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Socially Responsible Investing (SRI) Mutual Funds and Market Crises

An Empirical Analysis of the Risk-Adjusted Performance of SRI Funds Relative to Conventional Funds During Market Crises

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Master thesis in Financial Economics

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Abstract

The master thesis aims to investigate the risk-adjusted performance of socially responsible investing (SRI) funds relative to conventional funds. We study the performance in different market states from March 2003 to March 2020, where we distinguish between crisis and non-crisis periods. The master thesis contributes with new insight by including the economic disruptions caused by the coronavirus pandemic in 2020. In our analysis, we use a matching procedure where each SRI fund is matched with three conventional funds based on specified criteria. We apply multi-factor models with dummy variables to distinguish between the respective funds and market states. Besides, we include interaction terms to account for variations in the risk factors. We study the performance of U.S. SRI equity mutual funds compared to U.S. conventional equity mutual funds through Jensen's alpha. We find that SRI funds tend to outperform their conventional fund peers during the crisis period, but the result is not significant. Further, the result reveals that conventional funds contribute to a negative risk-adjusted return and are more exposed to market fluctuations during the crisis period. To test the robustness of the results, we analyze the funds using different SRI strategies and divide the period into two different sub-periods. The result show that the performance of SRI funds has improved over the years and tend to follow their conventional peers to a greater extent. We conclude that investing in SRI funds makes one neither better off, nor worse off.

Keywords: S*ustainable finance, socially responsible investing (SRI) mutual funds, coronavirus (COVID-19) pandemic, financial market crisis*.

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Contents

1. Introduction

The attention to Socially Responsible Investing (SRI) has experienced rapid growth over the last couple of years, due to increasing awareness of environmental, social, and governance (ESG) issues among investors and managers. Concerned about issues like climate change, corporate long-termism focusing on creating value for all stakeholders, and the UNs Sustainability Goals (SDGs), to mention some. To clarify, SRI is an investment strategy that aims to generate both financial return and positive social impact, which includes ethical and green investing. Funds that possess this investment strategy are becoming more prevalent. A USSIF (2010) report reveals that in the U.S. the number of SRI mutual funds was 250 in 2010. Whereas a more recent USSIF report (2018) reveals that as of year-end 2017 the number of SRI mutual funds has grown to 636. The development of SRI mutual fund assets invested, experienced similar growth going from $316.1 billion to $2.58 trillion in the same period. Overall, SRI assets account for $12.0 trillion, or one in four dollars, of the $46.6 trillion in total assets under management in the U.S. in the year-end 2017 (USSIF, 2018).

The objective of the master thesis is to compare the risk-adjusted return of SRI and conventional funds over a 17 years-period, distinguishing between crisis and non-crisis periods. We expect to find evidence that SRI funds tend to outperform conventional funds during market crises. The economic rationale behind the statement is that in times of market crises, investors' behavior can be explained by a tendency of the reduced willingness of taking additional financial risk. This is backed by the prospect theory described by Kahneman and Tversky (1979). The prospect theory suggests that people are more negatively impacted by a loss than they are positively impacted by a gain of similar magnitude. Also, Nofsinger and Varma (2014) believe that the prospect theory supports their findings of SRI funds outperforming conventional funds during market crises. They believe that it can explain why investors give up a small amount of return during non-crisis periods, in terms of investing in SRI funds, to balance it out. Consistent with the significant increase in SRI mutual funds in the U.S. after the financial crisis in 2008, investing in SRI may be seen as an 'insurance' among investors to decrease downside risk. Furthermore, high performing ESG companies tend to pose less financial risk in terms of environmental, social, and governance aspects, and potentially making them more attractive during market crises. SRI funds typically invest in companies practicing social responsibility. This again can be related to a good reputation for the company that will function as a protection against substantial declines in the stock price

during market crises, suggested by Areal et al. (2013). At last, a recent article from Morningstar in April 2020 presents supportive findings to our hypothesis (Hale, 2020). More precisely, the article reveals that sustainable funds perform better than their conventional fund peers in the first quarter of 2020. The difference in returns is reasoned with sustainable funds tend to emphasize companies with stronger ESG profiles or lower ESG risks. However, the main explanation for the outperformance is that SRI funds are less exposed to energy stocks and more exposed to technology stocks. In general, implying a notable difference between SRI and conventional funds. Also, we want to investigate whether SRI funds underperform relative to conventional funds during non-crisis periods. Becchetti et al. (2015) proposed that the underperformance can be explained by additional costs SRI funds bear. For instance, an implied diversification costs when excluding certain companies.

In our analysis, the crisis period covers the financial crisis in 2008 and the economic disruptions caused by the coronavirus pandemic in 2020. Previous studies have mainly been considering the dot-com bubble of 2001 and the financial crisis of 2008. Our thesis contributes with new insight into the field by including a more recent incident with the global crisis originating from the coronavirus pandemic in 2020. This is further supported by the Morningstar article, regarding the discussion about why investigating this period of a bear market is valuable (Hale, 2020). After the financial crisis in 2008, most of the growth in sustainable funds has taken place, and particularly over the last five years, the growth has been substantial. This means as Morningstar states: more sustainable funds will now undergo a bear market stress test for the first time. Concerning the outbreak of the coronavirus pandemic in 2020, causing a global health crisis and consequently disrupt financial markets all around the world. This again enables us to test the hypothesis on a larger and therefore potentially more reliable selection of data compared to previous studies. Further in the Morningstar article, they investigate SRI fund performance compared to conventional fund peers, but only the first-quarter return of 2020. In our analysis, we account for monthly risk-adjusted returns over a longer period.

To test our hypothesis, we collect data from Morningstar Direct and construct a panel dataset. We obtain an unbalanced panel data sample consisting of 144 U.S. SRI equity open-ended mutual funds and 432 U.S. conventional equity open-ended mutual funds. From now on, we will respectively refer to them as SRI funds and conventional funds. We choose open-end sustainable funds as these are more common than their counterparts, namely exchange-traded and closed-end sustainable funds. When it comes to the choice of the asset class, we choose

to restrict our sample to equity mutual funds investing in U.S. stocks, excluding fixed-income, balanced, and money market mutual funds, for two reasons. Firstly, since the majority of sustainable investing assets are allocated to public equities in 2018 (GSIA, 2018). Thus, we can be confident that we will be able to collect enough data for our analysis. Secondly, earlier research considering the performance of SRI funds in different market regimes has primarily been studying equity. For instance, see Nofsinger and Varma (2014) and Leite and Cortez (2015). Therefore, we choose to focus on equity investments to ensure access to sufficient data and obtain comparability across studies. The motives for restricting the market is to avoid being too broad in our analysis and the choice fell on the U.S. because of their developed SRI fund market of considerable size. Also, we choose to analyze the period from March 2003 to March 2020 to capture upturns in advance of the crises, and thus, ensures comparability of the respective crises. The crisis period covers the financial crisis in 2008 and the coronavirus pandemic in 2020. The remaining are defined as the non-crisis period. Furthermore, we use a matching procedure that is compliant with the methodology used in the Morningstar article, in terms of region, market capitalization, and investment style (Hale, 2020). Also, the matching method is applied in studies like Statman (2000); Bauer et al. (2005); Renneboog et al. (2008b); Nofsinger and Varma (2014). Fund performance is examined by using single-factor and multi-factor models through Jensen's alpha. Likewise applied in previous studies on SRI fund performance like Bauer et al. (2005); Renneboog et al. (2008b); Derwall et al. (2011); Nofsinger and Varma (2014). Moreover, we generate dummy variables and interaction terms to compare and assess the performance during crisis and non-crisis periods, in line with Nofsinger and Varma (2014) and Leite and Cortez (2015).

Our findings from the empirical analysis imply no significant differences between SRI and conventional funds in terms of risk-adjusted performance for the entire period. Consistent with previous studies about SRI funds compared to conventional funds, where the studies generally find no significant difference in terms of risk-adjusted performance. See for instance, Statman (2000); Bauer et al. (2005); Renneboog et al. (2008a); Becchetti et al. (2015); Revelli and Viviani (2015). On the other hand, scholars like Girard et al. (2007) and Hong and Kacperczyk (2009) argue that SRI funds underperform compared to conventional funds. Furthermore, when investigating the crisis period, we find that the SRI funds perform better than their conventional fund peers, but do not obtain significant results. This is in line with findings proposed by Leite and Cortez (2015) and Matallín-Sáez et al. (2019). On the contrary, Nofsinger and Varma (2014) find significant evidence that SRI funds tend to outperform their

conventional fund peers during market crises. Furthermore, we find significant evidence that conventional funds are more exposed to market risk and tend to perform worse than the market during the crisis period. Also, findings from the robustness test suggest that the performance of SRI funds have improved and match their conventional peers to a greater extent over the years.

The remainder of this master thesis is structured as follows: In Section 2 the background for the thesis is reviewed. Section 3 provides a literature review that covers academic papers relevant to the issue. Section 4 presents the data and the construction process and other considerations for the final data sample. Section 5 introduces the methodology used in our analysis. In Section 6 the results from the empirical analysis are summarized. In section 7 the main findings, robustness, and implications for our results are discussed, in addition to some forward-looking discussion about the topic. Section 8 provides concluding remarks.

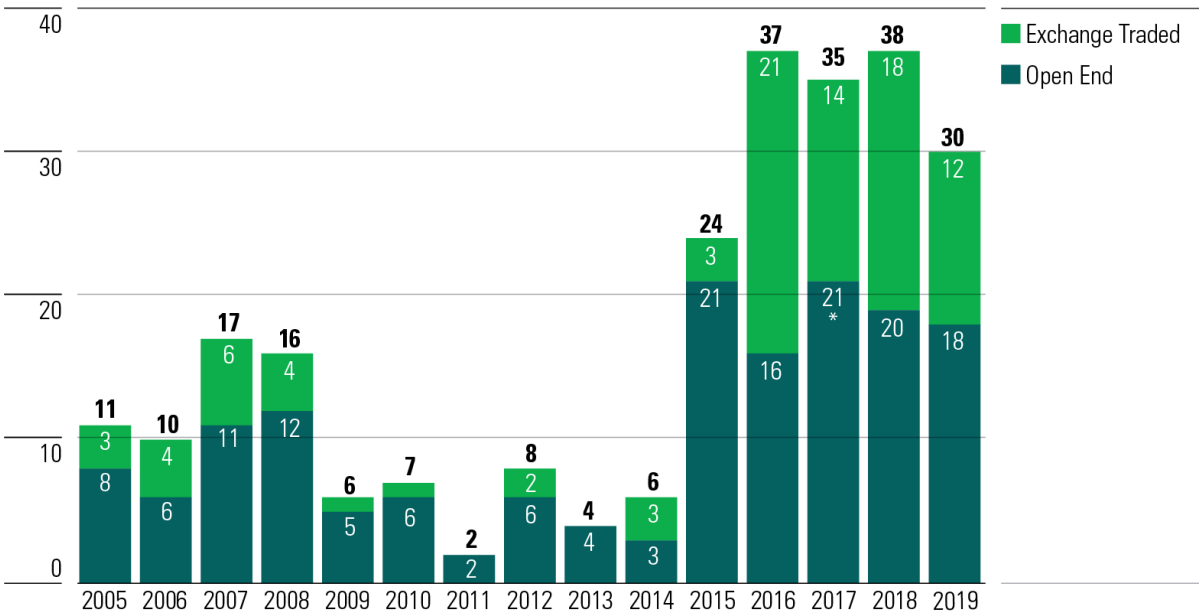
2. Background

This section outlines the background of the master thesis. Accordingly, we will present the topic of sustainable finance with fund specific references including the development of SRI funds and SRI strategies. Followed by an outline of market crises, with the financial crisis in 2008 and the coronavirus pandemic in 2020. As our master thesis intends to test the performance of SRI and conventional funds over different market regimes, we find it relevant to discuss these topics. The section is meant to give the reader an overview of the sustainable finance field and some background information about the market crises.

2.1 Sustainable funds development

Figure 2.1: New launches of U.S. Sustainable Funds

Figure 2.1 illustrates new launches of sustainable funds in the U.S in the Morningstar universe. Including the respectively asset classes: U.S. equity, Non-U.S. equity, sector equity, taxable bond, municipal bond, allocation, alternative and money market. To be noted: 38 open-ended funds were launched between 1971-2004, and the first sustainable ETF was launched in 2005. Data as of December 31, 2019. Source: Morningstar Sustainable Funds U.S. Landscape Report.



We observe from the Morningstar's *Sustainable Funds U.S. Landscape Report* (2020b) for 2019 that the growth in sustainable funds in the U.S. is in an accelerating phase in terms of ESG considerations and new launches. In Figure 2.1 we observe that 164 sustainable funds were launched from 2015 to 2019, and according to Morningstar representing more than half of the sustainable funds in the Morningstar universe. We observe that 18 of the 30 launched sustainable funds in 2019 were open-ended funds and the rest were exchange-traded funds

(ETFs). Also, the report reveals that 22 out of the 30 launched sustainable funds in 2019 were equity funds, seven bonds funds and one was a money market fund. Further in the report, when looking at the full selection of sustainable funds we see that by asset class, equity makes up 219 of 303 sustainable funds by 2019. Also, among the 303 sustainable funds, we find that U.S. equity consists of 66 active and 40 passive funds. Which makes U.S. equity the biggest class in terms of sustainable funds in the U.S. compared to the other asset classes, like non-U.S. equity, bonds, and money market. Further, one-third of the sustainable funds in the U.S. are passive funds, where some are constructed to be an alternative for broad index funds while others are more theme or sector-focused.

Figure 2.2: Development of Assets Under Management and Net Asset Flows

Figure 2.2 displays the development for the assets under management (AUM) on the left side and the net asset flows into open-ended and exchange-traded sustainable on the right. Both in Billion U.S. Dollars and are funds available for U.S. investors. Data from December 31, 2019. Source: Morningstar Sustainable Funds U.S. Landscape Report.

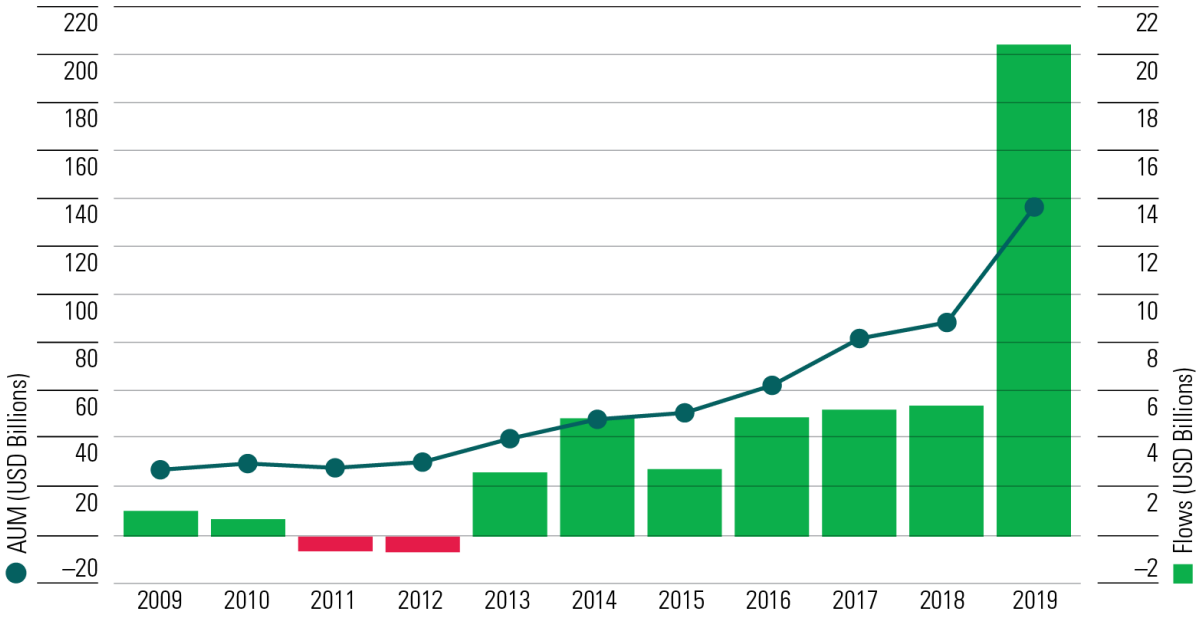


Figure 2.2 illustrates a record year for net asset flows into sustainable funds in 2019 which in total accounts for $21.4 billion. Where especially the fourth quarter in 2019 was the main driver for the growth, which alone stood for $7.9 billion of the net flows. When it comes to assets under management (AUM) in billion U.S. dollars we observe a significant increase over the last five years. Similarly, 2019 also stands out, with a record year for the AUM that almost reached $140 billion. Further, Morningstar states in their report that sustainable funds tend to outperform their conventional fund peers in 2019. This can reflect an increased emphasis on sustainable investing among investors over the last couple of years.

2.2 Socially responsible investing (SRI) strategies

Based on the Morningstar framework for sustainable investing, we distinguish between positive and negative screening, which Morningstar respectively choose to call "Sustainable Investment" and "Employs Exclusions" (Morningstar, 2020a). Positive screening often refers to including stocks that focus on one or several of the ESG attributes. Whereas, negative screening means avoid investing in companies that do not meet certain pre-set criteria. Both strategies are in line with one or several of the six methods for considering ESG issues identified by The CFA Institute (2015). The first method listed is exclusionary screening, followed by various positive screening methods like best-in-class-selection, thematic investing, active ownership, impact investing, and ESG integration. In other words, we observe similarities between The CFA Institute's six methods and the Morningstar framework. Accordingly, we consider the Morningstar framework for sustainable investing to be a sufficient classification. Followingly, we will describe the Morningstar strategies in the SRI funds, respectively Sustainable Investment and Employs Exclusions.

2.2.1 Sustainable Investment

Sustainable Investment is referred to as intentionally sustainable strategies where a fund is focusing on any kind of sustainability, impact, or one or more of the ESG factors in their prospectus or offering documents (Morningstar, 2020a). Morningstar divides the category into three types of funds: ESG fund, Impact fund, and Environmental Sector Fund. Firstly, the ESG fund is a diversified sustainable strategy that integrates environmental, social, and governance principles into the investment process or engagement activities. According to a CFA Institute survey, ESG integration is the most used (57 percent) of the six methods (CFA Institute, 2015). Secondly, Impact fund, also a diversified strategy, aims to generate a quantifiable impact with investments on specific issues alongside a financial return. Impact fund concentrates on issues like gender diversity, green bonds, or use the 17 U.N. Sustainable Development Goals. Thirdly, the Environmental Sector fund, also known as the Sustainable sector, refers to non-diversified funds with strategies aligned with investing in environmentally focused industries. Like renewable energy, water infrastructure, sustainable forestry, agriculture, and green real estate. Besides the mentioned Sustainable Investment strategies, there is a growing number of conventional funds that include ESG analysis into their investment process, but in a more limited way. The *Morningstar Sustainable Funds U.S. Landscape Report* discloses a six-fold increase in the number of funds applying ESG considerations from 2018 to 2019 (Morningstar,

2020b). This substantial growth can reflect a general acknowledgment among asset managers regarding the materiality of considering ESG issues into the investment process.

2.2.2 Employs Exclusions

The second SRI strategy, "Employs Exclusions", is an exclusionary strategy. Morningstar defines the exclusionary strategy as "excluding certain sectors, companies, or practices" (Morningstar, 2020a). A fund that employs exclusion intends to avoid a certain industry or group of industries that do not align with the principles of the fund, often excluding so-called "sin stocks". For instance, it can include norms-based screening or exclude alcohol, animal testing, controversial weapons, gambling, thermal coal, and/or tobacco, to mention some.

2.3 Market crises

The world has experienced several market crises over the past years and with a more globalized world; the impacts tend to become more widespread. Every crisis is different, making it challenging to predict and to see the right countermeasures. However, crises have in common that they are characterized by uncertainty, financial distress, and sometimes irrational decisions. In our thesis, the definition of the crisis period is based on fluctuations in the Standard & Poor's 500 (S&P 500) Index, the Volatility Index (VIX), and other economic indicators, that will be discussed in Section 4.5. Further, we choose to emphasize two crises in our analysis, respectively the financial crisis in 2008 and the coronavirus pandemic in 2020. In the following, we will describe the respective crises.

2.3.1 The Financial Crisis in 2008

The global financial crisis lasted from 2007 to 2009 as we for simplification choose to refer to as the f*inancial crisis in 2008* in our thesis. The crisis stems from a deprecation in the subprime mortgage market in the U.S. That was a consequence of the liberalization of the credit market around the world that made borrowing money accessible to many people. This developed into an international crisis with the bankruptcy of the American investment bank Lehman Brothers on September 15, 2008, as the tipping point. Further, it is pointed out as a result of the prevalence of the free market structure of capitalism since the 1980s and the increasing financialization of the world economy (Herrera-Cano & Gonzales-Perez, 2016). Financialization refers to a financial sector that increases in size and importance relative to the

overall economy (Kenton, 2019). The financial sector had become so big, often referred to as 'too big to fail', that the consequences of failure affected political, economic, and social dynamics on a global scale. The financial crisis in 2008 among several past crises has historically been described by Reinhart and Rogoff (2009) in their book *This time is different.* The authors argue that we tend to think that old rules of valuation do no longer apply this time and that new situations bear little comparisons to past crises. Reinhart and Rogoff state that even though we can learn from history that crises follow certain patterns, we still tend to forget. That is a major explanation for why we let the situation go so far. The phenomenon of forgetting past events can also say to be the case with global health emergencies, like with the coronavirus pandemic in 2020.

2.3.2 The Great Lockdown in 2020

The second crisis is initiated by the coronavirus pandemic in 2020. The coronavirus disease (COVID-19) is a severe acute respiratory syndrome and was characterized as a pandemic by the World Health Organization (WHO) by March 11, 2020 (WHO, 2020a). The International Monetary Fund (IMF) has chosen to call it *The Great Lockdown*, which we also find as a proper name for it (IMF, 2020). To clarify, the name for the crisis caused by COVID-19 will be referred to as *the coronavirus pandemic in 2020* and *the great lockdown in 2020* interchangeably in our thesis. To put it in perspective: IMF refers to the crisis as the worst downturn since the great depression in the 1930s and far severer than the financial crisis in 2008. Furthermore, the outbreaking coronavirus pandemic can say to be the worst epidemic crisis in the 21st century, forcing countries from the U.S. to India into lockdown and disrupt economic activities all around the world. To summarize the first quarter of 2020: MSCI All World (index for global stocks) had its worst quarter since 2008, S&P 500 Index dropped into a bear market on record time, an oil price shock with the lowest levels in 18 years, emerging market currencies crash, volatile U.S. Treasuries, and corporate bond yields rise along with deeper concerns about coronavirus (Georgiadis, Stubbington, Rennison, Szalay, & Johnson, 2020). It is the speed of the declines that stands out. Compared to the financial crisis in 2008 when the outbreak originated from the U.S., and with a less indebted world, higher interest rates, and China with financial muscles and willingness to save the U.S. economy, indicates a gentler shortfall than today where all this is turned upside down (Erikstad, 2020).

Furthermore, the coronavirus pandemic in 2020 is a global health crisis with an uncontrolled and exponential spread of infection across the globe. Financial countermeasures are not the

resolution to the crisis, but it is a vaccine against the virus. Therefore, we cannot come by the pandemic flu in 1918 and draw some parallels between the two pandemics. The pandemic flu in 1918 is an example of how misleading information about the severities of the virus killed many more people (Barry, 2005). Reliable and accurate communication is crucial under a crisis like this because it can save lives. An example is how the current U.S. president is criticized for misinforming the general public under the current pandemic, and in some cases does not rely on experts and scientists. This is probably one important reason why the U.S. has one of the highest death numbers in the world (FT, 2020). Another reason can be the U.S. government's slow reaction to the coronavirus pandemic. Compliance matters, as the pandemic flu in 1918 illustrated with governments that applied isolation and quarantine early, had lower death rates than the ones that did not take the same actions (Mineo, 2020). At last, to point out what differs from the pandemic flu in 1918 is how the world is much more connected due to the globalization and urbanization, and the world's population is much greater today. All of this breeds a rapid virus spread.

3. Literature review

The objective of this section is to outline relevant literature for our master thesis. First, a more overall literature review on the research on the performance of SRI funds will be presented. Then more specifically, the literature on socially responsible investing and market crises will be exhibited, which is the main topic for our master thesis.

3.1 SRI funds and performance

The studies about SRI funds compared to conventional funds find no significant difference in terms of performance. See Appendix Table A1 for an overview of the different research papers we find relevant to our thesis. One of the first studies to compare performance between SRI and conventional funds was Hamilton et al. (1993). They use monthly return data for equity mutual funds in the U.S. and measure performance by using the Capital Asset Pricing Model (CAPM), which is also one of the models we are using in our analysis. Hamilton et al. (1993) find a nonsignificant difference between SRI and conventional funds in risk-adjusted performance. They conclude that the market does not fully price in the non-financial benefits with social responsibility characteristics. Further, Bauer et al. (2005) suggest that SRI funds experienced a learning phase from the early to late 1990s, meaning that the risk-adjusted returns for SRI funds improved to similar levels of conventional funds in more recent years. Also, time and place affect the results according to Renneboog et al. (2008b). This can imply that social responsibility has not been fully priced in, but along with the development of SRI over the years the market has to a higher extent priced it in. Renneboog et al. (2008a) present an excellent overview of the earlier research on SRI performance with studies including different geographical areas and time series spanning from the 1960s to 2000s. Overall, there is no significant difference between the performance of SRI and conventional mutual funds. Similar results are presented in a meta-study by Revelli and Viviani (2015) where the findings on a global scale imply no real cost or benefit with SRI, but the results depend on the methodology being used in the studies.

In contrast, scholars like Girard et al. (2007) and Hong and Kacperczyk (2009) find evidence that SRI mutual funds tend to underperform relative to their conventional peers. One common explanation is the use of the SRI strategy with negative screening, which makes SRI funds less diversified, and thus, more exposed to systematic risk. Derwall et al. (2011) distinguish

between two types of investors with different SRI strategies: so-called value-driven and profit-seeking investors. They find that value-driven investors, also known as ethical investors, give up some profit by mainly using negative screening. In contrast, profit-seeking investors mainly use positive screening, which is proven to give higher abnormal returns.[1] Studies that only include value-driven funds can explain why some researches find the weak performance of SRI funds. Besides the cost with less diversification, Becchetti et al. (2015) point out two additional costs for SRI funds. First, higher costs due to asset managers' needs of putting higher effort in the investment process in terms of time and investigation because of a lack of standardized methods. Secondly, due to timing costs which refer to SRI funds managers being forced to sell stocks when companies included in the portfolio violates their SRI or ethical standards, even when the company is expecting to yield a good return in the future.

3.2 SRI funds and market crises

The empirical evidence on the performance of SRI funds throughout different market conditions is limited. Studies primarily analyze fund performance throughout a single period without considering different market conditions. As a matter of fact, there is evidence showing varying SRI fund performance in periods of expansion and recession. See Appendix Table A2 for an overview of research papers covering this issue. Consistent with the significant increase in SRI mutual funds in the U.S. after the financial crisis in 2008, the SRI method may decrease downside risk and therefore hold up better during market crises. Based on these statements we believe to potentially find some significant evidence in our analysis.

In a study by Nofsinger and Varma (2014) they account for the fact that risk-adjusted abnormal return performance varies in different sub-periods, accordingly crisis and non-crisis periods. In turn, Nofsinger and Varma imply that U.S. SRI mutual funds perform slightly better during crisis periods compared to their conventional fund peers, but during non-crisis periods SRI funds underperform, and for the overall period they find no significant difference. Nofsinger

[1] Derwall et al. (2011) refer to negative screening as an investment strategy that intends to avoid sin stocks and other controversial stocks, in line with our definition of the exclusionary strategy. Further, positive screening refers to investing in stocks that score positive on environmental and responsibility issues, also consistent with our definition of the sustainable investment strategy.

and Varma find that the outperformance in SRI funds during crisis periods is driven by mutual funds focusing on active ownership and ESG issues. Further, they find that positive screening rather than negative screening drives the differences in return patterns. Again, consistent with Derwall et al. (2011) which imply that variation in returns depends on the screening technique. Similar results are suggested by Areal et al. (2013), where the findings imply that the choice of screening strategy impacts performance differently across market regimes. However, they do not implicitly compare the performance between SRI and conventional mutual funds. Lastly, in line with more recent literature from Matallín-Sáez et al. (2019), where their findings suggest that during times of expansion U.S. SRI funds significantly underperform conventional funds in terms of risk-adjusted abnormal returns. During recessions, they find that the performance of SRI funds improves significantly but cannot conclude with a significant difference compared to conventional funds.

Leite and Cortez (2015) present evidence from French SRI funds investing in Europe during the crisis and non-crisis periods. They find significant underperformance for the SRI funds compared to conventional funds during the non-crisis periods, but in market downturns, SRI funds match their conventional peers. In contrast to Nofsinger and Varma (2014), Leite and Cortez do not find any protection from downside risk provided by the French SRI funds in times of crisis, but SRI funds still do not imply any sacrifice of financial return. Then again, in times of non-crisis, their results suggest that investors need to pay a price for ethics. As proposed by Nofsinger and Varma, the underperformance in non-crisis periods is driven by the SRI funds having a negative screening strategy, whereas the funds with a positive screening strategy perform similar to their conventional peers. We also find similar evidence for the outperformance of SRI funds during crisis in studies that use slightly different approaches. A study from Japan on the financial crisis in 2008, where particularly the bankruptcy of Lehman Brothers is being used as the event of study (Nakai, Yamaguchi, & Takeuchi, 2016). Their results imply that SRI funds better resisted the financial crisis in 2008 than their conventional peers, and therefore support the ‘insurance’ effect from downside risk SRI funds have during market crises. Besides, Silva and Cortez (2016) review green funds instead of SRI funds in general, and find supporting results stating that U.S. and European green funds perform better during crisis periods relative to non-crisis periods.

A shortcoming among these mentioned studies is that the samples are geographically limited to a maximum of one or two regions, making the results difficult to generalize on a global scale. On the other hand, Nakai et al. (2016) argue that domestic evidence applies to

international funds as SRI evaluation is more common for international firms rather than for domestic firms. However, Becchetti et al. (2015) overcome the shortcoming by expanding the sample to consist of 22,000 funds in several geographical areas of investment: global, North America, Europe, and Asia. To be noted, similar to us they gathered monthly equity investment funds returns from the Morningstar database. Overall, Becchetti et al. (2015) find no clear evidence that SRI and conventional funds differ in the entire period from 1992-2012. When looking at the crisis period, the study concludes that SRI funds perform better compared to conventional funds in the period of the financial crisis in 2008. However, they find no significant difference in North America. Furthermore, SRI funds do not outperform after the dot-com bubble in 2001 which is explained by that SRI funds tend to have an overexposure in technology stocks. Also, the study emphasizes the 'insurance role' SRI funds have in limiting downside risk compared to the conventional funds during the financial crisis in 2008, where the premium payment is in terms of lower returns in the expansion periods.

Regarding the findings from previous literature, our research will contribute to enhancing the understanding of SRI fund performance during crisis and non-crisis periods. To the best of our knowledge, most of the recent literature does not review the performance of SRI funds after 2017. Considering the rapid growth of socially responsible investing in the last five years, we want to test whether the findings remain unchanged or not. Our research differs from the previous literature, as we in addition to the financial crisis in 2008 also consider the financial disruptions caused by the coronavirus pandemic in 2020.

4. Data

In this section, we will describe the data we have used to study the performance of SRI and conventional funds from March 2003 to March 2020. Before the outbreak of the coronavirus in 2020, the economy experienced 11 years of expansion. To obtain consistency in the analysis, we consider a non-crisis period before the financial crisis in 2008 that has similar characteristics as the period between 2009 and 2020 in terms of upward market trends. For this reason, we begin the analysis period from 2003. Further, the data consists of 144 funds and 432 matching conventional funds based on four criteria, that we will discuss later in detail. We collect monthly returns series for all the funds and based on these we construct an unbalanced panel dataset. At last, we will justify the reason for the choice of the crisis period, both considering the financial crisis in 2008 and the great lockdown in 2020. All data from Morningstar Direct is collected on April 4th, 2020.

4.1 Data Source

The data collection is obtained from Morningstar Direct. According to Morningstar's annual report (2019), they are a leading provider of investment research and contribute to assisting their client's investment decisions by supplying data. Also, for those clients that do not want to make investment decisions themselves, Morningstar provides various tools to decide for them. In 2017, Morningstar acquired an influential ownership stake in Sustainalytics, a leading global provider of ESG research and ratings. In terms of the rapid growth in socially responsible investing, this is a powerful collaboration (Morningstar, 2019). Morningstar Direct also introduced several new ESG data points for clients to analyze in 2018. By using Morningstar Direct, we are ensured credible data points on both the financial and sustainable aspects. Thus, we find it reasonable to employ Morningstar Direct in our analysis.

4.2 SRI mutual funds

To begin with, we start by identifying SRI funds in Morningstar Direct. We search among 309,962 funds and apply three search criteria, respectively:

1. U.S. Category Group = U.S. Equity
2. Investment Type = Open-Ended Fund

3. Sustainable Investment = Yes and/or Employs Exclusions = Yes

The purpose of the first search criterion is to identify funds that mainly invest in equity traded assets listed on the U.S. stock market. As previously discussed, we choose to study the U.S. market to narrow our analysis. Since the SRI fund market is of considerable size in the U.S., we consider it more relevant to study the U.S. relative to other areas. Further, we restrict our analysis to equity investments to obtain sufficient data and compare results with previous studies. To control that the investments are traded in the U.S. market and invested in equity, we include a column showing the share of assets' allocation in U.S. Equity after the screening process, demonstrating that the funds invest 89.90 percent in equity in average. This is in line with The Norwegian Fund and Asset Management Association, which requires a mutual fund to have a minimum of 80 percent exposure to equity to be classified as an equity fund (VFF, 2012).

The second criterion restricts the search to only include open-ended funds because we want to study the most common mutual fund type. To exemplify, there are 292,554 open-ended funds, in contrast to ETFs that only consist of 17,408 funds. Also, by restricting our sample to consider one mutual fund type, we can be confident that the analysis is more consistent and less exposed to variations across fund types.

The third criterion reflects funds that consider sustainable strategies like positive screening and specific impact goals, and/or exclusionary screening (Morningstar, 2020a). Both strategies are in line with the methods for considering ESG issues identified by The CFA Institute (2015). Thus, we assume that we have collected SRI funds that certainly integrate sustainability in their equity investing. To clarify, the conventional funds will neither possess a Sustainable Investment and/or Exclusionary strategy. After applying these three criteria, we obtain 440 SRI funds. For the identified funds, we collect data points on the Morningstar Category Classification, inception date, fund size, and net assets value.

4.2.1 Controlling for survivorship bias

The initial list of SRI funds provided by Morningstar Direct is exposed to survivorship bias. Survivorship bias means that merged and/or liquidated mutual funds are excluded from the sample. For instance, a fund is normally liquidated due to bad performance. By default, Morningstar Direct does not include non-surviving funds in the search field, but the historical data remains in the database. This means that they provide a feature that allows us for including

non-surviving funds, which can easily be done by changing the default. A fund leaving the sample is so-called attrition. A study by Brown et al. (1992) discovered that excluding merged and liquidated funds can result in an overestimation of average performance. Further, other studies also consider the survivorship bias in their analysis, see Bauer et al. (2005); Renneboog et al. (2008b); Nofsinger and Varma (2014); Becchetti et al. (2015). To ensure that the fund performance is not exposed to the overestimation bias, we extend our search to include both surviving and non-surviving funds. As a result, we obtain a survivorship bias-free list that expands the sample to consist of 603 SRI funds.

4.2.2 Other refinements

When processing the dataset of the SRI funds, some of the listed funds were duplicates, meaning that different classes of the same fund appear as different funds. In general, we consider the first-established class fund and choose the class fund largest in net assets if two or more class funds were established simultaneously. This method is in line with Statman (2000) and Areal et al. (2013). When we account for this, our sample will not consist of duplicate funds with the same holding composition, which will in turn give more accurate results. Moreover, we exclude funds with less than 12 months of data to ensure consistency. For the funds with missing observations on fund size, a data point used in the matching procedure, we search for this through alternative sources like Bloomberg.com and remove funds we do not manage to find information about. After the data cleansing, the final number of SRI funds is reduced to 144 SRI funds.

4.3 Matching Conventional Funds

We are interested in comparing the performance of SRI funds relative to conventional funds, and to what extent the former outperforms the latter. In order to do that, we collect matching conventional funds of similar compositions and characteristics. The following matching procedure is used in several studies of SRI fund performance. See for instance, Statman (2000); Bauer et al. (2005); Renneboog et al. (2008b); Nofsinger and Varma (2014); Becchetti et al. (2015). In our sample, each SRI fund is matched with three conventional funds for the entire period. The matching criteria are based on:

1. Morningstar US Equity Category Classification
2. Fund inception date

3. Fund size (total net assets)
4. Expense ratio

The first criterion in the matching procedure allows for comparability across SRI and conventional funds. See Appendix Table A3 for further details on the Morningstar Category Classification. According to Becchetti et al. (2015), the SRI fund tends to be more exposed to the small-size risk factor and more growth-oriented than value-oriented. Similarly, Nofsinger and Varma (2014) find a difference in the characteristics of the companies held in the funds. Also, Matallín-Sáez et al. (2019) propose in a comparison between SRI and conventional mutual funds; that investment style is one of the most significant factors when to set up with proper peers, referring to the Morningstar category. As discussed earlier, we search for SRI funds among U.S. Equity and follow a similar procedure for the conventional funds. Within the U.S. Equity, funds are divided into nine Morningstar Categories based on market cap and investment style (value, blend, or growth). This is of relevance in the matching procedure because we aim to identify conventional funds that practice the same investment style as the respective SRI fund. Consequently, we begin searching for conventional funds in each category group, resulting in nine conventional fund samples. As the SRI funds follow the same classification, each SRI fund is matched with conventional funds from the same category.[2]

The second criterion is the fund inception date. Within each category, we continue the matching procedure by pairing SRI funds with conventional funds closest to fund age. More specifically, we choose conventional funds that are within 12 months of the inception date of the SRI funds. However, for some of the funds the one-year age criterion is too restrictive, which makes it difficult to collect three matching conventional funds. To solve this, we relax the criterion by including conventional funds that are within 36 months of the inception date of the SRI funds. If we still do not find three matching conventional funds, we drop the age criterion completely.

The third matching criterion is fund size, which is defined by Morningstar Direct as “the total amount of money managed as a standalone portfolio across share classes”. For each SRI fund,

[2] For example, an SRI fund belonging to Large-Growth is matched with conventional funds that operate in a similar category.

we select three conventional funds closest to fund size. As the value of the fund size changes frequently, we use the value on the day we collected the data, more precisely April 4th, 2020.

Fourthly, in contrast to the other studies mentioned at the beginning of this section, we also consider the level of expense ratio in the attempt to choose the most fitting matched funds.[3] Typically, an active (passive) investment strategy has a higher (lower) expense ratio (Hayes, 2019). Since the calculated return from Morningstar Direct is adjusted for expense ratio, we ensure performance comparability by matching SRI funds with a low expense ratio with conventional funds with a low expense ratio. Also, by matching based on expense ratio, we are better positioned to meet a potential tracking error bias. For the matching procedure, this means that we are more likely to match active SRI funds with active conventional funds and vice versa. Thus, we ensure comparability to a greater extent.

Furthermore, to control for whether our funds in fact hold an active or passive investment strategy, we supplement with an Active Share measure collected from Morningstar Direct. The Active Share is a measure of how similar the equity holdings of a fund are to its benchmark index.[4] In Morningstar Direct, an active share score of 0 indicates that the fund has the same equity holdings and proportions as its benchmark. Typically, an index fund receives a score equal to 0. In contrast, an active share score of 100 indicates that the equity portion of the fund and its benchmark has no common holdings. Considering this, we assume that the Active Share measure is somehow correlated with the Expense Ratio and control for this by plotting the data points. This is illustrated in Appendix Figure A4.

Besides the four matching criteria, we account for some additional considerations to utilize our matching procedure. Thus, increase the efficiency of our analysis. We ensure that for each SRI fund the three matched conventional funds come from different fund families. In this way, we can be confident that the conventional fund performance is not dominated by one single

[3] The expense ratio is the annual fee that all funds or ETF charge their shareholders, and include expenses like 12b-1 fees, management fees, administrative fees, operating costs, and all other asset-based costs incurred by the fund (Morningstar, 2020c).

[4] According to Cremers and Petajisto (2009), Active Share is calculated by taking the sum of the absolute value of the difference of the weight of each holding in the manager's portfolio and the weight of each holding in the benchmark index and dividing by two (Sais Jr & Sais, 2019).

fund family. We solve this by continuously monitoring the fund names during the matching procedure. Whenever we discover funds from similar fund families, we start over with the matching process for the respective SRI fund. Further, we try to match with similar share classes in the interest of obtaining the most appropriate peers. With these considerations in mind, we assume that the obtained sample of SRI and conventional funds are consistent and efficient.

Table 4.1: Summary of the funds

Table 4.1 displays the information about the funds in our data sample, grouped by SRI and conventional funds. All funds are U.S. Equity Open-End mutual funds. The Active Share and Asset Allocation are displayed in average percentages. The data is collected from Morningstar Direct.

	SRI funds	**Conventional funds**
# of all funds	144	432
Morningstar Category Classification:		
Large Value	14	42
Large Blend	53	159
Large Growth	27	81
Mid Value	7	21
Mid Blend	12	36
Mid Growth	9	27
Small Value	6	18
Small Blend	13	39
Small Growth	3	9
Sustainable Attributes:		
Sustainable Investing	108	0
ESG fund	104	0
Impact Fund	40	0
Environmental Sector	0	0
Employs Exclusions	106	0
Both strategies	70	0
Only Sustainable Investing	38	0
Only Exclusion	36	0
Active Share %, average	77.18	76.43
Asset Alloc US Equity %, average	89.90	89.81

Table 4.1 gives an overview of the 144 SRI funds and 423 conventional funds included in our dataset. Also, it illustrates how the different funds are distributed among the Morningstar Categories, where we see that most of the funds belong to the large-cap category. Further, we present an overview of the different strategies, where we observe that the majority of the SRI funds possess the Sustainable Investing strategy, more precisely 108 funds. Compatible with the CFA Institute's (2015) survey, the composition of our SRI funds illustrates an overweight

of the funds applying the ESG fund strategy namely 104 funds. Further, 70 funds apply both strategies, respectively Sustainable Investing and Employs Exclusions. Lastly, for the SRI funds, we see from Table 4.1 that the average amount of active share is 77.18 percent and the average asset allocation in US Equity is 89.90 percent. Whereas for the conventional funds, the average amount of active share is 76.43 percent and the average asset allocation in US Equity is 89.81 percent.

4.4 Data Collection

We retrieve monthly return series for the respective 144 SRI funds and 432 conventional funds from March 2003 to March 2020. Morningstar calculates the returns by taking the change in the monthly net asset, reinvesting all income and capital-gains distributions during that month, and dividing by the starting net asset. The total returns are adjusted for the expense ratio, but not for sales charges, such as front-end loads, deferred loads, and redemption fees (Morningstar, 2020d). Furthermore, the calculation of the return series is assumed to be consistent. This is due to the fact that they are collected from the same source. Thus, the return series is assumed to follow the same measurement method. In contrast to Nofsinger and Varma (2014) and Leite and Cortez (2015), we do not construct equally weighted portfolios for the funds. Instead, we consider each fund as an individual unit that we follow over time. In other words, we apply a panel data method. This makes us confident that the analysis will capture the individual effects instead of the average effects. This alternative approach contributes to a more precise analysis than the mentioned studies.

4.4.1 Review of the dataset

After the data cleansing, we review the quality of our sample. First and foremost, by saying that we are having panel data, we implicitly argue that the data are well arranged by both cross-sectional and time-series variables (Park, 2011). This holds for our analysis, as we follow 576 funds with varying return series (cross-sectional data) over a period of 205 months (time-series data). However, because some funds are liquidated and others have an inception date after the beginning of our period, we are not able to collect the monthly return series for the entire period for all funds. Consequently, we obtain an unbalanced panel data set of 89,876 observations. An unbalanced panel dataset is not problematic, given that the missing observations are uncorrelated with the error term (Wooldridge, 2013, p. 491). The panel data

is arranged in long form, including both individual and time variables. This means 576 entities (funds) and a minimum of 12 and a maximum of 205 time periods (months) are listed in multiple rows.

Table 4.2: Summary Statistics

Table 4.2 displays summary statistics for all the funds in the full sample period and for the crisis- and non-crisis period. The mean return is the average historical monthly cumulative return in percentages. The standard deviations (SD), Sharpe ratios, and minimum and maximum return for the SRI and conventional funds are also displayed in monthly percentages. The Sharpe ratio is calculated by dividing the average excess return by the average standard deviation for all of the respective funds. Observations are the total number of monthly observations for each variable. N is the total number of funds. The data is collected from Morningstar Direct.

Full period	**N**	**Mean Return**	**SD**	**Sharpe Ratio**	**Min**	**Max**	**Observations**
SRI	144	0.70	4.61	0.13	-40.31	31.31	20 992
Conv	432	0.73	4.68	0.13	-33.27	31.68	68 884
Crisis							
SRI	139	-4.25	7.25	-0.61	-40.31	14.67	1 921
Conv	414	-4.27	7.48	-0.59	-33.27	18.80	6 197
Non-crisis							
SRI	144	1.20	3.92	0.28	-18.76	31.31	19 071
Conv	432	1.22	3.97	0.28	-20.34	31.68	62 687

Table 4.2 summarizes our final data sample. We perceive that the average return of the SRI funds is slightly lower than the average return of the conventional funds during the full sample period. In terms of the crisis (non-crisis) period, the average return for SRI funds is to some extent higher (lower) relative to conventional funds. Considering the risk measure, the standard deviation is slightly lower for the SRI funds for all the periods compared to the conventional funds. In other words, SRI funds can say to be somehow less volatile. The Sharpe ratios show that conventional funds tend to hold up slightly better during crises, but the difference between the respective funds is small otherwise. Further, we observe that the number of funds (N) is reduced for the crisis period due to our unbalanced dataset. Also, the number of observations is considerably reduced in the crisis period as this constitutes of a shorter time period. The definition of the different periods will be described in detail in the upcoming section.

4.5 Crisis period

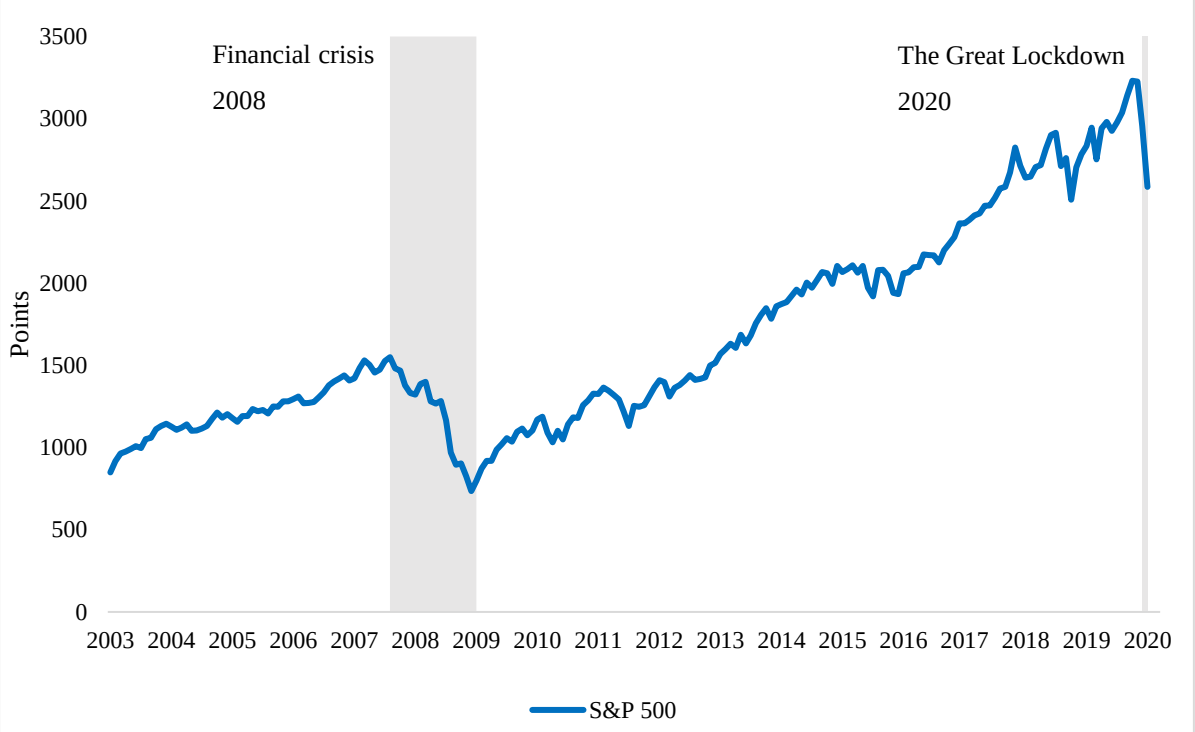
In our analysis, we distinguish between crisis and non-crisis for the entire period from March 2003 to March 2020. Therefore, we find it coherent to define the crisis period, covering both the financial crisis in 2008 and the recent coronavirus pandemic in 2020.

4.5.1 Defining the crisis period

According to Nofsinger and Varma (2014), crisis periods can be characterized by a big fall in the stock market. The S&P 500 Index is used as the benchmark when defining our crisis period. The index measures the stock performance of 500 large companies listed on U.S. stock exchanges. We find it appropriate as we study U.S. equity funds. Therefore, the crisis period is based on the peak and trough for the S&P 500 Index, consistent with Nofsinger and Varma (2014). During our period from March 2003 to March 2020, we identify two crises: October 2007 to March 2009, and February 2020 to March 2020, see Figure 4.1. Firstly, the crisis from October 2007 to March 2009 was the global financial crisis in 2008. For instance, Leite and Cortez (2015) define the period for the financial crisis 2008 differently, but in contrast to us, they study the European market. Other research papers that study the U.S. market are Becchetti et al. (2015) and Matallín-Sáez et al. (2019), which define the crisis period in line with The National Bureau of Economic Research (NBER). However, we still find it more consistent to use the S&P 500 Index to define both crises. Mainly because the period for the great lockdown in 2020 is not yet defined by NBER. Secondly, from February 2020 to March 2020 we identify the ongoing economic disruptions arising from a health crisis, referring to the outbreak of the coronavirus pandemic in 2020. On Wall Street, the S&P 500 Index took 16 days to drop from all-time highs and bring an end to 11 years of a bull market, which indicates that the index drops into a bear market on record time.

Figure 4.1: S&P 500 Index with market crises

Figure 4.1 illustrates the S&P 500 Index's monthly adjusted close price (adjusted for both dividends and splits) for our period of study from, March 2003 to March 2020. Source: Yahoo Finance.



The developments for the S&P 500 Index for the financial crisis in 2008 and the great pandemic in 2020 are illustrated in Figure 4.1. The levels of S&P 500 Index fell from a high 1,576.09 on October 11, 2007, to a low 666.79 on March 6, 2009, which indicates a drop of 58 percent over a time span of 482 days. When applying a time span from February 2020 to March 2020 we observe from all-time high levels of 3,393.52 on February 19, 2020, to lowest levels of 2,191.86 on March 23, 2020. This implies a 35 percent fall over a time span of 64 days.

NBER identifies one recession during our period, which is the financial crisis in 2008 (NBER, 2012). NBER defines the crisis period from December 2007 to June 2009, as they define a crisis based on several aspects of the economy.[5] Further, as the Great Lockdown 2020 is recent and ongoing, NBER has not yet considered this as a recession, and it is too early to

[5] NBER defines a recession as «a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales» (NBER, 2012).

define its starting and ending points. Despite the disruption from the ongoing coronavirus pandemic and that the financial market can decrease even more as we write our thesis, we still believe to get some useful conclusions from the incident. Also, we will include additional economic measures to strengthen our assertion that the coronavirus pandemic in 2020 can be considered as a market crisis.

4.5.2 The Volatility Index (VIX)

The Volatility Index (VIX), also known as the "Fear Index", can be a relevant measure when scanning for signals of a market crisis. VIX is created by the Chicago Board Options Exchange (CBOE) and can be defined as a real-time market index representing the market's expectation of volatility with a 30-day forward-looking window. It is derived from the price inputs of the S&P 500 Index short-term options and provides a measure of market risk and investors' outlooks (Kuepper & Scott, 2020). The more uncertainty in the market, the higher the option prices will be on the index, reflected through its increased fluctuations.

Figure 4.2: CBOE Volatility Index (VIX)

Figure 4.2 displays the daily CBOE Volatility Index (VIX) from the period March 1, 2003, to March 31, 2020. The market crises are shaded in light gray and based on the fluctuations in the S&P 500 Index. Source: Yahoo Finance.

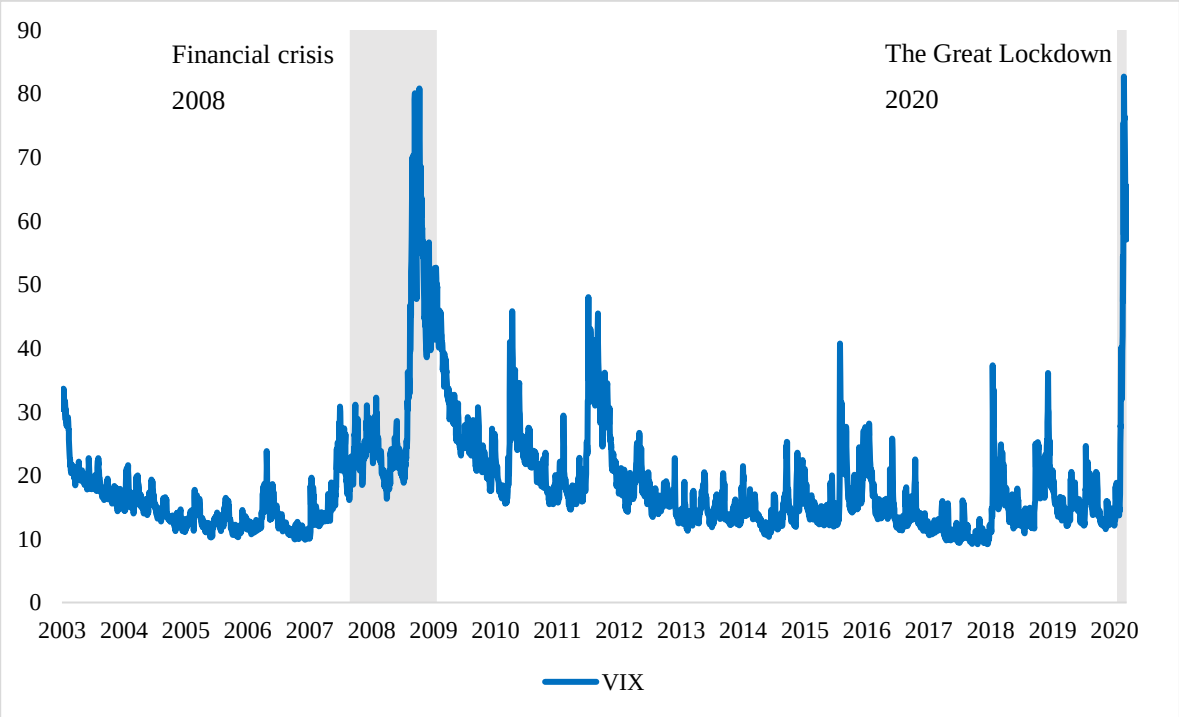


Figure 4.2 illustrates the development and the daily frequency of the VIX. We see that for the financial crisis in 2008 from the beginning of the crisis period on October 11, 2007, to its highest levels on October 20, 2008, it increased by 346 percent. In comparison, for the development of the Great Lockdown 2020 we observe from February 19, 2020, to March 16, 2020, that the VIX increased by 458 percent. VIX reached its record peak level on March 16, 2020, with a close level of 82.69. The rapid increasing levels of the VIX during the first quarter of 2020 gives us a clear indicator that the coronavirus pandemic is creating a volatile financial market in the U.S.

4.5.3 Additional metrics

Other relevant metrics when looking for a market crisis can be reflected through fluctuations in real gross domestic production (GDP), industrial production, unemployment rate, and the number of bankruptcies. Also, these metrics are in line with NBER's definition of a recession. However, for the coronavirus pandemic in 2020 to be defined as a crisis, its duration is seemingly still too short. Since our thesis is investigating U.S. mutual funds, accordingly statistics from the U.S. economy will be applied. It can also be said that as one of the world's biggest economies, data from the U.S. is often used as a defining benchmark for the world economy in general. First, one relevant metric for measuring the market conditions is to study the ISM Manufacturing Index, often referred to as the Purchasing Manager's Index (PMI). Coinciding with the drop in the S&P 500 Index after the all-time high levels on February 19, 2020, we observe contracting activity in the manufacturing sector for March 2020 and continuously decreasing levels for April 2020 (ISM, 2020). Secondly, we take a closer look at other metrics like the U.S. unemployment rate, illustrated in Figure 4.3:

Figure 4.3: Monthly U.S. Unemployment Rate %, Seasonally Adjusted

Figure 4.3 illustrates the seasonally adjusted monthly unemployment rate in percent in the U.S. from the period March 2003 to April 2020. In this figure, the crisis period for the financial crisis in 2008 is defined in line with NBER's definition of a recession, which is from December 2007 to June 2009. The Great Lockdown 2020 is defined from February 2020 based on our assumptions. Source: FRED (2020).

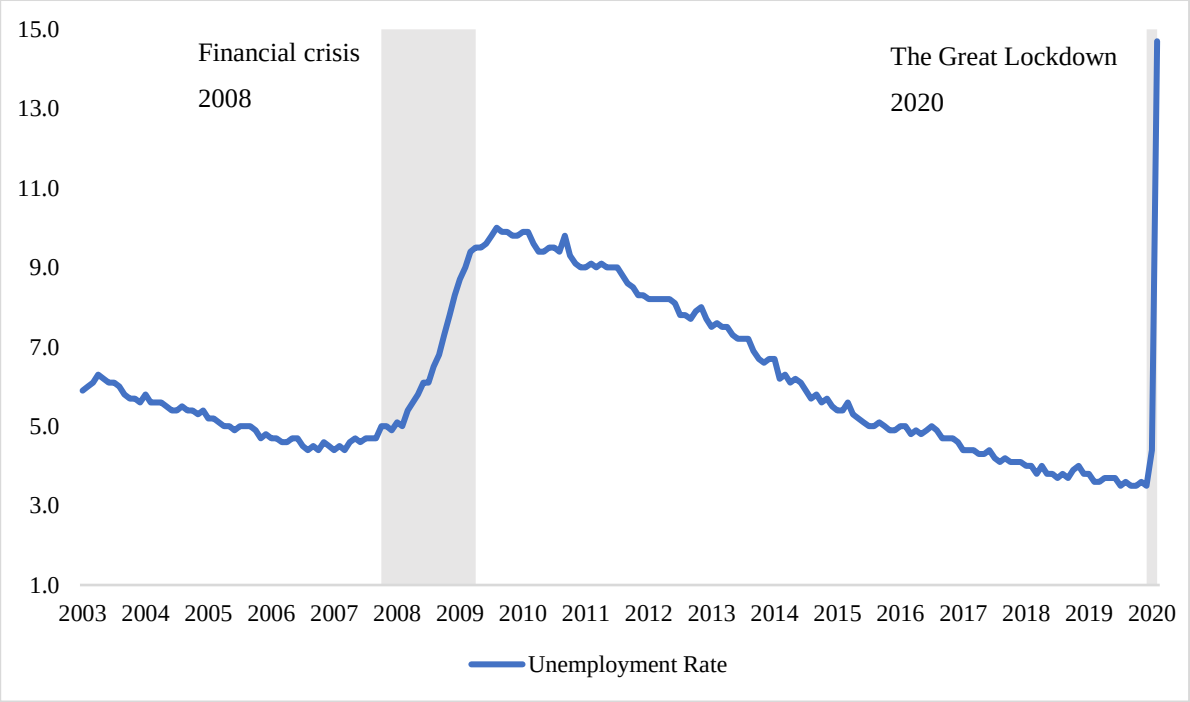


Figure 4.3 reveals a rise in the U.S. unemployment rate for March 2020 by 0.9 percent which is the first time in 10 years, and for April 2020 we observe an increase of 10.3 percent (FRED, 2020). The reason for including April 2020 is due to a general lag in the unemployment rate in response to economical events, like with the lockdown in the first quarter of 2020. This significant increase further confirms our assumption about an outbreaking market crisis in the U.S. stemming from the coronavirus pandemic.

Figure 4.4: Cumulative return in % for the SRI and conventional funds and the S&P 500 Index

Figure 4.4 illustrates with a green and blue line respectively the cumulative return in percent for the equally weighted SRI and conventional funds from the period March 2003 to March 2020., The red line represents the cumulative return in percent based on the monthly adjusted close price for the S&P 500 Index for the same period. The crises are shaded in gray and defined by the development of the S&P 500 Index. Source: Morningstar Direct and Yahoo Finance.

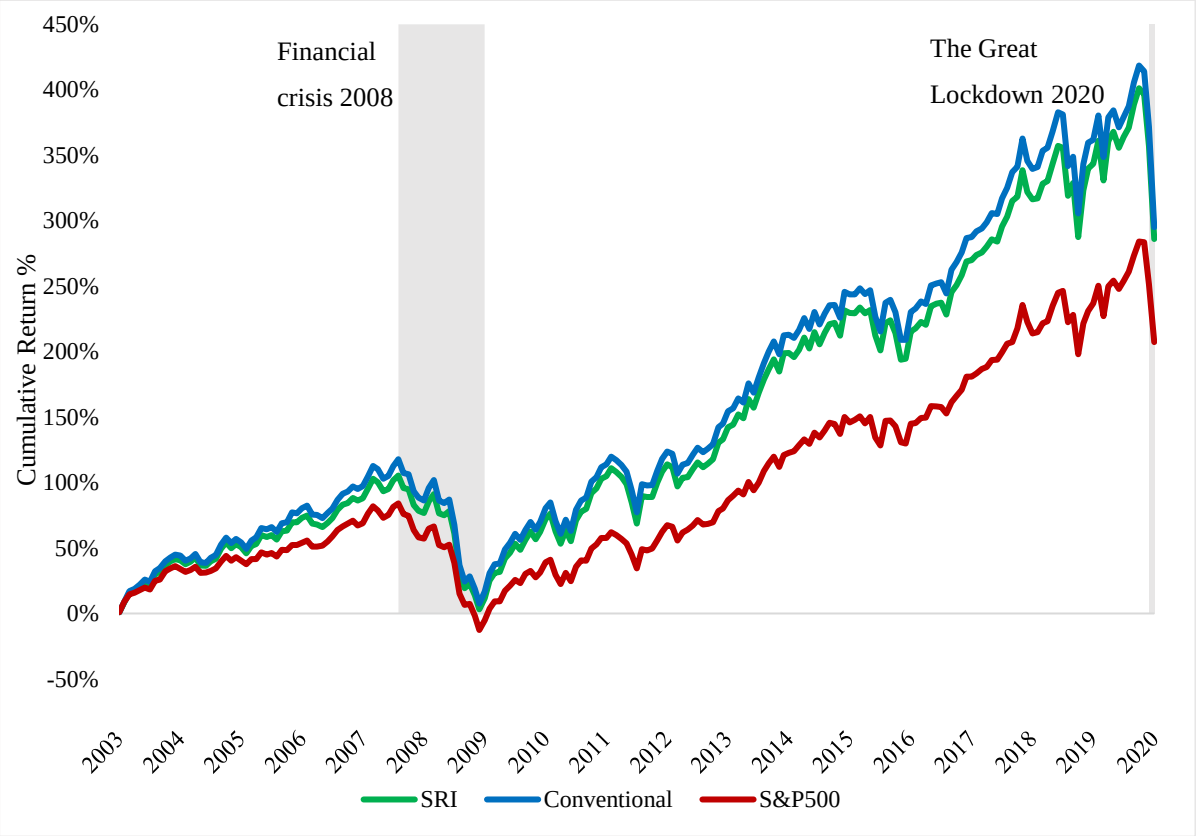


Figure 4.4 illustrates the development of the cumulative returns in percent for both the equally weighted SRI and conventional funds. We observe that the distinct funds follow the peaks and troughs for the S&P 500 Index. Also, we note that the conventional funds are performing somewhat better than the SRI funds over the entire period. However, during the downturns for the financial crisis in 2008 and the great lockdown in 2020, we observe that the performance of SRI funds tends to catch up with the conventional funds.

5. Methodology

5.1 Research Design

To fulfill the objective of our master thesis, we construct a quantitative research design including empirical analysis. Further, we have a deductive approach considering that we use panel data to test the theory. Thus, the study has an exploratory purpose as we want to clarify the understanding of the relationship between SRI fund risk-adjusted performance and conventional fund risk-adjusted performance during different market states over time (Saunders, Lewis, & Thornhill, 2016).

5.2 Model

To calculate the risk-adjusted return for the respective funds, we use asset-pricing models that incorporate systematic risk factors. Consequently, we make use of the Capital Asset Pricing Model (CAPM). To achieve a more precise assessment of risk-adjusted performance, we also make use of Fama and French (1993) Three-Factor Model and Carhart (1997) Four-Factor model. Furthermore, we use Jensen's Alpha (α) to measure out- or underperformance relative to a benchmark. Applying asset pricing models to calculate risk-adjusted return is commonly used in earlier studies of SRI fund performance. Thus, we consider the results to be consistent and comparable, see for instance Statman (2000) and Bauer et al. (2005). As we want to assess the performance in crisis and non-crisis period, we expand the factor models with dummy variables and interaction terms to capture the particular effects of SRI and market crises, similar to Nofsinger and Varma (2014) and Leite and Cortez (2015). All models are estimated using the Generalized Least Squares (GLS) random-effect model. GLS solves the serial correlation problem and can be extended to unbalanced panels (Wooldridge, 2013).

5.2.1 Capital Asset Pricing Model (CAPM)

The CAPM calculates the expected return of the funds when considering systematic risk. The model is widely used to price assets, where the intercept, (α), reflects whether an asset is fairly priced, resulting in model (1):

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_1\left(r_{mk,t} - r_{f,t}\right) + \varepsilon_{it} \quad (1)$$

Where:

α_i= the Jensen's alpha interpreted as the out- or underperformance relative to a benchmark

r_{i_t}= the return on a fund in month *t*

r_{f_t} = the risk-free rate in month *t*

r_{mk_t} = the return of the market benchmark in month *t*

In earlier research, CAPM has been applied to evaluate SRI fund risk-adjusted performance, see for instance Hamilton et al. (1993).

5.2.2 Fama-French three-factor model

Fama and French (1993) three-factor model extends the CAPM by including size and value factors. The size factor refers to the difference in return between small-capitalization stocks and big-capitalization stocks. Whereas the value factor refers to the difference in return between high book-to-market (value) stocks and low book-to-market (growth) stocks. In general, small-capitalization stocks tend to outperform big-capitalization stocks, while value stocks are likely to outperform growth stocks (Fama & French, 1993). We apply the Fama-French three-factor model to achieve a more precise estimate on the risk-adjusted return, resulting in the model (2):

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_1\left(r_{mk,t} - r_{f,t}\right) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{it} \qquad (2)$$

Where:

SMB_t = Small Minus Big is the monthly premium of an investment portfolio that is a long in small-capitalization stocks and short in big-capitalization stocks, in month t.

HML_t = High Minus Low is the monthly premium of an investment portfolio that has long position in high book-to-market stocks and short position in low book-to-market stocks, in month t.

5.2.3 Carhart four-factor model

To further advance our analysis, we use the Carhart (1997) four-factor model which is a refinement of the Fama and French (1993) three-factor model. The four-factor model also controls for momentum effects, which is defined as the return of past winners minus past losers. The rationale behind the momentum factor is that stocks that performed well the previous 12 months tend to continue increasing, opposite to the stocks that performed poorly in the same period (Carhart, 1997). Thus, we add the momentum factor, and this results in the model (3):

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_1(r_{mk,t} - r_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \varepsilon_{it} \quad (3)$$

Where:

WML_t = Winner Minus Loser is the monthly premium in an investment portfolio that is long in past winner stocks the previous 12 months and short in past losers stocks the previous 12 months, in month t.

The four-factor model is frequently used as a mutual fund evaluation model. Further, it has been broadly applied in SRI literature and especially for more recent research of SRI risk-adjusted performance, including Bauer et al. (2005); Renneboog et al. (2008b); Derwall et al. (2011); Nofsinger and Varma (2014). By using the three different factor models, we can expect robust results to a greater extent.

We collect monthly data for the market premium, the risk-free rate, and the systematic risk factors from Kenneth French data library for the period March 2003 to March 2020 (French, 2020). The market premium and the systematic risk factors include firms listed on the NYSE, AMEX, and NASDAQ. The market premium is the monthly return for the value-weighted stocks which have a CRSP share code of 10 or 11 at the beginning of month t. Further, the risk-free rate is the one-month Treasury bill rate. The systematic risk factors SMB and HML are constructed using six value-weight portfolios based on size and book-to-market. Whereas the MOM-factor is constructed by six value-weighted portfolios based on size and prior returns. The data is used as the benchmark when constructing the asset pricing models.

5.2.4 Expanded model

We include two dummy variables to reveal the effect of the SRI funds (δ_1) and the crisis period (δ_2). Generally, dummy variables are used to isolate certain periods that may differ from other periods in a dataset. Likewise, dummy variables can be used to separate groups (Wooldridge, 2013). We also add an interaction term (γ_1) between the dummy variables to capture the effect of SRI fund performance in the crisis period. Thus, by expanding the four-factor model with dummy variables and interaction terms, the model measures SRI fund performance relative to their conventional peers in the crisis and non-crisis period. These considerations result in the model (4):

$$r_{i,t} - r_{f,t} = \alpha_i + \delta_1 D_{SRI} + \delta_2 D_{Crisis} + \gamma_1(\delta_1 D_{SRI} * \delta_2 D_{Crisis}) \\ \beta_1(r_{mk,t} - r_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \varepsilon_{it} \quad (4)$$

Where:

δ_1 is a dummy variable that takes the value 1 if the fund is identified as an SRI fund and 0 otherwise.

δ_2 is a dummy variable that takes the value 1 if time t is defined as a crisis period and 0 otherwise.

In line with Areal et al. (2013) and Leite and Cortez (2015), we add interaction terms between the crisis dummy variable and the risk factors, meaning that we allow for variations in the risk factors across market states. Since performance varies across market states, it is reasonable to expect the same for the risk factors. By including interaction terms, we allow for different slope coefficients in the crisis and non-crisis period and thus ensure a better fit. This results in the final model (5):

$$r_{i,t} - r_{f,t} = \alpha_i + \delta_1 D_{SRI} + \delta_2 D_C + \gamma_1(\delta_1 D_{SRI} * \delta_2 D_C) + \\ \beta_1(r_{mk,t} - r_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \quad (5) \\ \gamma_2\beta_1(r_{mk,t} - r_{f,t})D_C + \gamma_3(\beta_2 SMB_t)D_C + \gamma_4(\beta_3 HML_t)D_C + \gamma_5(\beta_4 WML_t)D_C + \varepsilon_{it}$$

5.3 Model specifications

There are different assumptions in panel data that give rise to distinct models, which in turn will affect the accuracy of the analysis. Panel data distinguishes between Fixed Effects models (FE), Random Effects models (RE), and Pooled OLS (POLS). The appropriate estimation model depends on the data structure. In addition to other assumptions, POLS produces efficient and consistent parameter estimates when cross-sectional or time-specific effects do not exist (Wooldridge, 2013, pp. 481-483). However, this is an invalid assumption in our panel data. In particular, the variations are not constant and are related to each other. This is true due to the existence of variations across different funds and as we observe the same fund sample over time. The OLS estimator is no longer the best unbiased linear estimator. Therefore, panel data models like FE and RE both handle time-varying and time-constant errors and are more appropriate (Park, 2011).

In order to test the presence of fixed and random effects in the panel data, we follow the procedure presented by Park (2011) and Torres-Reyna (2007). Firstly, we conduct an F-test to compare FE to OLS to see how much FE can improve the goodness-of-fit (Park, 2011). We do this by creating dummy variables for the respective months for the sample period and conduct a joint test to see if the dummies for all months are equal to zero (Torres-Reyna, 2007). We follow a similar procedure for the fund-specific fixed effects. If the null hypothesis is rejected, we may conclude that there are significant fixed effects, indicating that the FE is better than POLS. The F-test for month-specific fixed effects with 575 degrees of freedom gives a small p-value. Similarly, we obtain a small p-value for the fund-specific fixed effects with 195 degrees of freedom. The p-value suggests rejecting the null hypothesis, and thus, FE is preferred.

Secondly, to contrast RE with POLS, we perform a Breusch-Pagan Lagrange multiplier (LM) test. The null hypothesis states that the individual specific variance components are zero, meaning no significant difference across units (Torres-Reyna, 2007). However, if we reject the null hypothesis, we can conclude that there is a significant random effect, and thus, RE is better than POLS to handle heteroskedasticity (Park, 2011). The result is shown in Appendix Table A5 and with a p-value of 0.0133, we reject the null hypothesis and favor the RE.

The F-test and the Breusch-Pagan LM-test indicate that our panel data set is exposed to both fixed effects and random effects. To determine which effect is more relevant and significant,

we perform a Hausman test. The purpose of the Hausman test is to detect whether the individual specific error terms are correlated with the regressors. The null hypothesis states that the preferred model is RE, while the alternative hypothesis states that the preferred model is FE. In other words, if the error terms are correlated, we use FE, but if they are independent of the regressors, we use RE (Park, 2011). We test this by applying both RE and FE and then assess for statistically significant differences in the coefficients on the time-varying explanatory variables (Wooldridge, 2013, p. 496). Consequently, if the RE and FE estimates are sufficiently close, we will choose RE, because this is a more efficient model. The result is shown in Appendix Table A6, and with a p-value of 0.4865, we fail to reject the null hypothesis. Hence, the test suggests that the unobserved effect is uncorrelated with each explanatory variable and we should choose RE.

The key issue that decides whether to use FE or RE is if we can reasonably assume that the unobserved effect is uncorrelated with all the independent variables. FE is intended to be robust to the correlation between unobserved effects and the explanatory variables, whereas RE is more efficient. In this case, there is a tradeoff between robustness and efficiency. The FE applies instantly to unbalanced panels which are the case for our panel data. Although, we must presume that the reason some periods are missing is not systematically related to idiosyncratic risk (Wooldridge, 2013, p. 501). For instance, with the liquidated funds, the reason can be macroeconomic forces like bad market conditions or simply poor performance forcing the fund to shut down. On the other hand, there can also be unobserved effects that are the reason for the attrition. In other words, there can be sensible to believe that the reasons for funds being liquidated or merged are not captured in our model. In general, models are simplifications of reality and all possible effects are difficult to include. The benefit of FE is that it allows the attrition to be correlated with unobserved effects.

For the RE, we are assuming that the unobserved effects are uncorrelated with all the explanatory variables, whether they are constant over time or not. The FE only allows for within-variation, whereas the between-variation is controlled out (Bell & Jones, 2015). In our case, the difference between different funds is controlled out with the FE. The justification for applying the RE approach is predominantly because it allows us to include time-constant explanatory variables, like with the SRI dummy variable. This is also what makes the advantage of RE over FE. As the SRI dummy variable is a key explanatory variable in our analysis, our preferable model should be the RE. For our analysis, we find it sensible to presume that the most relevant components are included in our expanded model which is the

case with the RE. Lastly, a failure to reject the Hausman test means in practice that either the RE or FE estimates are adequately close, and which one to choose does not matter (Wooldridge, 2013, p. 496). Also, we observe that the coefficients using RE are not very different from using FE. This indicates choosing RE over FE will unlikely generate substantially diverse results. Consider all this, we find it most accurate to use a random effect model to analyze our panel data.

5.4 Model requirements

To obtain valid results, we need to meet certain requirements for the error terms in the RE. We do this by performing the postestimation test on the residuals. This enables us to achieve precise and reliable standard errors and t-statistics, and thus, draw the right conclusions. Followingly, we will briefly describe the tests we have performed. We begin by testing for the presence of heteroskedasticity in the error term. The error term is expected to have the same variance given any values of the explanatory variables (Wooldridge, 2013, p. 93). If the assumption does not hold, then the model exhibits heteroskedasticity. Heteroskedasticity does not cause bias in the estimators but violates the estimations of standard errors. This will in turn affect the t-statistics, and impact whether the coefficient is significant or not (Wooldridge, 2013, p. 269). To meet this problem, we graph the residuals to look for patterns for heteroskedasticity. We observe that the residuals follow a cone shape pattern, indicating that heteroskedasticity is present.

Autocorrelation is a common issue that can violate the efficiency of the estimates. In short, autocorrelation is present when the error term of one variable is following the pattern of another error term across time (Wooldridge, 2013, p. 353). To begin with, we test for correlation between the different variables by making a correlation table. The result is shown in Appendix Table A7 and indicates that the correlation is low on average. This is not true for the interaction term and their respective variables, but this is expected. Further, we perform a Wooldridge test for autocorrelation panel data. With one degree of freedom, we obtain a small p-value and thus, reject the null hypothesis of no first-order autocorrelation. The test shows that both heteroskedasticity and autocorrelation are present in the regressions. Although this does not lead to biased estimators, they still lead to a violation of statistical inference. To meet this problem, we compute clustered standard errors for all the regressions to account for both heteroskedasticity and autocorrelation (Hoechle, 2007).

6. Study on SRI funds and market crises

The section outlines the results from the empirical analysis based on CAPM, Fama-French three-factor model, and Carhart four-factor model. The main purpose of our study is to test whether there is a significant difference in performance between SRI and conventional funds during the crisis and non-crisis period. Further, we include robustness tests to control for how coherent our main findings are. This means that we test for differences in SRI strategies and by dividing our period into two different sub-periods. The risk-adjusted return (α) is calculated and displayed in monthly returns in all the regressions.

6.1 Results from the empirical analysis

The main findings from our empirical analysis are structured into three sub-sections and will be presented followingly. First, we will present the fund performance for the entire sample period. Secondly, the fund performance for the crisis and non-crisis period will be presented. At last, we will present fund performance when including interaction terms and control for whether the results still hold.

6.1.1 Fund performance for the entire sample period

Table 6.1 presents the results from the regressions for the SRI funds, conventional funds, and the difference between the respective funds for the entire period. The result suggests that the overall fund sample is strongly correlated with the market portfolio (β_1) in all the models, implying that the fund sample tends to follow the market closely in terms of volatility. There is a significant positive size factor (β_2) in all the models, which implies that the fund performance is more exposed to small-capitalization stocks. There is also a significant negative momentum factor (β_4) in all the models, indicating that the fund performance tends to be more exposed to past losers than past winners. Furthermore, we observe a significant negative alpha (α), indicating that the funds tend to underperform in comparison to the market. The difference between the SRI and conventional funds is reflected through the SRI dummy variable (δ_1) and varies across the models. In CAPM, the difference is negative, which implies that SRI funds tend to underperform in comparison. On the other hand, the three-factor and four-factor model generate positive differences, indicating that SRI funds tend to outperform. However, the δ_1 is not significant in neither of the models and we cannot conclude any quantifiable differences.

Table 6.1: Regression results for the entire sample period

Table 6.1 presents the results of the estimation from CAPM, Fama-French three-factor, and Carhart four-factor models for the period of March 2003 to March 2020. Column (1) to (3) show the results for the SRI funds. Column (4) to (6) show the results for the matching conventional funds. Column (7) to (9) include all funds and shows how the performance differs for SRI funds relative to conventional funds. This is reflected through the SRI dummy variable (δ_1) that takes value 1 for SRI funds and 0 otherwise. The performance measure (α) is displayed in monthly returns. All regressions use clustered standard errors on the fund level.

	(1) SRI	(2) SRI	(3) SRI	(4) Conv	(5) Conv	(6) Conv	(7) SRI-Conv	(8) SRI-Conv	(9) SRI-Conv
α	-0.127***	-0.0970***	-0.0948***	-0.123***	-0.0938***	-0.0918***	-0.123***	-0.0949***	-0.0926***
	(-7.10)	(-7.34)	(-7.28)	(-13.47)	(-14.02)	(-13.66)	(-14.25)	(-14.39)	(-14.05)
δ_1SRI							-0.00159	0.000831	0.000517
							(-0.10)	(0.05)	(0.03)
β_1Mktrf	1.036***	1.000***	0.995***	1.034***	0.996***	0.993***	1.034***	0.997***	0.993***
	(91.40)	(132.18)	(141.69)	(117.57)	(137.74)	(138.79)	(143.13)	(171.78)	(173.98)
β_2SMB		0.158***	0.158***		0.155***	0.156***		0.156***	0.156***
		(6.36)	(6.39)		(10.02)	(10.06)		(11.80)	(11.85)
β_3HML		0.0149	0.00592		0.0188	0.0118		0.0179*	0.0104
		(0.86)	(0.38)		(1.62)	(1.10)		(1.83)	(1.16)
β_4MOM			-0.0153**			-0.0121***			-0.0129***
			(-2.10)			(-2.74)			(-3.39)
Observations	20,992	20,992	20,992	68,884	68,884	68,884	89,876	89,876	89,876
R^2	0.877	0.882	0.882	0.838	0.843	0.843	0.847	0.852	0.852

t statistics in parentheses
** p < 0.10, ** p < 0.05, *** p < 0.01*

CAPM for the entire sample period

With respect to CAPM in Column (1) and (4), we observe that both SRI and conventional funds obtain a negative alpha, respectively -0.127 and -0.123 percent. The alphas are significant, indicating that neither SRI funds nor conventional funds outperform the market. Also, the alphas reveal that part of the excess return cannot be explained by the exposure to the market factor. The R^2 in Column (1) and (4) indicates that 87.7 and 83.8 percent of the variation in excess return for respectively SRI and conventional funds can be explained by the CAPM. In terms of market beta, the coefficients are slightly greater than 1, which implies that they are more sensitive to the fluctuations in the market returns. In Column (7), δ_1 reveals that SRI funds obtain a lower risk-adjusted return of -0.00159 percent compared to the conventional funds. However, the coefficient is not significant and suggests that there is no statistical difference in risk-adjusted return between SRI and conventional funds.

Three-factor model for the entire sample period

We gain different results in the three-factor model that incorporates size and value factors. The alpha for the SRI funds increases to -0.097 percent in Column (2), whereas the alpha for the conventional funds increases to -0.0938 percent in Column (5). The alphas are significant

and still suggest that the funds underperform relative to the market. The R^2 in Column (2) and (5) increases with 0.5 percent for both SRI and conventional funds. Considering a smaller alpha and higher R^2, the variation in excess return can be explained by the three-factor model to a somewhat higher extent compared to the CAPM. In terms of a significantly positive size factor, we find evidence that the excess return of SRI funds is partly driven by small-capitalization stocks. This also applies to the conventional funds. Furthermore, the results show that both SRI and conventional funds have positive exposure to the value factor, but the coefficient is not significant. Relative to conventional funds in Column (8), we see that the SRI funds contribute to a positive, but insignificant, risk-adjusted return of 0.000831 percent.

Four-factor model for the entire sample period

In the four-factor model, we obtain similar results for the SRI and conventional funds when including a momentum factor, which is presented in Column (3) and (6). We observe that the alphas are significantly smaller, respectively at -0.0948 and -0.0918 percent. This indicates that the four-factor model is a better fit than the three-factor model. The R^2 is the same as for the three-factor model, indicating that 88.2 and 84.3 percent of the variation in excess return for the respective funds is explained by the four-factor model. To the same extent as in the previous models, the funds are following the market closely and are more exposed to small-capitalization stocks. The momentum factor reveals that SRI and conventional funds tend to be more exposed to past loser stocks than past winner stocks with respective coefficients of -0.0153 and -0.0121. Both coefficients are significant. Further, in Column (9), the SRI funds perform better than the conventional funds by 0.000517 percent. The difference is not significant, and thus, consistent with the previous models. Accordingly, we find no evidence that SRI funds tend to outperform conventional funds and vice versa when analyzing the entire sample period.

6.1.2 Fund performance for the crisis- and non-crisis period

Considering the objective of the master thesis, we present the results for fund performance in the crisis and non-crisis period in Table 6.2. Different from the previous regressions, we now include a crisis dummy variable (δ_2) to account for the different market conditions. Also, by extending with an interaction term (γ_1) between the SRI and crisis dummy variable, we can evaluate whether SRI funds outperform conventional funds during the crisis period. As before, fund performance tends to follow the market and are to some extent more exposed to

small stocks and losing stocks. Given that the risk exposure of the funds is the same as in Section 6.1.1, we choose to not discuss the risk factors any further in the following section. By summing δ_1 and γ_1, we find evidence that SRI funds tend to perform better than conventional funds in the crisis period. In the non-crisis period, we observe by studying the δ_1 that SRI funds perform worse compared to their conventional fund peers. However, in both the crisis and non-crisis period the difference is not significant in either of the models. Despite no significant difference across the respective funds; we find evidence that conventional funds tend to perform worse than the market during the crisis period.

Table 6.2: Regression results for the crisis and non-crisis period

Table 6.2 presents the results of the estimation from CAPM, Fama-French three-factor, and Carhart four-factor models for the period March 2003 to March 2020, distinguishing between crisis and non-crisis period. Column (1) to (3) represent the results for the SRI funds. Column (4) to (6) represent the results for the matching conventional funds. Column (7) to (9) include all funds and show how the performance differ for SRI funds relative to conventional funds. This is reflected through the SRI dummy variable (δ_1) that takes value 1 if SRI fund and 0 otherwise. Further, we include a crisis dummy variable (δ_2) that takes value 1 if crisis period and 0 otherwise. To interpret the effect of SRI funds in crisis periods, we include an interaction term (γ_1), between SRI and crisis. The performance measure (α) is displayed in monthly returns. All regressions use clustered standard errors on the fund level.

	(1) SRI	(2) SRI	(3) SRI	(4) Conv	(5) Conv	(6) Conv	(7) SRI-Conv	(8) SRI-Conv	(9) SRI-Conv
α	-0.147***	-0.0986***	-0.0944***	-0.122***	-0.0759***	-0.0721***	-0.124***	-0.0785***	-0.0745***
	(-8.39)	(-7.74)	(-7.68)	(-10.45)	(-7.50)	(-7.01)	(-11.91)	(-8.64)	(-8.11)
δ_2Crisis	0.188***	0.0159	-0.00316	-0.00421	-0.174***	-0.189***	0.00540	-0.164***	-0.180***
	(3.91)	(0.38)	(-0.08)	(-0.07)	(-2.86)	(-3.08)	(0.09)	(-2.87)	(-3.13)
δ_1SRI							-0.0150	-0.0120	-0.0123
							(-0.99)	(-0.81)	(-0.82)
γ_1(SRI*Crisis)							0.151*	0.147*	0.147*
							(1.71)	(1.68)	(1.67)
β_1Mktrf	1.041***	1.000***	0.995***	1.034***	0.991***	0.987***	1.035***	0.993***	0.989***
	(90.08)	(132.21)	(144.45)	(107.18)	(121.96)	(121.39)	(131.73)	(153.59)	(153.78)
β_2SMB		0.157***	0.158***		0.158***	0.159***		0.158***	0.159***
		(6.31)	(6.35)		(10.18)	(10.24)		(11.93)	(11.99)
β_3HML		0.0151	0.00587		0.0169	0.00903		0.0165*	0.00828
		(0.87)	(0.38)		(1.46)	(0.85)		(1.70)	(0.93)
β_4MOM			-0.0154**			-0.0132***			-0.0137***
			(-2.10)			(-2.95)			(-3.58)
Observations	20,992	20,992	20,992	68,884	68,884	68,884	89,876	89,876	89,876
R^2	0.877	0.882	0.882	0.838	0.843	0.844	0.847	0.852	0.852

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All ($\delta_1+\delta_2+\gamma_1$) and ($\delta_1+\gamma_1$) are tested for joint significance.

CAPM in the crisis and non-crisis period

In terms of CAPM, Column (1) and (4) show that the market exposure for the respective funds remains slightly greater than 1. The alphas are significantly negative in the non-crisis period for SRI and conventional funds, respectively -0.147 and -0.122 percent. Reflected through R^2, the model can explain 87.7 and 83.8 percent of the variation in the excess return of the SRI and conventional funds. Further, the crisis dummy variable in Column (1) suggests that SRI funds perform 0.188 percent significantly better than the market in the crisis period. On the contrary, in Column (4), the performance in conventional funds during the crisis period is expected to be negative but not significant. We compare the respective funds during the crisis period in Column (7) and notice that SRI funds perform better than conventional funds by 0.136 percent.[6] The difference is tested for joint significance and the p-value suggests no significant difference at a 10 percent level. Furthermore, in the non-crisis period, the SRI funds perform worse than the conventional funds and contribute to a reduction of -0.0150 percent in risk-adjusted return, but no significance is revealed.

Three-factor model in the crisis and non-crisis period

The findings in the three-factor model indicate that the size and value factor also can explain some of the excess return of the funds. This is reflected through a smaller alpha and a higher R^2. In Column (2), SRI funds perform 0.0159 percent better during the crisis period, but this is no longer significant. In contrast, Column (5) shows that the conventional funds perform -0.174 percent worse during the crisis period, and the result is significant. We also see that the alpha of the conventional funds is smaller compared to the three-factor model in Section 6.1.1. This indicates that the crisis dummy variable can explain some of the negative excess returns of the conventional funds. Further, we observe that SRI funds perform 0.135 percent better relative to conventional funds in the crisis period in Column (8).[7] The joint significance test reflects that the difference is not significant at a 10 percent level, also consistent with the

[6] The difference between SRI and conventional funds during the crisis period in Column (7) is obtained by adding δ_1 and γ_1 respectively 0.151-0.015=0.136 percent.

[7] The difference between SRI and conventional funds during the crisis period in Column (8) is obtained by adding δ_1 and γ_1 respectively 0.147-0.012=0.135 percent.

CAPM. In terms of the non-crisis period, SRI funds perform slightly worse than conventional funds by -0.0120 percent. However, the difference is not significant, also in line with CAPM.

Four-factor model in the crisis and non-crisis period

Regarding the Carhart four-factor model, Column (3) shows that SRI funds perform -0.00316 worse than the market in the crisis period, but the difference is not significant. In Column (6), conventional funds still tend to perform significantly worse than the market during the crisis period by -0.189 percent. As discussed above, the alpha is further reduced, indicating that the crisis period still captures some of the negative excess returns of the conventional funds. When comparing SRI funds to conventional funds during the crisis period in Column (9), the result reveals that the difference in performance is 0.1347.[8] That being said, the difference is not significant when testing for joint significance, in line with the CAPM and the three-factor model. As we obtain an even smaller alpha and the same R^2 as in the three-factor model, this indicates that the model explains more of the excess return. In the non-crisis period, we observe that SRI funds tend to perform worse than conventional funds by -0.0123, but this is also not significant. By incorporating systematic risk factors like size, value, and momentum, the outcomes imply a nonsignificant difference in the performance of SRI funds relative to conventional funds during the crisis period.

6.1.3 Fund performance for the crisis- and non-crisis period with interaction terms

In an attempt to obtain consistent and robust results, we present the regressions with interaction terms in Table 6.3. The interaction terms capture variation in the risk factors due to the crisis period. This allows for a more precise interpretation of the coefficients. Our results indicate that SRI funds tend to perform better than conventional funds during the crisis period, but the difference is not significant. This confirms the previous findings under Section 6.1.2. Thus, we can be more confident that SRI funds neither perform better nor worse than conventional funds during the crisis period. Furthermore, conventional funds still tend to perform worse than the market during the crisis period. Lastly, we interpret the results from the interaction

[8] The difference between SRI and conventional funds during the crisis period in Column (9) is obtained by adding δ_1 and γ_1 respectively 0.147-0.0123=0.1347 percent.

terms between the crisis dummy variable and the various risk factors. For instance, the interaction term (γ_2) between the crisis dummy variable and the market beta indicates that conventional funds are more volatile than the market during the crisis period.

Table 6.3: Regression results for the crisis and non-crisis period with interaction terms

Table 6.3 presents the results of the estimation from CAPM, Fama-French three-factor, and Carhart four-factor models for the period March 2003 to March 2020, distinguishing between crisis and non-crisis period. Column (1) to (3) represent the results for the SRI funds. Column (4) to (6) represent the results for the matching conventional funds. Column (7) to (9) include all funds and show how the performance differ for SRI funds relative to conventional funds. This is reflected through the SRI dummy variable (δ_1) that takes value 1 if SRI fund and 0 otherwise. Further, we include a crisis dummy variable (δ_2) that takes value 1 if crisis period and 0 otherwise. To interpret the effect of SRI funds in crisis periods, we include an interaction term (γ_1), between SRI and crisis. Also, we expand the regression analysis with interaction terms between the respective systematic risk factors and the crisis dummy. This allows for a more precise estimate of the fund performance in crisis periods. The performance measure (α) is displayed in monthly returns. All regressions use clustered standard error on the fund level.

	(1) SRI	(2) SRI	(3) SRI	(4) Conv	(5) Conv	(6) Conv	(7) SRI-Conv	(8) SRI-Conv	(9) SRI-Conv
α	-0.140***	-0.0935***	-0.0884***	-0.109***	-0.0629***	-0.0579***	-0.113***	-0.0673***	-0.0621***
	(-8.42)	(-7.19)	(-7.16)	(-9.62)	(-6.22)	(-5.66)	(-11.07)	(-7.33)	(-6.72)
δ_2Crisis	0.241***	-0.0274	-0.0313	0.113*	-0.154**	-0.151**	0.107*	-0.159***	-0.158***
	(5.01)	(-0.65)	(-0.76)	(1.73)	(-2.56)	(-2.46)	(1.78)	(-2.84)	(-2.77)
δ_1SRI							-0.0149	-0.0120	-0.0123
							(-0.98)	(-0.80)	(-0.82)
γ_1(SRI*Crisis)							0.154*	0.148*	0.149*
							(1.74)	(1.69)	(1.70)
β_1Mktrf	1.037***	0.996***	0.990***	1.023***	0.981***	0.976***	1.026***	0.985***	0.979***
	(92.30)	(125.75)	(137.63)	(109.73)	(125.35)	(124.70)	(134.84)	(156.84)	(157.13)
β_2SMB		0.148***	0.149***		0.151***	0.152***		0.150***	0.152***
		(5.94)	(5.99)		(9.72)	(9.79)		(11.35)	(11.43)
β_3HML		0.0169	0.00451		0.0195*	0.00797		0.0189*	0.00713
		(1.00)	(0.31)		(1.67)	(0.75)		(1.93)	(0.81)
β_4MOM			-0.0177**			-0.0168***			-0.0171***
			(-2.52)			(-3.80)			(-4.53)
γ_2(Mktrf*Crisis)	0.0182*	0.00779	0.0140	0.0416***	0.0382***	0.0481***	0.0361***	0.0311***	0.0401***
	(1.87)	(0.76)	(1.26)	(6.54)	(5.23)	(5.74)	(6.70)	(5.08)	(5.77)
γ_3(SMB*Crisis)		0.156***	0.155***		0.157***	0.156***		0.157***	0.156***
		(6.44)	(6.39)		(10.63)	(10.52)		(12.40)	(12.28)
γ_4(HML*Crisis)		-0.0352**	-0.0222		-0.0502***	-0.0337***		-0.0467***	-0.0310***
		(-2.08)	(-1.29)		(-4.19)	(-2.98)		(-4.67)	(-3.24)
γ_5(MOM*Crisis)			0.0194			0.0306***			0.0279***
			(1.61)			(3.99)			(4.30)
Observations	20,992	20,992	20,992	68,884	68,884	68,884	89,876	89,876	89,876
R^2	0.877	0.883	0.883	0.838	0.844	0.844	0.847	0.853	0.853

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All ($\delta_1+\delta_2+\gamma_1$) and ($\delta_1+\gamma_1$) are tested for joint significance.

CAPM with interactions terms

Column (1) reveals that SRI funds obtain a significant risk-adjusted return of -0.140 in the non-crisis period, whereas the performance significantly increases with 0.241 percent during the crisis period. A similar interpretation is present for the conventional funds. During the non-crisis period in Column (4), the conventional funds exhibit a -0.109 significant risk-adjusted return but perform 0.113 percent better during the crisis period. The R^2 is 87.7 and 83.8 percent for the respective SRI and conventional funds. In Column (7), the SRI funds tend to perform 0.1391 percent better than conventional funds in the crisis period.[9] After testing for joint significance, the p-value suggests that the difference is not significant. Considering the non-crisis period, we observe that SRI funds perform worse than conventional funds by -0.0149, but the difference is not significant. These findings are in line with previous results.

Three-factor model with interaction terms

In terms of the three-factor model, both SRI funds, Column (2), and conventional funds, Column (5), contribute to a negative risk-adjusted return during the crisis period, respectively -0.0274 and -0.154 percent. We note that the contribution to a negative return is greater and only significant among conventional funds. Considering a higher R^2 than in CAPM, the three-factor model is better to explain the excess return for the respective funds. The additional interaction terms can capture a part of the negative excess return of the conventional funds in the crisis-period, resulting in a smaller alpha. When assessing the difference in SRI funds relative to conventional funds in Column (8), we observe that the SRI funds perform slightly better during the crisis period. The difference is 0.136 percent but is not significant at a 10 percent level, after testing for joint significance.[10] The conclusion is in line with the results from CAPM and the findings from Section 6.1.2. For the non-crisis period, SRI funds still tend to perform worse than conventional funds, but no significance is proved.

[9] The difference between SRI and conventional funds during the crisis period in Column (7) is obtained by adding δ_1 and γ_1 respectively 0.154-0.0149=0.1391 percent.

[10] The difference between SRI and conventional funds during the crisis period in Column (8) is obtained by adding δ_1 and γ_1 respectively 0.148-0.012=0.136 percent.

Four-factor model with interaction terms

At last, the results are consistent with the four-factor model in the Section 6.1.2, revealing a negative return during the crisis period for the distinct funds. More precisely for the SRI funds in Column (3), they perform -0.0313 percent worse than the market, and the findings are still insignificant. For the conventional funds in Column (6), we find that they perform -0.151 percent worse than the market, and the findings are still significant. The alphas are further reduced, and with a similar R^2 as in three-factor model, the four-factor model is better to explain the excess return. When comparing the funds in Column (9) the results are consistent with previous results. Column (9) reveals that SRI funds tend to perform 0.1367 better than conventional funds in the crisis period.[11] We test the difference through joint significance and still obtain insignificant results at a 10 percent level. For the non-crisis periods, SRI funds continue to perform worse than conventional funds. However, no significance is revealed and again verifies that the previous results still hold.

Risk factors with interaction terms

The interaction terms between the crisis dummy variable and the various systematic risk factors reveal some interesting findings. The γ_2 gives rise to different interpretations across the distinct funds. In other words, we observe that the market beta for the SRI funds does not significantly contribute to additional risk in the crisis period in the three- and four-factor model. Whereas for the conventional funds, the market beta contributes significantly to additional risk in the crisis period in all the models. This can indicate that during the crisis period the conventional funds bear higher risk than the market, whereas SRI funds bear more or less the same risk as to the market during the crisis period. Nevertheless, whether the SRI and conventional fund market betas are significantly different from each other are not measured in our analysis, as this requires an additional interaction term between the market beta and the SRI dummy variable. Further, when considering γ_3, we see that both SRI and conventional funds load more positively to the size factor in the crisis period, both at 1 percent significance level. The γ_4 suggests that SRI and conventional funds tend to be more growth-

[11] The difference between SRI and conventional funds during crisis periods in Column (9) is obtained by adding δ_1 and γ_1 respectively 0.149-0.0123=0.1367 percent.

oriented during the crisis period. The coefficient is significant for both funds in the three-factor model, but only significant for the conventional funds in the four-factor model. Also, the performance of SRI and conventional funds in the crisis period can be explained by the exposure to winning stocks reflected by γ_5. However, the coefficient is only significant for conventional funds.

6.2 Robustness tests

The results so far suggest no significant difference between the respective funds. However, the regressions in Section 6.1 did not consider variations in SRI strategies nor variations in the sample period. As discussed, and evidenced in previous studies, SRI funds that consider positive screening in their investment decisions tend to outperform SRI funds that use negative screening. Furthermore, particularly after the financial crisis in 2008, the number of SRI funds have increased considerably. This can imply that SRI fund performance has changed over the years, especially after the mentioned crisis. Thus, we want to test to what extent our results still hold when considering these two additional factors.

6.2.1 Testing for performance difference in SRI strategies

In the first robustness test, we do not want funds that practice both screening strategies. Therefore, we restrict the sample to only include funds that either practice positive or negative screening. The initial SRI fund sample consists of 144 funds but is reduced to 74 SRI funds. Further, we restrict the analysis to only study SRI funds considering that we are interested in differences across the respective funds. We are aware that the sample is no longer consistent with the previous regressions, and potential implications will be discussed in Section 7.2. We replace the SRI dummy variable with a Sustainable Investing (SI) dummy variable to separate funds that use positive and negative screening. Otherwise, the model remains unchanged and the regressions are estimated by using CAPM, three-factor, and four-factor model. The results are presented in Table A8 in the Appendix.

In the non-crisis period, we observe from the results that negative screening gives a significantly negative risk-adjusted return. Further, positive screening does not perform significantly better nor worse than negative screening. In terms of the crisis period, funds that use a positive screening strategy perform worse than funds that use a negative screening strategy. However, when testing for joint significance, we obtain high p-values, which

suggests that there is no significant difference between the screening strategies at the 10 percent level. The evidence holds for all the models. Thus, the results imply that positive screening does not perform significantly different from negative screening in the crisis and non-crisis period. Overall, the SRI funds tend to underperform the market, consistent with the findings from Section 6.1.

6.2.2 Testing for performance difference in sub-periods

Furthermore, we find it relevant to control for whether dividing the period into two different subperiods can generate different fund performance. This is mainly due to the growth of SRI funds and increased emphasis on SRI in general after the financial crisis in 2008. To clarify, the subperiods are defined as follows: the first subperiod, Subperiod 1, is the period from March 2003 to March 2009. Therefore, covering the financial crisis in 2008 and the non-crisis period before the mentioned crisis. Further, the second subperiod, Subperiod 2, is the period from April 2009 to March 2020. Thus, including the coronavirus pandemic in 2020 and the non-crisis period between the financial crisis in 2008 and the coronavirus pandemic in 2020. The regression results are shown in Table A9 in the Appendix.

In Subperiod 1, we see that the SRI funds tend to perform significantly worse than the conventional funds in the non-crisis period for all models, but in Subperiod 2 the difference is not significant anymore. The result implies that only the results from Subperiod 2 are in line with our main findings where we find no significant difference between SRI and conventional fund performance in the non-crisis period. Furthermore, we study the performance of SRI funds compared to conventional funds in the crisis period. As previously, the difference is tested for joint significance. We observe in Subperiod 1 that the SRI funds outperform the conventional funds during the financial crisis in 2008, but the difference is not significant at the 10 percent level in any of the models. In terms of Subperiod 2, the difference between the respective funds in the crisis period has increased substantially but is only significant at the 10 percent level in CAPM. Considering the results, evidence indicates that in more recent times with the coronavirus pandemic in 2020 as the crisis period, the SRI funds tend to outperform conventional funds even more, but the difference is less certain. When we control for the difference in the three-factor and four-factor model, we cannot find any significant results. Overall, we conclude that the distinct sub-periods generate different results, and potential implications will be discussed in the subsequent section.

7. Discussion

This section covers the discussions and implications from the results revealed in our thesis. The results will be validated by relating them to previous literature. We will also do the same for the results from the robustness test. Further, a discussion of the limitations regarding our results that potentially can give rise to future research. At last, we will contribute with some thoughts about the future implications of the coronavirus pandemic in 2020.

7.1 Discussion of the results

Firstly, when we study the entire period the market beta reveals that SRI funds tend to follow the market as it is neither more nor less exposed to the market risk. In line with the findings from Nofsinger and Varma (2014) which find similar market risk exposure. Also, our findings suggest that SRI fund performance tends to be more exposed to small-capitalization stocks, consistent with Becchetti et al. (2015). Furthermore, SRI fund performance tends to more exposed to past loser stocks than past winner stocks. To some extent, this can say to be in line with the literature outlining the so-called 'price' investors pay for SRI. That is when ethical principles are prioritized regardless of expectations of good financial returns (Becchetti, Ciciretti, Dalò, & Herzel, 2015). The performance of conventional funds tends to have the same exposure to the risk factors and implies that the difference between the respective funds is marginal. In terms of performance difference between SRI and conventional funds, we observe that SRI funds tend to perform slightly worse in CAPM and slightly better in the three-factor and four-factor model. However, this is insignificant and holds for all the models. Our findings are consistent with Statman (2000); Bauer et al. (2005); Renneboog et al. (2008b), that do not find any significant differences. It is worth mentioning that no significant evidence proves that SRI funds are either more or less profitable than conventional funds.

Subsequently, we assess the performance of SRI funds relative to conventional funds in the crisis and non-crisis period with a crisis dummy variable. Our findings implicate that SRI funds tend to outperform conventional funds during the crisis period, and vice versa during the non-crisis period. However, the joint significance tests reveal that the results are not significant in any of the models. This conclusion contrasts with the findings from Nofsinger and Varma (2014) which find significant evidence that SRI funds outperform (underperform) conventional funds during the crisis (non-crisis) period. Our study differs from Nofsinger and

Varma (2014) in three ways: Firstly, we use monthly returns, whereas they use quarterly returns. Secondly, our sample consists of 89,876 observations, whereas they have 11,638 observations. Thirdly, they do not apply factor models when studying SRI funds in panel data but instead controls for several fund level variables. Considering these differences, we expect to obtain diverse results. However, our conclusion is in line with Becchetti et al. (2015) that do not find significant differences between the respective funds for the crisis period in North America. Despite this, we find evidence that conventional funds are likely to perform worse than the market during the crisis period.

Finally, we evaluate fund performance using interaction terms to see whether our conclusion still holds. The findings are consistent with the results without interaction terms, indicating robust results. We see that SRI funds tend to perform better during the crisis period and worse during the non-crisis period compared to conventional funds. However, when testing for joint significance, the result reveals that the difference is still not significant. The conclusion for the crisis period is in line with findings suggested by Leite and Cortez (2015). When accounting for interaction terms to capture variations in systematic risk factors, they do not find a significant difference in performance between SRI funds and conventional funds during the crisis period. Nevertheless, our analysis differs in terms of market, as we investigate the U.S. mutual fund market, whereas Leite and Cortez (2015) study the European mutual fund market. Furthermore, our results reveal that conventional funds are likely to perform worse than the market during the crisis period. Despite that SRI funds do not generate significantly positive returns during the crisis period, they do not contribute significantly negative as for the conventional funds. Overall, this can indicate that SRI funds hold up somewhat better during the crisis period. Further in our analysis, the interaction term between the market beta and the crisis dummy variable reveals that investing in SRI funds does not involve additional market risk in the crisis period. Whereas for the conventional funds there is a slightly higher market risk exposure during the crisis period. This can to some extent support the insurance effect the SRI funds can have, which is suggested by Becchetti et al. (2015), Nofsinger and Varma (2014), and Nakai et al. (2016). That is, investors pay a premium for SRI funds in terms of underperformance during non-crisis periods to limit downside risk during crisis periods. Considering the conventional fund performance and its risk exposure it can be discussed whether these funds do hold up as good as the SRI funds in the crisis period. As mentioned before, the difference is not significant.

7.2 Discussion of the robustness tests

We control for whether we obtain diverse results when dividing the SRI funds into the different investment strategies. As we are only interested in the SRI funds that practice one of the strategies, we reduce our fund sample to 74 funds. Consequently, we do not include the 70 remaining SRI funds that practice both strategies. The number of funds is approximately distributed equally across the two investment strategies. Our results suggest that SRI funds exhibit a negative risk-adjusted return in non-crisis periods, consistent with Section 6.1. Moreover, funds that use positive screening do not perform better nor worse than funds that use negative screening in crises. However, Derwall et al. (2011); Areal et al. (2013); Nofsinger and Varma (2014); Becchetti et al. (2015) find evidence that SRI funds applying positive screening tend to perform better than SRI funds applying negative screening. The fact that we reduced the sample, can have implications on the results. As this robustness test is only considered to be a control in our analysis, we do not further discuss the implications these results potentially can have.

Furthermore, when separating our period into two sub-periods we obtain diverse results. To some extent, this can be related to the learning phase SRI funds seemingly have been through over the years. This is illustrated by Bauer et al. (2005) and indicates that it is not straightforward to compare more recent fund performance by earlier years. However, the learning phase mostly applies to years before our sample period. More relevant to our results, is to control for a potential implication from the rapid growth in SRI funds after the financial crisis in 2008. Therefore, we find it comprehensible to test whether the SRI fund performance compared to conventional fund performance has changed during our sample period. In terms of the non-crisis period, the analysis reflects that the SRI fund performance is significantly worse than conventional fund performance in Subperiod 1. In contrast to the non-crisis period in Subperiod 2, we find no significant difference. This suggests that the performance in SRI funds have improved after the financial crisis in 2008 and match their conventional fund peers in more recent years. Further, for the SRI funds compared to their conventional fund peers during the crisis period, our findings suggest outperformance during the financial crisis in 2008, but the result is not significant. This is in contrast with previous literature that finds significant outperformance (Nofsinger & Varma, 2014). However, our finding is consistent with the analysis in Section 6.1. Further, when considering the coronavirus pandemic in 2020 represented in Subperiod 2, the outperformance in SRI funds relative to their fund peers is

diverse. In general, the outperformance is notably greater than during the financial crisis in 2008. The results from CAPM show significant outperformance at the 10 percent level, but nonsignificant results in the three-factor and four-factor model. We find it conceivable that the absence of significance can to some extent be explained by the fact that our second crisis period only captures two months. This again takes us to the main limitation of our model, which will be discussed in further detail in the next section.

7.3 Limitations and further research

First and foremost, lack of certainty in the writing moment of the full time-period regarding the coronavirus pandemic in 2020, is for sure a limitation to our analysis. There need to be said that an analysis of the entire crisis period is to be preferred. To be mentioned, we observe from April 2020 that the stock market has seemingly gained positive momentum. That is reflected in our SRI fund sample which reveals positive returns for April and May 2020, respectively an average of 12.91 and 5.89 percent. Implying that either has the downturn been short-lived or this can be a temporary upturn. However, at this moment, we do not know the exact duration of the ongoing crisis. Before any complete analysis can be established, more time and certainty are needed until a definite period can be determined. Further, the various definitions of the period for the financial crisis in 2008 can give rise to inconsistent comparison with other research papers. Mainly referring to those papers that base their crisis periods on NBER's definition. Consequently, another aspect to consider in our analysis is to move the crisis periods to control for whether we obtain different results. On the other hand, the period for the great lockdown in 2020 is not yet defined by NBER. Therefore, we find it most consistent to use the S&P 500 Index as an indicator of both the crises we are studying.

Another limitation of our study is how it exclusively focuses on open-ended mutual funds primarily investing in U.S. equity. The results on performance can vary across markets and asset classes but also when using different periods. In the Morningstar study, they include both open-end and exchange-traded U.S. equity funds. Also, their conventional matching peer sample seemingly consists of all U.S. equity from the different Morningstar categories in terms of market capitalization and investment style from Morningstar Direct. Based on this, they find that SRI funds hold up better compared to conventional funds during the first quarter of 2020 (Hale, 2020). A limitation to the Morningstar analysis is that they only study the first quarter of 2020 which is a relatively short period. Further, studies about SRI equity mutual

fund performance on a global scale demonstrate different results across countries (Renneboog, Horst, & Zhang, 2008b). Also, the asset pricing models are comprehensive when evaluating the active management of assets, but our sample includes both active and passive funds. The premiums for the passive funds are expected to not be significantly different from zero and can potentially have an impact on our results.

Furthermore, studies about SRI fund performance has questioned whether there exist unobserved effects that are correlated with the explanatory variables and can have implications for the results. An extension of the Carhart (1997) four-factor model is proposed by Renneboog et al. (2008b) and Matallín-Sáez et al (2019). Renneboog et al. (2008b) suggest that "the conventional four-factor model may not capture 'ethics or SRI' style and the alpha may suggest the expected return associated with the missing factor". However, they added only one ethical factor and the change in the result was limited. Matallín-Sáez et al. (2019) on the other hand, propose a hypothesis about omitting relevant benchmarks that causes bias in the evaluation of mutual fund performance. They introduce an eight-factor model that is an extension of the Carhart (1997) four-factor model by including idiosyncratic socially responsible features. They suggest that the four-factor model compared to the eighth-factor model generates different results for SRI fund performance during crisis periods. When considering the eight-factor model, SRI fund performance improves considerably in the crisis-periods and performed better than in non-crisis periods, but still lack significance. Also, when comparing with conventional funds the difference is not significant.

7.4 Possible outcomes from the Great Lockdown in 2020

Already, several proponents are trying to say something about the repercussions of the coronavirus pandemic in 2020. One relevant perception to be outlined is how the crisis creates an opportunity to upscale the transition to a low-carbon economy when rebuilding the economy in post-coronavirus time. For instance, the International Energy Agency (IEA) in collaboration with IMF recently published a report including several proposals for a sustainable recovery, with special attention to the energy sector (IEA, 2020). Further, the arguments from Herrea-Cano and Gonzalez-Perez (2016) can say to be meaningful in terms of the relevance of SRI. They state that SRI is used as a "powerful tool" in terms of regaining trust in political and economic institutions in the instance of market crises. Also, the digital transformation has been substantial during the pandemic reflected through the superior

performance of the technology stocks, and its development is not expected to decline in the future. In contrast, the energy stocks have been characterized by bad performance in the first quarter of 2020, mostly driven by the oil sector that has been through an oil price shock. Both developments are relevant for SRI funds, which tend to have an overweight in technology stocks and underweight in energy stocks. Also, from the Morningstar article, this is pointed out as one main explanation as to why SRI funds outperformed their conventional fund peers during the first quarter of 2020 (Hale, 2020). On the other hand, the proposals stated in the IEA-report, imply that potential future energy stocks can belong in an SRI fund portfolio. Overall, if the world in fact will demand more sustainable solutions as of political willingness and increased demand from investors. In turn, the potential time ahead can indicate a bright future for SRI funds compared to their conventional counterparts.

8. Conclusion

The main objective of our master thesis is to study whether SRI funds perform better on a risk-adjusted basis than conventional funds during market crises. To fulfill our objective, we conduct an analysis of SRI and conventional fund performance over the period of March 2003 to March 2020. The two crises we study are the financial crisis in 2008 and the coronavirus pandemic in 2020. In our analysis, we collect a matched pair of conventional funds to examine whether SRI funds perform better than their conventional fund peers. Based on asset pricing models, respectively the CAPM, Fama-French three-factor model, and Carhart four-factor model, we calculate the risk-adjusted returns for the different funds in our sample. We also introduce an expanded model by including dummies to distinguish the SRI and conventional funds and the crisis and non-crisis period. Furthermore, we include interaction terms between the SRI and crisis dummy variable, and between the distinct risk factors and the crisis dummy variable.

Based on our analysis, the results imply that during the crisis period the SRI funds hold up slightly better than their conventional fund peers. During the non-crisis period, the results imply that conventional funds do slightly better. For the full period, the results imply that the conventional funds also do somewhat better. Considering previous research, the results are not unexpected. However, based on the joint significance tests and the t-tests we conclude that there are no significant differences between the SRI and conventional fund performance. This applies for both the full period and when we distinguish between crisis and non-crisis period. Despite that, our results contribute to interesting findings in terms of conventional funds tend to be more volatile than the market during the crisis period. This in turn leads to negative returns during the crisis period. SRI funds, on the other hand, do not perform better nor worse during the crisis period. Although the difference between the respective funds is not significant, there are still indications implying that SRI funds hold up better during market crises in terms of risk.

Furthermore, the results reveal that the SRI funds tend to be more exposed to small-capitalization stocks, which is consistent with previous literature. Also, our findings imply that the SRI fund performance can to some extent be explained by exposure to losing stocks. Suggesting consistency with previous literature that pointed out this so-called ‘price’ investors pay for SRI, as with the ethical principles are prioritized over good financial outlooks. Further, we control for whether different SRI strategies and different sub-periods can have implications

on our results. First, we separate the SRI funds into sustainable investing (corresponding to positive screening) and exclusionary (corresponding to negative screening), to allow for further nuances in terms of different SRI strategies. The results imply that funds with positive screening perform worse than funds with negative screening in the crisis period, but the difference is not significant. Thus, we cannot conclude whether there is a difference between screening strategies. Secondly, we assess whether the substantial growth in SRI funds after the financial crisis in 2008 impacts the results. Consequently, we divide our sample period into two sub-periods to test for any differences across time. In terms of the coronavirus pandemic in 2020, the SRI funds tend to perform greater than the conventional funds compared to the financial crisis in 2008. Considering that the difference is only significant in CAPM, it is difficult to conclude with any certainty. During the non-crisis period, the SRI funds perform significantly worse than their fund peers in the period before the financial crisis in 2008. Moreover, the difference is no longer significant when considering the period after the financial crisis in 2008. This in turn implies that the performance in SRI funds matches their conventional peers to a greater extent in the period after the financial crisis in 2008.

A limitation of our study is that we only analyze the implications from the coronavirus pandemic until the end of March 2020. Mainly because we write throughout this time and are not yet aware of the actual duration of the crisis. Further, we investigate solely on U.S. equity open-ended mutual funds, but the results can vary across different markets and asset classes. Lastly, an extended model incorporating additional SRI factors suggested by some researchers can potentially include unobserved effects that are not captured in our model. That being said, the researchers did not find significant results and therefore a consideration with limited implication to our final results.

In terms of future research, a more complete analysis when the crisis is certainly over is recommended. By running the same analysis on the full period of coronavirus pandemic in 2020, one can more accurately examine the effects the crisis will have on the performance of SRI mutual funds compared to conventional mutual funds. Regards to the economic consequences of the coronavirus pandemic in 2020, we expect it to be a research field of great interest with a wide range of issues to be examined in the future. Moreover, our diverse results in the distinct sub-periods also deserve more attention as it can reflect that investors consider the materiality of SRI differently today compared to before the financial crisis in 2008.

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Appendix

A.1 Overview of studies about SRI funds and performance

Table A1: Overview of studies about performance of SRI funds

Table A1 is meant to give the reader an overview of the literature on SRI fund performance and we present the main findings from the different studies. Inspired by the table presented in the study by Renneboog et al. (2008a). To be mentioned, this is not a complete list of all literature on the subject but selected literature relevant to our thesis is included. Especially, with the emphasis on studies covering U.S. equity funds as this is our main field of study. We find it coherent to give this overview as sustainable finance, and more precisely SRI funds, are to some extent an emergent subject. The general conclusion of the various studies is that there is no significant difference between SRI and conventional funds.

Study	Country	Period	Asset class	Findings
Hamilton et al. (1993)	U.S.	1981-1990	Equity mutual funds	SRI funds do not earn a statistically significant excess return and the performance does not differ significantly from those of conventional funds.
Statman (2000)	U.S.	1990-1998	Equity mutual funds	No significant difference in monthly alpha between SRI and non-SRI funds.
Bauer et al. (2005)	Germany, UK, US	1990-2001	Equity mutual funds	Overall, find little evidence for risk-adjusted return differs significantly. The U.S. domestic ethical funds significantly underperform compared to conventional peers, but for the U.S. international funds, the difference is insignificant. Although, after significant underperformance in the early 1990s, they match conventional fund performance over 1998-2001.
Girard et al. (2007)	U.S.	1984-2003	Equity, fixed income (bonds) and balanced mutual funds	SRI funds underperform compared to conventional funds mainly due to diversification costs. But also, costs related to poor selection skills linked to the ethical screening process.
Renneboog et al. (2008b)	Global (17 countries around the world)	1991-2003	Equity mutual funds	In line with investors paying a price for ethics, SRI funds in many European and Asia-Pacific countries strongly underperform domestic benchmark portfolios. For the US and UK SRI, they find no significant underperformance.
Hong and Kacperczyk (2009)	U.S.	1962-2003	Individual stocks (equities)	Investors pay a price for not holding 'sin stocks' as they outperform comparable stocks.
Derwall et al. (2011)	U.S.	1992-2008	Equity (stocks)	Value-driven investors (primarily use negative screening) and profit-seeking investors (primarily use positive screening) generate different abnormal returns in the short-run.
Revelli and Viviani (2015)	Global	1972-2012	Single stocks (equities), funds, indices.	A meta-study that on a global scale finds no significant benefit or cost of investing in SRI, but the level of performance depends on the choice of methodology.

A.2 Overview of studies about SRI funds and market crises

Table A2: Overview of studies about SRI funds and market crises

Table A2 gives an overview of the literature on SRI funds and market crises, which is the main field of study in our master thesis. Also, we are inspired by the overview of relevant literature presented in Renneboog et al. (2008a). Also, this is not a complete list of all literature on the subject but mainly literature relevant to our thesis is included. Especially, with the emphasis on studies covering U.S. equity funds and market crises as this is our main field of study. In general, the findings imply a difference in performance when comparing SRI and conventional funds over different market states.

Study	Country	Period	Asset class	Findings
Areal et al. (2013)	U.S.	1993-2009	Equity mutual funds	Estimates of the performance vary across different market regimes. Conventional funds outperform during non-crisis periods (periods of low volatility) and underperform during crisis periods (periods of high volatility). Different types of screens affect the SRI fund performance differently across crisis and non-crisis periods.
Nofsinger & Varma (2014)	U.S.	2000-2011	Equity mutual funds	Compare SRI and conventional fund performance and find no significant difference for the entire period. During crisis-periods, SRI funds outperform conventional funds and underperform in non-crisis periods.
Leite & Cortez (2014)	Europe	2001-2012	Equity mutual funds	SRI funds significantly underperform characteristics-matched conventional funds during the non-crisis period but match the performance of their peers during the crisis period.
Becchetti et al. (2015)	Global, North America, Europe, and Asia	1992-2012	Equity funds	Find no significant difference between SRI and conventional funds for the entire period. In the financial crisis 2008, SRI funds outperform conventional funds, but find no significant difference for North America.
Nakai et al. (2016)	Japan	2002-2010	Equity (stocks) and/or fixed income (bond) mutual funds	Study the financial crisis in 2008 and use the bankruptcy of Lehman Brothers as the event. Concluded that SRI funds better resisted the bankruptcy compared to the conventional funds.
Matallín-Sáez et al. (2019)	U.S.	2000-2017	Equity mutual funds	When comparing performance for SRI and conventional funds over the business cycles, the evidence differs depending on the group of SRI, economic cycle, and type of model being used to measure performance. Overall, find that during non-crisis periods abnormal return of SRI funds is significantly negative, but find no significant difference for crisis periods.

A.3 Morningstar Category U.S. Equity Category Classification

Table A3: Morningstar Category U.S. Equity Category Classification

Large Value	"US large-value portfolios invest primarily in big U.S. companies that are less expensive or growing more slowly than other large-cap stocks. Stocks in the top 70% of the capitalization of the U.S. equity market are defined as large-cap. Value is defined based on low valuations (low price ratios and high dividend yields) and slow growth (low growth rates for earnings, sales, book value, and cash flow)."
Large Blend	"US large-blend portfolios are representative of the overall U.S. stock market in size, growth rates, and price. Stocks in the top 70% of the capitalization of the U.S. equity market are defined as large-cap. The blend style is assigned to portfolios where neither growth nor value characteristics predominate. These portfolios tend to invest across the spectrum of US industries, and owing to their broad exposure, the portfolios' returns are often similar to those of the S&P 500 Index."
Large Growth	"US large-growth portfolios invest in big U.S. companies that are projected to grow faster than other large-cap stocks. Stocks in the top 70% of the capitalization of the U.S. equity market are defined as large-cap. Growth is defined based on fast growth (high growth rates for earnings, sales, book value, and cash flow) and high valuations (high price ratios and low dividend yields). Most of these portfolios focus on companies in rapidly expanding industries."
Mid-cap Value	"Some mid-cap value portfolios focus on medium-size companies while others land here because they own a mix of small-, mid-, and large-cap stocks. All look for U.S. stocks that are less expensive or growing more slowly than the market. The U.S. mid-cap range for market capitalization typically falls between $1 billion and $8 billion and represents 20% of the total capitalization of the U.S. equity market. Value is defined based on low valuations (low price ratios and high dividend yields) and slow growth (low growth rates for earnings, sales, book value, and cash flow)."
Mid-cap Blend	"The typical mid-cap blend portfolio invests in U.S. stocks of various sizes and styles, giving it a middle-of-the-road profile. Most shy away from high-priced growth stocks but are not so price conscious that they land in value territory. The U.S. mid-cap range for market capitalization typically falls between $1 billion and $8 billion and represents 20% of the total capitalization of the U.S. equity market.

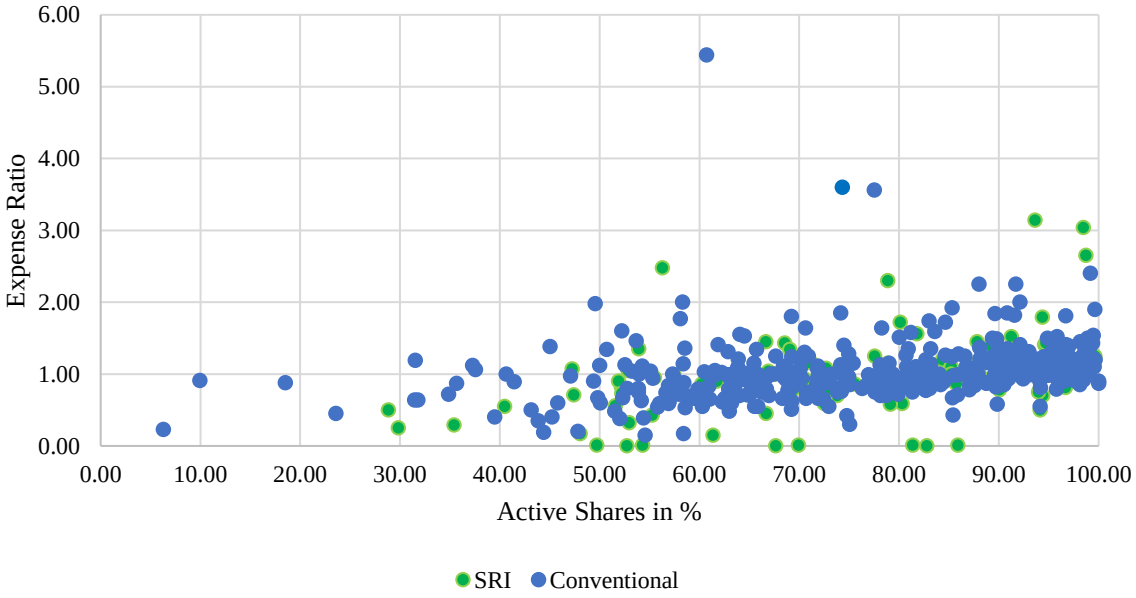
	The blend style is assigned to portfolios where neither growth nor value characteristics predominate."
Mid-cap Growth	"Some mid-cap growth portfolios invest in stocks of all sizes, thus leading to a mid-cap profile, but others focus on midsize companies. Mid-cap growth portfolios target U.S. firms that are projected to grow faster than other mid-cap stocks, therefore commanding relatively higher prices. The U.S. mid-cap range for market capitalization typically falls between $1 billion and $8 billion and represents 20% of the total capitalization of the U.S. equity market. Growth is defined based on fast growth (high growth rates for earnings, sales, book value, and cash flow) and high valuations (high price ratios and low dividend yields)."
Small Value	"Small-value portfolios invest in small U.S. companies with valuations and growth rates below other small-cap peers. Stocks in the bottom 10% of the capitalization of the U.S. equity market are defined as small cap. Value is defined based on low valuations (low price ratios and high dividend yields) and slow growth (low growth rates for earnings, sales, book value, and cash flow)."
Small Blend	"Small-blend portfolios favor U.S. firms at the smaller end of the market-capitalization range. Some aim to own an array of value and growth stocks while others employ a discipline that leads to holdings with valuations and growth rates close to the small-cap averages. Stocks in the bottom 10% of the capitalization of the U.S. equity market are defined as small cap. The blend style is assigned to portfolios where neither growth nor value characteristics predominate."
Small Growth	"Small-growth portfolios focus on faster-growing companies whose shares are at the lower end of the market-capitalization range. These portfolios tend to favor companies in up-and-coming industries or young firms in their early growth stages. Because these businesses are fast-growing and often richly valued, their stocks tend to be volatile. Stocks in the bottom 10% of the capitalization of the U.S. equity market are defined as small cap. Growth is defined based on fast growth (high growth rates for earnings, sales, book value, and cash flow) and high valuations (high price ratios and low dividend yields)."

Source: Morningstar (2016)

A.4 Active Shares and Expense Ratio

Figure A4: Active Shares and Expense Ratio

The correlation between Active Shares in % and Expense Ratio in % for SRI and conventional funds. Source: Morningstar Direct



A.5 Statistical tests

Table A5: Breusch-Pagan Lagrange Multiplier (LM) test

Test for Random Effect versus POLS

	Variance	Standard Error
Excess Return	21.7753	4.6664
e	2.9469	1.7167
u	0.0212	0.1457
Chi^2	4.920	
P-value	0.0133	

H_0: No difference across units, and OLS is the preferred model
H_1: Difference across units, and RE is the preferred model
df=1, α=0.05 gives a critical value of Chi^2=3.84

Table A6: Hausman test

Test for Fixed Effect versus Random Effect model

	β^{FE}	β^{RE}	$\beta^{FE} - \beta^{RE}$	$\sqrt{Var\beta^{FE} - Var\beta^{RE}}$
Crisis	-0.0695	-0.0637	-0.0058	0.0022
SRI*Crisis	0.0890	0.0864	0.0026	0.0041
Mktrf	0.9887	0.9887	0.0000	0.0001
SMB	0.1514	0.1517	-0.0002	0.0001
HML	0.0070	0.0073	-0.0004	0.0002
MOM	-0.0159	-0.0158	0.0000	0.0001
Mktrf*Crisis	0.0388	0.0389	-0.0001	0.0002
SMB*Crisis	0.1610	0.1609	0.0001	0.0004
HML*Crisis	-0.0343	-0.0343	0.0000	0.0002
MOM*Crisis	0.0321	0.0323	-0.0002	0.0002
Chi^2	9.490			
P-value	0.4865			

H_0: Both estimators are consistent, and RE is the preferred model
H_1: RE estimators are not consistent, and FE is the preferred model
df=10, α=0.05 gives a critical value of Chi^2=18.31

Table A7: Correlation matrix

The correlation between the explanatory variables

	SRI	Crisis	Mktrf	SMB	HML	MOM	SRI crisis	Mktrf crisis	SMB crisis	HML crisis	MOM crisis
SRI	1.000										
Crisis	0.002	1.000									
Mktrf	-0.002	-0.371	1.000								
SMB	-0.003	-0.017	0.386	1.000							
HML	-0.005	-0.203	0.312	0.179	1.000						
MOM	0.001	0.107	-0.369	-0.140	-0.450	1.000					
SRIcrisis	0.268	0.469	-0.177	-0.009	-0.098	0.051	1.000				
Mktrfcrisis	-0.003	-0.528	0.590	0.143	0.356	-0.245	-0.253	1.000			
SMBcrisis	-0.001	-0.036	0.262	0.295	0.274	-0.157	-0.020	0.474	1.000		
HMLcrisis	-0.003	-0.349	0.356	0.137	0.597	-0.237	-0.169	0.600	0.458	1.000	
MOMcrisis	0.001	0.247	-0.336	-0.111	-0.333	0.423	0.118	-0.577	-0.371	-0.558	1.000

A.6 Robustness tests

Table A8: Regression results with different SRI strategies

Table A8 presents the first robustness test results of the estimation from CAPM, Fama-French three-factor, and Carhart four-factor models for the period March 2003 to March 2020, separated in crisis and non-crisis period. Column (1) to (3) show the results for the 74 SRI funds in the distinct models. Different from previous models, the SI dummy variables (δ_1) takes value 1 if the fund uses positive screening and 0 if the fund uses negative screening. To interpret the effect from SI in crisis periods, we include a crisis dummy variable (δ_2) that takes value 1 if crisis period, and an interaction term (γ_1) between SI and crisis. We also include the interaction terms between the respective systematic risk factors and the crisis dummy variable. The performance measure (α) is displayed in monthly returns. All regressions use clustered standard error on the fund level.

	(1) CAPM	(2) FF3F	(3) C4F
α	-0.152***	-0.102***	-0.0993***
	(-5.52)	(-4.75)	(-4.81)
δ_2Crisis	0.251***	-0.0487	-0.0415
	(2.72)	(-0.65)	(-0.58)
δ_1SI	0.0213	0.0213	0.0214
	(0.64)	(0.64)	(0.64)
γ_1(SI*Crisis)	-0.213	-0.204	-0.203
	(-1.23)	(-1.17)	(-1.17)
βMktrf	1.046***	1.000***	0.997***
	(66.51)	(101.58)	(103.41)
βSMB		0.167***	0.168***
		(4.55)	(4.55)
βHML		0.0163	0.00987
		(0.65)	(0.45)
βMOM			-0.00924
			(-1.08)
γ_2(Mktrf*Crisis)	0.0166	0.0128	0.0219
	(1.27)	(0.91)	(1.48)
γ_3(SMB*Crisis)		0.166***	0.167***
		(5.44)	(5.46)
γ_4(HML*Crisis)		-0.0498**	-0.0365
		(-2.12)	(-1.54)
γ_5(MOM*Crisis)			0.0278**
			(2.06)
Observations	11,268	11,268	11,268
R^2	0.878	0.885	0.885

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
All ($\delta_1+\delta_2+\gamma_1$) and ($\delta_1+\gamma_1$) are tested for joint significance.

Table A9: Regression results with sub-periods

Table A9 presents the second robustness test results of the estimation from CAPM, Fama-French three-factor, and Carhart four-factor models for the two sub-periods. Column (1), (3), and (5) show the results for the performance of the funds in Subperiod 1. Column (2), (4), and (6) show the results for the performance of the funds in Subperiod 2. The performance measure (α) is displayed in monthly returns. All regressions use clustered standard error on the fund level.

	(1) Subperiod 1	(2) Subperiod 2	(3) Subperiod 1	(4) Subperiod 2	(5) Subperiod 1	(6) Subperiod 2
α	0.0334	-0.150***	0.0726***	-0.0968***	0.0645**	-0.0919***
	(1.38)	(-13.93)	(2.65)	(-10.80)	(2.41)	(-10.13)
$\delta_2$crisis	0.0113	2.955***	-0.181***	-13.22***	-0.173***	-12.34***
	(0.18)	(4.21)	(-2.97)	(-38.14)	(-2.84)	(-41.10)
δ_1SRI	-0.0916***	0.00891	-0.0876**	0.0103	-0.0890**	0.00990
	(-2.65)	(0.54)	(-2.51)	(0.62)	(-2.56)	(0.60)
γ_1(SRI*crisis)	0.169**	0.562*	0.163**	0.495	0.164**	0.495
	(2.07)	(1.78)	(2.01)	(1.58)	(2.02)	(1.58)
βMktrf	1.034***	1.026***	0.954***	0.989***	0.967***	0.981***
	(53.83)	(150.06)	(50.23)	(178.59)	(52.59)	(180.36)
βSMB			0.174***	0.145***	0.161***	0.145***
			(9.12)	(11.25)	(8.77)	(11.28)
βHML			-0.00569	0.0197**	-0.00639	-0.000473
			(-0.30)	(2.04)	(-0.35)	(-0.05)
βMOM					0.0334***	-0.0263***
					(4.58)	(-6.96)
γ_2(Mktrf*crisis)	-0.00627	0.389***	0.0658***	-2.183***	0.0530***	-1.396***
	(-0.42)	(6.24)	(4.14)	(-24.37)	(3.60)	(-13.32)
γ_3(SMB*crisis)			0.0351**	0.0868	0.0484***	-0.110
			(2.05)	(0.33)	(2.95)	(-0.52)
γ_4(HML*crisis)			-0.0820***	1.240***	-0.0818***	-0.0712
			(-4.28)	(6.10)	(-4.62)	(-0.23)
γ_5(MOM*crisis)					-0.0345***	-1.181***
					(-4.42)	(-2.68)
Observations	25681	64195	25681	64195	25681	64195
R^2	0.838	0.851	0.844	0.857	0.845	0.857

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All (δ_1+δ_2+γ_1) and (δ_1+γ_1) are tested for joint significance.