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Excluding countries based on environmental, social and governance (ESG) criteria in sovereign bond portfolios

Name: Julia Krips

Student ID Number: 456130

Supervisor: Onno Steenbeek

Second Assessor: Mary Pieterse-Bloem

ABSTRACT

The socially responsible investing (SRI) industry has grown rapidly over time. This has been accompanied by an increase in academic research on a variety of SRI topics, including the purpose and inspiration behind socially responsible investing and the financial performance of various asset classes. The area of ESG integration in sovereign bonds is still relatively unexplored and not as widely used as might be expected given the expansion within the industry. This study aims to provide an analysis of the ESG-integrated exclusion strategy in sovereign bond portfolios. It evaluates the practical application and financial performance by assessing the link between various ESG country rating indices and the application of these ratings to portfolio strategies. The results show that almost all the selected ESG country rating indices assessed are highly correlated and that exclusion strategies based on country-specific ESG ratings overall do not have a significant impact on the financial performance of sovereign bond portfolios. The emerging market subset of the portfolio is mainly responsible for small significance in differences. However, given the small allocation to emerging markets in the portfolios, the magnitude of the effect is small enough to see that there are no meaningful return or risk costs associated with implementing these strategies. It therefore supports the practical applicability of exclusion strategies in sovereign bond portfolios based on country-specific ESG ratings.

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Table of Contents

I.	Introduction	4
II.	Practical introduction to ESG investing and integration in the Dutch Pension fund industry	6
III.	Literature review	13
IV.	Data	20
V.	Methodology	29
VI.	Results	34
VII.	Conclusion	53
VIII.	References	56
IX.	Appendices	63
	Appendix I	63
	Appendix II	69
	Appendix III	82
	Appendix IV	91
	Appendix V	100
	Appendix VI	106

I. Introduction

Investors have become increasingly aware of the importance of socially responsible investing (SRI). The total amount invested in professionally managed portfolios that have integrated key elements of ESG assessments exceeds 17.5 trillion US dollar globally (Boffo & Patalano, 2020). ESG integration is underrepresented and understudied in sovereign bond portfolio construction. According to the 2018 Eurosif report, only 13% of SRI assets under management are in sovereign bonds (Eurosif, 2018). This is an interesting fact, given that the vast majority of sovereign bonds are in the portfolios of (especially institutional) investors. As the elements in ESG touch on the ethical way of investing, ESG integration also implies the ESG-based selection of countries in sovereign bonds portfolios. The ESG morality of investors seems to be two-sided. While investors are currently reluctant to invest in a company that violates basic labour standards, at the same time, by financing sovereign debt, the same investors are exposed to the regime of a country that violates human rights.

Whilst the academic literature and practical application in the SRI industry is growing, ESG integration in sovereign bond portfolios is not as widespread as might be expected. The application of ESG integration and its financial consequences in sovereign bond portfolios is therefore an interesting and important topic to investigate. This thesis examines the ESG-integrated exclusion strategy in sovereign bond portfolios. By analysing and using different country-specific ESG-indices, the financial performance of exclusion strategies in sovereign bond portfolios is tested. The research is applied to a sample of 100 countries, both developed and emerging economies.

Few articles have been written on the link between ESG and the performance of sovereign bond portfolios (World Bank, 2018). For example, Capelle-Blanchard et al. (2017), Hoepner and Neher (2013) and Lazard (2017) examine the relationship between country financial risk and ESG performance. Fewer articles have been published on the financial performance of exclusion-based strategies in sovereign bond portfolios. Drut (2010) examined the impact of incorporating ESG factors into the investment decision-making process, Martellini and Vallée (2021) looked more closely at the relationship between sovereign bond portfolio performance and ESG strategies, and Badia et al. (2019) investigated the difference in financial performance between portfolios of high ESG-rated and low ESG-rated countries. This study contributes to the literature by assessing the relationship between different sovereign rating indices, and applying it to the construction of exclusion strategies in sovereign bond portfolios. The portfolio construction is based on a sample that includes emerging markets.

The thesis is organised as follows. In Chapter 2, a practical introduction to ESG investing is provided with an analysis on the Dutch pension fund sector, followed by the literature review in Chapter 3. The study itself is conducted in two parts. The first part analyses the relationship between different country-specific ESG indices, the second part evaluates the performance of different exclusion strategies based

on the first part. As such, data, methodology and results are respectively described in Chapter 4, 5 and 6 and also organised in two parts. The thesis concludes in Chapter 7.

II. Practical introduction to ESG investing and integration in the Dutch pension fund industry

This practical introduction outlines the key themes in corporate responsibility and socially responsible investing (SRI). Growing public knowledge of the dangers of climate change, the benefits of ethical business conduct, the necessity of workplace diversity, and other factors suggest that societal values will increasingly influence consumer decisions, corporate performance and, ultimately, investor decisions. As a result, not only the academic world, but also stakeholders and investors in the institutional asset management industry are evolving rapidly moving towards a more socially responsible way of doing business. This Chapter provides an introduction to corporate responsibility and the interpretation of SRI. It also describes current trends in ESG investing in the institutional asset management industry, with a closer analysis of the Dutch pension fund industry. The Chapter concludes with the results of a qualitative analysis of ESG country policies in the Dutch pension fund industry.

The debate on corporate responsible behavior and socially responsible investments

Milton Friedman argued in 1970 that public companies possess only minimal ethical obligations beyond maximizing profits and obeying the law (Hill et al., 2006). The eminent economist states this from a purely rational economic argumentation as he sees that the implementation costs outweigh any potential tangible benefits to the firm. Due to this, ethical behavior leads to a misallocation and misappropriation of valuable company resources (Brooks and Oikonomou, 2017). Since Friedman's contributions to economic literature continue to be highly significant, there is considerable discussion surrounding his views on morality and corporate responsibility. In a more delegated philanthropy trend, where the company and its associated stakeholders are considered as a conduit for the expression of citizen values, society is evolving. As a result, firms and contributors are ready (and sometimes obligated) to forego profits to advance social objectives (Bénabou and Tirole, 2009). Modern theoretical discussions on corporate social responsibility (CSR) and SRI have thus shifted to more attention on a larger part of society (Carroll, 1999).

Beyond its societal significance, the widely ratified Paris Agreement on Climate Change has demonstrated that CSR and SRI go beyond behaving in an ethical and moral manner to also include investing in ways that ensure sustainability. Therefore, the importance and scope of SRI has been expanding.

With the announcement of the Principles for Responsible Investments (PRI) by the United Nations in 2006, SRI has formally entered the mainstream investment discourse. Following this trend, both academics and practitioners have focused on the various aspects of implementation and the impact of CSR and SRI. The academic paper by Shiller (2013), which discusses the crucial function of financial markets in a sustainable society, serves as an illustration of this shift in perspective. In his view,

innovation in finance is necessary to keep pace with the changes in and expected by society (Duuren et al., 2016).

As the importance of social responsibility has also gained prominence in the minds of investors, there has been much debate about the motivation, implementation and performance of SRI.

Corporate social responsibility and the rise of socially responsible investment (SRI)

Since 1990, CSR has become an important and prominent topic not only in academic literature, but also in practice. Several papers have been written on the motivation of investors to invest in socially responsible funds. According to McCann et al. (2003), the earliest ethical investors were religious institutions with a history of involvement in issues such as alcohol, tobacco, gambling and defence. Investors later added more other ethical considerations to the list. Currently, additional issues are being added such as climate change, human rights, animal welfare issues (Sparkes & Cowton, 2004).

As a result, society's demand for individual and corporate responsibility is encouraging every financial market participant to pursue additional societal goals beyond maximizing profits (Bénabou and Tirole, 2009). This is echoed by Bollen (2007), who argues that investors have a multi-attribute utility function based not only on financial performance but also on societal values. The motivation for companies and investors to integrate CSR can thus be explained in two ways. The first explanation can be found in the ethical and moral values of companies and investors, as already mentioned above. The second explanation is related to the need for management and mitigation of long-term risks (e.g., future regulatory restrictions, physical or reputational risks) (Bennani et al., 2018). To keep the different terms concise, the consideration of ESG-factors in the investment process is referred to as socially responsible investing (Johnsen, 2003; Eccles and Viviers, 2011).

SRI (or ESG) investing can be applied in a variety of contexts with different investment objectives. According to Giese et al. (2019), there are three main applications of ESG investing. First, ESG investing is applied through integration, where the main goal is to improve the risk-return relationship of the investment process. Second, ESG investing is value-based investing, where the investor aligns his/her portfolio with his/her norms and beliefs. And third, ESG investing is impact investing, where investors seek to use their capital to effect change for social or environmental purposes. An overview of the three applications is reported in Table 1. Given the definition of CSR and all that has been said above, one could argue that the first area cannot be the main objective of ESG investing. SRI is about prioritising a positive impact on society, not about optimizing the performance of an investors' portfolio using ESG criteria. In practice, however, ESG investing is generally integrated into the investment decision-making process, while maintaining the primacy of the fiduciary duty of (especially) institutional investors to deliver financial returns (Bennani et al., 2018). The fiduciary duty of institutional investors cannot be ignored. Therefore, this study focuses on the first area, the integration

of ESG. Here, the main goal of ESG investing is to improve the risk-return relationship (Giese et al., 2019).

By integrating ESG criteria into the investment selection process, investors can employ a variety of ESG strategies. The main ESG-strategies are negative screening (i.e., exclusion), positive screening (i.e., inclusion), best-in-class investing (i.e., selecting the best 10 or 10% of an industry in terms of ESG), activism and engagement (Duuren et al., 2016). Table 1 provides an overview of the three main applications of ESG investing.

Table 1

Overview of the three main applications of ESG investing

	Application	Goal	Main strategies	Example
1.	ESG-integration	Improve the risk-return relationship of the investment process	• Negative screening • Positive screening • Best-in-class investing • Activism • Engagement	Assessment of risks and opportunities of energy transition in the investment process
2.	Value-based investing	Alignment portfolio with ESG norms and beliefs	• Negative screening • Positive screening • Best-in-class investing • Activism • Engagement	Pension fund for healthcare professionals decides to exclude tobacco companies from its portfolio
3.	Impact investing	Using capital to effect change for social or environmental purposes		Investing in green, social or sustainability bonds

Note. This table demonstrates an overview of the main ESG applications according to Giese et al. (2019). Each application is described with the corresponding goal, strategies, and an example.

As mentioned earlier, the industry is constantly evolving. Keeping in mind the appropriate definitions and context for SRI and CSR, it is important to look at the current trends in the industry to provide a practical context for this study.

ESG investing in the Dutch pension fund sector

The institutional asset management sector in the Netherlands has played a key role in taking responsibility for the companies in which it invests. Due to active legislative support for SRI (i.e., special tax legislation), the Netherlands has a well-developed SRI sector for both individual and institutional investors (Scholtens, 2005; Wagemans, Koppen and Mol, 2017). In the institutional asset management market, the Dutch pension fund sector has a significant impact. With assets under management amounting to 210% of GDP in 2020, the Netherlands has the largest pension investments relative to its economy in the world (OECD, 2021). The Dutch pension system is built on a mandatory basis, which means that the pension funds act as the members' representatives in pursuing a predetermined objective: a pension in exchange for a contribution (IJzereef et al., 2023). As there is no freedom for individuals to organise their pensions, pension funds have a fiduciary duty to be responsible

stewards of public funds. As a result, the voice of society has become more prominent in the debate on how these public funds should be invested. For example, the largest Dutch pension fund, ABP, was sued in 2021 by the climate change organisation Fossil Free to determine whether it needed to divest from fossil fuels in order to align its investment strategy with the Paris Climate Agreement (The Guardian, 2021). The Dutch pension industry has shifted its focus from risk, return, and cost to an additional pillar called 'ESG' in response to many factors, including this lawsuit. The industry is also involved in various activities to demonstrate its commitment to responsible investment to its stakeholders. For example, a number of funds agreed to the 2019 Dutch Climate Accord and more than 80 pension funds joined the 2018 International Responsible Business Behaviour Agreement (IRBC) (Pensioenfederatie, n.d.).

Currently, the SRI policies of Dutch pension funds implement many ESG strategies. According to IJzerdreef et al. (2023), voting and exclusion policies are the most frequently used ESG activities, with a 96% adoption rate in the sector. The former aims to influence the sustainability of the company. The latter includes not investing in certain industries or countries for legal purposes (e.g. sanctions), for risk management purposes (e.g. stranded assets in the oil and gas industry) or for non-financial purposes (e.g. the tobacco industry).

It is interesting to clarify whether funds implement a country policy and whether this is part of the implementation of funds' social responsibility policies, as the Dutch pension fund sector is active in implementing ESG strategies and there is a lack of academic research on ESG implementation in government bond portfolios. The active role of the Dutch regulator adds to its appeal. To further encourage the uptake of these practices, De Nederlandsche Bank (DNB) and Authoriteit Financiële Markten (AFM) serve as important standard setters, keeping an eye on pension funds' SRI and creating new risk assessment tools. Furthermore, despite the industry's strong promotion of SRI, there is little self-regulation through codes of conduct (Anderson et al., 2019). As a result, the industry is constantly innovating to address ESG concerns in response to a combination of sector-wide efforts, social pressure, and entrepreneurial regulators. However, a fund is not required to adhere to rigid regulations or set parameters. Given the topic of ESG integration in sovereign bond portfolios, this makes the sector an interesting choice for research. The Dutch pension fund sector has a large exposure to sovereign securities (29.9%) within its funds, with bonds accounting for 47.7% of total investments of the sector (European Commission, 2019). It would therefore be useful to find out how much ESG integration is actually used in the largest asset class.

The Dutch socially responsible investments industry

Dutch pension funds have SRI policies. The top five largest insurance and pension funds provide the context for the rest of the business with reference to SRI (Eurosif, 2018). ESG aspects are taken into account through the funds' SRI policy (Pensioenfederatie, n.d.). 90% of the 50 largest pension funds

use ESG strategies, according to the VBDO Benchmark Responsible Investing 2021 study. The study also notes, in line with the 2018 Eurosif report on European institutional investors, that the most popular ESG strategies are exclusion and engagement (Eurosif, 2018). Pension funds use a wide range of ESG initiatives, according to the 2021 VBDO study, but not all of them are used consistently across all asset classes. Only 58% of pension funds clearly apply ESG integration across their entire portfolio (VBDO, 2021). This is also in line with the trends highlighted in the 2018 Eurosif study, according to which institutional investors exclusively use the most popular ESG-strategies when investing in public equities and corporate bonds. Exclusion in other asset classes, such as government bonds, is exclusively based on sanction lists (Eurosif, 2018).

When assessing the effectiveness of ESG strategies, the lack of ESG integration into asset classes other than public equities and corporate bonds is particularly relevant. Institutional investors cannot directly influence the issuer of government debt by purchasing the security, as would be possible when purchasing equity shares of a company. Sovereign bond portfolios can only incorporate ESG factors if specific countries are deliberately excluded. Furthermore, given that sovereign bonds represent the vast majority of pension fund investments, their significant and active role in SRI appears to be only partially accurate.

However, there are some important factors to consider. The fiduciary duty of pension funds is to ensure that the contributions made by participants today will provide an appropriate retirement income, so pension funds must invest the money wisely. The financial performance of the portfolio is influenced by the application of ESG criteria to the selection of investments, where there are issues with a smaller investors' universe and illiquidity. The use of an ESG approach requires caution because of the promise of sustainable financial performance. Second, investors claim that the lack of a clear methodology for assessing the ESG performance of countries makes it impossible to exclude countries on the basis of ESG criteria (Capelle-Blanchard et al., 2017). Third, and finally, some pension funds are reluctant to publicly support or oppose certain countries due to their size or sponsor. For example, if ABP, one of the largest participants in the global asset management market and the pension fund for civil servants, were to explicitly state that it excludes some countries for ethical reasons, it would reflect poorly on the Dutch government. If the fund were to explicitly state their exclusionary approach towards some countries, it would only use the argument of risk management to justify doing so.

These three considerations could be the reason why the 2018 Eurosif report and the 2021 VBDO report describe a low level of ESG implementation in sovereign bond portfolios. However, given the high level of ingenuity in the industry, increasing public pressure and the rapid growth of regulation, it is useful and valuable to find out what the current state of ESG implementation in government bond portfolios in the sector is. This qualitative research is carried out by examining pension funds' public reports on SRI.

Qualitative research on the industry

In collaboration with the Pension Fund Supervision division at DNB, qualitative research is done based on public information from 162 pension funds that are registered in the register of pension funds of the DNB.

Every pension fund is obliged to publish amongst others its investment policies and SRI policy. For the research, only public documents are used for data.

Of the 162 pension funds, 110 described explicitly that they have a country exclusion policy for the sovereign bond portfolio. These exclusion criteria are mostly based on official sanction lists (e.g. those from the United Nations and European Union) and thus legally mandatory to exclude. Only 38 funds report that they have additional ESG-related exclusion criteria in their exclusion policy. Regarding the legal obligation to exclude listed countries, one could argue that only 38 pension funds actively exclude countries. Interestingly, only four funds publish the concrete criteria on which basis the countries are excluded. The four funds and their exclusion criteria are reported in Table 2. The other funds report which indices or guidelines are used as starting point to exclude. These indices are reported in Table 3. The order of the list is categorised by how often an index is mentioned by the funds.

Table 2

Pension funds with publicly reported exclusion criteria

Pension Fund	Used index for exclusion	Criteria
ING pension fund	1. Freedom in the World Index 2. World Bank Governance Indicators Estimate Score 3. Fragile States Index	1. Excluding countries with an aggregated score of smaller or equal to 10 2. Excluding countries with an average score of smaller or equal to -1 3. Excluding countries with a score greater or equal to 95
UWV pension fund	1. ITUC Global Rights Index 2. Freedom in the World Index	1. Excluding countries that are included in the top 10 worst performing 2. Excluding countries with a score smaller than 18
SNS Reaal pension fund	1. Freedom in the World Index	1. Excluding countries with a score smaller or equal to 20
Glazenwassers pension fund	1. ITUC Global Rights Index	1. Excluding countries with a score higher or equal to 5

Note. This table demonstrates the pension funds that publicly reported their exclusion criteria of its country exclusion policy in their responsible investment policy documents. The center column shows the used country-specific ESG index.

Table 3

Indices and guidelines used by pension funds for country exclusion policy

Used index for exclusion	Used guidelines for exclusion
Minimum World Bank Governance Score	UN Global Compact
Freedom in the World Index	OESO Due Diligence Guidance for Responsible Business Conduct (RBC)
ITUC Global Rights Index	
Fund for Peace Fragile States Index	
Environmental Performance Index (EPI Yale)	
Corruption Perceptions Index	
World Press Freedom Index	
Notre Dame GAIN Index	
Human Development Index	
Democracy Index of the Economist Intelligence Unit	

Note. This table represents the indices and guidelines that are used by pension funds for their country exclusion policy. The list of indices is categorised by how often an index is mentioned by the funds. Chapter 3 describes the indices in more detail.

In the absence of a clear overarching policy and analysis of various standardised country-specific ESG criteria, and given that the risk-return remains the most important factor in asset allocation, it is useful and valuable to find out whether the financial performance of sovereign bond portfolios changes when countries are excluded on the basis of their ratings.

This research therefore makes a practical contribution by analysing the relationship between different ratings and the financial consequences of applying exclusionary criteria based on them in different portfolio strategies.

III. Literature review

Chapter 2 provided a practical overview of ESG investing. This Chapter includes a literature review of the academic papers on ESG-integrated asset performance, as much of the academic research has been written on this topic. The Chapter concludes with the academic gap that this study seeks to fill and the hypotheses formulated to answer the research question.

ESG integration and financial performance on equity portfolios

The literature on the financial performance of ESG integration in equity portfolios can be divided into theoretical economic theories and empirical research. In the theoretical economic theories, where ESG is incorporated into economic models, ESG integration has a positive impact on the equity portfolio performance (i.e., William Nordhaus won the Nobel Prize for integrating climate change into long-term macroeconomic analysis) (Benanni et al., 2018). However, when looking at empirical academic research on ESG performance, there is no coherent conclusion. A literature review by Capelle-Blancard and Monjon (2012) found that most research on the financial performance of SRI produced very similar results, namely that the impact on financial performance is minimal and not statistically significant (Duuren et al., 2016). However, a more recent meta-study of the literature focused on the relationship between ESG criteria and corporate financial performance by Friede, Busch and Bassen (2015) found that around 90% of the studies indicate a non-negative relationship after pooling the results of around 2200 individual studies. In addition, the majority of the studies provide positive results. Furthermore, Friede, Busch and Bassen (2015) find that the positive impact of ESG on firm financial performance appears to have remained constant over time. The most recent studies by Drei et al. (2019) and Bennani, et al. (2018) both refute the last result. Both analyses show that ESG investing was a source of outperformance in Europe and North America from 2014 to 2019. However, between 2010 and 2013, both passive and active ESG investors suffered lower returns. One explanation for the difference in performance over time could be the 'learning effect' described by Bauer et al. (2006, 2009), where ESG investment strategies underperform in the short run and outperform in the long run. The 'learning effect' refers to the process by which investors fully internalise the risks and take appropriate action. This is in line with the second motivation for socially responsible investing (described in Chapter 2), which is the need to manage and mitigate long-term risks (Bennani et al., 2018; Bruder et al., 2019).

ESG integration: exclusion

As the volume of SRI has grown exponentially over the last few decades, the financial industry is continuously innovating to implement the best ESG strategies. Looking at the different strategies, according to the 2018 Eurosif report, exclusion is the most prominent strategy in terms of assets, with a compound annual growth rate (CAGR) of 23.5% over the past eight years (Eurosif, 2018).

There is an emerging trend in the literature on the impact of ESG-based exclusion on the financial performance of equities. According to Trinks and Scholtens (2017), exclusion affects the size of the investment universe and leads to lower risk-adjusted returns, which has a negative impact on financial performance. This is consistent with the findings of Hong and Kacperczyk (2009), who find positive anomalous returns for sin stocks. However, Salaber (2009) and Humprey and Tan (2014) do not find this effect and find that investing in sin stocks has little impact on financial performance. According to many other studies, screening has little to no impact on financial performance (Fabozzi et al., 2018; Salaber, 2009; Humprey and Tan, 2014). More recently, Blitz and Swinkels (2020) have shared their thoughts on the usefulness of exclusion. They argue that the effectiveness of exclusionary policies is debatable. They believe that participation in companies (i.e., engagement) and voting as an active shareholder will have a greater impact. Note that whilst engagement might be possible for holders of fixed income instruments, voting is exclusively available for equity holders.

ESG integration and fixed income

While much has been written about SRI and the financial performance of ESG-integrated equity portfolios, much less has been written about SRI fixed income portfolios. Investors have fewer options for implementing ESG policies in fixed income portfolios due to the potentially smaller investment universe and the significant impact on liquidity. Compared to corporate bond portfolios, sovereign bond portfolios are more exposed to this issue. Nevertheless, ESG integration in corporate bond portfolios is limited (Slimane et al., 2019). While the reluctance to implement ESG criteria in bond portfolios has valid financial economic arguments, such as liquidity, it does not mean that the fixed income SRI market is not growing. For instance, impact investing is a more well-known application of ESG where investors put money into products that are primarily designed to have a real social impact (Clarkin & Cangioni, 2015). For illustration, an investor can fund climate-friendly initiatives by purchasing a green bond (Flammer, 2021). In the fixed income market, impact investing has grown rapidly, increasing to almost $2.9 trillion outstanding at the end of June 2022 (BIS, 2022) (Slimane et al., 2019). In parallel with this rapid expansion, the issue of "greenwashing" in fixed income is developing. Making false or misleading statements about a company's commitment to the environment is known as greenwashing. For example, a company may issue green bonds to present itself as environmentally conscious without actually doing anything. As a result, the company can capitalise on its "green" reputation by raising funds or receiving tax benefits (Flammer, 2021). The development of greenwashing suggests that regulation is also needed to keep the industry's social responsibility and moral standards transparent. The introduction of the Sustainable Finance Disclosure Regulation (SFDR) is therefore a notable trend in regulation that increases sustainability transparency (*Requirements under the SDFR*, n.d.). Compared to impact investing, developments in ESG integration in fixed income are less encouraging. According to a survey by Mercer (2017) on the integration of ESG criteria, 94.8% of fixed income investment managers scored in the two lowest categories for the consideration of ESG factors and only 5.1% received the highest

ratings, while in equities, 18% of equity investment managers received the highest ratings (Capucci, 2018).

The different levels of progress in ESG integration between equities and bonds can be explained by an investor's objective. For a stockholder, the long-term performance of a company is important and therefore financial risks are taken into account when holding a stock. For bond holders, the primary objective is to manage default risk (Merton, 1974). Long-term performance is not important if the company pays back the debt.

ESG integration and performance of fixed income portfolios

While most fixed income investment managers have not yet incorporated ESG criteria into their investment decision-making process, it can be a source of outperformance (Mercer, 2017). The 2018 World Bank report found that just over two-thirds of fixed income studies on SRI found a positive relationship between performance and SRI, while one-third found neutral or mixed results (Friede et al., 2015). Derwall and Koedijk (2009) found that SRI fixed-income funds do not perform differently from conventional funds when comparing the financial performance of SRI funds with conventional investment funds. This is in direct contrast to the findings of Goldreyer and Diltz (1999), who found that SRI funds underperformed their conventional peers. More recently, Zorina and Corlett-Roy (2022) found no statistically significant positive or negative alphas in the performance of ESG fixed-income funds. However, Slimane et al. (2019), in line with the study by Bennani et al. (2018), found that ESG screening in fixed-income portfolios has outperformed since 2014 in the case of Euro Investment Grade Bonds. However, this is not the case when looking at USD Investment Grade Bonds. In this case, ESG screening delivers negative alpha (World Bank, 2018). While ESG integration in fixed income shows promising performance results, it is noteworthy that the academic literature written on the impact of ESG integration on fixed income portfolio performance is still scarce.

ESG integration and sovereign bond portfolios

Compared to corporate bonds, investors in sovereign bonds are more likely to be concerned about illiquidity and a limited investor universe (Reinhart & Trebesch, 2015). As a result, ESG integration is used less frequently than in corporate bond portfolios. Looking back at the exclusionary considerations made by Blitz and Swinkels in 2020, it would seem logical for an investor to refrain from implementing other ESG strategies (such as engagement) in their sovereign debt portfolio, as there is no justification for an investor to engage or actively pursue a particular nation in their ESG beliefs. Holders of sovereign debt have no direct influence on sovereign governments. Therefore, exclusion is the only logical way to incorporate ESG into sovereign bond portfolios.

Interestingly, according to the 2018 Eurosif report, institutional investors only apply the exclusion strategy in public equities and corporate bonds. In other asset classes, such as sovereign bonds,

exclusion is based solely on sanction lists (Eurosif, 2018). The lack of wider application of ESG-based exclusion criteria can be attributed to, as already mentioned in Chapter 2, the reluctance of institutional investors to take a diplomatic or political stance towards countries. In addition, according to investors, there is a lack of a defined methodology to assess countries' ESG performance, making it currently impossible to exclude countries based on ESG criteria (Capelle-Blanchard et al., 2017).

Few articles have been written on the link between ESG and the performance of sovereign debt portfolios, as few investors use an ESG-integrated strategy (World Bank, 2018). Capelle-Blanchard et al. (2017) examined the relationship between the default risk and performance of OECD countries with high ESG ratings. They found that bond spreads are often lower in countries with strong ESG performance. They also suggested that the long-term effect is more significant. In addition, Hoepner and Neher (2013) found a negative and significant correlation between government bond yields and sustainability. In 2017, the investment bank Lazard published a study assessing how much of the yield spread is influenced by ESG factors. It found a significant correlation between a country's borrowing costs, taking into account macroeconomic fundamentals, and its ESG ranking. For emerging markets, the link is particularly strong (Lazard, 2017).

Looking more closely at ESG components, high institutional quality (e.g. good governance) is generally considered a relevant factor for sovereign creditworthiness (World Bank, 2018). A country with many strong institutions is associated with fewer default crises, as shown by Qian (2012). The level of sovereign defaults and corruption are also strongly correlated, according to Union Investment (2014). In addition, Choi and Hashimoto (2017) show how data transparency lowers the spreads of sovereign bonds issued by emerging markets.

Exclusion (or negative screening), as mentioned above, seems to be the most practical approach to implementing ESG strategies in the investment selection process when it comes to government bond portfolios. Drut (2010) examined the impact of incorporating ESG factors into the investment decision-making process on the mean-variance efficient frontier of a portfolio of government bonds from twenty developed countries. Drut found that SRI portfolios of sovereign bonds can be constructed without significant loss of diversification. In addition to this study, Martellini and Vallée (2021) recently looked more closely at the relationship between the performance of sovereign bond portfolios and ESG strategies (i.e., negative and positive screening). The authors found that negative screening produces more diverse portfolios than the positive screening portfolio and the portfolio optimisation strategy, with lower levels of tracking error in the portfolios. Badia et al. (2019) also found that high-rated ESG sovereign bond portfolios outperformed low-rated portfolios. However, the result was not statistically significant.

Literature contribution and hypotheses formulations

The SRI industry has grown rapidly over time. At the same time, academic research has increased on a variety of SRI topics, including the purpose and inspiration behind SRI, as well as the financial performance of various asset classes. A review of the literature suggests that the area of ESG integration in fixed income is still relatively unexplored and not as widely used as might be expected given the expansion of the industry. More research is needed on the integration of ESG factors into fixed income portfolios, particularly government bonds, in order to increase applicability. This study contributes to the existing literature on the following topics.

First, as mentioned above, the methodology for assessing a country's ESG performance is not yet clearly defined (Capelle-Blanchard et al., 2016). The link between the country rating indices of different (renowned) agencies (such as the World Bank Governance Score and the Freedom in the World Index) has not yet been explored. Second, ESG screening based on a set of standardised criteria has not yet been studied in sovereign bond portfolios. Studies such as Drut (2010), Hoepner and Neher (2013) and Badia et al. (2019) use a single standardised rating to evaluate ESG country performance. Third, to the best of my knowledge, only Capelle and Blanchard et al. (2017) examine the relationship between sovereign bond performance and country-specific ESG ratings. In analysing the relationship between sovereign bond spreads and ESG ratings, they only consider a subset of OECD countries. This study also analyses the financial performance of portfolios based on country-specific ESG indices and expands the sample to include emerging markets. Fourth and finally, the performance of sovereign bond portfolios with high and low ESG ratings will be examined using a larger sample than Badia et al. (2019). While the study of Badia et al. (2019) focuses on 24 countries, this study will focus on a sample of 100 countries.

In summary, this thesis examines the relationship between the country rating indices of reputable agencies by using a larger sample of countries. Furthermore, based on the indices, a larger sample than in previous studies is used to analyse the performance of the ESG strategy exclusion. This is done to answer the research question:

"What is the effect of ESG-based exclusion of countries on the risk-return relationship of sovereign bond portfolios?"

Based on the literature discussed above, the following five hypotheses are formulated to answer the research question.

The first part of the research examines the relationship between different country-specific ESG indices. As the indices examine different components of ESG, a country may score high on press freedom and low on environmental performance. However, it is reasonable to assume that there is some coherence between different indices. For example, a country with high levels of corruption is likely to have one

of the worst records for protecting human rights. Therefore, the coherence of the indices between the different country-specific ESG indices is the subject of the first hypothesis.

H1: The country-specific ESG rankings are highly correlated

According to the literature that has used country-specific indices (i.e., Drut, 2010; Hoepner and Neher, 2013; and Badia et al., 2019), the same countries consistently come out on top. The highest percentile scores are often achieved by the Nordic countries, while Afghanistan is never ranked higher than the bottom. It is therefore interesting to see where the correlation in rank is explained by a country's economic status (i.e., the IMF definition on emerging markets and advanced economies). As there are less advanced economies in the world and therefore also in the sample, the second hypothesis is that the correlation is higher in the subset of advanced economies.

H2: The high rank correlation is more present in the advanced economy subset of the sample

The second part of the study focuses on the performance of the different portfolios with an index-based exclusion strategy. The third hypothesis extends the aforementioned claims of Capelle-Blanchard et al. (2019) on the performance of sovereign bonds and ESG ratings. Due to the relationship between ESG ratings and country risk, the lower a country's rating, the higher the standard deviation, or risk. Furthermore, as mentioned above, the dataset is larger than the previously discussed literature and includes a subset that includes emerging markets. The inclusion of these countries makes the dataset more interesting, as the relationship between ESG and financial performance is not as clear-cut as it might seem. Emerging markets differ in terms of expected sovereign defaults. For example, Saudi Arabia, which is a wealthy country and has a high degree of certainty about repaying its creditors, has a much lower spread than a country like Angola. However, the level of human rights may be the same in both countries, making the consideration of ESG in the selection of the sovereign bond portfolio more interesting. Lazard (2017) argues that there is a significant correlation between ESG ratings and borrowing costs, which are particularly high in developing countries. Given the previous arguments, only a small fraction of countries from the sample of emerging markets have the same level of payback certainty as Saudi Arabia in terms of low risk. Thus, the third hypothesis builds upon the claims by Capelle-Blanchard et al. (2019) and Lazard (2017).

H3: Portfolios that include only high-rated countries have significantly lower standard deviations than portfolios that include lower-rated countries, especially in the emerging market subsample

There will be a variation in performance based on country-specific factors as many indices focus on different ESG issues (such as human rights, corruption, and press freedom). According to Qian (2012), strong institutions and debt crises are strongly negatively correlated. Furthermore, Union Investment (2014) found significant correlations between corruption and the number of sovereign defaults. As a

result, it makes sense that countries that rank high on corruption indices (i.e. have low corruption) tend to be associated with lower risk.

H4: There is a substantial difference in risk between high and low ranked portfolios based on corruption indices

Badia et al. (2019) find that high-scoring portfolios outperform low-scoring portfolios at all SRI levels. As the authors only base their research on 24 countries, it is interesting to test whether this result is also observable in a larger sample. The fifth and last hypothesis is based on the findings of Badia et al. (2019), where the prediction is made that the high-rated portfolios generate less risk without giving up significant returns.

H5: The highest ESG-ranked government bond portfolios outperform the lowest ESG-ranked portfolios

Finally, by testing the five hypotheses, an answer to the research question is formulated.

VI. Data

As already mentioned in Chapter 3, the research procedure is divided into two parts. First, the correlation between different country-specific indices is calculated and examined. Second, the indices are used to construct different sovereign bond portfolios. The financial performance of these different portfolios is measured and evaluated. Therefore, two different datasets are constructed, transformed and analysed to carry out the research. This Chapter describes the construction, transformation and analysis of the two datasets.

Part I: Rank correlation analysis

As already mentioned in Chapter 2, Dutch pension funds report on several country-specific ESG indices that are used as a starting point for exclusion strategies. The indices are listed in Table 2. The order of the list of indices is categorized by how often an index is mentioned by the pension funds. All ten indices are used for the analysis as they are repeatedly reported in public (socially responsible) investment policies and are therefore the most commonly used criteria in the industry. In addition, all indices are produced by internationally recognised institutions.

All data for the rank index analysis are extracted from the public websites of the institutions. Table 3 represents a summary of the indices, Appendix I includes more details on the data sources. Overall, the indices are composed quite similarly. Interestingly, some institutions claim to use additional indices into their scoring model. For instance, information from Freedom House, the Economist Intelligence Unit, the Press Freedom Index, and statistics from Transparency International are, amongst other sources, used to create the World Governance Indicators. There is also some coherence in the use of information from other data sources such as the World Bank and OECD.

Table 4

Overview of the country indices

Index	Description	Institution	Evaluated Indicators	Data Sources	Methodology	ESG focus
World Bank Governance Score Index (WGI)	The Worldwide Governance Indicators (WGI) report aggregate and individual governance indicators, for six dimensions of governance where it consists of the traditions and institutions by which authority in a country is exercised (The World Bank, n.d.)	The World Bank	1. Voice and Accountability 2. Political Stability and Absence of Violence/Terrorism 3. Government Effectiveness 4. Regulatory Quality 5. Rule of Law 6. Control of Corruption	The index is based on 31 individual data sources produced by a variety of survey institutes, think thanks, non-governmental organizations, international organizations, and private sector firms. The list is included in the Appendix	Data on the indicators are inputs in an unobserved components model to (i) standardize the data, (ii) construct an aggregate indicator of governance, and (iii) construct margins of error (Kaufmann et al.; 2010). All indicators are equally weighted in the overall score, assuming that each indicator is equally important. Total scores are scaled from 1-100	Governance
Freedom in the World Index (FIW)	The Freedom in the World Index (FIW) represents the condition of political rights and civil liberties in a country (Freedom House, n.d.)	Freedom House	1. Electoral Process 2. Political Pluralism and Participation 3. Functioning of the Government 4. Freedom of Expression and of Belief 5. Associational and Organizational Rights 6. The Rule of Law 7. Personal Autonomy and Individual Rights	The index is based on different data sources produced by on-the-ground research, consultations with local contacts, and information from news articles, nongovernmental organizations, governments. Freedom House did not publish its used sources	Scores are determined by the assessment of the data sources by analysts and discussed at a panel of expert advisers. The total scores are equally weighted, leading to the status: Not Free, Partly Free and Free. Total scores are scaled from 1-100	Social, Governance
ITUC Global Rights Index (GRI)	The ITUC Global Rights Index (GRI) depicts the world's worst countries for workers by rating countries on the degree of respect for workers' rights (ITUC Global Rights Index, 2022)	The International Trade Union Confederation (ITUC)	1. Civil Liberties 2. Right to establish or join unions 3. Trade union activities 4. Right to collective bargaining 5. Right to strike	The index is based on information recorded in the ITUC Survey	Legal analysts identify legislation in countries that fails to protect workers. Violations in practice are identified by ITUC affiliates in the countries. A country will receive a point for each violation matching the indicators. Once all data has been processed, and the final scores are tallied by the ITUC experts. Total scores are scaled from 1-5+	Social

Index	Description	Institution	Evaluated Indicators	Data Sources	Methodology	ESG focus
Fragile States Index (FSI)	The Fragile States Index (FSI) highlights the normal pressures that states experience and identifies when those pressures are outweighing a states' capacity to manage those pressures (The Fund for Peace, n.d.)	The Fund for Peace	1. Security Apparatus 2. Factionalized Elites 3. Group Grievance 4. Economic Decline and Poverty 5. Uneven Development 6. Human Flight and Brain Drain 7. State Legitimacy 8. Public Services 9. Human Rights and Rule of Law 10. Demographic Pressures 11. Refugees and IDPS 12. External Intervention	The index is based on different data sources collected both quantitative (i.e., information from a content aggregator including media articles, research reports) and qualitative data from international and multilateral statistical agencies are used. Separately, a team of social science researchers review key events in that year with a suitable assessment. The Fund for Peace did not publish its used sources	Scores are calculated on the basis of the CAST framework. This framework is applied on three main inputs; the pre-existing quantitative data sets, content analysis, and qualitative expert analysis. This is triangulated and subjected to critical review to obtain final scores for the Index. Total scores have no scale.	Governance
Environmental Performance Index (EPI)	The Environmental Performance Index (EPI) provides a summary of the state of sustainability. The EPI rankings indicate which countries are best addressing the environmental challenges that every nation faces (Yale University, n.d.)	University of Yale Yale Centre for Environmental Law & Policy	1. Climate Change 2. Environmental Health 3. Ecosystem Vitality	The index is based on different data collected from international organizations, research institutions, academia, produced by a variety in methods: satellite observations, observations from surface monitoring stations, surveys and questionnaires, and more. The list of data sources is included in the Appendix.	The index is a composite index, created by combining and distilling data on 40 critical sustainability issues into a single number that summarises the country level performance. This process involves identifying and cleaning data, translating data into metrics of success, and aggregating individual metrics into an overall composite score. Total scores have no scale.	Environmental
Corruption Perceptions Index (CPI)	The Corruption Perceptions Index is a global corruption ranking that ranks countries and territories around the world by their perceived levels of public sector corruption (Transparency International, 2023)	Transparency International	1. Bribery 2. Diversion of public funds 3. Use of public office for private gain 4. Nepotism in the civil service 5. State capture 6. Mechanisms available to prevent corruption	The index is based on 13 different data sources that capture perceptions of corruption within the past two years. The list of data sources is included in the Appendix	The index aggregates data from the different sources. The data sources are standardised to a scale of 0 – 100 and multiplied by the standard deviation of the CPI in 2012 and then, the mean of the CPI in 2012 is added. A country's CPI score is calculated as the average of all scores available for that country. Total scores are scaled from 0-100.	Governance

Index	Description	Institution	Evaluated Indicators	Data Sources	Methodology	ESG focus
World Press Freedom Index (WPF)	The World Press Freedom Index (WPF) represents the level of press freedom enjoyed by journalists and media in countries and territories (RSF, n.d.)	Reporters without borders (RSF)	1. Political context 2. Legal framework 3. Economic context 4. Sociocultural context 5. Safety	The index is based on the data collected from a quantitative survey of press freedom violations and abuses against journalists, media, and a qualitative study based on responses of hundreds of RSF-selected press freedom experts. RSF did not publish its used sources	A country is evaluated on the five indicators based on the data collected from the surveys. A subsidiary score between 0 – 100 is calculated for each indicator, all the subsidiary scores contribute equally to the global score. Total scores are scaled from 0-100.	Social
Notre Dame GAIN Index (ND-GAIN)	The Notre Dame GAIN Country Index (ND-GAIN) summarizes a country's vulnerability to climate change and other challenges combined with its readiness to improve resilience (University of Notre Dame, n.d.)	University of Notre Dame Notre Dame Global Adaptation Initiative	1. Vulnerability (exposure, sensitivity and adaptive capacity) 2. Readiness (economic, governance and social)	The index is based on different data sources collected from academic literature, consulted scholars, adaptation practitioners and global development experts. The list of data sources is included in the Appendix	Total scores are scaled from 0-100. A country's score is calculated with the following formula: $NDGAIN\ country\ score = (Readiness\ Indicators - Vulnerability\ Indicators + 1) * 50$	Environmental
Human Development Index (HDI)	The Human Development Index (HDI) is a measure of average achievement in key dimensions of human development: a long, healthy life, being knowledgeable and having a decent standard of living (UN, n.d.)	United Nations Development Programme (UNDP)	1. Health dimension 2. Standard of living dimension 3. Education dimension	The index is based on different data collected from international organizations, research institutions, academia produced by a variety in methodology; surveys, academic papers and other indicators. The list of data sources is included in the Appendix	The HDI is the geometric mean of the normalized indices for each of the three dimensions. Total scores are scaled from 0-1.	Social, Governance
Economist Intelligence Unit Democracy Index (EIU)	The Economist Intelligence Unit (EIU) Democracy Index provides a snapshot of the state of democracy in countries (Economist Intelligence Unit, 2023)	Economist Intelligence Unit	1. Electoral process and pluralism 2. Civil liberties 3. Functioning of government 4. Political participation 5. Political culture	The index is based on different data sources collected from experts' assessments and public-opinion surveys. The list of data sources is included in the Appendix.	Each country receives a rating on a zero to ten scale on every indicator. The overall index score per country is the average of the five total category scores. Each country is then grouped into four types of regimes, based on their average score: "full democracies", "flawed democracies", "hybrid regimes" and "authoritarian regimes".	Social, Governance

Note. This table demonstrates an overview of the country-specific ESG indices that are used for the study extracted from the agencies' websites. The list of indices is formed by an analysis of the public (socially responsible) investment policies of Dutch pension funds and are the most commonly used rankings. The list of indices is categorised by how often an index is mentioned by the funds in the policy documents.

Descriptive statistics

To see the distribution by year for each index, boxplots and descriptive statistics are created. Appendix II contains the graphs and tables. Interestingly, most indices have a steady mean and distribution over time. The only indices with outliers are the Notre Dame GAIN index, the World Press Freedom index and the Environmental Performance Index. The outliers are located respectively in a subperiod from 1995-2000, in the full period with the exception of one year and only in year 2022. The outlier analysis is included in Appendix II. As countries can have very low scores when it comes to the different indices, and the outliers are not measurement errors, they are included in the dataset.

All indices are also analysed over the years to see if there is stability over the years. This stability would be an interesting observation, as it would not make any difference in the second part of the research whether to use the 2008 index or the 2020 index. However, not all indices are stable over time. This can be explained by the information available in earlier years of the datasets. Especially in emerging markets, information on certain topics (e.g. human rights) is sometimes scarce, incomplete, and varies from year to year. The year chosen for the index in the second part of the research can therefore not be random and requires a logic reasoning.

Data transformation

To conduct a rank correlation analysis, all the indices have to be comparable. As earlier mentioned, ten country-specific ESG indices are used to do the analysis. All the indices have different numbers of countries included in the dataset, different scales, and different interpretations of scores. The index datasets are summarised in Table 4. To make the datasets comparable, the following transformations are conducted[1].

First, as shown in Table 4, the ITUC Global Rights Index has a score scale of 1 – 5+. To avoid data problems, countries with the highest score (i.e., 5+) have instead of a 5+, a score of 6. If a country has poor institutions as a result of internal war and/or military occupation and a worker has no rights there, it receives a score of 5+ (*GRI*, n.d.). The country performs worse than countries with a score of 5 because it has a greater number of violations and therefore deserves a higher score. Second, considering the understanding of the scores, only the ITUC Global Rights Index and the Fragile States Index have decided to give a low score to the best performing countries and vis-à-vis high score for the worst performing countries. This data is transformed by multiplying with -1 to align the understanding of the scores.

Third, as part of the dataset preparation, each index is transformed from scores to rankings in comparison to the scores from the other countries on the list. The ranking is done equally, not with

[1] The transformation of the data is discussed extensively with data experts at the Dutch National Bank, as there are no papers that carry out a comparable analysis.

average, so that the rank is always a full number (no halves). Moreover, if one country has the same rank as another, the top rank of that set of values is then returned. Thus, countries with the same score will receive the same rank in the dataset.

Fourth, as there are differences in the number of countries per index, the datasets have undergone a normalization procedure whereby the rankings are normalised with a min-max formula where

$$rating = \frac{(X - X_{min})}{X_{difference}}$$

and where $$X_{difference} = X_{max} - X_{min}$$

The normalisation procedure is used to create a dataset with rankings on a scale of 0 – 1. The normalisation was done to align each rating on the same scale.

The normalised dataset contains rankings for 215 countries, both advanced and emerging, from the ten different indices per year. As shown in Table 5, each index has its own number of countries included. Therefore, some countries are not included in a particular index for that year and there is a missing value for that observation. The correlation tests are carried out separately for each pair of ratings in order to reduce the impact of missing values on the tests by using the most observations.

The data from 2020 is primarily used for the analysis, as this is the only year in which every index has data. The rank correlation research is also conducted on the 2021 data. However, the ND-GAIN Index is not included as there is only data available until 2020.

The indices analysed in the rank correlation research are consequently used to construct the different bond portfolios. With different criteria in the scores per ranking, different exclusion strategies are used to construct sovereign bond portfolios. Once the government bond portfolios have been constructed, the final part of the analysis is carried out to finally answer the research question.

Table 5

Overview datasets per rating index

Variables	WGI	FIW	GRI	FSI	EPI	CPI	WPF	ND-GAIN	HDI	EIU
Number of countries included	214	196	148	179	180	181	180	182	191	167
Score scale	1 - 100	1 - 100	1 - 5+	No scale	No scale	0 - 100	0 - 100	0 - 100	0 - 1	0 - 10
Understanding of the score	The higher, the better	The higher, the better	The lower, the better	The lower, the better	The higher, the better	The higher, the better	The higher, the better	The higher, the better	The higher, the better	The higher, the better
Number of years available	10	17	4	16	3	10	21	26	32	14
Years available	2012-2021	2006-2022	2019-2022	2007-2022	2020-2022	2012-2021	2002–2022[a]	1995-2020	1990-2021	2006-2021
Periodicity	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual[b]

Note. This table demonstrates an overview of the datasets per country-specific ESG index. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

[a] The World Press Freedom Index has changed its methodology since 2013. Prior years are not considered in the analysis as it can cause data problems
[b] From 2006 - 2010 the EIU Democracy index was published bi-annually

Part II: Exclusion in sovereign bond portfolio analysis

Data from the JP Morgan EMBI and GBI are extracted from Bloomberg to construct the various sovereign bond portfolios. The dataset includes monthly dollar-denominated returns on sovereign bond indices for 100 countries, both emerging and advanced. The dataset covers the period from 2008 to 2023. The 2008 financial crisis, the sovereign bond crisis and the COVID-19 pandemic are therefore included in the dataset. The list of countries is presented in Appendix 3.

Bond portfolio construction

The analysis is based on 32 portfolios. These portfolios are constructed using different exclusion strategies. Each portfolio contains 20% (equally weighted) emerging market government bonds and 80% (equally weighted) advanced markets government bonds. This allocation is in line with the recommendation of Cha & Jithendranathan (2009). The authors contend that an investor can achieve considerable diversification benefits by holding at least 20% in emerging markets.

As mentioned above, the portfolios are constructed on the basis of different exclusion criteria. The first two portfolios have included the most countries, with the first portfolio including all the 100 countries, the 100% portfolio, and the second portfolio, the 'sanctioned countries excluded' portfolio, including all countries except the sanctioned countries. The list of sanctioned countries is included in Appendix 3. If the restrictive measures against a country include 'freezing of assets and prohibition to make funds available' or 'financial measures' (*EU Sanctions Map,* n.d.), the country is considered a sanctioned country and is excluded from that specific portfolio. The other 30 portfolios are constructed on the basis of the exclusion criteria of the different country-specific ESG indices and the exclusion of sanctioned countries.

The 2020 score of each index is used to exclude countries in the analysis. The 2020 score is chosen for the following reasons. First, 2020 is the only (most recent) year for which all index agencies have provided data (Table 4). Second, earlier years are not considered because of the problem of scarcity and incompleteness of information in some countries, as mentioned above. Third, the methodology of each index has not changed over the period of 2013-2023. Therefore, assuming that the information provided is more complete in the more recent years, combined with the same methodology, it can be assumed that, on average, there is stability. The score in 2020 is therefore a good reference year for the second part of the research, where portfolios are tested over the years.

The portfolios for each rating are constructed according to different criteria of the scored countries, with the exclusion of sanctioned countries. Each rating has a high-rated portfolio, which excludes countries with a score above 0.25, a medium-rated portfolio, which excludes countries with a score above 0.50, and a low-rated portfolio, which excludes only countries with a score above 0.75. In total, each rating has three portfolios with returns from 2008 to 2023.

In order to compare the portfolio performance, the 'sanctioned countries excluded' portfolio is taken as the base case portfolio. As mentioned above, most institutional investors use sanctions as the sole basis for their exclusion strategy in sovereign bonds portfolios. Moreover, in most countries, UN and (if part of) EU sanctions legislation is legally binding and therefore prohibits investment (*European Commission*, n.d.).

Data analysis

Before testing for statistical differences between the portfolios, the normality of the portfolio returns is tested. The normality test is important for the choice of the correct test to determine whether the exclusion has a significant effect on the risk and return of the sovereign bond portfolios. The Shapiro-Wilk test for normality is exercised for each portfolio. The test can detect deviations from normality due to skewness, kurtosis or both. The original Shapiro-Wilk test statistic (Shapiro, 1965) is defined as follows:

$$W = \frac{\left(\sum_{i=1}^{n} a_i y_i\right)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$$

Where y_i is the i[th] order statistic, $\bar{y}$ is the sample mean, and $a_i = (a_1, \ldots, a_n) = \frac{m^T V^{-1}}{(m^T V^{-1} V^{-1} m)^{1/2}}$ and $m_i = (m_1, \ldots, m_n)$, are the expected values of the order statistics of independent and identically distributed random variables drawn from the normal distribution, and V is the covariance matrix of these order statistics (Yap & Sim, 2011).

With the exception of the 100% portfolio, which is non-normal at the 10% significance level, all portfolios are not normally distributed at the 1% significance level. The results of the Shapiro-Wilk test can be found in Appendix 3. A kurtosis and skewness test is also performed to determine the source of the non-normality. All return series are significant for skewness and kurtosis. The results of the skewness and kurtosis tests are given in Appendix 3. The descriptive statistics of the constructed portfolios are also included in Appendix 3.

V. Methodology

Part I: Rank correlation analysis

The rank correlation method is used to examine the coherence between country indices. Due to the non-normal distribution of the indices, non-parametric tests are appropriate. Since the most common method of determining correlation, Pearson's correlation, assumes that the variables are normally distributed, this method is not applicable. The non-parametric tests Spearman's and Kendall's correlation are used because they do not assume any distribution and are appropriate when the variables are measured on an ordinal scale. These methods are therefore appropriate as the index datasets have an ordinal scale and, as shown in Chapter 4, do not have a normal distribution.

Comparing rank correlation methodology to the Pearson correlation coefficient, rank correlation is an approach less susceptive to extreme values. Both Spearman's rank correlations and Kendall's rank correlations are computed for the analysis. To do a robustness check on the results, last stated is used. Both approaches use ranking data to conduct comparable non-parametric tests that assess a monotonic relationship. Spearman's rank correlation test is simpler to calculate and Kendall's rank correlation is more accurate (Gauthier, 2001).

The Pearson's correlation calculated on the ranks and average ranks is comparable to Spearman's (1904) rank correlation (Conover, 1999). Each variable is sorted from lowest to highest independently, and the difference between each set of data is reported. The sum of the square of the difference between rankings will be modest if the data are correlated. The strength of the association is inversely proportional to the size of the aggregate (Gauthier, 2001).

The formula for calculating the Spearman rank correlation coefficient is as follows:

$$r_s = \frac{1 - 6\sum_{i=1}^{n} d_i^2}{n^3 - n}$$

Where d_i is the difference between ranks for each x_i, y_i data pair and n is the number of data pairs.

The Kendall's rank correlation score is also generated for robustness checks. Compared to confidence intervals for Kendall's parameters, Spearman's correlation has less dependable and interpretable confidence intervals (Kendall and Gibbons, 1990).

Kendall's (1938) rank correlation score S is defined as $C - D$, where $C(D)$ is the number of concordant pairs. Let $N = \frac{n(n-1)}{2}$ be the total number of pairs, so that the correlation coefficient is:

$$\tau_a = \frac{S}{N}$$

and

where

$$U = \sum_{i=1}^{N_1} \frac{u_i(u_i - 1)}{2}$$

$$V = \sum_{j=1}^{N_2} \frac{v_j(v_j - 1)}{2}$$

And where N_1 is the number of sets of tied x values, u_i is the number of tied x values in the ith set, N_2 is the number of sets of tied y values, and v_j is the number of tied y values in the jth set (Kendall and Gibbons, 1990) (Becketti, n.d.).

If there are indices that are strongly correlated, additional research is conducted to examine or give a possible explanation for the relationships. For instance, the dataset is filtered on economic status (i.e., emerging market economy or advanced economy) and criteria in scores. To analyse the results based on economic status, the IMF definition on emerging markets and advanced economies is used from the IMF data mapper (Duttagupta, et al., 2021).

Moreover, deeper qualitative research is conducted by comparing the different data sources and methodologies. All the quantitative correlation analysis is iterated with the Kendall's rank correlation methodology.

Part II: Exclusion in sovereign bond portfolio analysis

To test whether exclusion based on different country-specific ESG indices has a significant effect on the risk and return of sovereign bond portfolios, each portfolio's cumulative monthly total returns, annualized returns and standard deviations are compared with the sanctioned countries exclusion strategy or base case portfolio. The difference in returns between 2008 and 2023 is tested by using the Wilcoxon signed rank test. The difference in risk between 2008 and 2023 is tested by using Levene's test for equality of variances. The comparison of financial performance in these tests is preferred to a deeper regression analysis of the relationship between ESG and the risk-return of government bonds for the following reasons. First, a regression analysis of financial performance for sovereign bond portfolios requires several control variables to explain the risk-return relationship of the bonds. As the relationship between the ratings and these control variables is not clear, the risk of omitted variable bias is high. Second, data on the control variables are difficult to obtain for the large sample of countries. Third and finally, the relationship between ESG indices in countries and sovereign bond spread may be minimal. For example, if countries have high levels of public debt due to poor governance, there is unlikely to be money available for ESG ambitions. The relationship may therefore be too tenuous to be priced into the investment decisions of financial market participants. Therefore, to answer the research question, a comparison using the statistical tests is a more practical application of the various country-

specific ESG indices and would therefore be more applicable and the results would be more clear to interpret. The non-normality of the portfolio returns is shown in Chapter 4. Consequently, the test for statistical difference should be non-parametric.

The Wilcoxon signed rank test is a non-parametric test for paired data. The test is more appropriate than the Mann-Whitney-Wilcoxon test because the portfolio returns are not completely independent of each other (Nachar, 2018).

The Wilcoxon signed rank tests whether a random variable D is distributed with median zero. It allows testing whether there is a significant difference between the financial performance of the portfolios before and after an intervention (i.e., exclusion). Furthermore, the test makes an additional assumption to that of the sign test, namely that the distribution of D is symmetric. As mentioned above, the dataset has comparable return series and similar distributions (all including kurtosis and skewness), so this assumption can be made. The Wilcoxon signed rank test has more power and is therefore preferred over the sign test (Harris & Hardin, 2013).

The steps for performing the Wilcoxon signed rank test are as follows:

First, the difference for any pair of observations is computed:

$$d_i = x_{1,i} - x_{2,i}$$

Where d_j denotes the difference for any matched pair of observations for $i = 1, 2, \dots, n$

Then, let $r(|d_i|)$ be the rank assigned to $|d_i|$, the absolute value of the ith difference d_i; for i = 1, 2, … , n (Oyeka & Ebuh, 2012)

Let $Z_i = \begin{cases} 1, & if\ d_i < 0 \\ 0, & if\ d_i < 0 \end{cases}$

Let $\theta = P(Z_i = 1)$

$$T^+ = \sum_{i=1}^{n} Z_i\ r(|d_i|)$$

Where T is the sum of the ranks of the absolute values with positive differences.

$$\mathrm{E}(Z_i) = \theta \text{ and } \mathrm{Var}(Z_i) = \theta(1 - \theta)$$

Hence,

$$\mathrm{E}(T^+) = \mathrm{E}\left(\sum_{i=1}^{n} Z_i\ r(|d_i|)\right) = \sum_{i=1}^{n} r(|d_i|) * \mathrm{E}(Z_i)$$

For simplicity, the assumption is made that $r(|d_i|) = i$ so that $\mathrm{E}(T^+) = \sum_{i=1}^{n} i * \mathrm{E}(Z_i)$

That is,

$$\mathrm{E}(T^+) = \frac{n(n+1)}{2} * \theta$$

$$\mathrm{Var}(T^+) = \mathrm{Var} * ((\sum_{i=1}^{n} i * \mathrm{E}(Z_i)) = \sum_{i=1}^{n} (i^2 * \mathrm{Var}(Z_i)))$$

Since $\mathrm{Cov}(Z_i, Z_j) = 0$, for $i \neq j$, that is

$$\mathrm{Var}(T^+) = \frac{n(n+1)(2n+1)}{6} * \theta(1 - \theta)$$

And the test statistic is given by (Oyeka & Ebuh, 2012)

$$Z = \frac{T^+ - \frac{n(n+1)}{2} * \theta_0}{\sqrt{\frac{n(n+1)(2n+1)}{6} * \theta_0(1 - \theta_0)}}$$

Levene's test is used to test whether there is a significant difference in risk. This test is more suitable than the traditional F-test for the homogeneity of variances and Barlett's generalisation of this test to more samples, as these tests are sensitive to the assumption that the data are distributed normally. Levene's test is robust to non-normality (Tobias, 1998).

The test for $\sigma_x^2 = \sigma_y^2$ is given by

$$F = \frac{s_x^2}{s_y^2}$$

which is distributed as F with $n_x - 1$ and $n_y - 1$ degrees of freedom.

Let X_{ij} be the jth observation of X for the ith group. Let $\mathrm{Z}_{ij} = \left|\mathrm{X}_{ij} - \bar{X}_i\right|$, where $\bar{X}_i$ is the mean of X in the ith group. Levene's test statistic is

$$W_0 = \frac{\sum_i n_i(\bar{Z}_i - \bar{Z})^2/(g-1)}{\sum_i \sum_j (Z_{ij} - \bar{Z}_i)^2 / \sum_i (n_i - 1)}$$

where n_i is the number of observations in group i and g is the number of groups (Tobias, 1998).

Research outline

The research is carried out is as follows. In the first part of the research, the rank correlation between different country-specific ESG indices is calculated using Spearman's correlation coefficient and Kendall's correlation coefficient to determine the relationship between the different country indices. Based on the results of the correlation analysis, additional qualitative research is conducted on the methodology and data sources of the indices. Further correlation research is then carried out based on geographical status and score criteria to provide more explanatory context for the different levels of correlation.

The second part of the research tests the effect of exclusion criteria based on the different country-specific ESG indices in sovereign bond portfolios. For each index, three portfolios are constructed based on different exclusion strategies. The financial performance of these three portfolios are compared with the financial performance of the base case portfolio which includes all the countries, except sanctioned countries. The differences in financial performance are tested for significance using the Wilcoxon signed rank test and Levene's test. The procedure is iterated by looking only at the subset of emerging market sovereign bonds to see if the exclusion effect is driven by the emerging market allocation.

VI. Results

Part I: Rank correlation analysis

The Spearman's rank correlation test results are reported in Table 5. To visualize the strongness of the correlation, a heatmap is also produced. The darkness of a colour represents the level of the correlation. Figure 1 represents the heatmap from the 2020 data. As hypothesized, the coherence in rank between the various country-specific indices on the topics of ESG is high for almost all indices. Moreover, there are many indices that have more than 85% similar ratings with other indices. Interestingly, only the GRI (i.e., ITUC Global Rights Index) has low correlations with the other indices. The low correlation could be explained by the fact that the index is based on a perhaps more subjective methodology, as the score of country is computed based on answers on the ITUC Survey which is answered by experts, such as legal analysts and ITUC affiliates, not based on other data sources (Table 3).

As reported in Table 5, almost all results are significant on a 1%-level. The data from 2021 is also considered in the rank correlation analysis to compare the results between years (without data from Notre Dame GAIN). The results are similar, except for the GRI correlations with other indices. For instance, the rank correlation between GRI and EPI was in 2020 0.17, in 2021 0.40. Moreover, the rank correlation has increased from an average Spearman's correlation coefficient of 0.20 in 2020 to 0.39 in 2021. This is interesting as there is no report of a different methodology or use of extra data sources compared to 2020. The 2021 results are reported in Appendix IV with robustness checks and a heatmap. The Kendall's rank correlation results also show high and significant rank correlation between indices, but in a lesser degree. The results on Kendall's test and corresponding heatmap are reported in Appendix IV. The results are therefore in line with the first hypothesis: the country-specific ESG indices are highly correlated.

Table 6

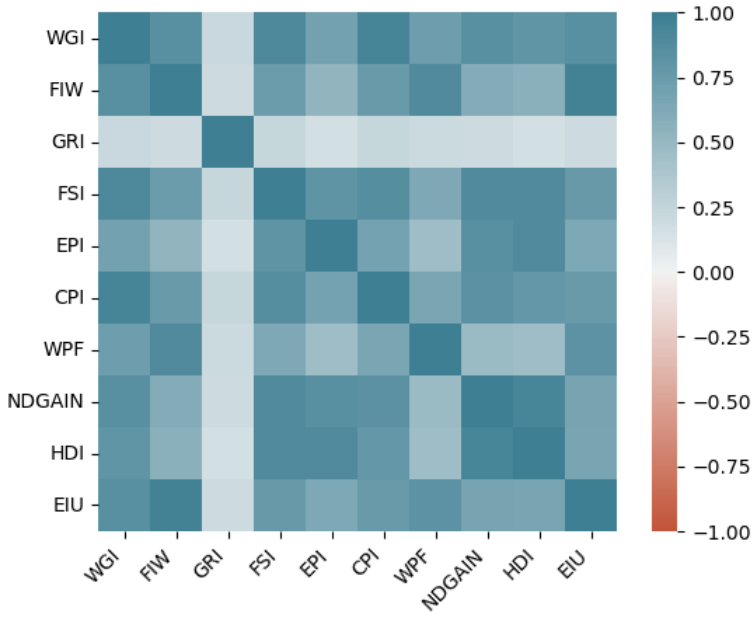
Results Spearman's rank correlation 2020

Index	WGI	FIW	GRI	FSI	EPI	CPI	WPF	ND-GAIN	HDI	EIU
WGI	1.00									
FIW	0.84***	1.00								
GRI	0.22***	0.19**	1.00							
FSI	0.91***	0.75***	0.24***	1.00						
EPI	0.69***	0.53***	0.17**	0.81***	1.00					
CPI	0.95***	0.75***	0.24***	0.86***	0.68***	1.00				
WPF	0.73***	0.90***	0.21**	0.63***	0.47***	0.65***	1.00			
ND-GAIN	0.84***	0.60***	0.19**	0.90***	0.84***	0.84***	0.48***	1.00		
HDI	0.80***	0.57***	0.17**	0.90***	0.89***	0.78***	0.46***	0.94***	1.00	
EIU	0.85***	0.96***	0.19**	0.76***	0.65***	0.76***	0.83***	0.68***	0.66***	1.00

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.
* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Figure 1

Heatmap results Spearman's rank correlation 2020



Note. This figure demonstrates a heatmap of the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020. The colours indicate the hight of the rank correlation. The darker the colour, the higher the correlation. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

High correlated ratings

Continuing the analysis, the indices with the highest correlation are further analysed. Considering the results, four rank correlations are considered as exceptionally high (for Spearman, above 0.9, Kendall's from rounded to 0.8 and up). The highest correlation pairs are summarized in Table 7, with Spearman's and Kendall's coefficient reported horizontally.

The extended analysis is exercised in the following steps: first, the data sources and methodologies are analysed, using Table 4 from Chapter 4. Second, the sample is split into emerging markets and advanced economies to determine whether the correlation is explained by economic status. Third, the sample is split into different groups (i.e., bottom, middle and top) to examine whether the correlation is explained by, for instance, the high performing countries.

Table 7

Combination of Spearman's and Kendall's correlation respectively reported per index

Index	WGI	FIW	GRI	FSI	EPI	CPI	WPF	ND-GAIN	HDI	EIU
FSI	0.91***									
	0.76***									
CPI	0.95***									
	0.82***									
HDI								0.94***		
								0.80***		
EIU		0.96***								
		0.83***								

Note. This table represents the rank correlation results for Spearman's (above) and Kendall's (below) test, respectively, for the pairs of indices that have the highest correlation. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Qualitatively finding an explanation for the high correlations

Comparing the information in Table 4 of the four pairs of indices, three of the four pairs have comparable ESG-focus points. Thus, this could be a logical explanation for high correlated indices. Low performing countries in a democracy index such as EIU, will probably also perform badly in the FSI as comparable indicators are used for the same end. In addition to the focus, there is also coherence in the evaluated indicators. For instance, all the evaluated indicators of the FIW can be summarised into the evaluated indicators from the EIU. In addition, the strong correlation between CPI and WGI can be partly explained by the sixth evaluated indicator of WGI, control of corruption, which is defined as

"Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests." (*World Bank*, n.d.)

The definition captures all the reported evaluation indicators for the CPI as they capture (1) bribery, (2) diversion of public funds, (3) use of public office for private gain, (4) nepotism, (5) state capture and (6) mechanisms available to prevent corruption (*CPI*, n.d.). Also interesting to note is the fact that from the 13 published data sources of the CPI, 8 sources are the same as the used data sources from WGI. Therefore, a high rank correlation seems explainable.

Only the strong relationship between the ND-GAIN, which indicates the level of a country's vulnerability to climate change and other global challenges, and the HDI, which reflects the human development of a country, is not explained by using the same sources or having the same focus of measurement. As the resilience against climate change and the level of human development will have a relationship, it is questionable whether it is such a strong relationship as the level of development does not have a direct effect on a country's vulnerability to climate change, or vice versa.

The qualitative analysis showed some interesting insights and possible explanations to the high correlations. An overview of the qualitative observations are included in Appendix IV. As earlier mentioned, a deeper dive into the characteristic behaviour of the correlations is also interesting and further examined, starting with economic status.

Rank correlations in emerging markets and advanced economies

The change in rank correlation per economic status subset is summarised in Table 8. The subsets include 183 emerging market economies and 32 advanced economies countries. As mentioned earlier, the division of countries is based on the IMF definition on emerging markets and advanced economies (Duttagupta, et al., 2021). The results from the extended analysis per index are also reported in Appendix IV.

Considering the results from the emerging markets sample, the rank correlation has slightly decreased for each pair. Thus, the high rank correlation is not mainly driven by the emerging market countries in the sample but it is still high and significant. Important to note is the fact that, as there is in the world, in the sample, emerging market countries are overrepresented relative to advanced economy countries. One could therefore assume that the rank correlation would be higher in the advanced economies sample, ceteris paribus.

When looking at the advanced economies in the case of WGI/FSI, the rank correlation did not change. This means that the rankings are the same for 91% of the advanced economy countries. This could mean that advanced economies are for 91% equally ranked in the indices, more than the emerging markets countries in the sample. This is an interesting finding given the fact that rank correlation has decreased in the case of WGI/FSI in the emerging markets sample. As both indices focus on the governance of a country, the fact that the high correlation is more present in the subset of advanced economies, is interesting. It could be explained by the higher transparency in governance by advanced economies as they have the means and will to improve ESG. The higher transparency can lead to coherent ratings.

Moreover, the decrease in rank correlation for HDI/ND-GAIN and EIU/FIW, is also important to note. The similarity between ranks of advanced economies countries in the indices has decreased with more than respectively 10 and 20 percent when compared to the original dataset. For the HDI/ND-GAIN ranking this seems logical, as the status of being an advanced economy country typically positively relates to the human development score, it does not necessarily positively relate to the climate vulnerability or the resilience of a country against climate change. For EIU/FIW, a possible reason for the large decrease is more difficult to explain. As both indices are measuring the conditions of political rights and civil liberties (one more focused on democracy than the other), one would suspect that there would be a higher positive relationship between the similarity of the rankings in a sample of advanced economies.

To conclude, the high rank correlation is more present in the emerging markets sample for WGI/CPI, HDI/ND-GAIN and EIU/FIW. For WGI/FSI, the correlation is higher in the advanced economies country scores. The second hypothesis is thus rejected.

Table 8

Change in rank correlation after filtering for economic status

Rank correlation comparison	Change Spearman's (1) and Kendall's (2) correlation emerging markets sample	Change Spearman's (1) and Kendall's (2) correlation advanced economies sample
WGI / FSI	(0.06) (0.09)	0.00 0.00
WGI /CPI	(0.03) (0.05)	(0.07) (0.12)
HDI / ND-GAIN	(0.04) (0.08)	(0.13) (0.18)
EIU / FIW	(0.03) (0.05)	(0.22) (0.28)

Note. This table represents the change in rank correlation results for Spearman's (above) and Kendall's (below) test, respectively, for the pairs of indices that have the highest correlation when looking only at the subsets emerging markets and advanced economies. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

Table 9

Rank correlations in emerging markets sample

Index	WGI	FIW	GRI	FSI	EPI	CPI	WPF	ND-GAIN	HDI	EIU
FSI	0.85***									
	0.67***									
CPI	0.92***									
	0.77***									
HDI								0.90***		
								0.72***		
EIU		0.93***								
		0.78***								

Note. This table represents the rank correlation results for Spearman's (above) and Kendall's (below) test, respectively, for the pairs of indices that have the highest correlation when looking only at the subset emerging markets. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table 10

Rank correlations in advanced economies sample

Index	WGI	FIW	GRI	FSI	EPI	CPI	WPF	ND-GAIN	HDI	EIU
FSI	0.91***									
	0.76***									
CPI	0.88***									
	0.70***									
HDI								0.81***		
								0.62***		
EIU		0.74***								
		0.55***								

Note. This table represents the rank correlation results for Spearman's (above) and Kendall's (below) test, respectively, for the pairs of indices that have the highest correlation when looking only at the subset advanced economies. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Ranking correlation per score performance group

To look whether the high correlation lies more in the different score performance, the data is divided into quartiles where countries with a score lower than or equal to 0.25 are considered as 'high performing', countries with a score higher than or equal to 0.75 are considered as 'low performing', countries with a score between 0.25 and 0.50 are considered as 'medium-high performing' countries and countries with a score between 0.50 and 0.75 are considered as 'medium-low performing' countries. Table 11 displays the results where Spearman's correlation is first reported, followed by Kendall's per pair of indices.

As reported in Table 11, the rank correlations are the highest in the high performing countries quartiles for WGI/FSI, WGI/CPI and HDI/ND-GAIN. One could expect this result considering the fact that for these relationships, the rank correlations were also high in the advanced economy subsample (i.e., Spearman correlation of respectively 0.91, 0.88 and 0.81). Moreover, considering the nature of the governance indices (i.e., WGI, FSI and CPI), advanced economies tend to have a higher level of governance and will thus score higher on the considered indices. Again, the high correlation coefficient for HDI/ND-GAIN is interesting. The correlation coefficient is high in the subset of emerging markets and as the result in Table 11 reports, does the correlation lie more in the top score quartile.

Comparing all the different quartiles with the full sample correlations, the rank correlation is the highest in the 'high-performing' country group in the WGI/FSI, WGI/CPI and HDI/ND-GAIN. Interestingly, for EIU/FIW, the highest correlation lies in the 'low performing' countries. Another interesting observation from Table 12 is the fact that correlation decreases with almost 50% in EIU/FIW in the middle of the samples, so 'medium-high' and 'medium-low' countries. This means that the correlation

is more present in the low and high performing countries. The ratings are much less similar in the middle of the ratings.

Table 11

Rank correlations per score quartiles

Rank correlation comparison	Spearman's (1) and Kendall's (2) correlation in high score quartile (score < 0.25)	Spearman's (1) and Kendall's (2) correlation in mid-high score quartile (0.25 < score < 0.50)	Spearman's (1) and Kendall's (2) correlation in mid-low score quartile (0.50 < score < 0.75)	Spearman's (1) and Kendall's (2) correlation in low score quartile (score > 0.75)
WGI / FSI	0.89*** 0.72***	-0.09 -0.05	0.17 0.11	0.69*** 0.51***
WGI / CPI	0.86*** 0.67***	0.46** 0.32**	0.70*** 0.47***	0.75*** 0.56***
HDI / ND-GAIN	0.83*** 0.63***	0.17 0.11	0.47** 0.33**	0.55*** 0.39***
EIU / FIW	0.68*** 0.48***	0.52*** 0.36***	0.45** 0.32**	0.80*** 0.60***

Note. This table represents the rank correlation results for Spearman's (above) and Kendall's (below) test, respectively, for the pairs of indices that have the highest correlation when looking only at the subsets in score quartiles. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table 12

Difference in rank correlations between full sample and score quartiles subsamples

Rank correlation comparison	Change Spearman's (1) and Kendall's (2) correlation in high score quartile (score < 0.25)	Change Spearman's (1) and Kendall's (2) correlation in mid-high score quartile (0.25 < score < 0.50)	Change Spearman's (1) and Kendall's (2) correlation in mid-low score quartile (0.50 < score < 0.75)	Change Spearman's (1) and Kendall's (2) correlation in low score quartile (score > 0.75)
WGI / FSI	(0.02) (0.04)	-	-	(0.22) (0.25)
WGI / CPI	(0.09) (0.15)	(0.49) (0.50)	(0.25) (0.35)	(0.20) (0.26)
HDI / ND-GAIN	(0.11) (0.17)	-	(0.47) (0.47)	(0.39) (0.41)
EIU / FIW	(0.28) (0.35)	(0.44) (0.47)	(0.51) (0.51)	(0.16) (0.23)

Note. This table represents the difference in rank correlation between the full sample (all scores) and different score quartiles for Spearman's (above) and Kendall's (below), respectively. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

To summarise the results, all indices are strongly correlated. The four most similar pairs of indices are WGI and FSI, CPI and WGI, HDI and ND-GAIN and EIU and FIW. The possible explanations for the four pairs of most similar indices are summarised as follows.

WGI and FSI

The overall rank correlation of the pair is 91%. This high similarity is for 85% represented in the same ranking of emerging market countries; 91% of the advanced economies have the same ranking. The similarity lies mostly in the top quartile of the indices. The high correlation can be explained by the fact that both indices rate countries on governance performance and have therefore very similar evaluated indicators.

CPI and WGI

The indices have a rank correlation of 95%. 92% of the emerging markets countries have the same ranking, 88% of the advanced economy countries are equally rated. Additionally, the similarity lies most in the high performing countries in the indices. The strong coherence can be explained by the fact that both indices are rating countries on the basis of their governance performance, use the same sources and the fact that the evaluated indicators of CPI are fully integrated into the Control of Corruption indicator of WGI.

HDI and ND-GAIN

The HDI and ND-GAIN have a rank correlation of 94%. 90% of the emerging markets countries are similarly ranked, 81% of the advanced economy countries are similarly ranked. Considering the coherence of country scores in the sample, the high and low performing countries are mostly similar. This means that the rankings are especially overlapping at the top and the bottom. The high correlation is not easily explained given the fact that the purpose of rating the countries differs. Moreover, there is no overlap in methodology or use of data sources.

EIU and FIW

The highest rank correlation is between EIU and FIW as the ratings have a correlation of 96%. In the sample, 93% of the emerging markets countries are equally ranked, 74% of the advanced economy countries are equally ranked. The coherence in rankings lies mostly in the low performing countries with the lowest scores. As both ratings measure the level of civil and political rights, the high level of coherence seems explainable, also considering the similar evaluated indicators.

Part II: Exclusion in sovereign bond portfolio analysis

Figure 3 shows the absolute difference in annualised returns against the base case portfolio, i.e. the portfolio without sanctioned countries, over time. Absolute differences are shown because it is useful to look at the change in the difference over time, regardless of whether the difference is negative or positive. Interestingly, the difference in annualised returns increases over the years, with for some portfolios a sharp increase at the beginning of 2017. Figure 4 shows only the high performing portfolios over time. Here, almost all differences show a sharp increase. The sudden increase can be attributed to

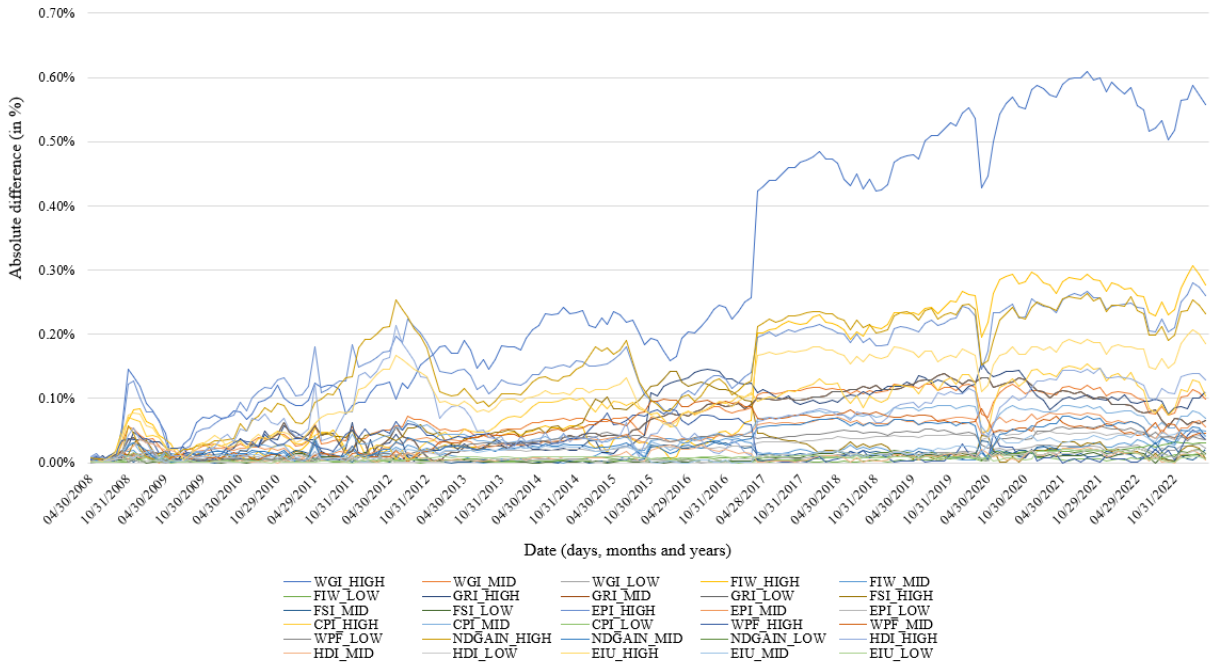
two events. First, interest rates had been gradually rising thanks to the US Federal Reserve. In March 2017, interest rates were raised by 25 basis points (*Federal Reserve issues FOMC statement,* n.d.). This may have led to an increase in the difference. Second, the start of the Brexit negotiations. In April 2017, the Brexit negotiations were officially launched (Street, 2017). Brexit might have an impact, as European countries are over-represented in the high performing portfolios. In the analysis, the sharp increase may have a large impact on the results. Therefore, robustness checks are carried out on the results to check whether the this sharp increase has an impact.

It is also worth noting that the gap narrowed considerably during the Corona crisis. One would expect the gap to widen, as the Corona crisis involved a large increase in risk. However, the annualised returns converged during this period. Finally, the deviation between the 'high WGI strategy' and the base case portfolio stands out among the other differences.

Figure 5 shows the absolute difference in annualised returns of the emerging markets (EM) sample relative to the emerging markets base case portfolio, over time. Notably, the differences are larger and more volatile over time. Again, the pronounced narrowing of the gap during the Corona crisis is evident. Looking at both figures, the differences in annualised returns appear to be driven by the EM sample. However, the low allocation to EM in the full portfolio (only 20%) tends to dampen the magnitude of the differences.

Figure 3

Absolute differences in annualised returns portfolios and base case portfolio over time

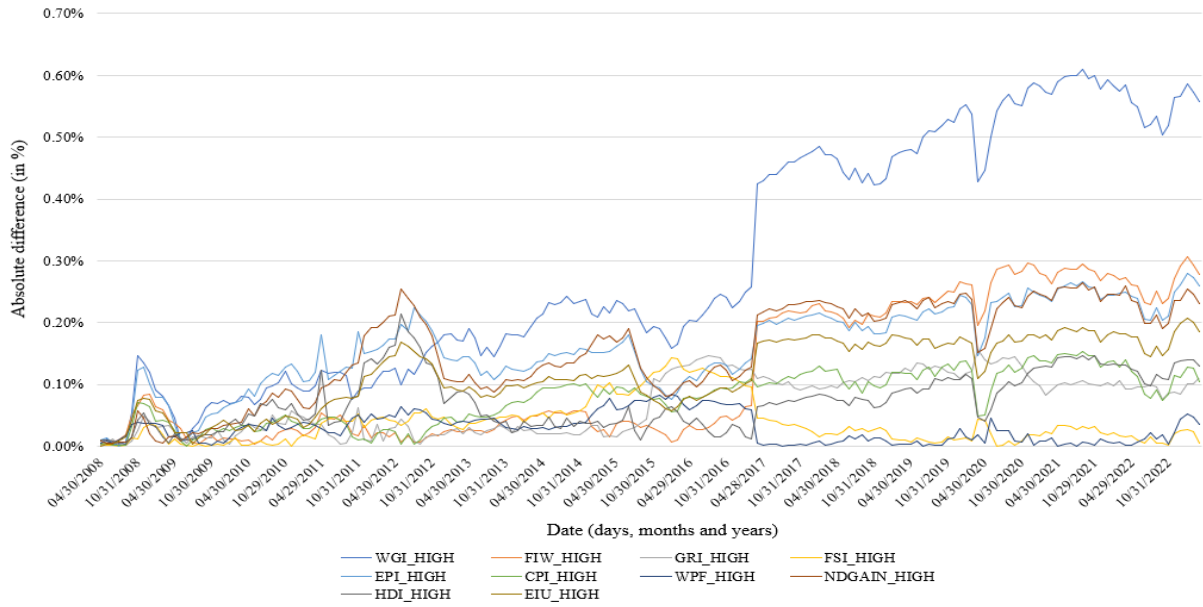


Note. This figure demonstrates a line diagram of the absolute differences in annualised returns between different index portfolios and the base case portfolio, over time. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions

Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

Figure 4

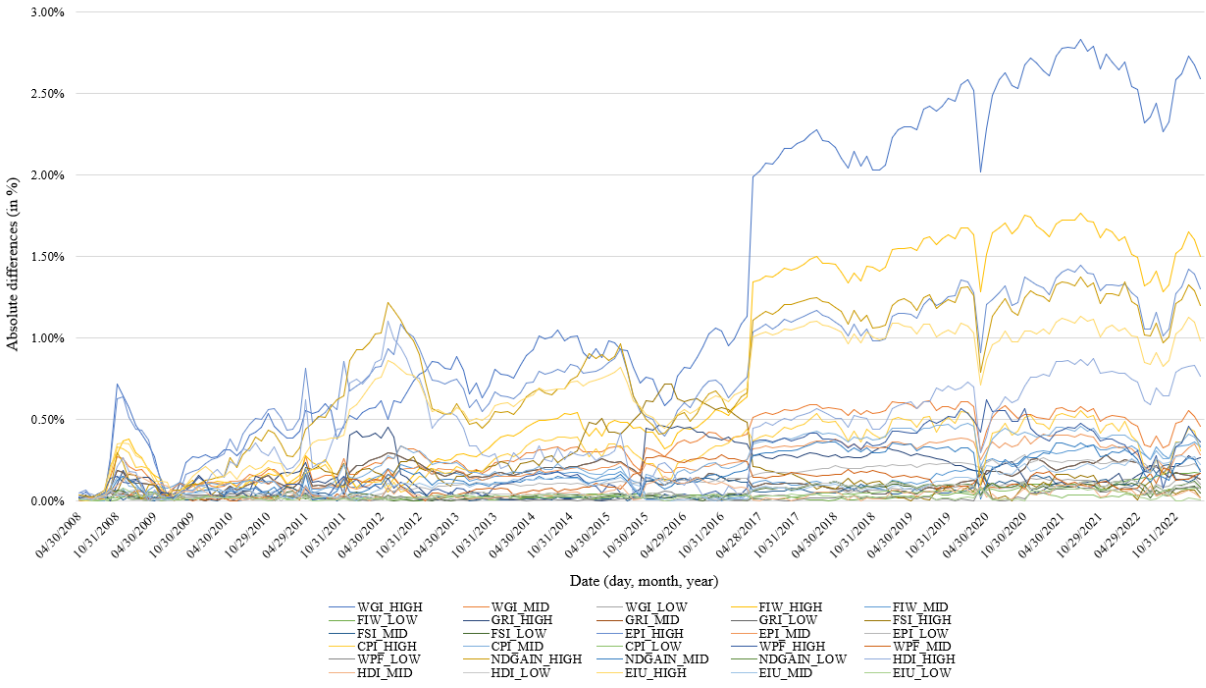
Absolute differences in annualised returns high-performing portfolios and base case portfolio over time



Note. This figure demonstrates a line diagram of the absolute differences in annualised returns between the high performance portfolios of different ratings and the base case portfolio, over time. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

Figure 5

Absolute differences in annualised returns of portfolios and base case portfolio in EM sample over time



Note. This figure demonstrates a line diagram of the absolute differences in annualised returns between the different performance portfolios in the emerging markets subsample of different ratings and the base case portfolio, over time. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN = Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

Table 13 shows the cumulative return, annualised return and standard deviation of the base case portfolio and the 100% portfolio. Wilcoxon signed rank and Levene's test results are also reported on the difference between the return series and variances. As expected, the base case portfolio bears more risk and generates more return. As reported in Table 13, the Wilcoxon signed rank test and Levene's test show a significant difference. Thus, even though many investors are legally required to exclude sanctioned countries, it also has a significant effect on financial performance. The portfolio's annual return increases by 0.55% and the standard deviation, or risk, increases by 0.27%.

Table 13

Results risk-return comparison base case portfolio and 100% portfolio

	Cumulative returns	**Average annualised return**	**Standard deviation**	**Number of bonds in portfolio**
Base case portfolio (exclusion based on sanction law)	60.29%	3.20%	1.26%	91
100% portfolio	48.02%	2.65%	0.99%	100
Difference[a]	**12.27%*** **	**0.55%*** **	**0.27%*** **	9
	Wilcoxon signed rank test		**Levene's test**	
Test statistic	-2.98		0.62	
Degrees of freedom			179	
Prob > |test statistic|	0.00		0.00	

Note. This table represents the cumulative returns, annualised returns, standard deviation and number of bonds in the base case portfolio and 100% portfolio (i.e. no countries excluded). The table also demonstrates the differences between the last said variables and the results from the Wilcoxon signed rank test and Levene's test on significance in difference.

[a] Difference = base case sanctioned portfolio – 100% portfolio
* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Hypothesis testing

The Wilcoxon signed rank test and Levene's test are also performed on the differences between the base case portfolio and the portfolios of the different index-based exclusion strategies. The cumulative returns, annualised returns, standard deviations and number of bonds in both sample portfolios are shown in Appendix V.

Table 14 reports the differences between the variances of the high and low portfolios, with Levene's test results. The portfolios that exclude countries with scores above 0.25 (i.e. the high-portfolios) are not at all less risky than the portfolios that exclude only the low-scoring countries (i.e. the low-portfolios), as shown by the difference in standard deviations per portfolio in Table 14. For example, when looking at the Freedom in the World Index, the high-portfolio has a standard deviation of 1.29%,

while the low-portfolio has a standard deviation of 1.26%. Similarly, when the standard deviations of the different emerging market portfolios by rating are considered in Table 15, the Global Rights Index, the Fragile States Index and the Human Development Index all show lower standard deviations for the low-scored portfolio than for the high-scored portfolio. Moreover, all the test statistics are insignificant. Thus, the high-performing portfolios do not carry significantly less risk than the low-performing portfolios.

For the emerging market countries, the difference in standard deviation is greater than the full portfolio. More specifically, almost all differences are significant. Only the negative differences are insignificant. Thus, in the emerging market sample, almost all of the high-performing portfolios carry significantly less risk than in the low-performing portfolios. This result is therefore consistent with Lazard's (2017) findings that risk differences are particularly strong when looking at developing countries. Consequently, the third hypothesis cannot be rejected.

Examining only the corruption-based index portfolios, derived from the Corruption Perceptions Index (CPI), the observations from the aforementioned papers by Qian (2012) and Union Investment (2014) are consistent with the results in Tables 14 and 15. Excluding all countries that score above 0.25 on the CPI, reduces the standard deviation by 0.06% (Table 14). This reduction is more pronounced when looking at the emerging market sub-sample in Table 15. The standard deviation of the portfolio falls by almost 1% (0.93%) compared to the low-portfolio. This difference is significant and the largest compared to the other indices. Thus, the fourth hypothesis is supported.

Table 14

Results Levene's test on equal variances in high and low portfolios per rating in full sample

Portfolios	Difference in standard deviation	Levene's test statistics on variance equality	P-value
WGI low and high portfolio	0.06%	0.90	0.50
FIW low and high portfolio	-0.03%	1.04	0.80
GRI low and high portfolio	-0.05%	1.07	0.63
FSI low and high portfolio	-0.04%	1.05	0.75
EPI low and high portfolio	0.03%	0.95	0.75
CPI low and high portfolio	0.06%	0.90	0.49
WPF low and high portfolio	0.01%	0.98	0.91
NDGAIN low and high portfolio	0.06%	0.90	0.49
HDI low and high portfolio	-0.01%	1.02	0.90
EIU low and high portfolio	0.04%	0.94	0.70

Note. This table represents the results on Levene's test on variance equality between high and low portfolios of the different ratings. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, NDGAIN = Notre Dame GAIN Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table 15

Results Levene's test on equal variances in high and low portfolios per rating in Emerging Markets sample

Emerging Markets Portfolios	Difference in standard deviation	Levene's test statistics on variance equality	P-value
WGI EM low and high portfolio	**0.70%*** **	0.53	0.00
FIW EM low and high portfolio	**0.36%***	0.76	0.07
GRI EM low and high portfolio	-0.11%	1.07	0.65
FSI EM low and high portfolio	-0.09%	1.07	0.66
EPI EM low and high portfolio	**0.44%** **	0.70	0.02
CPI EM low and high portfolio	**0.93%*** **	0.43	0.00
WPF EM low and high portfolio	**0.40%** **	0.69	0.01
NDGAIN EM low and high portfolio	**0.39%** **	0.74	0.04
HDI EM low and high portfolio	-0.30%	1.23	0.17
EIU EM low and high portfolio	**0.71%*** **	0.56	0.00

Note. This table represents the results on Levene's test on variance equality between high and low portfolios of the different ratings in the emerging markets sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, NDGAIN = Notre Dame GAIN Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

The difference between the cumulative returns and annualised returns of the high and low performing portfolios by rating is shown in Table 16 and in Table 17 for the emerging market sample. When the annualised returns of the high and low performing portfolios by rating are compared, only the 'high-FSI' portfolio has higher cumulative total returns than the 'low-FSI' portfolio. This observation holds for both the full and the emerging market sample. The differences are insignificant. Moreover, with respect to the other indices, the high portfolios all underperform the low portfolios, which is in contradiction to the results of Badia et al. (2019) and the fifth hypothesis. Furthermore, another interesting observation is the difference between the WGI low and high portfolios. This variation is fairly large, also taking into account the variation in Tables 14 and 15. Thus, investing in the WGI high-portfolio strategy performs significantly worse than the WGI low-portfolio.

Table 16

Results Wilcoxon signed rank test on the differences between low and high portfolios per index in full sample

Portfolios	Difference in cumulative returns	Difference in annual returns	Wilcoxon signed rank test statistic	P-value
WGI low and high portfolio	**18.86%*** **	**0.86%*** **	-3.07	0.00
FIW low and high portfolio	8.87%	0.40%	-1.21	0.23
GRI low and high portfolio	1.65%	0.07%	0.43	0.67
FSI low and high portfolio	-0.04%	0.00%	-0.28	0.78
EPI low and high portfolio	**8.03%***	**0.36%***	-1.73	0.08
CPI low and high portfolio	3.33%	0.14%	-1.63	0.10
WPF low and high portfolio	2.59%	0.11%	-0.39	0.69
NDGAIN low and high portfolio	**7.83%***	**0.34%***	-1.74	0.08
HDI low and high portfolio	4.21%	0.19%	-1.00	0.32
EIU low and high portfolio	**6.89%***	**0.3%***	-1.68	0.09

Note. This table represents the results on the Wilcoxon signed rank test on the difference in returns between high and low portfolios of the different ratings. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, NDGAIN = Notre Dame GAIN Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table 17

Results Wilcoxon signed rank test on the differences between low and high portfolios per index in EM sample

Emerging Markets Portfolios	Difference in cumulative returns	Difference in annual returns	Wilcoxon signed rank test statistic	P-value
WGI EM low and high portfolio	**93.15%*** **	**4.01%*** **	-3.05	0.00
FIW EM low and high portfolio	**56.09%***	**2.16%***	-1.83	0.07
GRI EM low and high portfolio	17.82%	0.58%	0.79	0.43
FSI EM low and high portfolio	-1.02%	-0.03%	-0.22	0.83
EPI EM low and high portfolio	**45.95%***	**1.74%***	-1.93	0.05
CPI EM low and high portfolio	14.76%	0.50%	-1.61	0.11
WPF EM low and high portfolio	20.95%	0.70%	-0.61	0.54
NDGAIN EM low and high portfolio	**46.97%***	**1.74%***	-1.74	0.08
HDI EM low and high portfolio	29.57%	1.05%	-1.00	0.32
EIU EM low and high portfolio	**45.36%***	**1.63%***	-1.90	0.06

Note. This table represents the results on the Wilcoxon signed rank test on the difference in returns between high and low portfolios of the different ratings in the emerging markets sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, NDGAIN = Notre Dame GAIN Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Comparison financial performance in full portfolios

Table 18 shows the differences between the base case portfolio and the different exclusion strategy portfolios over the period from 2008 to 2023. Focusing on the differences in returns, only the 'high-

WGI strategy', 'high-EPI strategy' and 'high-CPI strategy' have returns significantly lower than the base case portfolio. This is also where the difference in annual returns to the 'high-WGI strategy' is also the largest. On an annual basis, the 'high-WGI strategy' portfolio earns 0.90% less, but also carries 0.06% less risk. The 'high-CPI strategy' has 0.06% less risk. It is worth noting that the portfolio earns only 0.17% less per year. The difference is therefore small compared to the greater reduction in risk. The 'high-EPI strategy' earns 0.42% less per annum and has 0.02% less risk.

The performance of the other exclusion strategy portfolios is not significantly different. This is an interesting finding as it implies strategies in which a significant number of bonds are excluded do not change financial performance. Thus, the results show that investing in any of the 27 portfolios does not result in a significant difference in financial performance compared to the base case portfolio. Only investing in the 'high-WGI strategy', 'high-EPI strategy' and 'high-CPI strategy' significantly, but minimally, reduces the return of the portfolio.

Table 18

Difference base case with portfolios in cumulative, annualised returns and standard deviations

Ratings	Portfolios	Difference[a] in cumulative returns	Difference[a] in annualised total returns	Difference[a] in standard deviation	Number of bonds in portfolio
World Governance Index Score 2020	High-portfolio Exclusion when score > 0.25	**19.68%*** **	**0.90%*** **	0.06%	27
	Mid-portfolio Exclusion when score > 0.50	3.59%	0.16%	0.04%	54
	Low-portfolio Exclusion when score > 0.75	0.82%	0.04%	0.00%	84
Freedom in the World Index Score 2020	High-portfolio Exclusion when score > 0.25	9.97%	0.45%	-0.03%	26
	Mid-portfolio Exclusion when score > 0.50	1.77%	0.08%	-0.01%	56
	Low-portfolio Exclusion when score > 0.75	1.10%	0.05%	0.00%	77
Global Rights Index Score 2020	High-portfolio Exclusion when score > 0.25	4.04%	0.18%	-0.03%	23
	Mid-portfolio Exclusion when score > 0.50	2.39%	0.11%	0.02%	58
	Low-portfolio Exclusion when score > 0.75	2.39%	0.11%	0.02%	58
Fragile States Index Score 2020	High-portfolio Exclusion when score > 0.25	0.20%	0.01%	-0.05%	38
	Mid-portfolio Exclusion when score > 0.50	-0.79%	-0.03%	-0.01%	60
	Low-portfolio Exclusion when score > 0.75	0.24%	0.01%	-0.01%	78
Environmental Performance Index Score 2020	High-portfolio Exclusion when score > 0.25	**9.36%***	**0.42%***	0.02%	35
	Mid-portfolio Exclusion when score > 0.50	2.05%	0.09%	0.01%	60
	Low-portfolio Exclusion when score > 0.75	1.33%	0.06%	-0.01%	75
Corruption Perceptions Index Score 2020	High-portfolio Exclusion when score > 0.25	**3.81%***	**0.17%***	0.06%	32
	Mid-portfolio Exclusion when score > 0.50	2.52%	0.11%	0.03%	57

World Press Freedom Index Score 2020	Low-portfolio Exclusion when score > 0.75	0.48%	0.03%	0.00%	79
	High-portfolio Exclusion when score > 0.25	1.29%	0.06%	-0.02%	20
	Mid-portfolio Exclusion when score > 0.50	-1.67%	-0.07%	-0.01%	51
Notre Dame GAIN Index Score 2020	Low-portfolio Exclusion when score > 0.75	-1.30%	-0.05%	-0.03%	75
	High-portfolio Exclusion when score > 0.25	8.35%	0.37%	0.05%	34
	Mid-portfolio Exclusion when score > 0.50	1.52%	0.07%	0.02%	57
Human Development Index Score 2020	Low-portfolio Exclusion when score > 0.75	0.52%	0.03%	-0.01%	77
	High-portfolio Exclusion when score > 0.25	4.68%	0.21%	-0.02%	36
	Mid-portfolio Exclusion when score > 0.50	0.13%	0.01%	0.00%	57
Economist Intelligence Unit Index Score 2020	Low-portfolio Exclusion when score > 0.75	0.47%	0.02%	-0.01%	77
	High-portfolio Exclusion when score > 0.25	6.68%	0.30%	0.02%	33
	Mid-portfolio Exclusion when score > 0.50	1.51%	0.07%	-0.01%	59
	Low-portfolio Exclusion when score > 0.75	-0.21%	0.00%	-0.02%	77

Note: This table demonstrates the difference in cumulative returns, average annualised returns, and standard deviations between different exclusion portfolio strategies and the base case portfolio. The stars indicate the significance results in returns from the Wilcoxon signed rank test and the significance results in variances from Levene's test. The last column represents the number of bonds per portfolio.

[a] Difference = base case sanctioned portfolio – exclusion strategy portfolio

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Comparison financial performance in emerging market portfolios

As the cross-country diversity in the portfolio composition of the index exclusion strategies is more pronounced in the emerging market sample than in the advanced economies sample, it is also interesting to look at the differences in the emerging market sample. The cumulative returns, annualised returns, standard deviations and number of bonds in the emerging market portfolios are reported in Appendix V.

Table 19 shows the results for the Emerging Markets (EM) sample. Comparing these results with the differences in the 80%/20% sample, the variation in the return series between the portfolios is more significant. This may suggest that the impact of index-based exclusion strategies on financial performance is driven by the EM countries in the portfolios. In both portfolio samples, the 'high-WGI strategy', the 'high-EPI strategy' and the 'high-CPI strategy' differ significantly in terms of financial performance. Evidently, the effects on financial performance are primarily determined by the proportion of emerging markets in the portfolio construction. Moreover, the difference in returns is 20% weighted in the results, as emerging markets are 20% weighted in the full portfolios. For example, considering the 'high-EPI strategy' in Table 19, 20% of a 2.07% annualised return is 0.41%. This is roughly the same as the 0.42% annualised return difference of the 'high-EPI strategy' for the full sample in Table 18. Considering the difference in standard deviations per index, more deviations are significant. The

risk level of ten portfolios differs significantly from the base case portfolio. Thus, the exclusion of emerging markets from the portfolio on the basis of the different indices has a significant impact on the risk level of some portfolios.

Moreover, the following results stand out. In addition to the significant differences in the 'high-WGI strategy', 'high-EPI strategy' and 'high-CPI strategy' portfolios, the 'high-EIU strategy' and 'high-FIW strategy' portfolios also generate significantly lower returns than the EM base case portfolio. Turning to the differences in standard deviations, the 'high-CPI strategy' portfolio has a significantly lower standard deviation of 0.91%. This EM portfolio is therefore significantly less risky. In addition, similar to the results in Table 19, the 'high-CPI strategy' EM portfolio has a small difference in annual return of 0.61%. This exclusion strategy therefore appears to be an advantageous investment strategy. The Global Rights Index also stands out in the results. The different portfolios are all more risky than the base case portfolio. Therefore, in the case of the emerging markets sub-portfolio, excluding based on the Global Rights Index, does not seem to improve the financial performance in comparison with the base case portfolio.

Despite the fact that there are more significant differences in returns, most of the differences in financial performance are still insignificant. Similarly, index-based exclusion strategies in EM portfolios do not have a large significant impact on the financial performance of government bond portfolios either.

Table 19

Difference EM base case with EM portfolios in average return and variance

Ratings	Emerging Markets Portfolios	Difference[a] in cumulative returns	Difference[a] in annualised total returns	Difference[a] in standard deviation	Number of bonds in portfolio
World Governance Index Score 2020	EM High-portfolio Exclusion when score > 0.25	**99.35%*** **	**4.21%*** **	**0.79%*** **	7
	EM Mid-portfolio Exclusion when score > 0.50	22.13%	0.75%	**0.49%*** **	32
	EM Low-portfolio Exclusion when score > 0.75	6.20%	0.20%	0.09%	59
Freedom in the World Index Score 2020	EM High-portfolio Exclusion when score > 0.25	**63.56%** **	**2.40%** **	**0.33%* **	7
	EM Mid-portfolio Exclusion when score > 0.50	15.53%	0.52%	0.08%	35
	EM Low-portfolio Exclusion when score > 0.75	7.47%	0.24%	-0.01%	55
Global Rights Index Score 2020	EM High-portfolio Exclusion when score > 0.25	11.02%	0.36%	**-0.47%** **	12
	EM Mid-portfolio Exclusion when score > 0.50	-6.80%	-0.22%	**-0.36%* **	41
	EM Low-portfolio Exclusion when score > 0.75	-6.80%	-0.22%	**-0.36%* **	41
Fragile States Index Score 2020	EM High-portfolio Exclusion when score > 0.25	2.87%	0.09%	-0.16%	17
	EM Mid-portfolio Exclusion when score > 0.50	-5.79%	-0.19%	-0.03%	39
	EM Low-portfolio Exclusion when score > 0.75	3.89%	0.12%	-0.07%	56
	EM High-portfolio Exclusion when score > 0.25	**55.93%** **	**2.07%** **	**0.47%** **	14

Environmental Performance Index Score 2020	EM Mid-portfolio Exclusion when score > 0.50	14.99%	0.50%	0.13%	38
	EM Low-portfolio Exclusion when score > 0.75	9.98%	0.33%	0.03%	53
Corruption Perceptions Index Score 2020	EM High-portfolio Exclusion when score > 0.25	**18.27%***	**0.61%***	**0.91%*****	11
	EM Mid-portfolio Exclusion when score > 0.50	16.70%	0.56%	0.25%	35
	EM Low-portfolio Exclusion when score > 0.75	3.51%	0.11%	-0.02%	57
World Press Freedom Index Score 2020	EM High-portfolio Exclusion when score > 0.25	17.37%	0.58%	0.29%	14
	EM Mid-portfolio Exclusion when score > 0.50	-6.99%	-0.23%	-0.03%	30
	EM Low-portfolio Exclusion when score > 0.75	-3.58%	-0.12%	-0.20%	54
Notre Dame GAIN Index Score 2020	EM High-portfolio Exclusion when score > 0.25	**52.23%***	**1.91%***	**0.35%***	12
	EM Mid-portfolio Exclusion when score > 0.50	11.05%	0.36%	0.24%	35
	EM Low-portfolio Exclusion when score > 0.75	5.26%	0.17%	-0.04%	55
Human Development Index Score 2020	EM High-portfolio Exclusion when score > 0.25	34.60%	1.21%	-0.33%	14
	EM Mid-portfolio Exclusion when score > 0.50	2.12%	0.07%	0.15%	35
	EM Low-portfolio Exclusion when score > 0.75	5.03%	0.16%	-0.03%	55
Economist Intelligence Unit Index Score 2020	EM High-portfolio Exclusion when score > 0.25	**44.93%***	**1.61%***	**0.52%*****	12
	EM Mid-portfolio Exclusion when score > 0.50	11.72%	0.39%	0.00%	37
	EM Low-portfolio Exclusion when score > 0.75	-0.43%	-0.02%	-0.20%	55

Note: This table demonstrates the difference in cumulative returns, average annualised returns, and standard deviations between different exclusion portfolio strategies and the base case portfolio in the emerging markets subsample. The stars indicate the significance results in returns from the Wilcoxon signed rank test and the significance results in variances from Levene's test. The last column represents the number of bonds per portfolio.

[a] Difference = base case sanctioned portfolio – exclusion strategy portfolio
* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Robustness check

As mentioned above, the sharp increase in the differences in April 2017 is an interesting and also important observation in the data that could affect the significance of the results. Therefore, to check the robustness of the results, the tests are iterated on two subsets of the data. Table 20 reports the results of the Wilcoxon signed rank test and Levene's test on the differences between the base portfolio and the different exclusion strategy portfolios, and within the portfolios, for the subset period from 2008 to 2016 and for the subset period from mid-2017 to 2023. The tests also show significant results in both periods. However, the results are much less significant in the second period. It is important to note the difference in the number of observations per subset, as the subset for the second period contains fewer years. Nevertheless, the robustness check shows that the results of the previously conducted tests are not mainly driven by the large increase in April 2017, and thus the earlier reported conclusions still hold. The robustness check is also conducted for the subset of

emerging markets. The results are reported in Appendix V and are consistent with the conclusions presented.

Table 20

Robustness check in subsets of data

	Subset 2008-2016				Subset mid 2017-2023			
	Wilcoxon signed rank test		Levene's test		Wilcoxon signed rank test		Levene's test	
Portfolio differences	**z-score**	**p-value**	**Levene's test statistic**	**p-value**	**z-score**	**p-value**	**Levene's test statistic**	**p-value**
Base portfolio - 100% portfolio	**(3.13)*** **	**0.00**	**0.65** **	**0.03**	(0.58)	0.56	**0.60** **	**0.04**
Base portfolio - WGI High	**2.38** **	**0.02**	1.23	0.29	1.34	0.18	1.19	0.48
Base portfolio - WGI Mid	1.55	0.12	1.06	0.77	(0.18)	0.86	1.08	0.74
Base portfolio - WGI Low	0.35	0.73	1.00	0.99	1.31	0.19	1.00	0.99
Base portfolio - FIW High	0.91	0.36	0.92	0.68	0.61	0.54	1.08	0.76
Base portfolio - FIW Mid	(1.04)	0.30	0.99	0.95	0.90	0.37	0.99	0.97
Base portfolio - FIW Low	(0.68)	0.50	1.00	0.99	**1.85** *	**0.06**	0.99	0.96
Base portfolio - GRI High	1.10	0.27	0.89	0.53	0.15	0.88	1.01	0.96
Base portfolio - GRI Mid	1.64	0.10	1.00	0.98	(0.35)	0.73	1.05	0.83
Base portfolio - GRI Low	**1.65** *	**0.10**	1.00	0.98	(0.35)	0.73	1.05	0.83
Base portfolio - FSI High	(0.94)	0.35	0.83	0.35	1.06	0.29	1.05	0.85
Base portfolio - FSI Mid	(0.25)	0.80	0.94	0.74	(0.02)	0.99	1.01	0.95
Base portfolio - FSI Low	(0.31)	0.76	0.95	0.78	0.30	0.76	1.00	0.99
Base portfolio - EPI High	1.48	0.14	0.98	0.93	0.60	0.55	1.11	0.67
Base portfolio - EPI Mid	1.05	0.29	0.97	0.88	0.05	0.96	1.03	0.91
Base portfolio - EPI Low	0.97	0.33	0.97	0.87	0.94	0.33	0.99	0.97
Base portfolio - CPI High	**1.96** **	**0.05**	1.05	0.80	0.47	0.64	1.12	0.63
Base portfolio - CPI Mid	0.49	0.62	1.02	0.93	0.21	0.83	1.06	0.81
Base portfolio - CPI Low	0.07	0.94	0.97	0.89	1.04	0.30	1.00	0.99
Base portfolio - WPF High	(0.85)	0.40	0.94	0.76	0.19	0.85	1.00	1.00
Base portfolio - WPF Mid	**(0.17)***	**0.08**	0.92	0.68	0.24	0.81	1.03	0.90
Base portfolio - WPF Low	**(0.17)***	**0.08**	0.94	0.76	(0.25)	0.80	0.95	0.82
Base portfolio - NDGAIN High	1.28	0.20	1.06	0.78	0.68	0.50	1.15	0.57
Base portfolio - NDGAIN Mid	0.60	0.55	0.98	0.90	0.03	0.97	1.05	0.84
Base portfolio - NDGAIN Low	0.18	0.86	0.95	0.77	0.17	0.86	0.99	0.97
Base portfolio - HDI High	0.09	0.93	0.85	0.41	1.13	0.26	1.09	0.71
Base portfolio - HDI Mid	0.29	0.77	0.94	0.77	0.27	0.79	1.03	0.90
Base portfolio - HDI Low	0.18	0.86	0.95	0.77	0.16	0.87	0.99	0.97
Base portfolio - EIU High	1.28	0.20	1.01	0.96	0.48	0.63	1.05	0.85
Base portfolio - EIU Mid	(0.04)	0.97	0.96	0.82	0.53	0.60	0.98	0.93
Base portfolio - EIU Low	(0.49)	0.63	0.96	0.85	0.49	0.62	0.96	0.85
WGI High – Low	**(2.49)*** **	**0.01**	0.81	0.29	(1.31)	0.19	0.84	0.49
FIW High – Low	(1.02)	0.31	1.08	0.67	(0.32)	0.75	0.92	0.72
GRI High – Low	0.57	0.57	1.12	0.55	(0.36)	0.72	1.04	0.87
FSI High – Low	1.02	0.31	1.14	0.51	(1.35)	0.18	0.95	0.84
EPI High – Low	(1.34)	0.18	0.99	0.94	(0.62)	0.54	0.89	0.64
CPI High – Low	**(1.92)***	**0.06**	0.93	0.70	(0.37)	0.71	0.89	0.62
WPF High – Low	0.07	0.95	1.00	0.99	(0.27)	0.79	0.95	0.82
NDGAIN High – Low	(1.23)	0.22	0.89	0.57	(0.77)	0.44	0.86	0.55
HDI High – Low	(0.04)	0.97	1.11	0.59	(1.19)	0.23	0.91	0.69
EIU High – Low	(1.42)	0.16	0.95	0.81	(0.43)	0.67	0.91	0.71

Note. This table demonstrates the robustness check of the tests where the Wilcoxon signed rank test and Levene's test are done on two period subsets of the dataset to check whether the results are influenced by the large increase in differences in 2017. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, NDGAIN = Notre Dame GAIN Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

VII. Conclusion

ESG integration in sovereign bond portfolios is not as common as one might expect, despite the growing academic research and practical application in the SRI industry. Therefore, it is interesting and important to study the use of ESG integration and its financial impact in sovereign bond portfolios. This thesis has investigated the ESG-integrated exclusion strategy in sovereign bond portfolios. By analysing and using different country-specific ESG-indices, the financial performance of exclusion strategies in sovereign bond portfolios is tested to answer the following research question:

"What is the effect of ESG-based exclusion of countries on the risk-return relationship of sovereign bond portfolios?"

Part I: Rank correlation analysis

The study was divided into two parts. First, the relationship between different country-specific ESG indices was examined using correlation tests. Since countries with a high level of human development are expected to have better press freedom circumstances, the first hypothesis implied a high degree of coherence between different indices. The second hypothesis extended the first by taking into account a country's economic status. The second hypothesis assumed that coherence might be higher in advanced economies. The results of the correlation analysis show a high correlation between all the indices, thus maintaining the first hypothesis. However, the high correlation is less pronounced in the sub-sample of advanced economies, rejecting the second hypothesis.

Part II: Exclusion in sovereign bond portfolio analysis

The second part of the research tested the performance of different index-based exclusion strategy portfolios. Different portfolios were compared in terms of returns and variances in order to examine the different financial consequences of exclusion strategies. The third hypothesis was that, given the individual indices, high-performing portfolios would be less risky than low-performing portfolios, especially in the emerging market subsample. Index-based portfolios that include only the best performing countries are not significantly less risky than portfolios that exclude only the worst performing countries. It is only in the emerging market sample that almost all of the high-performing portfolios are significantly less risky than the low-performing portfolios. Thus, the third hypothesis is only partially rejected. Looking only at the corruption index, the fourth hypothesis was tested based on Qian's (2012) finding that corruption significantly increases risk. The results were consistent with the fourth hypothesis, as the high-performing portfolios on corruption (low corruption levels) had significantly less risk than the low-performing portfolios on corruption.

Zooming out and looking at all different constructed portfolios, the fifth hypothesis predicted that the highest ESG-ranked portfolios would outperform the lowest ESG-ranked portfolios. The results were not consistent with this prediction as for almost all indices, the high-ranked portfolio underperformed

the low-ranked portfolio. Only for the portfolios based on the Fragile States Index did the high-ranked portfolio outperform the low-ranked portfolio.

Looking at the overall performance of the constructed portfolios, the differences in financial performance between the base case portfolio and the exclusion strategies portfolios are almost all insignificant. Focusing on the emerging market subset of the portfolio increases the size and the number of significant differences between the base case portfolio and the other exclusion strategy portfolios. The variation in financial performance is thus mainly driven by the emerging markets in the full portfolio. Some of the exclusion strategies in the emerging market portfolios have a significant impact on the returns, while others have a significant impact on the risk profile. Overall, with the exception of the Global Rights Index, excluding emerging markets on the basis of index scores results in the portfolio taking on less risk and generating lower returns.

Answering the research question

In conclusion, country-specific ESG indices are closely related, as the correlation between the indices is high. In addition, overall, exclusion strategies based on these country-specific ESG indices do not have a significant impact on the financial performance of sovereign bond portfolios. There are significant differences, these are mainly driven by the emerging market subset of the portfolio. However, given the small allocation to emerging markets in the portfolios, the magnitude of the effect is small enough to suggest that there are no meaningful return or risk costs associated with implementing these strategies. The answer to the research question on what the effect is of ESG-based exclusion strategies of countries on the risk-return relationship is thus, that overall, there is no significant effect on the financial performance by applying ESG-based exclusion strategies of countries in sovereign bond portfolios. This thus supports the practical applicability of exclusion strategies in sovereign bond portfolios based on country-specific ESG indices.

Practical implications

Looking at the first part of the study, the high coherence of indices has an important practical implication when using different index criteria to construct sovereign bond portfolios. As most indices are highly correlated, the inclusion of an additional ESG index criterion in portfolio construction may not add the desired value to the ESG score of the portfolio. It is therefore advisable to compare the different indices using the methodologies, data sources and the correlation analysis provided to create a combination of desired ESG country exclusion criteria with the maximum impact. For example, the Global Rights Index is the only index that has a low correlation with the other indices. This index, in combination with another, can add more desired value to the ESG-score of the portfolio, as there is little coherence. The results of the second part of the research provide support for the exclusion strategies in sovereign bond portfolios. The results suggest that there are no substantial financial consequences of excluding countries. However, an important caveat is that the results are based on historical data and

are therefore not predictive of the future. There is also a general practical implication for investors to consider. The results show that when it comes to excluding countries, emerging markets have a considerable impact on the risk reduction of the portfolio after excluding them from the portfolio. Implementing some of the proposed exclusion strategies will exclude various countries from external financing. As an investor's social responsibility lies in its social morality, economic inequality should also be a factor to consider.

Additional research

As the study is done in two parts and the area is relatively unexplored, there is a lot of potential for additional research. Regarding the index correlation analysis, it would be interesting to look at the autocorrelation of each index over time to test whether the assumption of consistency in the rating of countries in the indices from 2020 onwards is true. In addition, this study constructs portfolios on the basis of only one index, whereas it could also be interesting to look at a combination of indices for portfolio construction. Looking at the second part of the study, the sovereign bond portfolios can be constructed using a more advanced optimalisation methodology and therefore not only be based on equal weighting. Moreover, the performance of the portfolios can be predicted in the future using more advanced statistical methods (i.e. multivariate regression analysis, machine learning techniques). Lastly, it would also be interesting to look whether there is a relationship between the ESG-rating and the sovereign bond spread using regression analysis.

As the field of ESG investing continues to evolve through contributions from both academics and practitioners, the integration of ESG into sovereign bond portfolios is underexposed and not as widely applied as expected. Society wants investors to influence corporate responsibility and change in the morality of doing business. Why stop there and not try to influence the social responsibility of countries?

VIII. References

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Appendix I: published data sources per rating

Table A1.1

Published data sources World Bank Governance Indicators Index

Code	Source	Type	Public	Country Coverage
ADB	African Development Bank Country Policy and Institutional Assessments	Expert (GOV)	Partial	53
AFR	Afrobarometer	Survey	Yes	19
ASD	Asian Development Bank Country Policy and Institutional Assessments	Expert (GOV)	Partial	29
BPS	Business Enterprise Environment Survey	Survey	Yes	27
BTI	Bertelsmann Transformation Index	Expert (NGO)	Yes	125
CCR	Freedom House Countries at the Crossroads	Expert (NGO)	Yes	62
DRI	Global Insight Global Risk Service	Expert (CBIP)	Yes	144
EBR	European Bank for Reconstruction and Development Transition Report	Expert (GOV)	Yes	29
EIU	Economist Intelligence Unit Riskwire & Democracy Index	Expert (CBIP)	Yes	181
FRH	Freedom House	Expert (NGO)	Yes	197
GCB	Transparency International Global Corruption Barometer Survey	Survey	Yes	80
GCS	World Economic Forum Global Competitiveness Report	Survey	Yes	134
GII	Global Integrity Index	Expert (NGO)	Yes	79
GWP	Gallup World Poll	Survey	Yes	130
HER	Heritage Foundation Index of Economic Freedom	Expert (NGO)	Yes	179
HUM	Cingranelli Richards Human Rights Database and Political Terror Scale	Expert (GOV)	Yes	192
IFD	IFAD Rural Sector Performance Assessments	Expert (GOV)	Yes	90
IJT	iJET Country Security Risk Ratings	Expert (CBIP)	Yes	185
IPD	Institutional Profiles Database	Expert (GOV)	Yes	85
IRP	IREEP African Bectoral Index	Expert (NGO)	Yes	53
LBO	Latinobarometro	Survey	Yes	18
MSI	International Research and Exchanges Board Media Sustainability Index	Expert (NGO)	Yes	76
OBI	International Budget Project Open Budget Index	Expert (NGO)	Yes	85
PIA	World Bank Country Policy and Institutional Assessments	Expert (GOV)	Partial	142
PRC	Political Economic Risk Consultancy Corruption in Asia Survey	Survey	Yes	15
PRS	Political Risk Services International Country Risk Guide	Expert (CBIP)	Yes	140
RSF	Reporters Without Borders Press Freedom Index	Expert (NGO)	Yes	170
TPR	US State Department Trafficking in People report	Expert (GOV)	Yes	153
VAB	Vanderbilt University Americas Barometer	Survey	Yes	23
WCY	Institute for Management and Development World Competitiveness Yearbook	Survey	Yes	55
WMO	Global Insight Business Conditions and Risk Indicators	Expert (CBIP)	Yes	203

Note. This table demonstrates the public data sources that are used to construct the World Bank Governance Indicators

Table A1.2

Published data sources Environmental Performance Index Yale University

Code	Source	Data type
AMP	World Database on Protected Areas. Flanders Marine Institute Maritime Boundaries Geodatabase. World EEZ. version 9	Total area of all Marine Protected Areas in a country
APR	Meggi et al. (2019)	Pesticide application rate
BHV	Commonwealth Scientific and Industrial Research Organization	Biodiversity Habitat Index – Vascular Plants
BLC	Community Emissions Data Systems	Black Carbon Emissions [Gg]
CDL	Mullion Group	CO2 emissions from land cover change
CDO	Potsdam Institute for Climate Impact Research	CO2 emissions [Gg]. excluding land use and forestry
CH4	Potsdam Institute for Climate Impact Research	Methane emissions [Gg]
COE	Copernicus Atmosphere Monitoring Service	CO exposure
CTH	Sea Around Us	Fish catch [tonnes]
CXN	UNSD	Proportion of population connected to wastewater system
CXN	OECD	Proportion of population connected to wastewater system
CXN	Eurostat	Proportion of population connected to wastewater system
CXN	Malik et al. (2015)	Proportion of population connected to wastewater system
EEZ	World Database on Protected Areas	Total area of all Economic Exclusion Zones in a country
EXG	World Bank	Exports of goods and services (% of GDP)
FTD	Sea Around Us	Fish catch by trawling and dredging [tonnes]. by EEZ and gear type
FOG	Potsdam Institute for Climate Impact Research	F-gasses emissions [Gg CO2-eq.]
FSS	Sea Around Us	Fish stock status [%]
GDP	World Bank	GDP [PPP. constant 2017 international $]
GDP	IMF	GDP [PPP. constant international $]
GL5	Copernicus	Gross loss in Grassland area over five-year interval
GOE	Worldwide Governance Indicators	Government Effectiveness
GRA	Copernicus	Grassland area [km2]
HAD	Institute for Health Metrics and Evaluation	Household Air Pollution [DALY rate]
IEF	Heritage Foundation	Index of Economic Freedom
LDA	World Database on Protected Areas	Land area (sq. km)
MAG	World Bank	Exports of goods and services (% of GDP)
MSW	Wiedinmyer et al. (2013)	Sustainably controlled solid waste
MSW	What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050	Sustainably controlled solid waste
MSW	Lebreton and Andrady (2019)	Sustainably controlled solid waste
MSW	Jambeck et al. (2015)	Sustainably controlled solid waste
MSW	Law et al. (2020)	Sustainably controlled solid waste
NOE	Copernicus Atmosphere Monitoring Service	NOx exposure
NOT	Potsdam Institute for Climate Impact Research	N2O emissions [Gg]
NOx	Community Emissions Data Systems	NOx emissions [Gg]
OCP	Chen et al. (2020)	Marine plastic pollution emissions
OCP	Borelle et al. (2020)	Marine plastic pollution emissions
OCP	Meijer et al. (2021)	Marine plastic pollution emissions
OZD	Institute for Health Metrics and Evaluation	Ozone [DALY rate]
PAR	Commonwealth Scientific and Industrial Research Organization	Protected Areas Representativeness Index
PBD	Institute for Health Metrics and Evaluation	Lead Exposure [DALY rate]
PMD	Institute for Health Metrics and Evaluation	Ambient PM2.5 [DALY rate]

PST	Tang et al. (2021)	Pesticide risk score
POP	World Bank	Population
POP	IMF	Population
REC	Chen et al. (2020)	Recycling rate
RMS	Sea Around Us	Slope of RMTI from peak year to 2018
ROL	Worldwide Governance Indicators	Rule of Law
RQU	Worldwide Governance Indicators	Regulatory Quality
SEG	World Bank	Services. value added (pct of GDP)
SHI	Map of Life	Species Habitat Index
SNM	University of Maryland Center for Environmental Science	Sustainable Nitrogen Management Index
SO2	Community Emissions Data Systems	SO2 emissions [Gg]
SOE	Copernicus Atmosphere Monitoring Service	SO2 exposure
SPI	Map of Life	Species Protection Index
TCA	Global Forest Watch	Tree cover area (30% canopy cover)
TCL	Global Forest Watch	Tree cover loss. annual (30% canopy cover)
TEW	World Wildlife Fund	Areas of biomes
TPA	World Database on Protected Areas	Terrestrial protected areas
USD	Institute for Health Metrics and Evaluation	Unsafe Sanitation [DALY rate]
UWD	Institute for Health Metrics and Evaluation	Unsafe Water [DALY rate]
VOE	Copernicus Atmosphere Monitoring Service	Volatile organic compound exposure
WL5	Copernicus	Gross loss in Wetland area over five-year interval (km2)
WST	UNSD	Proportion of wastewater collected that is treated
WST	OECD	Proportion of wastewater collected that is treated
WST	Eurostat	Proportion of wastewater collected that is treated
WST	Malik et al. (2015)	Proportion of wastewater collected that is treated
WTA	Copernicus	Wetland area [km2]

Note. This table demonstrates the public data sources that are used to construct the Yale University Economic Performance Index

Table A1.3

Published data sources Corruption Perceptions Index 2020

Source
African Development Bank Country Policy and Institutional Assessment 2018
Bertelsmann Stiftung Sustainable Governance Indicators 2020
Bertelsmann Stiftung Transformation Index 2020
Economist Intelligence Unit Country Risk Service 2020
Freedom House Nations in Transit 2020
Global Insight Country Risk Ratings 2019
IMD World Competitiveness Center World Competitiveness Yearbook Executive Opinion Survey 2020
Political and Economic Risk Consultancy Asian Intelligence 2020
The PRS Group International Country Risk Guide 2020
World Bank Country Policy and Institutional Assessment 2019
World Economic Forum Executive Opinion Survey 2019
World Justice Project Rule of Law Index Expert Survey 2020
Varieties of Democracy (V-Dem v. 12) 2020

Note. This table demonstrates the public data sources that are used to construct the Transparency International Corruption Perceptions Index

Table A1.4

Published data sources Notre Dame GAIN index

Source	Data source	Country coverage
Earth System Grid Federation	Projected change of agricultural cereal yield	189
World Bank Health Nutrition and Population Statistics (HNPStats)	Projected population change	191
FAOSTAT	Food import dependency	169
WDI	Rural population	191
FAOSTAT	Agriculture capacity	181
WDI	Agriculture capacity	181
WDI	Child malnutrition	137
World Resource Institute	Projected change of annual runoff	168
Portmann et al. (2013)	Projected change of annual groundwater recharge (GWR)	178
AQUASTAT	Freshwater withdrawal rate	163
AQUASTAT	Water dependency ratio	186
AQUASTAT	Dam capacity	186
WDI	Access to reliable drinking water	187
Ebi (2008)	Projected change of deaths from climate change induced diseases	186
Caminade. et al. (2014)	Projected change in vector-borne diseases due to changes in length of transmission season (LTS)	192
WHO	Projected change in vector-borne diseases due to changes in length of transmission season (LTS)	192
WDI	Dependency on external resource for health services	179
MDG indicators	Slum population	83
WDI	Medical staffs	190
WDI	Access to improved sanitation facilities	186
Gonzalez et al. (2010)	Projected change of biome distribution	168
Chueng et al. (2009)	Projected change of marine biodiversity	192
World Bank	Natural capital dependency	148
National Footprint Accounts 2010 edition	Ecological Footprint	151
Environmental Performance Index	Protected Biomes	176
Environmental Treaties and Resource Indicators	Engagement in international environmental conventions	198
WSDI	Projected change of warm periods	192
Rx5day	Projected change of flood hazard	192
WDI	Urban concentration	192
UN Urbanization Prospects: the 2011 revision	Urban concentration	192
WDI	Age dependency ratio	181
WDI	Quality of trade and transport infrastructure	162
WDI	Paved roads	180
Hamududu & Kilingtveit (2012)	Projected change of hydropower generation capacity	125
Dependency on hydropower	Projected change of hydropower	125

	generation capacity	
1 arc-minute global relief model of Earth's surface. integrating land topography and ocean bathymetry	Projected change of sea level rise impacts	192
WDI	Dependency on imported energy	133
WDI	Population living under 5m above sea level	190
WDI	Electricity access	117
HFA National Progress	Disaster preparedness	136
Doing Business Index	Ease of doing business index	136
WGI Political stability and Absence of Violence/Terrorism: Estimate	Political stability and non-violence	191
WGI Political stability and Absence of Violence/Terrorism: Estimate	Control of corruption	189
WGI Regulatory quality: Estimate	Regulatory quality	189
WGI Rule of Law: Estimate	Rule of law	191
MDG indicators	Social inequality	149
WDI	Information Communication Technology (ICT) infrastructure	192
ITU	Information Communication Technology (ICT) Infrastructure	192
WDI	Education	176
WDI	Innovation	126

Note. This table demonstrates the public data sources that are used to construct the Notre Dame GAIN Index

Table A1.5

Published data sources Human Development Index

Source	**Data source**
UNDESA	Life expectancy at birth
CEDLAS	Expected years of schooling
ICP Macro Demographic and Health Surveys	Expected years of schooling
UNESCO Institute for Statistics	Expected years of schooling
United Nations Children's Fund	Expected years of schooling
Barro and Lee (2018)	Mean years of schooling
ICF Macro Demographic and Health Surveys	Mean years of schooling
OECD	Mean years of schooling
UNESCO Institute for Statistics	Mean years of schooling
UNICEF Multiple Indicator Cluster Surveys	Mean years of schooling
IMF	GNI per capita
UNDESA	GNI per capita
United Nations Statistics Division	GNI per capita
World Bank	GNI per capita

Note. This table demonstrates the public data sources that are used to construct the United Nations Human Development Index

Table A1.6

Published data sources Economist Intelligence Unit Democracy Index

Sources
World Values Survey
Eurobarometer Surveys
Gallup Polls
Asian Barometer
Latin American Barometer
National Surveys

Note. This table demonstrates the public data sources that are used to construct the Economist Intelligence Unit Democracy Index

Appendix II: Data analysis research part I

A. World Governance Indicators

Table A2.1

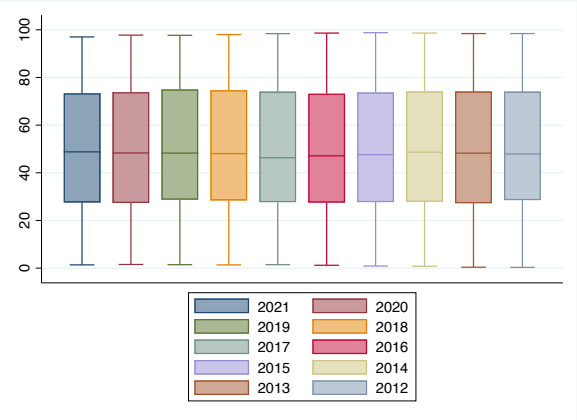
Summary statistics World Governance Indicators rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2012	214	50.13	26.78	0.31	98.43
2013	214	50.14	26.82	0.39	98.43
2014	211	50.38	26.65	0.80	98.62
2015	211	50.38	26.73	0.88	98.79
2016	211	50.36	26.76	0.21	98.63
2017	211	50.39	26.80	0.15	98.39
2018	213	50.59	26.90	0.14	98.00
2019	213	50.56	26.88	1.44	97.69
2020	213	50.56	26.88	1.52	97.76
2021	213	50.57	26.87	1.36	97.00

Note. This table demonstrates the summary statistics from the World Bank Governance Indicators dataset

Figure A2.1

Boxplot World Governance Indicators rating data



Note. This figure demonstrates the boxplot from the World Bank Governance Indicators dataset where the distribution of the data is visualised

B. Freedom in the World Index

Table A2.2

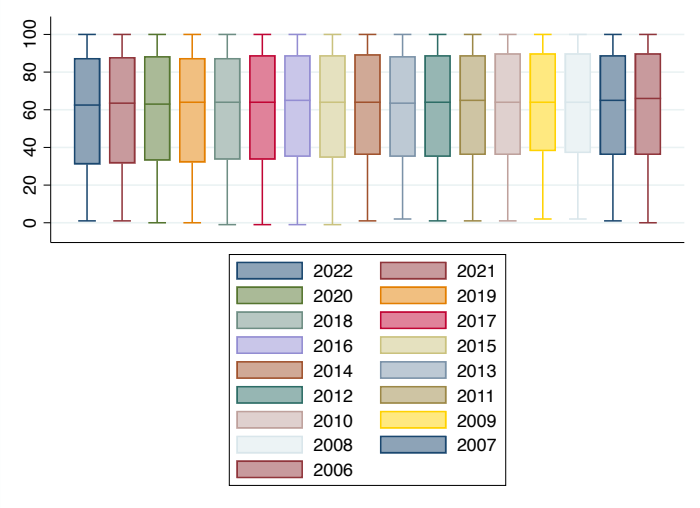
Summary statistics Freedom in the World Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2006	194	62.34	28.77	0	100
2007	195	62.32	28.69	1	100
2008	195	62.09	28.70	2	100
2009	195	61.95	28.71	2	100
2010	195	61.48	28.95	1	100
2011	195	61.43	29.07	1	100
2012	196	61.35	29.05	1	100
2013	196	61.14	29.00	2	100
2014	196	61.11	29.10	1	100
2015	196	60.89	29.43	-1	100
2016	196	60.61	29.59	-1	100
2017	196	60.09	29.81	-1	100
2018	196	59.71	29.86	-1	100
2019	196	59.42	30.00	0	100
2020	196	59.16	29.95	0	100
2021	196	58.68	30.24	1	100
2022	196	58.14	30.69	1	100

Note. This table demonstrates the summary statistics from the Freedom in the World Index dataset

Figure A2.2

Boxplot Freedom in the World Index data



Note. This figure demonstrates the boxplot from the Freedom in the World dataset where the distribution of the data is visualised

C. ITUC Global Rights Index

Table A2.3

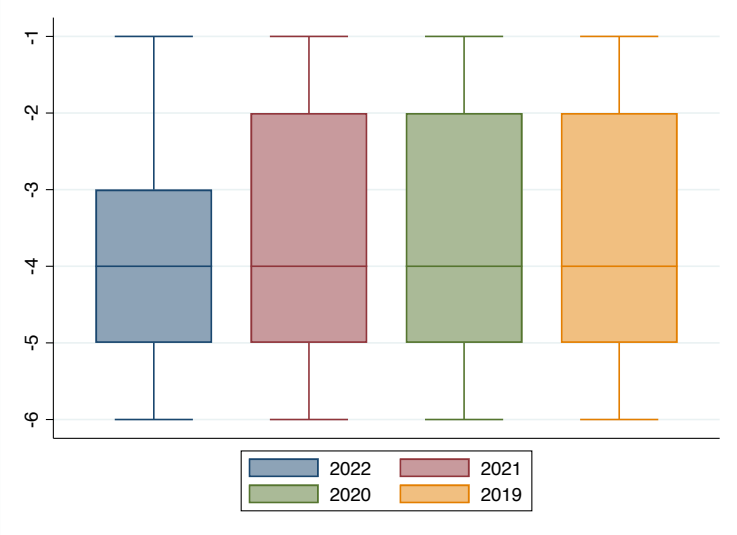
Summary statistics ITUC Global Rights Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2019	141	-3.60	1.40	-6	-1
2020	142	-3.56	1.40	-6	-1
2021	148	-3.57	1.38	-6	-1
2022	148	-3.62	1.36	-6	-1

Note. This table demonstrates the summary statistics from the ITUC Global Rights Index dataset

Figure A2.3

Boxplot ITUC Global Rights Index data



Note. This figure demonstrates the boxplot from the ITUC Global Rights Index dataset where the distribution of the data is visualised

D. Fragile States Index

Table A2.4

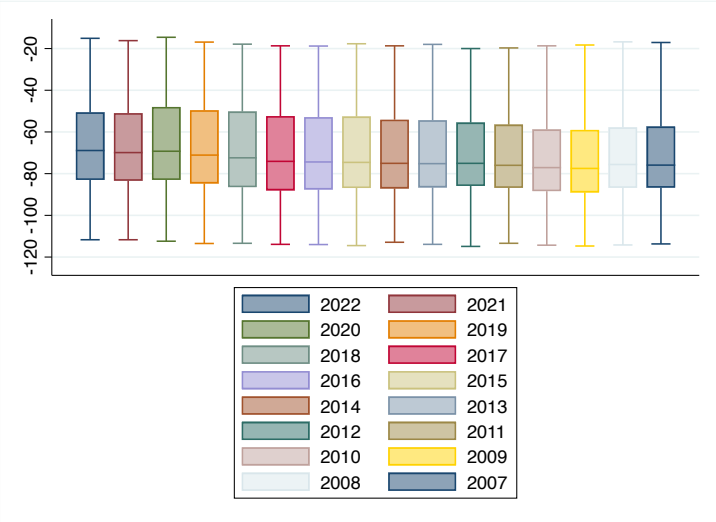
Summary statistics Fragile States Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2007	177	-70.56	23.10	-113.70	-17.10
2008	177	-70.86	23.25	-114.20	-16.80
2009	177	-72.07	23.25	-114.70	-18.30
2010	177	-71.87	23.15	-114.30	-18.70
2011	177	-71.10	22.82	-113.40	-19.70
2012	178	-70.88	22.71	-114.90	-20.00
2013	178	-70.49	23.58	-113.90	-18.00
2014	178	-70.58	23.21	-112.90	-18.70
2015	178	-70.19	24.00	-114.50	-17.70
2016	178	-70.30	24.22	-114.00	-18.80
2017	178	-69.89	24.09	-113.90	-18.70
2018	178	-68.63	24.21	-113.40	-17.90
2019	178	-67.25	24.10	-113.50	-16.90
2020	178	-65.93	24.20	-112.40	-14.60
2021	179	-66.86	23.52	-111.70	-16.20
2022	179	-66.12	23.73	-111.70	-15.10

Note. This table demonstrates the summary statistics from the Fragile States Index dataset

Figure A2.4

Boxplot Fragile States Index data



Note. This figure demonstrates the boxplot from the Fragile in the States Index dataset where the distribution of the data is visualised

E. Environmental Performance Index

Table A2.5

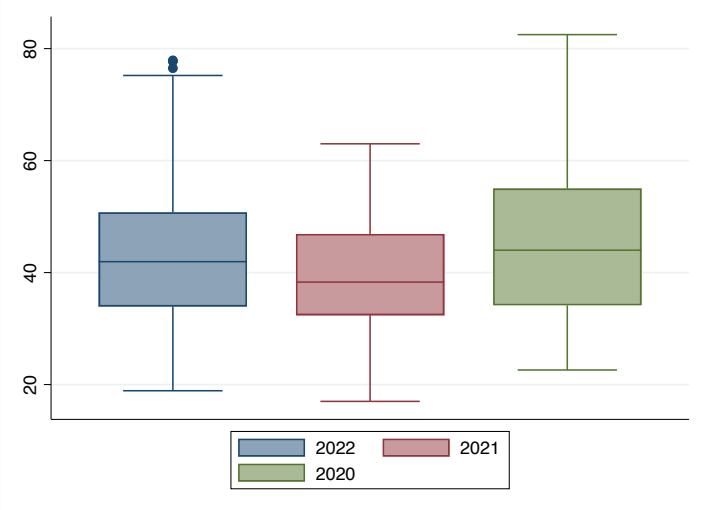
Summary statistics Environmental Performance Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2020	180	46.429	15.422	22.6	82.5
2021	180	39.673	10.017	17	63
2022	180	43.103	12.298	18.9	77.9

Note. This table demonstrates the summary statistics from the Environmental Performance Index dataset

Figure A2.5

Boxplot Environmental Performance Index data



Note. This figure demonstrates the boxplot from the Environmental Performance Index dataset where the distribution of the data is visualised

F. Corruption Perceptions Index

Table A2.6

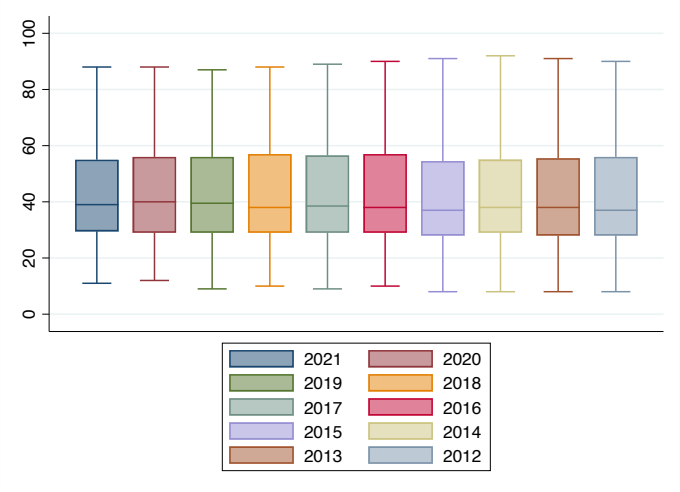
Summary statistics Corruption Perceptions Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2012	175	43.15	19.67	8	90
2013	176	42.55	19.93	8	91
2014	174	43.16	19.84	8	92
2015	168	42.60	20.20	8	91
2016	176	42.95	19.44	10	90
2017	180	43.07	19.05	9	89
2018	180	43.12	19.14	10	88
2019	180	43.17	18.96	9	87
2020	180	43.34	18.88	12	88
2021	180	43.27	18.78	11	88

Note. This table demonstrates the summary statistics from the Corruption Perceptions Index dataset

Figure A2.6

Boxplot Corruption Perceptions Index data



Note. This figure demonstrates the boxplot from the Corruption Perceptions Index dataset where the distribution of the data is visualised

G. World Press Freedom Index

Table A2.7

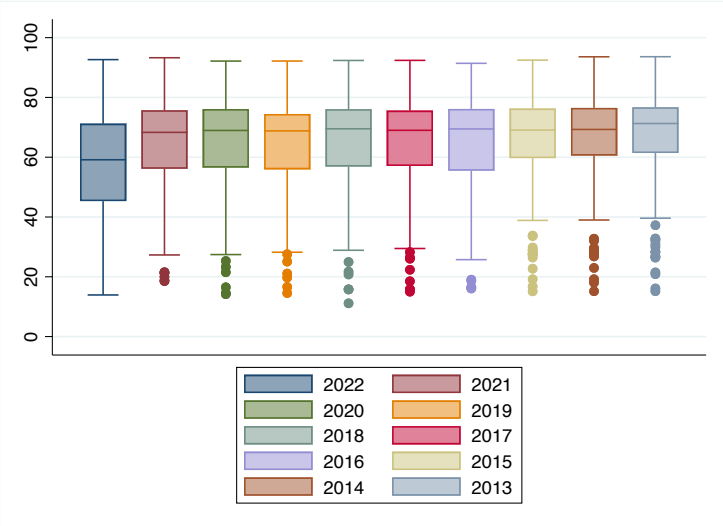
Summary statistics World Press Freedom Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2013	179	68	17	15.17	93.62
2014	180	67	17	15.17	93.60
2015	180	67	16	15.14	92.48
2016	180	65	17	16.08	91.41
2017	180	65	17	15.02	92.4
2018	180	65	16	11.13	92.37
2019	180	65	16	14.56	92.18
2020	180	65	16	14.18	92.16
2021	180	65	16	18.55	93.28
2022	180	58	17	1392	92.65

Note. This table demonstrates the summary statistics from the World Press Freedom Index dataset

Figure A2.7

Boxplot World Press Freedom Index data



Note. This figure demonstrates the boxplot from the World Press Freedom Index dataset where the distribution of the data is visualised

H. Notre Dame GAIN Index

Table A2.8

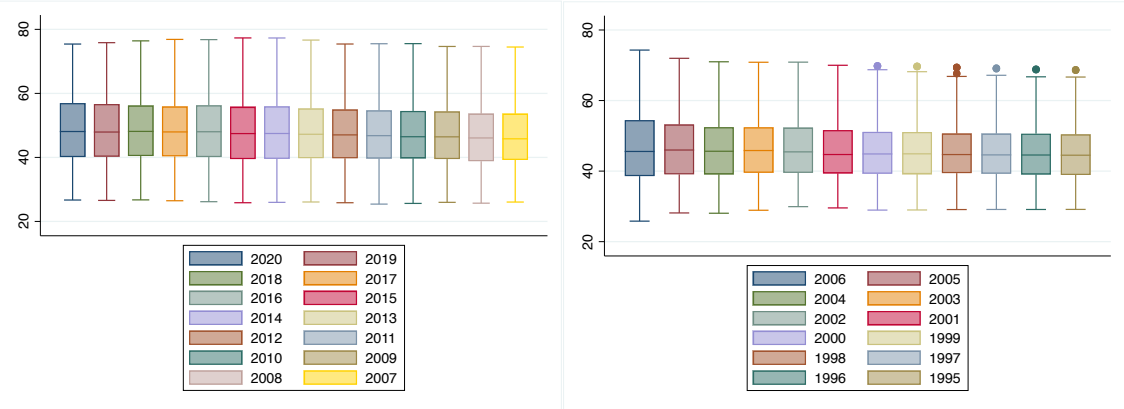
Summary statistics ND-GAIN Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
1995	182	45.90	8.93	29.14	68.70
1996	182	45.96	8.98	29.12	68.88
1997	182	46.08	9.05	29.12	69.17
1998	182	46.19	9.13	29.10	69.41
1999	182	46.27	9.19	28.98	69.70
2000	182	46.48	9.42	28.95	69.83
2001	182	46.56	9.48	29.57	70.00
2002	182	46.71	9.62	29.92	70.89
2003	182	46.81	9.65	28.90	70.86
2004	182	46.85	9.73	28.05	70.99
2005	182	47.07	10.04	28.14	71.97
2006	182	47.23	11.01	25.81	74.30
2007	182	47.47	11.09	26.06	74.48
2008	182	47.65	11.13	25.71	74.67
2009	182	47.75	11.04	25.97	74.66
2010	182	47.95	11.35	25.63	75.54
2011	182	48.10	11.38	25.41	75.51
2012	182	48.25	11.32	25.84	75.43
2013	182	48.48	11.44	26.07	76.66
2014	182	48.64	11.58	25.96	77.31
2015	182	48.74	11.52	25.84	77.32
2016	182	48.86	11.07	26.17	76.80
2017	182	48.96	11.04	26.47	76.87
2018	182	49.06	10.98	26.74	76.41
2019	182	49.06	10.92	26.57	75.84
2020	182	49.11	10.89	26.69	75.41

Note. This table demonstrates the summary statistics from the Notre Dame GAIN Index dataset

Figure A2.8

Boxplots ND-GAIN Index data



Note. These figures demonstrate the boxplots from the Notre Dame Gain Index dataset where the distribution of the data is visualised

I. Human Development Index

Table A2.9

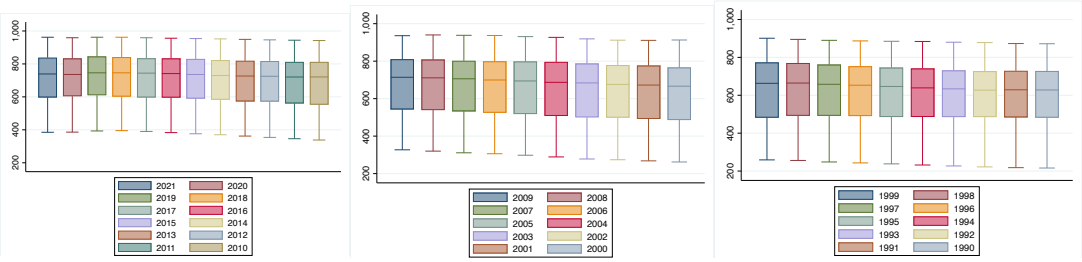
Summary statistics Human Development Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
1990	141	599.28	164.04	216	872
1991	141	601.98	164.10	218	873
1992	141	604.53	164.46	222	878
1993	141	608.50	165.46	227	880
1994	141	613.41	166.19	232	884
1995	152	617.63	164.99	238	885
1996	152	623.34	165.71	243	887
1997	152	628.60	166.59	248	890
1998	152	634.06	167.49	256	895
1999	157	631.59	170.19	259	901
2000	174	635.20	169.40	262	913
2001	174	641.36	169.02	268	911
2002	177	645.50	167.87	274	912
2003	179	650.57	167.41	278	919
2004	181	657.17	165.21	289	927
2005	186	662.59	163.54	298	931
2006	186	669.32	162.22	306	937
2007	187	676.54	160.99	311	938
2008	187	682.20	159.78	320	940
2009	187	685.97	156.87	327	936
2010	189	689.19	156.69	338	942
2011	190	694.59	154.36	346	944
2012	190	699.42	153.33	354	946
2013	190	704.15	153.18	362	949
2014	190	708.46	152.38	370	952
2015	190	712.26	151.87	376	954
2016	190	716.06	151.51	383	956
2017	190	719.55	151.38	390	959
2018	191	723.93	150.75	395	962
2019	191	727.50	150.42	393	962
2020	191	721.52	149.42	386	959
2021	191	720.58	150.66	385	962

Note. This table demonstrates the summary statistics from the Human Development Index dataset

Figure A2.9

Boxplots Human Development Index data



Note. These figures demonstrate the boxplots from the Human Development Index dataset where the distribution of the data is visualised

J. Economist Intelligence Unit Democracy Index

Table A2.10

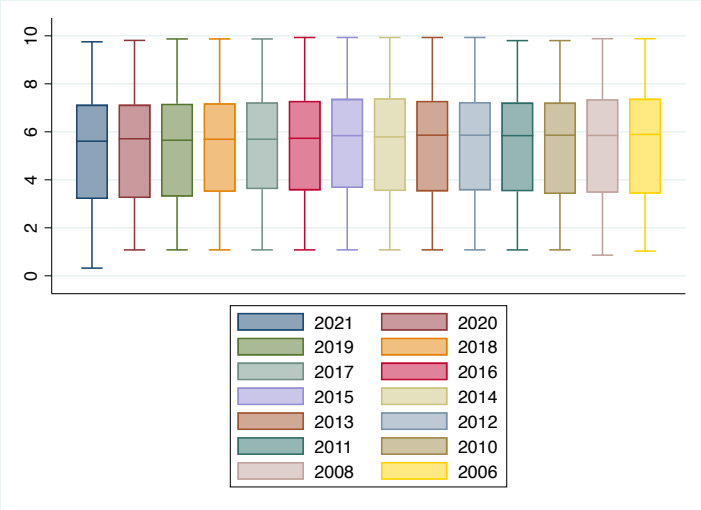
Summary statistics Economist Intelligence Unit Democracy Index rating

Variable	Number of observations	Mean	Std. Dev.	Min	Max
2006	167	5.52	2.26	1.03	9.88
2008	167	5.55	2.25	0.86	9.88
2010	167	5.46	2.23	1.08	9.8
2011	167	5.49	2.18	1.08	9.8
2012	167	5.52	2.19	1.08	9.93
2013	167	5.53	2.19	1.08	9.93
2014	167	5.55	2.18	1.08	9.93
2015	167	5.55	2.20	1.08	9.93
2016	167	5.52	2.20	1.08	9.93
2017	167	5.48	2.19	1.08	9.87
2018	167	5.48	2.20	1.08	9.87
2019	167	5.44	2.24	1.08	9.87
2020	167	5.37	2.25	1.08	9.81
2021	167	5.28	2.31	0.32	9.75

Note. This table demonstrates the summary statistics from the Economist Intelligence Unit Democracy Index dataset

Figure A2.10

Boxplot Economist Intelligence Unit Democracy Index data

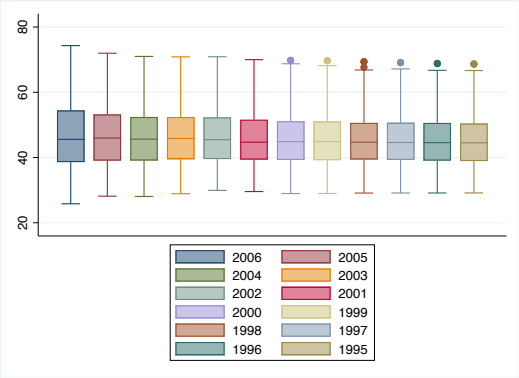


Note. This figure demonstrates the boxplot from the Economist Intelligence Unit Democracy Index dataset where the distribution of the data is visualised

K. Outlier analysis

Figure A2.11

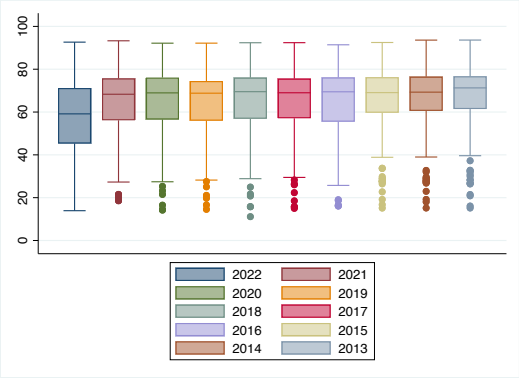
Boxplot subperiod 1995-2006 ND-GAIN index



Note. This figure demonstrates the boxplot from the Notre Dame Gain Index dataset in subperiod 1995-2006 where the distribution of the data is visualised and outliers are present

Figure A2.12

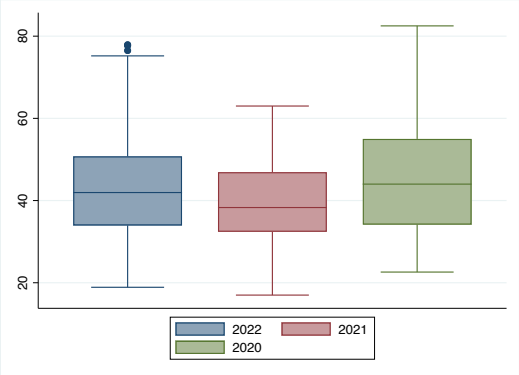
Boxplot World Press Freedom index



Note. This figure demonstrates the boxplot from the World Press Freedom Index dataset where the distribution of the data is visualised and outliers are present

Figure A2.13

Boxplot Environmental Performance Index



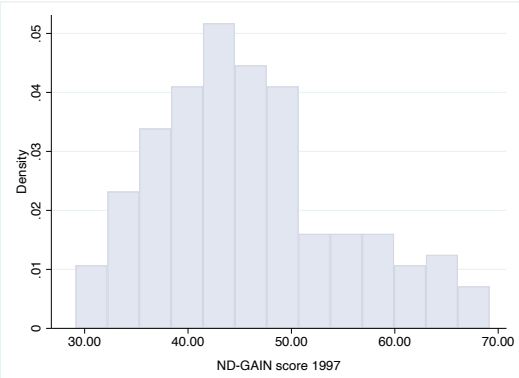
Note. This figure demonstrates the boxplot from the Environmental Performance Index dataset where the distribution of the data is visualised and outliers are present

ND-GAIN data analysis

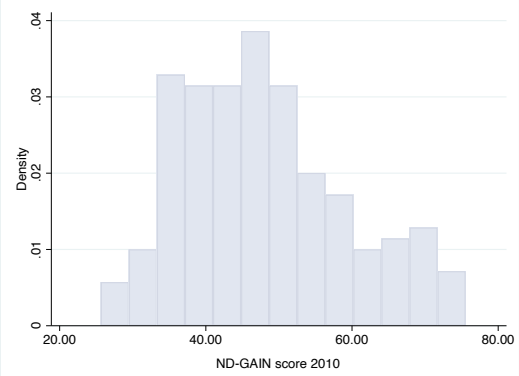
The Notre Dame GAIN index shows in the subperiod with outliers skewness to the left. The skewness can be interpreted as the fact that in the subperiod from 1995-2000, many countries scored highly on vulnerability to climate change (i.e., had a low ND-GAIN score). Over the years, the skewness to the left disappears, as visualised in Figure A2.14, which can mean that countries are changing policies against climate change.

Figure A2.14

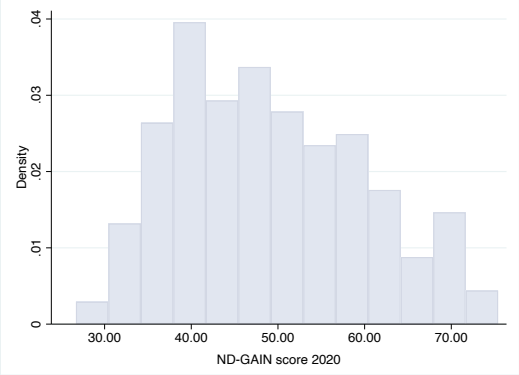
Histograms of the ND-GAIN score in 1997, 2010 and 2020



a) 1997



b) 2010



c) 2020

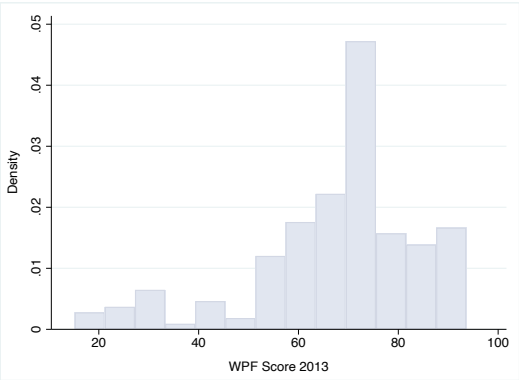
Note. These figures demonstrate the histograms from the Notre Dame GAIN Index score dataset where the distribution of the data is visualised in 1997, 2010 and 2020 to show the difference in distribution over the years.

WPF data analysis

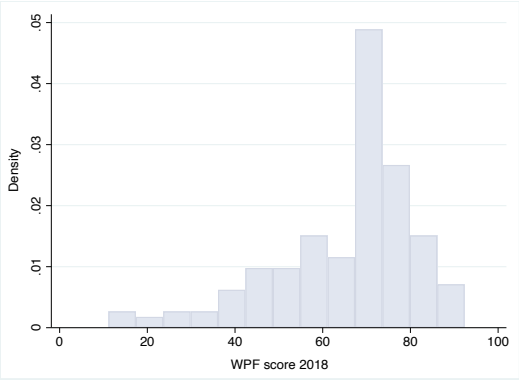
Controversially, the World Press Freedom Index data from the prior years (i.e., 2013-2018) is skewed to the right in the earlier years (Figure A2.15). This means that countries scored on average quite well on the level of press freedom. Interestingly, the skewness is diminished in 2022, making the data more widely distributed. Thus, one could argue that the average level of press freedom has decreased in 2022 compared to 2013 and 2018.

Figure A2.15

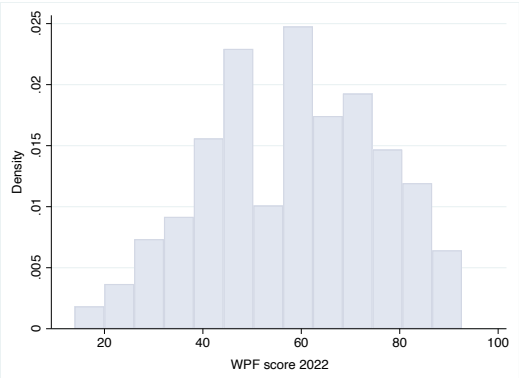
Histograms World Press Freedom index 2013, 2018 and 2022



a) 2013



b) 2018



c) 2022

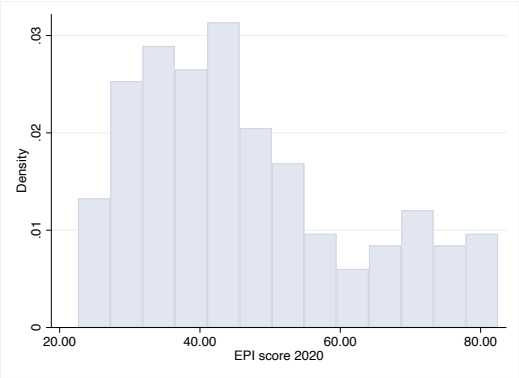
Note. These figures demonstrate the histograms from the World Press Freedom Index score dataset where the distribution of the data is visualised in 2013, 2018 and 2022 to show the difference in distribution over the years.

EPI data analysis

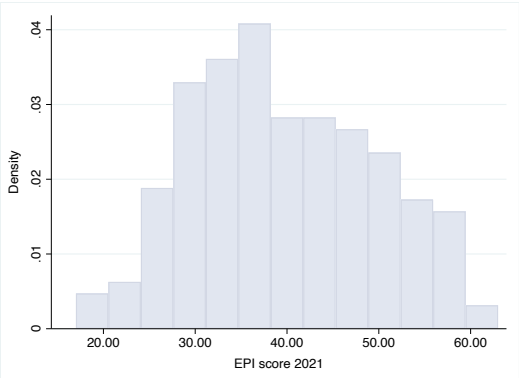
The Environmental Performance Index data shows inconsistent behaviour in the data when it comes to its distribution (Figure A2.16). The data from 2020 is a bit skewed to the left, similarly to the ND-GAIN index from 2020, as it may seem that both environmental awareness indices are showing slow adaptation of environmental policies. The skewedness diminishes in 2021 to a more normal distribution, with the highest density just under the (normal) average score. One could argue that according to EPI, countries have enhanced their environmental performance compared to the year before. However, in 2022, countries' performances have deteriorated, as the distribution is again a bit skewed to the left, with some outliers in the high-score area.

Figure A2.16

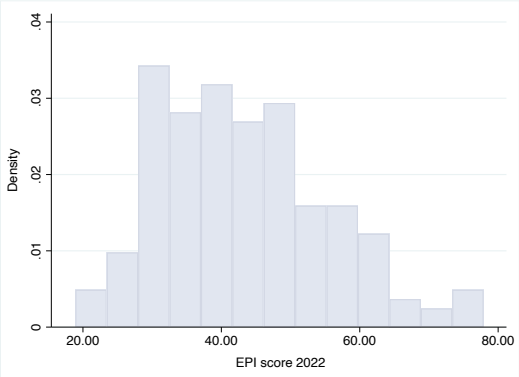
Histograms Environmental Performance Index 2020, 2021 and 2022



a) 2020



b) 2021



c) 2022

Note. These figures demonstrate the histograms from the Environmental Performance Index score dataset where the distribution of the data is visualised in 2020, 2021 and 2022 to show the difference in distribution over the years.

Appendix III: Data analysis research part II

Table A3.1

List of included advanced economy countries

ISO 3 country code	Country
AUS	Australia
AUT	Austria
BEL	Belgium
CAN	Canada
DNK	Denmark
FIN	Finland
FRA	France
DEU	Germany
GRC	Greece
IRL	Ireland
ISR	Israel
ITA	Italy
JPN	Japan
KOR	Korea. Rep.
NLD	Netherlands
NZL	New Zealand
NOR	Norway
PRT	Portugal
SGP	Singapore
ESP	Spain
SWE	Sweden
CHE	Switzerland
TWN	Taiwan. China
GBR	United Kingdom
USA	United States

Note. This table demonstrates the list of included advanced economies countries used for the sovereign bond portfolio analysis. The IMF definition of advanced economies countries is used.

Table A3.2

List of included emerging economy countries

ISO 3 country code	Country
AGO	Angola
ARG	Argentina
ARM	Armenia
AZE	Azerbaijan
BHR	Bahrain
BRB	Barbados
BLR	Belarus
BEN	Benin
BRA	Brazil
BGR	Bulgaria
CMR	Cameroon
CHN	China
COL	Colombia
CRI	Costa Rica
CIV	Cote d'Ivoire
HRV	Croatia
CZE	Czech Republic
DOM	Dominican Republic
ECU	Ecuador
EGY	Egypt. Arab Rep.

SLV	El Salvador
EST	Estonia
ETH	Ethiopia
GAB	Gabon
GEO	Georgia
GHA	Ghana
GTM	Guatemala
HND	Honduras
HUN	Hungary
IND	India
IDN	Indonesia
IRQ	Iraq
JAM	Jamaica
JOR	Jordan
KAZ	Kazakhstan
KEN	Kenya
KWT	Kuwait
LBN	Lebanon
LTU	Lithuania
MYS	Malaysia
MEX	Mexico
MNG	Mongolia
MNE	Montenegro
MAR	Morocco
MOZ	Mozambique
NAM	Namibia
NGA	Nigeria
OMN	Oman
PAK	Pakistan
PAN	Panama
PNG	Papua New Guinea
PRY	Paraguay
PER	Peru
PHL	Philippines
POL	Poland
QAT	Qatar
ROU	Romania
RUS	Russian Federation
SAU	Saudi Arabia
SEN	Senegal
SRB	Serbia
SVK	Slovak Republic
ZAF	South Africa
LKA	Sri Lanka
SUR	Suriname
TTO	Trinidad and Tobago
TUN	Tunisia
TUR	Turkiye
UKR	Ukraine
ARE	United Arab Emirates
URY	Uruguay
UZB	Uzbekistan
VEN	Venezuela. RB
VNM	Vietnam
ZMB	Zambia

Note. This table demonstrates the list of included emerging markets countries used for the sovereign bond portfolio analysis. The IMF definition of emerging markets is used.

Table A3.3

List of sanctioned countries from the EU Sanctions Map

ISO 3 country code	Country	Specification (Type)	Adopted by	Restrictive measures
AFG	Afghanistan	Restrictive measures imposed with respect to the Taliban	UN	Arms export Asset freeze and prohibition to make funds available Restrictions on admissions
BLR	Belarus	Restrictive measures in view of the situation in Belarus and the involvement of Belarus in the Russian aggression against Ukraine	EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admissions Embargo on dual-use goods Financial measures
BIH	Bosnia & Herzegovina	Restrictive measures in view of the situation in Bosnia and Herzegovina	EU	Asset freeze and prohibition to make funds available
BDI	Burundi	Restrictive measures in view of the situation in Burundi	EU	Asset freeze and prohibition to make funds available Prohibition to satisfy claims Restrictions on admission
CAF	Central African Republic	Restrictive measures in view of the situation in the Central African Republic	UN	Arms export Asset freeze and prohibition to make funds available Prohibition to satisfy claims Restrictions on admission
CHN	China	Specific restrictive measures in relation to the events at the Tiananmen Square protests of 1989	EU	Arms embargo
PRK	Democratic People's Republic of Korea	Restrictive measures in relation to the non-proliferation of the weapons of mass destruction	UN and EU	Arms export Asset freeze and prohibition to make funds available Prohibition to satisfy claims Restrictions on admission Financial measures
COD	Democratic Republic of the Congo	Restrictive measures in view of the situation in the Democratic Republic of the Congo	UN and EU	Arms export Asset freeze and prohibition to make funds available Prohibition to satisfy claims Restrictions on admission
GIN	Guinea	Restrictive measures in view of the situation in Guinea	EU	Asset freeze and prohibition to make funds available Restrictions on admission
GNB	Guinea-Bissau	Restrictive measures in view of the situation in Guinea-Bissau	UN and EU	Asset freeze and prohibition to make funds available Restrictions on admission
HTI	Haiti	Restrictive measures in view of the situation in Haiti Prohibiting the satisfying of certain claims by the Haitian authorities	UN and EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
IRN	Iran	Restrictive measures in relation to serious human rights violations in Iran Restrictive measures in relation to the non-proliferation of weapons of mass destruction	EU and UN	Asset freeze and prohibition to make funds available Restrictions on admission Restrictions on equipment used for internal repression Telecommunications equipment
IRQ	Iraq	Restrictive measures on Iraq	UN	Arms embargo Asset freeze and prohibition to make funds available Cultural property
LBN	Lebanon	Restrictive measures in relation to the UN Security Council Resolution 1701 on Lebanon Restrictive measures in relation to the 14 February 2005 terrorist bombing in Beirut. Lebanon Restrictive measures in view of the situation in Lebanon	UN and EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
LBY	Libya	Restrictive measures in view of the situation in Libya Prohibiting the satisfying of certain claims in relation to transactions that have been prohibited by the UN	UN and EU	Arms export Asset freeze and prohibition

		Security Council Resolution 883 (1993) and related resolutions		to make funds available Prohibition to satisfy claims
MLI	Mali	Restrictive measures in view of the situation in Mali	UN and EU	Asset freeze and prohibition to make funds available Restrictions on admissions
MDA	Moldova	Restrictive measures in relation to the campaign against Latinscript schools in the Transnistrian region	EU	Restrictions on admissions
MNE	Montenegro	Prohibiting the satisfying of certain claims in relation to transactions that have been prohibited by the UN Security Council Resolution 757 (1992) and related resolutions	UN and EU	Prohibition to satisfy claims
MMR	Myanmar	Restrictive measures in the view of the situation in Myanmar/Burma	EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
NIC	Nicaragua	Restrictive measures in view of the situation in the Republic of Nicaragua	EU	Asset freeze and prohibition to make funds available Restrictions on admissions
RUS	Russia	Restrictive measures in view of Russia's actions destabilising the situation in Ukraine (sectoral restrictive measures)	EU	Arms export Arms import Financial measures
SRB	Serbia	Prohibiting the satisfying of certain claims in relation to transactions that have been prohibited by the UN Security Council Resolution 757 (1992) and related resolutions	UN and EU	Prohibition to satisfy claims
SOM	Somalia	Restrictive measures against Somalia	UN	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
SSD	South Sudan	Restrictive measures in the view of the situation in South Sudan	UN and EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
SDN	Sudan	Restrictive measures in the view of the situation in Sudan	UN and EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
SYR	Syria	Restrictive measures in relation to the 14 February 2005 terrorist bombing in Beirut. Lebanon Restrictive measures against Syria	UN and EU	Asset freeze and prohibition to make funds available Restrictions on admissions Financial measures
TUN	Tunisia	Misappropriation of state funds of Tunisia	EU	Asset freeze and prohibition to make funds available
TUR	Turkey	Restrictive measures in view of Turkey's unauthorised drilling activities in the Eastern Mediterranean	EU	Asset freeze and prohibition to make funds available Restrictions on admissions
UKR	Ukraine	Restrictive measures in response to the illegal annexation of Crimea and Sevastopol Restrictive measures in respect of actions undermining or threatening the territorial integrity. sovereignty and independence of Ukraine Restrictive measures in response to the illegal recognition. occupation or annexation by the Russian Federation of certain non-government controlled areas of Ukraine Misappropriation of state funds of Ukraine	EU	Financial measures Asset freeze and prohibition to make funds available Restrictions on admission
VEN	Venezuela	Restrictive measures in view of the situation in Venezuela	EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
YEM	Yemen	Restrictive measures in view of the situation in Yemen	UN	Arms export Asset freeze and prohibition to make funds available Restrictions on admission
ZWE	Zimbabwe	Restrictive measures in view of the situation in Zimbabwe	EU	Arms export Asset freeze and prohibition to make funds available Restrictions on admission

Note. This table demonstrates the list of sanctioned countries from the EU sanctions map

Table A3.4

Results Shapiro-Wilk test on normality in return series of full portfolio sample

Variable	Number of observations	W	V	z	Prob > z
Returns 100% portfolio	180	0.985	1.995	1.581	0.057
Returns base case sanction exclusion	180	0.964	4.897	3.635	0.000
WGI high-portfolio	180	0.976	3.302	2.733	0.003
WGI mid-portfolio	180	0.974	3.532	2.888	0.002
WGI low-portfolio	180	0.964	4.885	3.630	0.000
FIW high-portfolio	180	0.977	3.109	2.596	0.005
FIW mid-portfolio	180	0.964	4.968	3.668	0.000
FIW low-portfolio	180	0.962	5.173	3.761	0.000
GRI high-portfolio	180	0.970	4.029	3.189	0.001
GRI mid-portfolio	180	0.965	4.801	3.590	0.000
GRI low-portfolio	180	0.965	4.801	3.590	0.000
FSI high-portfolio	180	0.974	3.576	2.916	0.002
FSI mid-portfolio	180	0.967	4.490	3.437	0.000
FSI low-portfolio	180	0.963	5.072	3.716	0.000
EPI high-portfolio	180	0.981	2.641	2.223	0.013
EPI mid-portfolio	180	0.966	4.590	3.488	0.000
EPI low-portfolio	180	0.965	4.775	3.578	0.000
CPI high-portfolio	180	0.981	2.646	2.227	0.013
CPI mid-portfolio	180	0.970	4.097	3.227	0.001
CPI low-portfolio	180	0.964	4.835	3.606	0.000
WPF high-portfolio	180	0.976	3.243	2.693	0.004
WPF mid-portfolio	180	0.967	4.482	3.433	0.000
WPF low-portfolio	180	0.960	5.446	3.879	0.000
NDGAIN high-portfolio	180	0.982	2.495	2.092	0.018
NDGAIN mid-portfolio	180	0.973	3.715	3.004	0.001
NDGAIN low-portfolio	180	0.963	5.046	3.704	0.000
HDI high-portfolio	180	0.976	3.278	2.717	0.003
HDI mid-portfolio	180	0.971	3.975	3.158	0.001
HDI low-portfolio	180	0.963	5.036	3.700	0.000
EIU high-portfolio	180	0.979	2.827	2.378	0.009
EIU mid-portfolio	180	0.963	5.012	3.689	0.000
EIU low-portfolio	180	0.960	5.408	3.863	0.000

Note. This table demonstrates the results from the Shapiro-Wilk test on normality in the return series of the full portfolio

Table A3.5

Results Shapiro-Wilk test on normality in return series of emerging markets sample

Variable	Number of observations	W	V	z	Prob > z
Returns EM portfolio	180	0.827	23.535	7.228	0.000
Returns EM base case sanction exclusion	180	0.834	22.584	7.134	0.000
WGI EM high portfolio	180	0.526	64.476	9.535	0.000
WGI EM mid-portfolio	180	0.868	17.988	6.613	0.000
WGI EM low-portfolio	180	0.836	22.274	7.102	0.000
FIW EM high-portfolio	180	0.849	20.554	6.918	0.000
FIW EM mid-portfolio	180	0.747	34.388	8.096	0.000
FIW EM low-portfolio	180	0.843	21.425	7.013	0.000
GRI EM high-portfolio	180	0.828	23.456	7.221	0.000
GRI EM mid-portfolio	180	0.824	23.951	7.268	0.000
GRI EM low-portfolio	180	0.824	23.951	7.268	0.000
FSI EM high-portfolio	180	0.851	20.348	6.895	0.000
FSI EM mid-portfolio	180	0.840	21.839	7.057	0.000
FSI EM low-portfolio	180	0.813	25.399	7.403	0.000
EPI EM high-portfolio	180	0.838	22.096	7.084	0.000
EPI EM mid-portfolio	180	0.836	22.358	7.111	0.000
EPI EM low-portfolio	180	0.839	21.893	7.063	0.000
CPI EM high-portfolio	180	0.868	17.982	6.613	0.000
CPI EM mid-portfolio	180	0.864	18.523	6.680	0.000
CPI EM low-portfolio	180	0.843	21.314	7.002	0.000
WPF EM high-portfolio	180	0.821	24.325	7.304	0.000
WPF EM mid-portfolio	180	0.868	17.999	6.615	0.000
WPF EM low-portfolio	180	0.823	24.034	7.276	0.000
NDGAIN EM high-portfolio	180	0.888	15.265	6.238	0.000
NDGAIN EM mid-portfolio	180	0.876	16.899	6.470	0.000
NDGAIN EM low-portfolio	180	0.824	23.920	7.266	0.000
HDI EM high-portfolio	180	0.867	18.075	6.624	0.000
HDI EM mid-portfolio	180	0.872	17.421	6.540	0.000
HDI EM low-portfolio	180	0.824	24.002	7.273	0.000
EIU EM high-portfolio	180	0.893	14.546	6.127	0.000
EIU EM mid-portfolio	180	0.839	21.893	7.063	0.000
EIU EM low-portfolio	180	0.830	23.084	7.184	0.000

Note. This table demonstrates the results from the Shapiro-Wilk test on normality in the return series of the emerging markets portfolio

Table A3.6

Results kurtosis and skewness test in full portfolio sample

Variable	Number of observations	Pr(Skewness)	Pr(Kurtosis)	Adjusted Chi2(2)	Prob > chi2
Returns 100% portfolio	180	0.086	0.019	7.77	0.021
Returns base case sanction exclusion	180	0.001	0.014	14.31	0.001
WGI high-portfolio	180	0.003	0.007	13.64	0.001
WGI mid-portfolio	180	0.008	0.037	10.07	0.007
WGI low-portfolio	180	0.001	0.016	13.56	0.001
FIW high-portfolio	180	0.015	0.036	9.25	0.010
FIW mid-portfolio	180	0.001	0.013	14.23	0.001
FIW low-portfolio	180	0.001	0.015	14.56	0.001
GRI high-portfolio	180	0.001	0.012	15.43	0.000
GRI mid-portfolio	180	0.001	0.010	14.96	0.001
GRI low-portfolio	180	0.001	0.010	14.96	0.001
FSI high-portfolio	180	0.060	0.017	8.37	0.015
FSI mid-portfolio	180	0.003	0.020	12.28	0.002
FSI low-portfolio	180	0.001	0.014	14.07	0.001
EPI high-portfolio	180	0.063	0.026	7.77	0.021
EPI mid-portfolio	180	0.002	0.020	12.72	0.002
EPI low-portfolio	180	0.002	0.018	13.32	0.001
CPI high-portfolio	180	0.024	0.054	8.06	0.018
CPI mid-portfolio	180	0.005	0.026	11.22	0.004
CPI low-portfolio	180	0.001	0.016	14.10	0.001
WPF high-portfolio	180	0.006	0.041	10.21	0.006
WPF mid-portfolio	180	0.002	0.026	12.32	0.002
WPF low-portfolio	180	0.000	0.007	16.39	0.000
NDGAIN high-portfolio	180	0.008	0.150	8.25	0.016
NDGAIN mid-portfolio	180	0.008	0.033	10.18	0.006
NDGAIN low-portfolio	180	0.001	0.015	13.95	0.001
HDI high-portfolio	180	0.070	0.023	7.78	0.021
HDI mid-portfolio	180	0.006	0.029	10.75	0.005
HDI low-portfolio	180	0.001	0.015	13.95	0.001
EIU high-portfolio	180	0.011	0.066	8.90	0.012
EIU mid-portfolio	180	0.001	0.014	13.99	0.001
EIU low-portfolio	180	0.000	0.008	16.17	0.000

Note. This table demonstrates the results from the kurtosis and skewness test on normality in the return series of the full sample portfolio

Table A3.7

Summary statistics full portfolios

Portfolios	Number of observations	Mean	Standard deviation	Minimum	Maximum
100% portfolio	180	0.002	0.010	(0.034)	0.031
Base case portfolio	180	0.003	0.013	(0.038)	0.035
WGI high-portfolio	180	0.002	0.012	(0.042)	0.034
WGI mid-portfolio	180	0.003	0.012	(0.036)	0.034
WGI low-portfolio	180	0.003	0.013	(0.037)	0.036
FIW high-portfolio	180	0.002	0.013	(0.039)	0.039
FIW mid-portfolio	180	0.003	0.013	(0.038)	0.036
FIW low-portfolio	180	0.003	0.013	(0.038)	0.034
GRI high-portfolio	180	0.003	0.013	(0.046)	0.033
GRI mid-portfolio	180	0.003	0.012	(0.039)	0.034
GRI low-portfolio	180	0.003	0.012	(0.039)	0.034
FSI high-portfolio	180	0.003	0.013	(0.038)	0.041
FSI mid-portfolio	180	0.003	0.013	(0.036)	0.038
FSI low-portfolio	180	0.003	0.013	(0.036)	0.036
EPI high-portfolio	180	0.002	0.012	(0.038)	0.039
EPI mid-portfolio	180	0.003	0.013	(0.036)	0.037
EPI low-portfolio	180	0.003	0.013	(0.037)	0.035
CPI high-portfolio	180	0.002	0.012	(0.036)	0.035
CPI mid-portfolio	180	0.003	0.012	(0.036)	0.035
CPI low-portfolio	180	0.003	0.013	(0.038)	0.034
WPF high-portfolio	180	0.003	0.013	(0.040)	0.035
WPF mid-portfolio	180	0.003	0.013	(0.037)	0.036
WPF low-portfolio	180	0.003	0.013	(0.041)	0.035
NDGAIN high-portfolio	180	0.002	0.012	(0.037)	0.034
NDGAIN mid-portfolio	180	0.003	0.012	(0.037)	0.037
NDGAIN low-portfolio	180	0.003	0.013	(0.036)	0.035
HDI high-portfolio	180	0.003	0.013	(0.038)	0.044
HDI mid-portfolio	180	0.003	0.013	(0.037)	0.037
HDI low-portfolio	180	0.003	0.013	(0.036)	0.035
EIU high-portfolio	180	0.002	0.012	(0.038)	0.036
EIU mid-portfolio	180	0.003	0.013	(0.037)	0.035
EIU low-portfolio	180	0.003	0.013	(0.041)	0.034

Note. This table demonstrates the summary statistics of the monthly returns of the full portfolios over the period from 2008-2023

Table A3.8

Summary statistics EM portfolios

Portfolios	Number of observations	Mean	Standard Deviation	Minimum	Maximum
100% portfolio	180	0.004	0.027	(0.176)	0.085
Base case portfolio	180	0.005	0.027	(0.169)	0.082
WGI high-portfolio	180	0.001	0.019	(0.201)	0.055
WGI mid-portfolio	180	0.004	0.022	(0.131)	0.089
WGI low-portfolio	180	0.004	0.026	(0.169)	0.075
FIW high-portfolio	180	0.003	0.024	(0.162)	0.057
FIW mid-portfolio	180	0.004	0.026	(0.170)	0.071
FIW low-portfolio	180	0.004	0.027	(0.168)	0.085
GRI high-portfolio	180	0.004	0.032	(0.200)	0.119
GRI mid-portfolio	180	0.005	0.031	(0.202)	0.087
GRI low-portfolio	180	0.005	0.031	(0.202)	0.087
FSI high-portfolio	180	0.005	0.028	(0.170)	0.155
FSI mid-portfolio	180	0.005	0.027	(0.184)	0.071
FSI low-portfolio	180	0.005	0.028	(0.192)	0.072
EPI high-portfolio	180	0.003	0.022	(0.085)	0.148
EPI mid-portfolio	180	0.004	0.026	(0.174)	0.069
EPI low-portfolio	180	0.004	0.027	(0.170)	0.078
CPI high-portfolio	180	0.004	0.018	(0.117)	0.051
CPI mid-portfolio	180	0.004	0.024	(0.149)	0.087
CPI low-portfolio	180	0.005	0.027	(0.170)	0.083
WPF high-portfolio	180	0.004	0.024	(0.163)	0.071
WPF mid-portfolio	180	0.005	0.027	(0.176)	0.079
WPF low-portfolio	180	0.005	0.029	(0.188)	0.086
NDGAIN high-portfolio	180	0.003	0.023	(0.108)	0.069
NDGAIN mid-portfolio	180	0.004	0.024	(0.148)	0.088
NDGAIN low-portfolio	180	0.005	0.027	(0.184)	0.073
HDI high-portfolio	180	0.004	0.030	(0.132)	0.169
HDI mid-portfolio	180	0.005	0.025	(0.157)	0.076
HDI low-portfolio	180	0.005	0.027	(0.184)	0.073
EIU high-portfolio	180	0.003	0.022	(0.122)	0.056
EIU mid-portfolio	180	0.004	0.027	(0.175)	0.076
EIU low-portfolio	180	0.005	0.029	(0.180)	0.091

Note. This table demonstrates the summary statistics from monthly returns of the EM portfolios over the period of 2008-2023

Appendix IV: Results research part I

Table A4.1

Results Kendall's rank correlation 2020

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	ND-GAIN	HDI	EIU
WGI	1.00									
	1.00									
FIW	0.67***	1.00								
	0.68***	1.00								
GRI	0.15***	0.13**	1.00							
	0.17***	0.15**	1.00							
FSI	0.76***	0.58***	0.16***	1.00						
	0.76***	0.59***	0.18***	1.00						
EPI	0.51***	0.37***	0.11**	0.61***	1.00					
	0.51***	0.38***	0.12**	0.61***	1.00					
CPI	0.82***	0.60***	0.16***	0.68***	0.49***	1.00				
	0.83***	0.60***	0.18***	0.69***	0.50***	1.00				
WPF	0.54***	0.72***	0.14**	0.46***	0.32***	0.48***	1.00			
	0.54***	0.72***	0.15**	0.46***	0.32***	0.49***	1.00			
ND-GAIN	0.67***	0.44***	0.13**	0.73***	0.65***	0.65***	0.33***	1.00		
	0.67***	0.44***	0.14**	0.73***	0.65***	0.66***	0.33***	1.00		
HDI	0.61***	0.41***	0.11**	0.73***	0.71***	0.59***	0.32***	0.80***	1.00	
	0.61***	0.42***	0.13**	0.73***	0.71***	0.60***	0.32***	0.80***	1.00	
EIU	0.68***	0.83***	0.13**	0.60***	0.46***	0.59***	0.64***	0.51***	0.49***	1.00
	0.68***	0.83***	0.14**	0.60***	0.46***	0.60***	0.64***	0.51***	0.49***	1.00

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Figure A4.1

Heatmap Kendall's rank correlation 2020

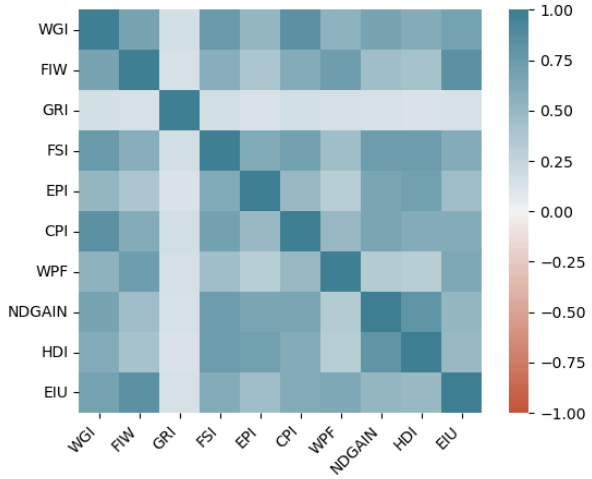


Table A4.2

Results Spearman's rank correlation 2021

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	HDI	EIU
WGI	1.00								

FIW	0.83***	1.00							
	(0.00)								
GRI	0.62***	0.73***	1.00						
	(0.00)	(0.00)							
FSI	0.92***	0.75***	0.62***	1.00					
	(0.00)	(0.00)	(0.00)						
EPI	0.62***	0.63***	0.58***	0.61***	1.00				
	(0.00)	(0.00)	(0.00)	(0.00)					
CPI	0.96***	0.77***	0.58***	0.87***	0.58***	1.00			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				
WPF	0.72***	0.89***	0.75***	0.63***	0.58***	0.68***	1.00		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
HDI	0.79***	0.57***	0.41***	0.89***	0.56***	0.76***	0.45***	1.00	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
EIU	0.86***	0.95***	0.64***	0.78***	0.58***	0.78***	0.82***	0.66***	1.00
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2021. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.5

Results Kendall's rank correlation 2021

Variable	**WGI**	**FIW**	**GRI**	**FSI**	**EPI**	**CPI**	**WPF**	**HDI**	**EIU**
WGI	1.00								
	1.00								
FIW	0.66***	0.99							
	0.66***	1.00							
	(0.00)								
GRI	0.44***	0.52***	1.00						
	0.49***	0.59***	1.00						
	(0.00)	(0.00)							
FSI	0.77***	0.58***	0.43***	1.00					
	0.77***	0.58***	0.48***	1.00					
	(0.00)	(0.00)	(0.00)						
EPI	0.44***	0.44***	0.40***	0.44***	1.00				
	0.44***	0.45***	0.45***	0.44***	1.00				
	(0.00)	(0.00)	(0.00)	(0.00)					
CPI	0.84***	0.60***	0.41***	0.70***	0.40***	0.98			
	0.84***	0.61***	0.46***	0.70***	0.41***	1.00			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				
WPF	0.54***	0.72***	0.54***	0.45***	0.41***	0.50***	1.00		
	0.54***	0.72***	0.60***	0.45***	0.41***	0.51***	1.00		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
HDI	0.61***	0.41***	0.28***	0.72***	0.39***	0.57***	0.31***	1.00	
	0.61***	0.41***	0.31***	0.72***	0.39***	0.58***	0.31***	1.00	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
EIU	0.69***	0.81***	0.46***	0.62***	0.40***	0.61***	0.62***	0.49***	1.00
	0.69***	0.81***	0.51***	0.62***	0.41***	0.62***	0.63***	0.49***	1.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

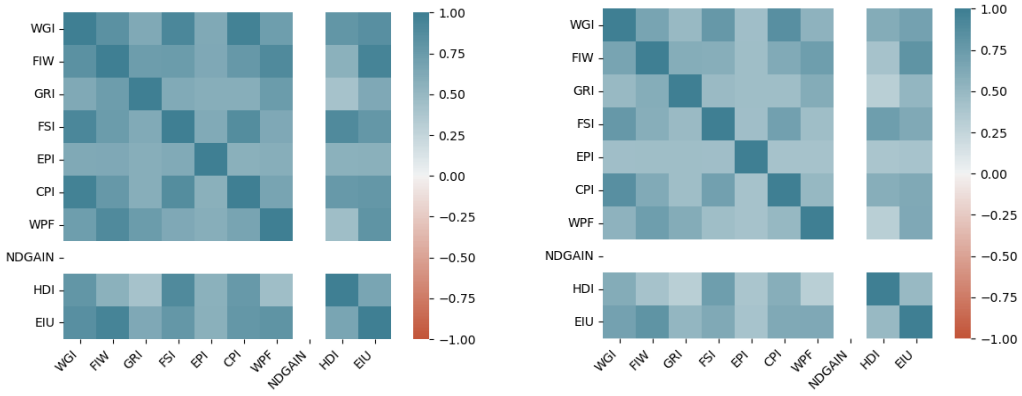
Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2021. WGI = World Governance Indicators, FIW

= Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Figure A4.2

Heatmaps of 2021 rank correlation data



a) Spearman's *b) Kendall's*

Table A4.6

Spearman correlations 2020 in the emerging markets sample

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
FIW	0.74***	1.00								
	(0.00)									
GRI	0.10	0.10	1.00							
	(0.27)	(0.27)								
FSI	0.85***	0.58***	0.13	1.00						
	(0.00)	(0.00)	(0.19)							
EPI	0.46***	0.21**	0.04	0.68***	1.00					
	(0.00)	(0.01)	(0.69)	(0.00)						
CPI	0.92***	0.60***	0.13	0.77***	0.45***	1.00				
	(0.00)	(0.00)	(0.17)	(0.00)	(0.00)					
WPF	0.55***	0.84***	0.12	0.40***	0.10	0.45***	1.00			
	(0.00)	(0.00)	(0.22)	(0.00)	(0.24)	(0.00)				
NDGAIN	0.72***	0.33***	0.03	0.83***	0.73***	0.71***	0.14*	1.00		
	(0.00)	(0.00)	(0.77)	(0.00)	(0.00)	(0.00)	(0.10)			
HDI	0.63***	0.28***	-0.00	0.83***	0.82***	0.60***	0.10	0.90***	1.00	
	(0.00)	(0.00)	(0.99)	(0.00)	(0.00)	(0.00)	(0.27)	(0.00)		
EIU	0.72***	0.93***	0.09	0.58***	0.33***	0.57***	0.72***	0.40***	0.38***	1.00
	(0.00)	(0.00)	(0.38)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the emerging markets sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.7

Spearman correlations 2020 in the advanced economies sample

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
FIW	0.73***	1.00								
	(0.00)									
GRI	0.19	-0.08	1.00							
	(0.34)	(0.68)								
FSI	0.91***	0.76***	0.17	1.00						
	(0.00)	(0.00)	(0.41)							
EPI	0.46***	0.47***	0.11	0.47***	1.00					
	(0.01)	(0.00)	(0.57)	(0.01)						
CPI	0.88***	0.68***	0.20	0.78***	0.50***	1.00				
	(0.00)	(0.00)	(0.30)	(0.00)	(0.00)					
WPF	0.67***	0.81***	0.14	0.73***	0.37**	0.59***	1.00			
	(0.00)	(0.00)	(0.48)	(0.00)	(0.03)	(0.00)				
NDGAIN	0.85***	0.53***	0.37*	0.81***	0.50***	0.90***	0.53***	1.00		
	(0.00)	(0.00)	(0.10)	(0.00)	(0.00)	(0.00)	(0.00)			
HDI	0.65***	0.51***	0.18	0.77***	0.44**	0.80***	0.43***	0.81***	1.00	
	(0.00)	(0.00)	(0.37)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)		
EIU	0.78***	0.74***	0.06	0.77***	0.45***	0.64***	0.64***	0.73***	0.64***	1.00
	(0.00)	(0.00)	(0.75)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the advanced economies sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.8

Spearman correlations top performing countries with score of 0.25 or higher (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
FIW	0.67***	1.00								
	(0.00)									
GRI	0.49*	0.23	1.00							
	(0.09)	(0.42)								
FSI	0.89***	0.75***	0.28	1.00						
	(0.00)	(0.00)	(0.32)							
EPI	0.57***	0.49***	0.41	0.65***	1.00					
	(0.00)	(0.01)	(0.15)	(0.00)						
CPI	0.86***	0.74***	0.54***	0.75***	0.60***	1.00				
	(0.00)	(0.00)	(0.05)	(0.00)	(0.00)					
WPF	0.68***	0.67***	-0.02	0.68***	0.45**	0.63***	1.00			
	(0.00)	(0.00)	(0.93)	(0.00)	(0.01)	(0.00)				
NDGAIN	0.84***	0.66***	0.46*	0.81***	0.67***	0.84***	0.58***	1.00		
	(0.00)	(0.00)	(0.08)	(0.00)	(0.00)	(0.00)	(0.00)			
HDI	0.62***	0.61***	0.32	0.87***	0.65***	0.76***	0.63***	0.83***	1.00	
	(0.00)	(0.00)	(0.26)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
EIU	0.78***	0.68***	0.35	0.75***	0.50***	0.77***	0.48***	0.77***	0.79***	1.00
	(0.00)	(0.00)	(0.17)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the high performing countries sample. WGI = World

Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.9

Spearman correlations bad performing countries with a score of 0.75 or higher (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
FIW	0.51***	1.00								
	(0.00)									
GRI	0.57**	0.48*	1.00							
	(0.02)	(0.07)								
FSI	0.69***	0.43**	0.61**	1.00						
	(0.00)	(0.04)	(0.02)							
EPI	0.21	-0.20	0.41	0.08	1.00					
	(0.32)	(0.52)	(0.27)	(0.73)						
CPI	0.75***	0.55***	0.61**	0.53***	-0.16	1.00				
	(0.00)	(0.00)	(0.02)	(0.00)	(0.49)					
WPF	0.17	0.49***	0.06	-0.02	-0.03	0.07	1.00			
	(0.39)	(0.00)	(0.84)	(0.93)	(0.93)	(0.76)				
NDGAIN	0.37**	0.09	-0.22	0.53***	0.27	0.14	0.21	1.00		
	(0.04)	(0.70)	(0.50)	(0.00)	(0.14)	(0.48)	(0.45)			
HDI	0.19	0.48**	0.05	0.29*	0.32*	0.13	0.10	0.55***	1.00	
	(0.30)	(0.03)	(0.87)	(0.09)	(0.06)	(0.51)	(0.74)	(0.00)		
EIU	0.43**	0.80***	0.08	0.43**	0.44*	0.34*	0.43**	0.27	0.53**	1.00
	(0.02)	(0.00)	(0.73)	(0.05)	(0.09)	(0.09)	(0.02)	(0.24)	(0.01)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the low performing countries sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.10

Spearman correlation medium-high performing countries with scores between 0.25 and 0.50 (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
FIW	0.18	1.00								
	(0.39)									
GRI	-0.04	0.25	1.00							
	(0.89)	(0.37)								
FSI	-0.09	0.60***	0.30	1.00						
	(0.72)	(0.00)	(0.26)							
EPI	-0.26	0.19	0.56**	0.36	1.00					
	(0.39)	(0.51)	(0.02)	(0.10)						
CPI	0.46**	0.44**	-0.28	-0.10	-0.43	1.00				
	(0.03)	(0.04)	(0.36)	(0.69)	(0.11)					
WPF	-0.39	0.40*	-0.34	0.21	-0.21	0.19	1.00			
	(0.17)	(0.07)	(0.18)	(0.51)	(0.56)	(0.52)				
NDGAIN	0.01	-0.21	-0.12	-0.14	0.07	0.34	0.10	1.00		
	(0.98)	(0.41)	(0.63)	(0.52)	(0.73)	(0.14)	(0.74)			

HDI	-0.14	0.17	0.33	0.58***	0.17	0.04	0.07	0.17	1.00	
	(0.53)	(0.53)	(0.17)	(0.00)	(0.36)	(0.90)	(0.81)	(0.39)		
EIU	0.45	0.52***	0.25	0.19	0.45	-0.10	-0.28	-0.09	-0.29	1.00
	(0.12)	(0.01)	(0.37)	(0.42)	(0.11)	(0.72)	(0.28)	(0.72)	(0.23)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the mid-high performing countries sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.11

Spearman correlations medium-low performing countries with a score between 0.50 and 0.75 (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
FIW	0.19	1.00								
	(0.39)									
GRI	.	.	.							
	.	.								
FSI	0.17	-0.14	.	1.00						
	(0.44)	(0.57)	.							
EPI	0.22	0.03	.	0.07	1.00					
	(0.37)	(0.90)	.	(0.78)						
CPI	0.67***	0.16	.	0.02	0.03	1.00				
	(0.00)	(0.47)	.	(0.93)	(0.94)					
WPF	-0.06	0.31	.	0.16	-0.52	-0.12	1.00			
	(0.83)	(0.15)	.	(0.62)	(0.08)	(0.64)				
NDGAIN	0.24	0.39	.	0.24	0.04	0.55	-0.24	1.00		
	(0.29)	(0.21)	.	(0.31)	(0.88)	(0.03)	(0.48)			
HDI	0.06	-0.13	.	0.51**	0.41*	0.26	0.50	0.47**	1.00	
	(0.82)	(0.70)	.	(0.02)	(0.05)	(0.41)	(0.14)	(0.01)		
EIU	0.22	0.45**	.	-0.15	0.12	0.25	-0.09	-0.61*	-0.37	1.00
	(0.41)	(0.02)	.	(0.54)	(0.72)	(0.32)	(0.70)	(0.06)	(0.26)	

Note. This table demonstrates the results from the Spearman's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the mid-low performing countries sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.12

Kendall's correlations 2020 in the emerging markets sample

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
	1.00									
FIW	0.57***	1.00								
	0.58***	1.00								
	(0.00)									
GRI	0.07	0.07	1.00							
	0.08	0.08	1.00							
	(0.25)	(0.24)								
FSI	0.67***	0.43***	0.09	1.00						
	0.67***	0.44***	0.10	1.00						
	(0.00)	(0.00)	(0.17)							

EPI	0.32***	0.14**	0.03	0.48***	1.00					
	0.32***	0.14**	0.03	0.49***	1.00					
	(0.00)	(0.01)	(0.69)	(0.00)						
CPI	0.77***	0.46***	0.09	0.58***	0.30***	1.00				
	0.78***	0.46***	0.10	0.59***	0.30***	1.00				
	(0.00)	(0.00)	(0.17)	(0.00)	(0.00)					
WPF	0.39***	0.65***	0.08	0.28***	0.06	0.32***	1.00			
	0.39***	0.65***	0.09	0.27***	0.06	0.32***	1.00			
	(0.00)	(0.00)	(0.21)	(0.00)	(0.28)	(0.00)				
NDGAIN	0.53***	0.24***	0.02	0.63***	0.52***	0.51***	0.09	1.00		
	0.53***	0.24***	0.02	0.63***	0.52***	0.51***	0.09	1.00		
	(0.00)	(0.00)	(0.78)	(0.00)	(0.00)	(0.00)	(0.11)			
HDI	0.44***	0.19***	-0.01	0.64***	0.62***	0.42***	0.06	0.72***	1.00	
	0.44***	0.19***	-0.01	0.64***	0.62***	0.43***	0.06	0.72***	1.00	
	(0.00)	(0.00)	(0.99)	(0.00)	(0.00)	(0.00)	(0.31)	(0.00)		
EIU	0.55***	0.78***	0.06	0.44***	0.23***	0.43***	0.54***	0.28***	0.27***	1.00
	0.55***	0.79***	0.06	0.44***	0.23***	0.43***	0.54***	0.28***	0.27***	1.00
	(0.00)	(0.00)	(0.38)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the emerging markets sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.13

Kendall's correlations 2020 in the advanced economies sample

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
	1.00									
FIW	0.55***	1.00								
	0.57***	1.00								
	(0.00)									
GRI	0.13	-0.07	1.00							
	0.14	-0.08	1.00							
	(0.34)	(0.62)								
FSI	0.76***	0.55***	0.09	1.00						
	0.76***	0.57***	0.10	1.00						
	(0.00)	(0.00)	(0.50)							
EPI	0.32***	0.35***	0.07	0.33***	1.00					
	0.32***	0.36***	0.08	0.33***	1.00					
	(0.01)	(0.00)	(0.61)	(0.01)						
CPI	0.70***	0.52***	0.14	0.58***	0.37***	1.00				
	0.71***	0.55***	0.16	0.59***	0.38***	1.00				
	(0.00)	(0.00)	(0.28)	(0.00)	(0.00)					
WPF	0.47***	0.63***	0.10	0.54***	0.28**	0.42***	1.00			
	0.47***	0.65***	0.11	0.54***	0.28**	0.42***	1.00			
	(0.00)	(0.00)	(0.45)	(0.00)	(0.02)	(0.00)				
NDGAIN	0.66***	0.37***	0.25*	0.62***	0.40***	0.70***	0.38***	1.00		
	0.66***	0.39***	0.27*	0.62***	0.40***	0.71***	0.38***	1.00		
	(0.00)	(0.00)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)			
HDI	0.46***	0.33***	0.11	0.58***	0.32***	0.60***	0.30**	0.62***	1.00	
	0.46***	0.34***	0.12	0.58***	0.32***	0.61***	0.30**	0.63***	1.00	
	(0.00)	(0.00)	(0.41)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)		
EIU	0.58***	0.55***	0.03	0.57***	0.33***	0.50***	0.46***	0.58***	0.52***	1.00

	0.58***	0.57***	0.03	0.57***	0.33***	0.51***	0.46***	0.58***	0.52***	1.00
	(0.00)	(0.00)	(0.84)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the advanced economies sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.14

Kendall's correlations high performing countries with score of 0.25 or higher (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
	1.00									
FIW	0.49***	1.00								
	0.51***	1.00								
	(0.00)									
GRI	0.31	0.14	1.00							
	0.42	0.20	1.00							
	(0.10)	(0.44)								
FSI	0.72***	0.54***	0.17	1.00						
	0.72***	0.56***	0.23	1.00						
	(0.00)	(0.00)	(0.33)							
EPI	0.40***	0.35***	0.25	0.46***	1.00					
	0.40***	0.37***	0.34	0.46***	1.00					
	(0.00)	(0.01)	(0.16)	(0.00)						
CPI	0.67***	0.52***	0.33*	0.56***	0.45***	1.00				
	0.68***	0.55***	0.46*	0.57***	0.46***	1.00				
	(0.00)	(0.00)	(0.06)	(0.00)	(0.00)					
WPF	0.49***	0.48***	-0.01	0.52***	0.34***	0.43***	1.00			
	0.49***	0.50***	-0.02	0.52***	0.34***	0.44***	1.00			
	(0.00)	(0.00)	(0.96)	(0.00)	(0.01)	(0.00)				
NDGAIN	0.65***	0.48***	0.29*	0.64***	0.50***	0.63***	0.40***	1.00		
	0.65***	0.50***	0.39*	0.64***	0.50***	0.64***	0.40***	1.00		
	(0.00)	(0.00)	(0.09)	(0.00)	(0.00)	(0.00)	(0.00)			
HDI	0.44***	0.42***	0.20	0.70***	0.47***	0.54***	0.44***	0.63***	1.00	
	0.44***	0.44***	0.27	0.70***	0.47***	0.55***	0.44***	0.64***	1.00	
	(0.00)	(0.00)	(0.27)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
EIU	0.57***	0.48***	0.21	0.55***	0.34***	0.59***	0.34***	0.57**	0.60***	1.00
	0.57***	0.50***	0.30	0.55***	0.34***	0.60***	0.34***	0.57**	0.61***	1.00
	(0.00)	(0.00)	(0.18)	(0.00)	(0.01)	(0.00)	(0.00)	(0.02)	(0.00)	

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the high performing countries sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.15

Kendall's correlations low performing countries with a score of 0.75 or higher (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
	1.00									

FIW	0.36***	1.00								
	0.37***	1.00								
	(0.00)									
GRI	0.23**	0.24*	1.00							
	0.48**	0.41*	1.00							
	(0.03)	(0.08)								
FSI	0.51***	0.29**	0.26**	1.00						
	0.52***	0.30**	0.51*	1.00						
	(0.00)	(0.05)	(0.04)							
EPI	0.14	-0.14	0.17	0.06	1.00					
	0.14	-0.14	0.36	0.06	1.00					
	(0.33)	(0.54)	(0.33)	(0.71)						
CPI	0.56***	0.38***	0.26**	0.36***	-0.10	1.00				
	0.58***	0.40***	0.53**	0.37***	-0.11	1.00				
	(0.00)	(0.00)	(0.03)	(0.01)	(0.52)					
WPF	0.13	0.35***	0.03	-0.05	0.00	0.07	1.00			
	0.13	0.35***	0.06	-0.05	0.00	0.07	1.00			
	(0.35)	(0.00)	(0.91)	(0.82)	(1.00)	(0.67)				
NDGAIN	0.26**	0.07	-0.08	0.37***	0.21	0.11	0.13	1.00		
	0.26**	0.07	-0.19	0.37***	0.21	0.12	0.13	1.00		
	(0.04)	(0.67)	(0.56)	(0.00)	(0.11)	(0.40)	(0.52)			
HDI	0.12	0.34**	0.03	0.20*	0.24*	0.09	0.13	0.39***	1.00	
	0.12	0.35**	0.04	0.20*	0.24*	0.10	0.13	0.39***	1.00	
	(0.36)	(0.04)	(0.93)	(0.09)	(0.05)	(0.50)	(0.58)	(0.00)		
EIU	0.29**	0.60***	0.04	0.29*	0.30	0.23	0.31**	0.15	0.41**	1.00
	0.29**	0.61***	0.06	0.30*	0.31	0.24	0.31**	0.19	0.41**	1.00
	(0.02)	(0.00)	(0.91)	(0.06)	(0.11)	(0.10)	(0.02)	(0.36)	(0.01)	

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the low performing countries sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.16

Kendall's correlation medium-high performing countries with scores between 0.25 and 0.50 (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
	1.00									
FIW	0.12	1.00								
	0.12	1.00								
	(0.41)									
GRI	-0.03	0.15	1.00							
	-0.04	0.21	1.00							
	(0.94)	(0.38)								
FSI	-0.05	0.41***	0.16	1.00						
	-0.05	0.42***	0.25	1.00						
	(0.77)	(0.01)	(0.27)							
EPI	-0.13	0.13	0.34**	0.23	1.00					
	-0.13	0.14	0.47**	0.23	1.00					
	(0.58)	(0.52)	(0.02)	(0.14)						
CPI	0.32**	0.31**	-0.17	-0.05	-0.30	1.00				
	0.34**	0.34**	-0.25	-0.05	-0.32	1.00				

	(0.03)	(0.04)	(0.37)	(0.79)	(0.12)					
WPF	-0.33	0.26*	-0.21	0.06	-0.18	0.11	1.00			
	-0.33	0.26*	-0.29	0.06	-0.18	0.11	1.00			
	(0.11)	(0.09)	(0.19)	(0.84)	(0.53)	(0.62)				
NDGAIN	0.01	-0.15	-0.07	-0.11	0.04	0.25	0.07	1.00		
	0.01	-0.15	-0.10	-0.11	0.04	0.27	0.07	1.00		
	(0.96)	(0.40)	(0.65)	(0.48)	(0.79)	(0.12)	(0.78)			
HDI	-0.09	0.09	0.20	0.41***	0.10	0.03	0.05	0.11	1.00	
	-0.09	0.09	0.28	0.41***	0.10	0.03	0.06	0.11	1.00	
	(0.61)	(0.65)	(0.17)	(0.00)	(0.44)	(0.91)	(0.83)	(0.42)		
EIU	0.35	0.36***	0.15	0.13	0.33	-0.06	-0.21	-0.03	-0.20	1.00
	0.35	0.36***	0.21	0.13	0.33	-0.06	-0.21	-0.03	-0.20	1.00
	(0.11)	(0.01)	(0.39)	(0.46)	(0.11)	(0.80)	(0.27)	(0.90)	(0.25)	

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the mid-high performing sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.17

Kendall's correlations medium-low performing countries with a score between 0.50 and 0.75 (2020)

Variable	WGI	FIW	GRI	FSI	EPI	CPI	WPF	NDGAIN	HDI	EIU
WGI	1.00									
	1.00									
FIW	0.16	1.00								
	0.17	1.00								
	(0.31)									
GRI	.	.	.							
	.	.	.							
	.	.								
FSI	0.11	-0.14	.	1.00						
	0.11	-0.15	.	1.00						
	(0.49)	(0.42)	.							
EPI	0.13	0.02	.	0.07	1.00					
	0.13	0.02	.	0.07	1.00					
	(0.47)	(0.96)	.	(0.71)						
CPI	0.48***	0.10	.	0.03	0.02	1.00				
	0.51***	0.11	.	0.03	0.02	1.00				
	(0.00)	(0.51)	.	(0.90)	(1.00)					
WPF	0.00	0.21	.	0.12	-0.39	-0.09	1.00			
	0.00	0.22	.	0.12	-0.40	-0.09	1.00			
	(1.00)	(0.16)	.	(0.63)	(0.09)	(0.64)				
NDGAIN	0.17	0.26	.	0.13	0.01	0.38*	-0.13	1.00		
	0.17	0.26	.	0.13	0.01	0.39*	-0.13	1.00		
	(0.29)	(0.27)	.	(0.46)	(1.00)	(0.05)	(0.64)			
HDI	0.01	-0.07	.	0.37**	0.33**	0.17	0.33	0.33**	1.00	
	0.01	-0.07	.	0.37**	0.33**	0.18	0.33	0.34**	1.00	
	(1.00)	(0.81)	.	(0.02)	(0.03)	(0.49)	(0.21)	(0.01)		
EIU	0.19	0.32**	.	-0.10	0.11	0.15	-0.09	-0.47*	-0.24	1.00
	0.19	0.32**	.	-0.10	0.11	0.16	-0.09	-0.47*	-0.24	1.00
	(0.32)	(0.02)	.	(0.60)	(0.68)	(0.40)	(0.61)	(0.07)	(0.35)	

Note. This table demonstrates the results from the Kendall's rank correlation test where the rank correlation is calculated between the different country-specific ESG indices in 2020 in the mid-low performing sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental

Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, ND-GAIN =Notre Dame GAIN-Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Table A4.18

Qualitative analysis of rankings based on the information in Table 1

Rank correlation variables	ESG focus comparison	Evaluated Indicators	Data sources
FSI / WGI	Both Governance ranking indices	Identical evaluated indicators on every topic except for the economic state of economy indicators	FSI does not publish its used sources. i.e.. no comparison possible
CPI / WGI	Both Governance ranking indices	Control of corruption captures all the evaluated indicators of CPI	8 of the 13 used CPI data sources are the same as in the list of WGI used data sources
HDI / NDGAIN	HDI is focused on the social component; ND-GAIN environmentally focused	No corresponding indicators	No corresponding used data sources
EIU / FIW	Both Governance and Social ranking indices	Matching evaluated indicators	FIW does not publish its used sources. i.e.. no comparison possible

Note. This table demonstrates the qualitative analysis of the potential explanation for the highest correlated indices based on information in Table 4

Appendix V: Results research part II

Table A4.19

Cumulative and annualised turns and standard deviations different portfolios

Index	Portfolio	Cumulative return	Annualised return	Standard deviation	Number of bonds in portfolio
None	Base portfolio with exclusion of sanction countries	60.29%	3.20%	1.26%	91

World Governance Index Score 2020	High portfolio Exclusion when score > 0.25	40.61%	2.30%	1.20%	27
	Mid portfolio Exclusion when score > 0.50	56.70%	3.04%	1.22%	54
	Low portfolio Exclusion when score > 0.75	59.47%	3.16%	1.26%	84
Freedom in the World Index Score 2020	High portfolio Exclusion when score > 0.25	50.32%	2.75%	1.29%	26
	Mid portfolio Exclusion when score > 0.50	58.52%	3.12%	1.27%	56
	Low portfolio Exclusion when score > 0.75	59.19%	3.15%	1.26%	77
Global Rights Index Score 2020	High portfolio Exclusion when score > 0.25	56.25%	3.02%	1.29%	23
	Mid portfolio Exclusion when score > 0.50	57.90%	3.09%	1.24%	58
	Low portfolio Exclusion when score > 0.75	57.90%	3.09%	1.24%	58
Fragile States Index Score 2020	High portfolio Exclusion when score > 0.25	60.09%	3.19%	1.31%	38
	Mid portfolio Exclusion when score > 0.50	61.08%	3.23%	1.27%	60
	Low portfolio Exclusion when score > 0.75	60.05%	3.19%	1.27%	78
Environmental Performance Index Score 2020	High portfolio Exclusion when score > 0.25	50.93%	2.78%	1.24%	35
	Mid portfolio Exclusion when score > 0.50	58.24%	3.11%	1.25%	60
	Low portfolio Exclusion when score > 0.75	58.96%	3.14%	1.27%	75
Corruption Perceptions Index Score 2020	High portfolio Exclusion when score > 0.25	56.48%	3.03%	1.20%	32
	Mid portfolio Exclusion when score > 0.50	57.77%	3.09%	1.23%	57
	Low portfolio Exclusion when score > 0.75	59.81%	3.17%	1.26%	79
World Press Freedom Index Score 2020	High portfolio Exclusion when score > 0.25	59.00%	3.14%	1.28%	20
	Mid portfolio Exclusion when score > 0.50	61.96%	3.27%	1.27%	51
	Low portfolio Exclusion when score > 0.75	61.59%	3.25%	1.29%	75
Notre Dame GAIN Index Score 2020	High portfolio Exclusion when score > 0.25	51.94%	2.83%	1.21%	34
	Mid portfolio Exclusion when score > 0.50	58.77%	3.13%	1.24%	57
	Low portfolio Exclusion when score > 0.75	59.77%	3.17%	1.27%	77
Human Development Index Score 2020	High portfolio Exclusion when score > 0.25	55.61%	2.99%	1.28%	36
	Mid portfolio Exclusion when score > 0.50	60.16%	3.19%	1.26%	57
	Low portfolio Exclusion when score > 0.75	59.82%	3.18%	1.27%	77
Economist Intelligence Unit Index Score 2020	High portfolio Exclusion when score > 0.25	53.61%	2.90%	1.24%	33
	Mid portfolio Exclusion when score > 0.50	58.78%	3.13%	1.27%	59
	Low portfolio Exclusion when score > 0.75	60.50%	3.20%	1.28%	77

Note. This table demonstrates the cumulative and annualised returns per different exclusion strategy portfolio with the standard deviation and number of bonds included. The different exclusion strategy portfolios are based on different country-specific ESG indices and are equally weighted with 20% emerging markets and 80% advanced economies

Table A4.20

Cumulative and annualised turns and standard deviations EM portfolios

Index	Emerging Markets Portfolio	Cumulative return	Annualised return	Standard deviation	Number of bonds in portfolio
None	EM Base portfolio with exclusion of sanction countries	116.79%	5.29%	2.69%	69
World Governance Index Score 2020	EM Top portfolio Exclusion when score > 0.25	17.44%	1.08%	1.90%	7
	EM Mid portfolio Exclusion when score > 0.50	94.66%	4.54%	2.20%	32
	EM Low portfolio Exclusion when score > 0.75	110.59%	5.09%	2.60%	59
Freedom in the World Index Score 2020	EM Top portfolio Exclusion when score > 0.25	53.23%	2.89%	2.36%	7
	EM Mid portfolio Exclusion when score > 0.50	101.26%	4.77%	2.61%	35
	EM Low portfolio Exclusion when score > 0.75	109.32%	5.05%	2.70%	55
Global Rights Index Score 2020	EM Top portfolio Exclusion when score > 0.25	105.77%	4.93%	3.16%	12
	EM Mid portfolio Exclusion when score > 0.50	123.59%	5.51%	3.05%	41
	EM Low portfolio Exclusion when score > 0.75	123.59%	5.51%	3.05%	41
Fragile States Index Score 2020	EM Top portfolio Exclusion when score > 0.25	113.92%	5.20%	2.85%	17
	EM Mid portfolio Exclusion when score > 0.50	122.58%	5.48%	2.72%	39
	EM Low portfolio Exclusion when score > 0.75	112.90%	5.17%	2.76%	56
Environmental Performance Index Score 2020	EM Top portfolio Exclusion when score > 0.25	60.86%	3.22%	2.22%	14
	EM Mid portfolio Exclusion when score > 0.50	101.80%	4.79%	2.56%	38
	EM Low portfolio Exclusion when score > 0.75	106.81%	4.96%	2.66%	53
Corruption Perceptions Index Score 2020	EM Top portfolio Exclusion when score > 0.25	98.52%	4.68%	1.78%	11
	EM Mid portfolio Exclusion when score > 0.50	100.09%	4.73%	2.44%	35
	EM Low portfolio Exclusion when score > 0.75	113.28%	5.18%	2.71%	57
World Press Freedom Index Score 2020	EM Top portfolio Exclusion when score > 0.25	99.42%	4.71%	2.40%	14
	EM Mid portfolio Exclusion when score > 0.50	123.78%	5.52%	2.72%	30
	EM Low portfolio Exclusion when score > 0.75	120.37%	5.41%	2.89%	54
Notre Dame GAIN Index Score 2020	EM Top portfolio Exclusion when score > 0.25	64.56%	3.38%	2.34%	12
	EM Mid portfolio Exclusion when score > 0.50	105.74%	4.93%	2.45%	35
	EM Low portfolio Exclusion when score > 0.75	111.53%	5.12%	2.73%	55
Human Development Index Score 2020	EM Top portfolio Exclusion when score > 0.25	82.19%	4.08%	3.02%	14
	EM Mid portfolio Exclusion when score > 0.50	114.67%	5.22%	2.54%	35
	EM Low portfolio Exclusion when score > 0.75	111.76%	5.13%	2.72%	55
Economist Intelligence Unit Index Score 2020	EM Top portfolio Exclusion when score > 0.25	71.86%	3.68%	2.17%	12
	EM Mid portfolio Exclusion when score > 0.50	105.07%	4.90%	2.69%	37

EM Low portfolio Exclusion when score > 0.75	117.22%	5.31%	2.89%	55

Note. This table demonstrates the cumulative and annualised returns per different exclusion strategy portfolio with the standard deviation and number of bonds included in the emerging market sample. The different exclusion strategy portfolios are based on different country-specific ESG indices

Table A4.21

Robustness checks in subsets of EM data

	Subset 2008-2016				**Subset mid 2017-2022**			
	Wilcoxon signed rank test		**Levene's test**		**Wilcoxon signed rank test**		**Levene's test**	
Portfolio differences	**z-score**	**p-value**	**Levene's test statistic**	**p-value**	**z-score**	**p-value**	**Levene's test statistic**	**p-value**
Base portfolio - 100% portfolio	0.85	0.40	0.96	0.82	**(3.11)*** **	**0.00**	0.98	0.92
Base portfolio - WGI High	**2.35****	**0.02**	**5.46*****	**0.00**	1.30	0.19	**6.13*****	**0.00**
Base portfolio - WGI Mid	1.55	0.12	1.31	0.17	(0.18)	0.86	**1.92*****	**0.01**
Base portfolio - WGI Low	0.35	0.73	1.02	0.91	1.31	0.19	1.14	0.60
Base portfolio - FIW High	**1.74***	**0.08**	1.35	0.13	0.64	0.52	**3.26*****	**0.00**
Base portfolio - FIW Mid	(0.24)	0.81	0.98	0.91	0.90	0.37	1.23	0.40
Base portfolio - FIW Low	(0.64)	0.53	0.99	0.98	**1.85***	**0.06**	0.97	0.99
Base portfolio - GRI High	(0.06)	0.95	**0.64****	**0.03**	0.36	0.72	0.54	0.86
Base portfolio - GRI Mid	(0.78)	0.43	0.74	0.13	0.16	0.87	0.83	0.45
Base portfolio - GRI Low	(0.78)	0.43	0.74	0.13	0.16	0.87	0.83	0.45
Base portfolio - FSI High	(0.91)	0.36	**0.68***	**0.05**	0.85	0.39	**1.81****	**0.02**
Base portfolio - FSI Mid	(0.36)	0.72	0.82	0.30	(0.33)	0.74	1.35	0.22
Base portfolio - FSI Low	(0.29)	0.77	0.85	0.41	0.30	0.76	1.13	0.62
Base portfolio - EPI High	1.60	0.11	1.13	0.55	0.63	0.53	**3.36*****	**0.00**
Base portfolio - EPI Mid	1.05	0.29	0.97	0.88	0.05	0.96	1.37	0.20
Base portfolio - EPI Low	0.97	0.33	1.00	0.99	0.94	0.35	1.05	0.85
Base portfolio - CPI High	**2.08****	**0.04**	**1.95*****	**0.01**	0.34	0.73	**3.02*****	**0.00**
Base portfolio - CPI Mid	0.49	0.62	1.05	0.81	0.22	0.83	**1.58***	**0.06**
Base portfolio - CPI Low	0.07	0.94	0.96	0.85	1.04	0.30	1.01	0.97
Base portfolio - WPF High	0.04	0.97	1.14	0.50	(0.02)	0.99	**1.71****	**0.03**
Base portfolio - WPF Mid	(1.18)	0.24	0.82	0.31	0.03	0.97	1.35	0.22
Base portfolio - WPF Low	(0.61)	0.54	0.86	0.45	(1.04)	0.30	0.86	0.54
Base portfolio - NDGAIN High	1.28	0.20	1.04	0.83	0.68	0.50	**3.78*****	**0.00**
Base portfolio - NDGAIN Mid	0.60	0.55	1.01	0.95	0.03	0.97	**1.69****	**0.03**
Base portfolio - NDGAIN Low	0.18	0.86	0.89	0.56	0.17	0.86	1.11	0.67
Base portfolio - HDI High	0.09	0.93	**0.58*****	0.01	1.13	0.26	**2.17*****	**0.00**
Base portfolio - HDI Mid	0.29	0.77	0.97	0.88	0.27	0.79	1.44	0.13
Base portfolio - HDI Low	0.18	0.86	0.89	0.56	0.16	0.87	1.12	0.65
Base portfolio - EIU High	**1.83***	**0.07**	**1.39***	**0.10**	0.26	0.79	**2.33*****	**0.00**
Base portfolio - EIU Mid	(0.04)	0.97	0.96	0.82	0.53	0.60	1.07	0.78
Base portfolio - EIU Low	(0.49)	0.63	0.90	0.59	0.49	0.62	0.82	0.41
WGI High – Low	**(2.47)****	**0.01**	**0.19*****	**0.00**	(1.24)	0.21	**0.19*****	**0.00**
FIW High – Low	**(1.88)***	**0.07**	0.74	0.12	(0.28)	0.78	**0.30*****	**0.00**
GRI High – Low	(0.68)	0.49	1.15	0.48	(0.63)	0.53	0.97	0.89
FSI High – Low	1.00	0.32	1.25	0.26	(1.31)	0.19	**0.63***	**0.05**
EPI High – Low	(1.47)	0.14	0.89	0.55	(0.77)	0.44	**0.31*****	**0.00**
CPI High – Low	**(1.96)***	**0.05**	**0.49*****	**0.00**	(0.29)	0.77	**0.33*****	**0.00**
WPF High – Low	(0.28)	0.78	0.76	0.15	(0.25)	0.80	**0.50*****	**0.01**
NDGAIN High – Low	(1.23)	0.22	0.85	0.42	(0.77)	0.44	**0.29*****	**0.00**

HDI High – Low	(0.04)	0.97	**1.53****	**0.03**	(1.19)	0.23	**0.51*****	**0.01**
EIU High – Low	**(1.89)***	**0.06**	**0.65****	**0.03**	(0.28)	0.78	**0.35*****	**0.00**

Note. This table demonstrates the robustness check of the tests where the Wilcoxon signed rank test and Levene's test are done on two period subsets of the dataset to check whether the results are influenced by the large increase in differences in 2017 in the emerging market sample. WGI = World Governance Indicators, FIW = Freedom in the World Index, GRI = Global Rights Index, FSI = Fragile States Index, EPI = Environmental Performance Index, CPI = Corruption Perceptions Index, WPF = World Press Freedom Index, NDGAIN = Notre Dame GAIN Index, HDI = Human Development Index, EIU = Economist Intelligence Unit Index.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$

Appendix VI: do-file

***** Preparing datasets before merging all ranking datasets *****

```
encode ISO, gen(ISOcode)

drop ISO

rename ISOcode ISO

order ISO A B C D E F G H I J

rename A WIG12

rename B WIG13

rename C WIG14

rename D WIG15

rename E WIG16

rename F WIG17

rename G WIG18

rename H WIG19

rename I WIG20

rename J WIG21

save "/Users/juliakrips/Documents/MASTER THESIS/WIGDATA.dta"

// iterate with the other datasets //

save "/Users/juliakrips/Documents/MASTER THESIS/WPIDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/NDGAINDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/ITUCDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/HDIDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/FSIDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/FIWDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/EUIDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/EPIDATA.dta"

save "/Users/juliakrips/Documents/MASTER THESIS/CPIDATA.dta"
```

// descriptive statistics //

```
summarize
```

graph box WIG21 WIG20 WIG19 WIG18 WIG17 WIG16 WIG15 WIG14 WIG13 WIG12

graph save "BoxplotWIG" "/Users/juliakrips/Documents/MASTER THESIS/BoxplotWIG.gph"

****Repeat with the other rankings****

*** outlier analysis ***

use NDGAINDATA.dta

histogram ND97

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/Histogram 1997 ND-GAIN.gph"

histogram ND10

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/Histogram ND-GAIN 2010.gph"

histogram ND20

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/ND-GAIN 2020.gph"

use WPIDATA.dta

histogram WPI13

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/WPF 2013.gph"

histogram WPI18

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/WPF 2018.gph"

histogram WPI22

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/WPF 2022.gph"

use EPIDATA.dta

histogram EPI22

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/EPI 2022.gph"

histogram EPI21

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/EPI 2021.gph"

histogram EPI20

graph save "Graph" "/Users/juliakrips/Documents/MASTER THESIS/EPI 2020.gph"

// rank correlation analysis //

2020

spearman WIG3 FIW, stats(rho p)

spearman WIG3 ITUC, stats(rho p)

spearman WIG3 FSI, stats(rho p)

```
spearman WIG3 EPI , stats(rho p)

spearman WIG3 CPI, stats(rho p)

spearman WIG3 WPI, stats(rho p)

spearman WIG3 NDGAIN, stats(rho p)

spearman WIG3 HDI, stats(rho p)

spearman WIG3 EIU, stats(rho p)

ktau WIG3 FIW, stats(taua taub p)

ktau WIG3 ITUC, stats(taua taub p)

ktau WIG3 FSI, stats(taua taub p)

ktau WIG3 EPI , stats(taua taub p)

ktau WIG3 CPI, stats(taua taub p)

ktau WIG3 WPI, stats(taua taub p)

ktau WIG3 NDGAIN, stats(taua taub p)

ktau WIG3 HDI, stats(taua taub p)

ktau WIG3 EIU, stats(taua taub p)

*repeat for all ratings*

*repeat for 2021 data*

*repeat for country development subsets*

*repeat for different ranking quartiles subsets*

// part two research //

* testing portfolios *

import excel "/Users/juliakrips/Library/Containers/com.apple.mail/Data/Library/Mail Downloads/B732D14C-646C-46FE-A68B-
        2B68FB6E0F1D/Bonds data_V2.xlsx", sheet("Full portfolio dataset STATA") firstrow

encode Date, gen(date)

drop Date

order date Ret_Base

tsset date, format(%tm)

* testing for normality *

swilk Ret_Base Ret_Sanction WGI_TOP WGI_MID WGI_LOW FIW_TOP FIW_MID FIW_LOW GRI_TOP GRI_MID GRI_LOW
        FSI_TOP FSI_MID FSI_LOW EPI_TOP EPI_MID EPI_LOW CPI_TOP CPI_MID CPI_LOW WPF_TOP WPF_MID
        WPF_LOW NDGAIN_TOP NDGAIN_MID NDGAIN_LOW HDI_TOP HDI_MID HDI_LOW EIU_TOP EIU_MID
        EIU_LOW
```

sktest Ret_Base Ret_Sanction WGI_TOP WGI_MID WGI_LOW FIW_TOP FIW_MID FIW_LOW GRI_TOP GRI_MID GRI_LOW FSI_TOP FSI_MID FSI_LOW EPI_TOP EPI_MID EPI_LOW CPI_TOP CPI_MID CPI_LOW WPF_TOP WPF_MID WPF_LOW NDGAIN_TOP NDGAIN_MID NDGAIN_LOW HDI_TOP HDI_MID HDI_LOW EIU_TOP EIU_MID EIU_LOW

*** testing for significance in returns***

****WILCOXON SIGN RANK TEST****

signrank Ret_Base = Ret_Sanction

signrank Ret_Sanction = WGI_TOP

signrank Ret_Sanction = WGI_MID

signrank Ret_Sanction = WGI_LOW

signrank Ret_Sanction = FIW_TOP

signrank Ret_Sanction = FIW_MID

signrank Ret_Sanction = FIW_LOW

signrank Ret_Sanction = GRI_TOP

signrank Ret_Sanction = GRI_MID

signrank Ret_Sanction = GRI_LOW

signrank Ret_Sanction = FSI_TOP

signrank Ret_Sanction = FSI_MID

signrank Ret_Sanction = FSI_LOW

signrank Ret_Sanction = EPI_TOP

signrank Ret_Sanction = EPI_MID

signrank Ret_Sanction = EPI_LOW

signrank Ret_Sanction = CPI_TOP

signrank Ret_Sanction = CPI_MID

signrank Ret_Sanction = CPI_LOW

signrank Ret_Sanction = WPF_TOP

signrank Ret_Sanction = WPF_MID

signrank Ret_Sanction = WPF_LOW

signrank Ret_Sanction = NDGAIN_TOP

signrank Ret_Sanction = NDGAIN_MID

signrank Ret_Sanction = NDGAIN_LOW

signrank Ret_Sanction = HDI_TOP

signrank Ret_Sanction = HDI_MID

signrank Ret_Sanction = HDI_LOW

signrank Ret_Sanction = EIU_TOP

signrank Ret_Sanction = EIU_MID

signrank Ret_Sanction = EIU_LOW

hypothesis 5 testing

signrank WGI_TOP = WGI_LOW

signrank FIW_TOP = FIW_LOW

signrank GRI_TOP = GRI_LOW

signrank FSI_TOP = FSI_LOW

signrank EPI_TOP = EPI_LOW

signrank CPI_TOP = CPI_LOW

signrank WPF_TOP = WPF_LOW

signrank NDGAIN_TOP = NDGAIN_LOW

signrank HDI_TOP = HDI_LOW

signrank EIU_TOP = EIU_LOW

TESTING FOR EQUALITY IN VARIANCES

****LEVENE'S TEST****

sdtest Ret_Base==Ret_Sanction

sdtest Ret_Sanction==WGI_TOP

sdtest Ret_Sanction==WGI_MID

sdtest Ret_Sanction==WGI_LOW

sdtest Ret_Sanction==FIW_TOP

sdtest Ret_Sanction==FIW_MID

sdtest Ret_Sanction==FIW_LOW

sdtest Ret_Sanction==GRI_TOP

sdtest Ret_Sanction==GRI_MID

sdtest Ret_Sanction==GRI_LOW

sdtest Ret_Sanction==FSI_TOP

sdtest Ret_Sanction==FSI_MID

sdtest Ret_Sanction==FSI_LOW

sdtest Ret_Sanction==EPI_TOP

sdtest Ret_Sanction==EPI_MID

sdtest Ret_Sanction==EPI_LOW

sdtest Ret_Sanction==CPI_TOP

sdtest Ret_Sanction==CPI_MID

sdtest Ret_Sanction==CPI_LOW

sdtest Ret_Sanction==WPF_TOP

sdtest Ret_Sanction==WPF_MID

sdtest Ret_Sanction==WPF_LOW

sdtest Ret_Sanction==NDGAIN_TOP

sdtest Ret_Sanction==NDGAIN_MID

sdtest Ret_Sanction==NDGAIN_LOW

sdtest Ret_Sanction==HDI_TOP

sdtest Ret_Sanction==HDI_MID

sdtest Ret_Sanction==HDI_LOW

sdtest Ret_Sanction==EIU_TOP

sdtest Ret_Sanction==EIU_MID

sdtest Ret_Sanction==EIU_LOW

****hypothesis 3/hypothesis 4 testing ****

sdtest WGI_TOP==WGI_LOW

sdtest FIW_TOP==FIW_LOW

sdtest GRI_TOP==GRI_LOW

sdtest FSI_TOP==FSI_LOW

sdtest EPI_TOP==EPI_LOW

sdtest CPI_TOP==CPI_LOW

sdtest WPF_TOP==WPF_LOW

sdtest NDGAIN_TOP==NDGAIN_LOW

sdtest HDI_TOP==HDI_LOW

sdtest EIU_TOP==EIU_LOW

*** repeat for EM portfolios ***

```
import excel "/Users/juliakrips/Library/Containers/com.apple.mail/Data/Library/Mail Downloads/B732D14C-646C-46FE-A68B-2B68FB6E0F1D/Bonds data_V2.xlsx", sheet("EM portfolio dataset STATA") firstrow clear

encode Date, gen(date)

drop Date

order date Ret_Base

tsset date, format(%tm)
```

normality testing

```
swilk Ret_Base_EM Ret_Sanction_EM WGI_TOP_EM WGI_MID_EM WGI_LOW_EM FIW_MID_EM FIW_TOP_EM FIW_LOW_EM GRI_TOP_EM GRI_MID_EM GRI_LOW_EM FSI_TOP_EM FSI_MID_EM FSI_LOW_EM EPI_TOP_EM EPI_MID_EM EPI_LOW_EM CPI_TOP_EM CPI_MID_EM CPI_LOW_EM WPF_TOP_EM WPF_MID_EM WPF_LOW_EM NDGAIN_TOP_EM NDGAIN_MID_EM NDGAIN_LOW_EM HDI_TOP_EM HDI_MID_EM HDI_LOW_EM EIU_TOP_EM EIU_MID_EM EIU_LOW_EM

sktest Ret_Base_EM Ret_Sanction_EM WGI_TOP_EM WGI_MID_EM WGI_LOW_EM FIW_TOP_EM FIW_MID_EM FIW_LOW_EM GRI_TOP_EM GRI_MID_EM GRI_LOW_EM FSI_TOP_EM FSI_MID_EM FSI_LOW_EM EPI_TOP_EM EPI_MID_EM EPI_LOW_EM CPI_TOP_EM CPI_MID_EM CPI_LOW_EM WPF_TOP_EM WPF_MID_EM WPF_LOW_EM NDGAIN_TOP_EM NDGAIN_MID_EM NDGAIN_LOW_EM HDI_TOP_EM HDI_MID_EM HDI_LOW_EM EIU_TOP_EM EIU_MID_EM EIU_LOW_EM
```

TESTING FOR SIGNIFICANCE IN RETURNS

****Wilcoxon signed rank test****

```
signrank Ret_Base_EM = Ret_Sanction_EM

signrank Ret_Sanction_EM = WGI_TOP_EM

signrank Ret_Sanction_EM = WGI_MID_EM

signrank Ret_Sanction_EM = WGI_LOW_EM

signrank Ret_Sanction_EM = FIW_TOP_EM

signrank Ret_Sanction_EM = FIW_MID_EM

signrank Ret_Sanction_EM = FIW_LOW_EM

signrank Ret_Sanction_EM = GRI_TOP_EM

signrank Ret_Sanction_EM = GRI_MID_EM

signrank Ret_Sanction_EM = GRI_LOW_EM

signrank Ret_Sanction_EM = FSI_TOP_EM

signrank Ret_Sanction_EM = FSI_MID_EM

signrank Ret_Sanction_EM = FSI_LOW_EM

signrank Ret_Sanction_EM = EPI_TOP_EM

signrank Ret_Sanction_EM = EPI_MID_EM

signrank Ret_Sanction_EM = EPI_LOW_EM
```

signrank Ret_Sanction_EM = CPI_TOP_EM

signrank Ret_Sanction_EM = CPI_MID_EM

signrank Ret_Sanction_EM = CPI_LOW_EM

signrank Ret_Sanction_EM = WPF_TOP_EM

signrank Ret_Sanction_EM = WPF_MID_EM

signrank Ret_Sanction_EM = WPF_LOW_EM

signrank Ret_Sanction_EM = NDGAIN_TOP_EM

signrank Ret_Sanction_EM = NDGAIN_MID_EM

signrank Ret_Sanction_EM = NDGAIN_LOW_EM

signrank Ret_Sanction_EM = HDI_TOP_EM

signrank Ret_Sanction_EM = HDI_MID_EM

signrank Ret_Sanction_EM = HDI_LOW_EM

signrank Ret_Sanction_EM = EIU_TOP_EM

signrank Ret_Sanction_EM = EIU_MID_EM

signrank Ret_Sanction_EM = EIU_LOW_EM

hypothesis 5 testing

signrank WGI_TOP_EM = WGI_LOW_EM

signrank FIW_TOP_EM = FIW_LOW_EM

signrank GRI_TOP_EM = GRI_LOW_EM

signrank FSI_TOP_EM = FSI_LOW_EM

signrank EPI_TOP_EM = EPI_LOW_EM

signrank CPI_TOP_EM = CPI_LOW_EM

signrank WPF_TOP_EM = WPF_LOW_EM

signrank NDGAIN_TOP_EM = NDGAIN_LOW_EM

signrank HDI_TOP_EM = HDI_LOW_EM

signrank EIU_TOP_EM = EIU_LOW_EM

****TESTING FOR EQUALITY IN VARIANCES****

LEVENE'S TEST

sdtest Ret_Sanction_EM==Ret_Base_EM

sdtest Ret_Sanction_EM==WGI_TOP_EM

sdtest Ret_Sanction_EM==WGI_MID_EM

sdtest Ret_Sanction_EM==WGI_LOW_EM

sdtest Ret_Sanction_EM==FIW_TOP_EM

sdtest Ret_Sanction_EM==FIW_MID_EM

sdtest Ret_Sanction_EM==FIW_LOW_EM

sdtest Ret_Sanction_EM==GRI_TOP_EM

sdtest Ret_Sanction_EM==GRI_MID_EM

sdtest Ret_Sanction_EM==GRI_LOW_EM

sdtest Ret_Sanction_EM==FSI_TOP_EM

sdtest Ret_Sanction_EM==FSI_MID_EM

sdtest Ret_Sanction_EM==FSI_LOW_EM

sdtest Ret_Sanction_EM==EPI_TOP_EM

sdtest Ret_Sanction_EM==EPI_MID_EM

sdtest Ret_Sanction_EM==EPI_LOW_EM

sdtest Ret_Sanction_EM==CPI_TOP_EM

sdtest Ret_Sanction_EM==CPI_MID_EM

sdtest Ret_Sanction_EM==CPI_LOW_EM

sdtest Ret_Sanction_EM==WPF_TOP_EM

sdtest Ret_Sanction_EM==WPF_MID_EM

sdtest Ret_Sanction_EM==WPF_LOW_EM

sdtest Ret_Sanction_EM==NDGAIN_TOP_EM

sdtest Ret_Sanction_EM==NDGAIN_MID_EM

sdtest Ret_Sanction_EM==NDGAIN_LOW_EM

sdtest Ret_Sanction_EM==HDI_TOP_EM

sdtest Ret_Sanction_EM==HDI_MID_EM

sdtest Ret_Sanction_EM==HDI_LOW_EM

sdtest Ret_Sanction_EM==EIU_TOP_EM

sdtest Ret_Sanction_EM==EIU_MID_EM

sdtest Ret_Sanction_EM==EIU_LOW_EM

****hypothesis 3/hypothesis 4 testing****

sdtest WGI_TOP_EM==WGI_LOW_EM

sdtest FIW_TOP_EM==FIW_LOW_EM

sdtest GRI_TOP_EM==GRI_LOW_EM

sdtest FSI_TOP_EM==FSI_LOW_EM

sdtest EPI_TOP_EM==EPI_LOW_EM

sdtest CPI_TOP_EM==CPI_LOW_EM

sdtest WPF_TOP_EM==WPF_LOW_EM

sdtest NDGAIN_TOP_EM==NDGAIN_LOW_EM

sdtest HDI_TOP_EM==HDI_LOW_EM

sdtest EIU_TOP_EM==EIU_LOW_EM