analysis, we used Carhart's (1997) model, which, generally, is applied at one level only: the national, regional, or global. In this study, we rely on global control factors that are available on the Kenneth French database. However, since SWFs own well-diversified portfolios and invest in a range of countries, our results may be biased in that we rely only on global factors and neglect regional control factors. Hoepner et al. (2011) show that considering global benchmark factors alone does not realistically reflect the financial performance and investment style of well-diversified funds. To solve this issue, we decided to develop a two-level Carhart model to simultaneously control for exposure to various regional and global markets. Based on Hoepner et al. (2011) and Gregory and Whitaker's (2007) work, we developed an eight-factor model by adding to a global Carhart model the different returns between each of the four global benchmark factors and its regional equivalent²⁰, given as follows:

²⁰ For the Norwegian, Irish, and French funds, we have taken factors of the European zone. For the Alaskan fund, we have considered factors for the North American zone. Finally, for the New Zealand fund, we have taken factors for the Asia Pacific ex-Japan zone.

$$\begin{aligned}
r_{i,t} = & \alpha_i + \beta_{reg,i}(r_m - r_f)_{reg,t} + \beta_{glo,i}(r_m - r_f)_{glo,t} + \gamma_{reg,i}SMB_{reg,t} + \\
& \gamma_{glo,i}SMB_{glo,t} + \delta_{reg,i}HML_{reg,t} + \delta_{glo,i}HML_{glo,t} + \varphi_{reg,i}WML_{reg,t} + \\
& \varphi_{glo,i}WML_{glo,t} + u_{i,t}
\end{aligned} \tag{5}$$

where the abbreviations *reg* and *glo* refer to regional and global respectively and indicate whether a coefficient represents the regional or global level.

The results are displayed in Table 7. We notice that, overall, the two-level Carhart model provides similar alphas to the traditional Carhart model. The main difference concerns the alpha of the FFR fossil fuel portfolio (Portfolio B) that now displays a negative and significant alpha at the 10% level. Moreover, the adjusted R² found in the two-level Carhart model are not significantly different from the ones found using the traditional Carhart model. Overall, these results are in line with our findings.

Insert Table 7 about here

Value-weighted performance results of SWFs using the two-level Carhart model

Insert Table 8 about here

Performance results by type of fossil fuel firm

Finally, in Table 8, we analyzed the performance of each fund's fossil fuel portfolios by distinguishing extraction and production firms from refining and integrated firms to identify whether fossil fuel firms differ in terms of financial performance according to their sub-sectors. In addition, several SWFs (e.g., the GPF and the NZSF) focus their fossil fuel divestment on extraction and production firms. Our analysis thus allows us to better capture possible differences between the two categories, and it seems that some disparities exist. While refining 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 GPF and the NZSF exhibit negative and significant alphas (at the 5% and 1% levels respectively), meaning that both extraction and production portfolios underperform their alternatives. 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. The decision to exclude only the 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. While it is difficult to obtain concrete evidence of this affirmation, our results may suggest a financial motivation, without refuting an ethical motivation. Nevertheless, we cannot generalize our conclusion because not all SWFs show similar results.

5.3 Robustness tests

5.3.1 Negative screening and risk implications

We also examine whether negative screening influences SWF risk features. In fact, incorporating socially responsible policies via negative screening serves to manage risk rather than to maximize returns. Excluding unethical firms from the funds' portfolios contributes to reducing risk since avoiding investing in these companies exempts investors from the costs associated with 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 Ghouli et al., 2018; El Ghouli et al., 2011), or litigation risks (Hong & Kacperczyk, 2009; Hong & Kostovetsky, 2012). This issue has been covered broadly in the literature dealing with SRI, and more specifically with negative screening and its risk implications (Hoepner & Schopohl, 2018; J. Humphrey & Lee, 2011). Hence, we analyze the riskiness of the exclusion portfolios with and without fossil fuel exclusions and compare them to the funds' benchmark index. We begin by analyzing the total risk of the different portfolios using the standard deviation of returns, as follows:

$$sd_p = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (r_{xp,t} - \bar{r}_{xp})^2} \quad (6)$$

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.

Since we are comparing the performance of “unethical” SWF portfolios to a market index 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 return losses endured by an investor compared to their expectations (Trinks et al., 2018). Such measures are appropriate when examining the impact of screening on financial performance since most of the exclusions concern firms implied in unethical activities and business practices, with associated risks and volatile and negative shocks for returns arising from costs related to legal actions and boycotts (J. Humphrey & Lee, 2011). These measures reflect investor attitudes to risk as they tend to fear losses but welcome larger than expected gains. Therefore, we propose a measure—the semi-standard deviation—that accommodates this asymmetry, which focuses only on the negative deviations from expected returns, and is calculated as follows:

$$ssd_p = \sqrt{\frac{1}{T-1} \sum_{t=1}^T \max[(\bar{r}_{xp} - r_{xp,t}), 0]^2} \quad (7)$$

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 considered.

Finally, we also consider the minimum abnormal return of a portfolio over the last year to capture the largest potential loss a portfolio could experience over a particular period. Examining the minimum abnormal return of SWF exclusion portfolios allows us to determine

whether excluding firms with low ESG standards or operating in the oil business protects SWFs from significant losses. The results of the risk measures are displayed in Table 9.

Insert Table 9 about here
Risk measures of SWF exclusion portfolios

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. Panel B shows the differences of risk measures between SWF portfolios and the MSCI, 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 exhibits the lowest standard deviation *vis-à-vis* SWF portfolios and, overall, the lowest risk measure (semi-standard deviation and minimum return), apart from the semi-standard deviation and minimum return for the NZSF in Portfolio A. This is unsurprising because this index is more diversified than exclusion portfolios, and therefore is less exposed to unsystematic risk. Because we consider the MSCI as representative of SWF global portfolios in terms of holdings allocation and diversification, we can assume that SWF global portfolio risk measures resemble those of the MSCI. This implies that SWF exclusion portfolios represent a higher risk than SWF global portfolios and, consequently, excluding these firms would decrease the level of risk to which SWFs are exposed. We also observe higher values for oil divestment portfolio risk measures when compared with both the MSCI and exclusion portfolios, implying that oil firms are riskier than other excluded firms, and SWFs would therefore decrease their exposure to risk by excluding them.

Panel B displays the mean differences between the MSCI and the SWF exclusion and oil divestment portfolio risk measures. Regarding Portfolio A featuring excluded firms, it

seems that only the ISIF presents a higher standard deviation and semi-standard deviation compared to the MSCI. Other SWF 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 exhibit significantly higher standard and semi-standard deviations than both the MSCI and, implicitly, SWF 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 at the 1% and 5% levels respectively. Based on these results, we can deduce that oil firms tend to be riskier than their counterparts, and therefore that SWFs should reduce their exposure to risk by divesting from fossil fuel industries. Moreover, SWF 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. In short, we believe that it is in the best interests of SWFs to divest from fossil fuel industries.

5.3.2 Crisis versus non-crisis period

The sample time horizon used in this study covers the period 2005–2019, which corresponds to the date when SWFs exercised their first exclusions. Although this time frame is relatively short, many events affected the economic and financial sphere, including of course the financial crisis in 2008 and the collapse of the oil price in 2014. These two events alone had a significant impact on financial securities, including those companies affected by SWF exclusion portfolios and oil divestment portfolios. We could then presume that our results are likewise affected by these events. However, to ensure robustness, we decided to examine several sub-periods to distinguish between crisis and non-crisis periods.

Regarding excluded firms in Portfolio A, we divided the studied time frame with regard to the financial crisis of 2008 into three sub-periods: from 2005 to mid-2008, which

corresponds to a period of stock market growth before the 2008 crisis; from mid-2008 to 2012, which corresponds to the subprime crisis and its repercussions; and from 2013 to 2019, a period in which the market returned to something more like normal. For the determination of the sub-periods, we used the price curve of the MSCI, which corresponds best in terms of geographical allocation with the exclusion portfolios. We also examined the performance of exclusions and fossil fuel firm portfolios during the sub-periods (i.e., Portfolio C). The results are presented in Table 10.

Insert Table 10 about here

Crisis vs. non-crisis performance of excluded firm portfolios

For the period preceding the financial crises, we notice that excluded firm portfolios (Portfolio A) do not underperform their alternatives; in fact we observe a significant outperformance of the FRR and ISIF portfolios at the 10% and 5% levels respectively. Moreover, when examining the period following the subprime crisis, we observe that exclusion portfolios do not exhibit an underperformance, and the GPFG displays a positive Jensen's alpha. It seems that, overall, excluded firm portfolios perform well during non-crisis times. However, for the sub-period corresponding to the 2008 financial crisis, all SWF exclusion portfolios exhibit negative Jensen's 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 compared to their alternatives. We also analyzed SWF portfolios that include both excluded firms and fossil fuel firms (Portfolio C) to better capture how both excluded and fossil fuel firms impact SWF performance during crisis and non-crisis times. We find that SWF portfolios C do not under- or overperform during financial crises. However, they tended to underperform prior to the financial crisis of 2008 since the GPFG, the FRR, and the NZSF exhibit significant negative returns but show no significant

performance differences after the financial crisis. The evidence for performance during the non-crisis period is inconclusive, while it seems that during times of financial turmoil SWFs tend not to be negatively impacted by either excluded or fossil fuel firms.

Insert Table 11 about here

Oil crisis vs. non-oil crisis performance of fossil fuel firm portfolios

Since our sample contains a significant number of fossil fuel firms, we thought it would be interesting to examine how these companies are affected by fluctuations in the price of crude oil. We analyzed the extent to which fossil fuel firms are affected by oil shocks, and, intuitively, if SWFs are vulnerable to these shocks. We first identified three sub-periods corresponding to different oil price trends: from January 2005 to June 2008, when oil prices were increasing; from July 2008 to June 2014, when oil prices were decreasing; and from July 2014 to 2019, when a more severe oil shock occurred. The results are displayed in Table 11. For the first shock (2008–2014), only the NZSF fossil portfolio exhibits a significant negative coefficient, while other SWF fossil fuel portfolios do not show significant performance disparities. Likewise, all SWF fossil fuel portfolios do not exhibit significant differences in returns from their more conventional funds, implying that these fossil fuel portfolios do not harm SWF performance in times of oil shocks. However, during the period 2005–2008, when oil prices were increasing, we observe that all SWF fossil fuel portfolios display negative Jensen’s alphas, which are significant for the GPF, the FRR, and the NZSF. It seems then that fossil fuel holdings can reduce the global financial performance of SWFs during non-oil shock periods.

6. Conclusions

Negative screening represents an effective strategy to prevent investors from backing 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 agreed financial objectives. Hence, employing negative screening creates a dilemma since exclusions may reduce the financial returns of these funds. This study addresses this issue by examining several SWFs that apply negative screening. Moreover, to analyze exclusions that had already occurred, we assessed fossil fuel divestment after 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 considered four SWFs that already use an exclusionary strategy—namely the GPFG (Norway), the NZSF (New Zealand), the FRR (France), and the ISIF (Ireland)—and we looked at the APF (Alaska), an SWF considering engaging in fossil fuel divestments.

To test the effects of negative screening on the financial returns of SWFs, we used two standard asset pricing models: the CAPM and the four-factor model. Regarding exclusions unrelated to the fossil fuel sector, we find overall that SWF financial performance is unchanged. We also document that SWF fossil fuel portfolios do not under- or overperform their more conventional alternatives, suggesting that excluding fossil fuel firms does not adversely affect the financial performance of SWFs. Even when we account for both existing exclusions and fossil fuel divestment, we find that the financial performance of SWFs would not be affected by divesting. 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—extraction and production firms and refining and integrated firms—to capture possible disparities between the two. The first category has slightly more significant results than the second since the extraction and production portfolios of both the GPFG of Norway and the NZSF of New Zealand underperform. This means that the motivation behind SWFs excluding only extraction and production firms could to some extent be driven by financial considerations rather than ethical

issues alone. However, we do not have enough evidence to support this statement, since not all SWFs show the same results. However, one possible reason why some socially responsible SWFs might not exclude refining and integrated firms is that they believe such firms can in time transition to cleaner and renewable energies, which is not necessarily the case for extraction and production firms.

We also consider how negative screening might affect SWF exposure to risk. By evaluating several measures, we acknowledge that excluded firms and fossil fuel portfolios exhibit higher downside risk levels, which increases SWF exposure to risk. This suggests that, when excluding such firms, the global risk to which SWFs are exposed should decrease. We also test for the impact of the financial and oil crises on our results.

Through this study, we have provided new insights about negative screening and its effects on SWF performance. We have relied on actual exclusions and real-world fossil fuel portfolios, giving our results a realistic aspect. SWFs should be encouraged by our finding that divestment from fossil fuels to meet their ethical objectives will not reduce their overall financial performance. Moreover, the relative share of extraction and production firms in an SWF's portfolio should not significantly impact its overall financial performance. This should encourage other SWFs and institutional investors to consider not only fossil fuel divestment but also, more generally, the implementation of social and environmental values. Future studies could investigate other SWFs committed to ethical investments.

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Tables

Table 1. Responsible SWFs and screens applied

	GPGF	NZSF	ISIF	APF	FRR
<i>General information</i>					
Name	Government Pension Fund Global	New Zealand Superannuation Fund	Ireland Strategic Investment Fund	Alaska Permanent Fund	Fonds de Réserve pour les Retraites
Country	Norway	New Zealand	Ireland	United States	France
Assets under management (in USD)	1,098,820,000,000	28,939,100,000	24,521,500,000	81,098,900,000	36,400,000,000
Date of creation	1990	2001	2001	1975	2001
<i>SRI implementation</i>					
Date of implementation	2005	2005	2006	-	2006
Negative screening	Yes	Yes	Yes	No	Yes
Positive screening	Yes	Yes	-	-	Yes
Shareholder activism	Yes	Yes	Yes	No	Yes
<i>Screen(s) applied</i>					
Tobacco	Excluded	Excluded	-	-	Excluded
Alcohol	Excluded	-	-	-	-
Weapons production	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 SWFs: the GPGF of Norway, the FRR, the NZSF, the ISIF, and the APF. 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. The data used in this table is from 2020.

Table 2a. Number of stocks in 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: 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 “refining and integrated” firms for each fund.

Table 2b. Descriptive statistics on exclusion portfolio returns for each SWF, 2005–2019

	GPFG	FFR	NZSF	ISIF	APF
<i>Portfolio A returns</i>					
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	-
<i>Portfolio B returns</i>					
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
<i>Portfolio C returns</i>					
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
<i>Portfolio D returns</i>					
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
<i>Portfolio E returns</i>					
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

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

	GPFG	FRR	NZSF	ISIF	APF
<i>Portfolio A</i>					
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	168	180	168	-
R ²	0.7695	0.7533	0.0245	0.5418	-
Adjusted R ²	0.7682	0.7519	0.0191	0.5392	-
<i>Portfolio B</i>					
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	168	180	168	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
<i>Portfolio C</i>					
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	168	180	168	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: 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. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

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

	GPFG	FRR	NZSF	ISIF	APF
<i>Portfolio A</i>					
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	168	180	168	-
R ²	0.7743	0.7571	0.0409	0.5661	-
Adjusted R ²	0.7692	0.7515	0.0190	0.5562	-
<i>Portfolio B</i>					
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	168	180	168	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
<i>Portfolio C</i>					
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	168	180	168	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: 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 add the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

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

	GPFG	FRR	NZSF	ISIF	APF
<i>Portfolio A</i>					
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	168	180	168	-
R ²	0.6814	0.5809	0.5281	0.4980	-
Adjusted R ²	0.6796	0.5785	0.5254	0.4952	-
<i>Portfolio B</i>					
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	168	180	168	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
<i>Portfolio C</i>					
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	168	180	168	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: 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. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

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

	GPFG	FRR	NZSF	ISIF	APF
<i>Portfolio A</i>					
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	168	180	168	-
R ²	0.6907	0.5984	0.5628	0.5099	-
Adjusted R ²	0.6836	0.5892	0.5528	0.4987	-
<i>Portfolio B</i>					
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	168	180	168	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
<i>Portfolio C</i>					
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	168	180	168	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: 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 add the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 7. Value-weighted performance results of SWFs using the two-level Carhart model

SWF	Intercept	Market exposures		SMB exposures		HML exposures		WML exposures		Adjusted R ²
	Alpha	M _{reg}	M _{glo}	SMB _{reg}	SMB _{glo}	HML _{reg}	HML _{glo}	WML _{reg}	WML _{glo}	
GPFG										
Portfolio A	0.0017	0.7254***	0.9175***	-0.0105	-0.2418*	0.1021	-0.2301*	0.0017	-0.0021	0.6913
Portfolio B	0.0011	0.8901***	1.0127***	0.5921*	0.6719*	0.4853*	0.5264*	0.3401*	0.2625	0.2514
Portfolio C	0.0021	0.8366***	0.9943***	0.3175	0.3268	0.2906*	0.2074	0.1772	0.1498	0.3501
FFR										
Portfolio A	0.0037	0.8254***	0.8163***	-0.0643*	-0.0051**	0.2497*	-0.0005	-0.0025	-0.0003	0.5932
Portfolio B	-0.0052*	0.4985**	0.7847***	0.3708*	0.0932	0.2179	0.3097*	0.1145	0.1329*	0.4895
Portfolio C	-0.0041	0.7103***	0.8021***	0.1273	-0.0021*	0.2195	0.1749	0.0938	0.1147	0.6173
NZSF										
Portfolio A	-0.0002	0.8613***	0.8294***	-0.0019*	-0.0035**	0.0007	-0.0039***	0.1027*	0.0013	0.4928
Portfolio B	-0.0063	0.8369***	0.9248***	0.1417	0.1906	0.2541**	0.3414***	0.0141*	0.0166**	0.5863
Portfolio C	-0.0059	0.8407***	0.8982***	0.0071	0.0068	0.1309*	0.1602	0.0968*	0.1017*	0.5571
ISIF										
Portfolio A	0.0029	0.5013**	0.8920***	-0.0001	0.0027	-0.0031	0.0268	-0.0063	-0.0827	0.4784
Portfolio B	0.0009	0.8206***	0.9506***	0.2031	0.0974	0.3782*	0.4074**	0.1417*	0.1684**	0.6109
Portfolio C	0.0017	0.6947**	0.9281***	0.0961	0.0503	0.1802	0.2907*	0.1279	0.1476*	0.5741
APF										
Portfolio A	-	-	-	-	-	-	-	-	-	-
Portfolio B	-0.0011	1.0006***	1.0025***	0.1364	0.2804	0.2704*	0.3425**	0.2149**	0.2461***	0.6431
Portfolio C	-0.0011	1.0006***	1.0025***	0.1364	0.2804	0.2704*	0.3425**	0.2149**	0.2461***	0.6431

Key: This model estimates the exposure of a portfolio to its regional equity market and the global equity market. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Table 8. Performance results by type of fossil fuel firm

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: Refining 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: Portfolio D exhibits “extraction and production” firms for each fund. Portfolio E exhibits “refining and integrated” firms for each fund. Performance is measured according to the Carhart four-factor model, where we add the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 9. Risk measures of SWF exclusion portfolios

	Panel A			Panel B		
	Standard deviation	Semi-standard deviation	Minimum return	Standard deviation	Semi-standard deviation	Minimum return
<i>MSCI</i>	0.0388 (0.0185)	0.0293 (0.0146)	-0.0744 (0.0515)	-	-	-
<i>Portfolio A</i>						
GPF	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	-	-	-	-	-	-
<i>Portfolio B</i>						
GPF	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)
<i>Portfolio C</i>						
GPF	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: Panel A displays mean values and standard deviations of the monthly risk measures of SWFs as well as the MSCI. Panel B shows the mean differences in the monthly risk measures between the MSCI and SWF exclusion portfolios. Numbers in brackets represent *t* values for a paired *t*-test of the mean values of the MSCI against SWF exclusion portfolios. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 10. 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
<i>2005–2007</i>									
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
<i>2008–2012</i>									
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
<i>2013–2019</i>									
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 add the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 11. Oil crisis vs. non-oil crisis performance of fossil fuel firm portfolios

	GPFG	FRR	NZSF	ISIF	APF
<i>2005–2008</i>					
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
<i>2009–2013</i>					
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
<i>2014–2019</i>					
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. Performance is measured according to the Carhart four-factor model, where we add the size factor (SMB), value factor (HML), and momentum factor (WML) to the market factor. *T* values are reported in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.